United States Environmental Protection Agency
Office of Water (4203)
EPA 833-F-00-014
January 2001
Fact Sheet 3.1

EPA

Storm Water Phase II Final Rule

Construction Rainfall Erosivity Waiver

The 1972 amendments to the Federal Water Pollution Control Act, later referred to as the Clean Water Act (CWA), prohibit the discharge of any pollutant to navigable waters of the United States unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Because construction site storm water runoff can contribute significantly to water quality problems, the Phase I Storm Water Rule imposed a requirement that all construction sites with a planned land disturbance of 5 acres or more obtain an NPDES permit and implement storm water runoff control plans. Phase II extends the requirements of the storm water program to sites of between 1 and 5 acres. The Rainfall erosivity waiver, along with the water quality waiver, allows permitting authorities to waive those sites that do not have adverse water quality impacts.

What is Erosivity?

Erosivity is the term used to describe the potential for soil to wash off disturbed, devegetated earth into waterways during storms. The potential for erosion is in part determined by the soil type and geology of the site. For instance, dense, clay-like soils on a glacial plain will erode less readily when it rains than will sandy soils on the side of a hill. Another important factor is the amount and force of precipitation expected during the time the earth will be exposed. While it is impossible to predict the weather several months in advance of construction, for many areas of the country, there are definite optimal periods, such as a dry season when rain tends to fall less frequently and with less force. When feasible, this is the time to disturb the earth, so that the site is stabilized by the time the seasonal wet weather returns. There are many other important factors to consider in determining erosivity, such as freeze/thaw cycles and snow pack.

How Is Site Erosivity Determined?

The method for determining if a site qualifies for the erosivity waiver is based on the Universal Soil Loss Equation (USLE) developed by the U.S. Department of Agriculture (USDA) in the 1950s to help farmers conserve their valuable topsoil. The USLE has been updated to the Revised USLE (RUSLE). Using a computer model supported by decades worth of soil and rainfall data, USDA established estimates of annual erosivity values (R) for sites throughout the country. These R factors are used as surrogate measures of the impact that rainfall had on erosion from a particular site. They have been mapped using isoerodent contours, as shown in Figures 2 through 5.

USDA developed the Erosivity Index Table (EI Table, provided here in Table 1), to show how the annual erosivity factor is distributed throughout the year in two-week increments. Table 1 is based on 120 rainfall distribution zones for the continental U.S. Detailed instructions for calculating a project R Factor are provided later in this fact sheet.

The Storm Water Phase II rule allows permitting authorities to waive NPDES requirements for small construction sites if the value of the rainfall erosivity factor is less than 5 during the period of construction activity (see § 122.26(b)(15)(i)(A)). Note that the permitting authority has the option to not allow waivers for small construction activity. If the permitting authority in a State chooses to use the rainfall erosivity waiver, it will not become effective until permits are required from small construction activity.

This Page Intentionally
Left Blank

If the R Factor for the period of construction calculates to 5 or lower, and the permitting authority allows the use of the waiver, the site owner may apply for a waiver under the low rainfall erosivity provision of the applicable NPDES Construction General Permit. When applying, owners are encouraged to consider other site-specific factors, such as proximity to water resources and the sensitivity of receiving waters to sedimentation impacts. The small construction operator must certify to the permitting authority that the construction activity will take place during a period when the rainfall erosivity factor is less than 5.

The start and end dates used for the construction activity will be the initial date of disturbance and the anticipated date when the site will have achieved final stabilization as defined by the permit. If the construction continues beyond this period, the operator will need to recalculate the EI for the site based on this new ending date (but keeping the old start date) and either resubmit the certification form or apply for NPDES permit coverage.

What Other Factors Can Affect Waiver Availability and Eligibility?

EPA has established the R Factor of 5 or lower as the criteria for determining waiver eligibility. However, since the intent is to waive only those construction activities that will not adversely impact water quality, State and Tribal permitting authorities have considerable discretion in determining where, when, and how to offer it. They can establish an R Factor threshold lower than 5, or they can suspend the waiver within an area where watersheds are known to be heavily impacted by, or sensitive to, sedimentation. They can also suspend the waiver during certain periods of the year. They may opt not to offer the waiver at all. NOTE: This waiver is not available to sites that will disturb more than 5 acres of land (large construction).

What if My Site Is Not Eligible?

If your site is not eligible for a waiver, you must submit a Notice of Intent under the NPDES General Permit, and comply with its requirements. These requirements are described in more detail in Storm Water Phase II Fact Sheet 3.0.

How Do I Compute the R Factor for My Project?

1. Estimate the construction start date. This is the day you expect to begin disturbing soils, including grubbing, stockpiling, excavating, and grading activities. Pick the 15-day period for your start date (e.g., June 1-15.)
2. Estimate the day you expect to have a permanent vegetative cover of at least 70%, or as defined by your permitting authority, over all previous disturbed areas. Round to the nearest 15-day period.
3. Refer to Figure 1 to find your Erosivity Index (EI) Zone based on your geographic location.
4. Refer to Table 1, the Erosivity Index (EI) Table. Find the number of your EI Zone in the left column. Locate the EI values for the 15-day periods that correspond to the project start and end periods you identified in Steps 1 and 2. Subtract the start value from the end value to find the % EI for your site. The maximum annual EI value for a project is 100%.
5. Refer to the appropriate Isoerodent Map (Figures 2 through 5). Interpolate the annual isoerodent value for your area. This is the annual R Factor for your site.
6. Multiply the percent value obtained in Step 4 by the annual isoerodent value obtained in Step 5. This is the R Factor for your scheduled project.

Examples

1. Construction started and completed in one calendar year.

Find the R value of a construction site in Denver, Colorado. Assume the site will be disturbed from March 1 to May 15.

The EI distribution zone is 84 (Figure 1). Referring to Table 1, the project period will span from March 1 to May 15. The difference in values between these two periods is 4.7 % (4.9-0.2 =4.7). Since the annual erosion index for this location is about 45 (interpolated from Figure 2), the R Factor for the scheduled construction project is 4.7% of 45, or 2.1.

Because 2.1 is less than 5, the operator of this site would be able to seek a waiver under the low rainfall erosivity provision.

2. Construction spanning two calendar years.

Find the R value for a construction site in Pittsburgh, Pennsylvania. Assume the site will be disturbed from August 1 to April 15.

The EI distribution zone is 111 (Figure 1). Referring to Table 1, the project will span from August 1 to April 15. The difference in values between August 1 and December 30 is 35% (100- 65.0 = 35.0). The difference between January 1 and April 15 is 8%. The total percentage EI for this project is 43% (35 + 8). Since the annual erosion index for this location is 112 (interpolated from Figure 2), the R Factor for the scheduled construction is 43% of 112, or 48.

Since 48 is greater than 5, the operator of this site would not be able to seek a waiver under the low rainfall erosivity provision.

Can I Use A Personal Computer to Calculate the R Factor?

The computer program used by USDA to develop the current R Factor maps and table is called the Revised Universal Soil Loss Equation, or RUSLE. The current version of RUSLE (v. 1.60) will calculate the R factor for the entire year for a limited number of cities in the U.S., but does not allow the R factor to be easily adjusted based on a shorter period of construction. If you are interested in using RUSLE; Version 1.06 for Mined Lands, Construction Sites, and Reclaimed Lands, is downloadable free of charge from the Internet at http://www.sedlab.olemiss.edu/rusle.

Where Can I Get Help?

- A copy of "Chapter 2, Rainfall-Runoff Erosivity Factor (R)" from the *USDA Handbook 703 - Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE)*, January 1997, is available on EPA's web site at http://www.epa.gov/npdes/stormwater.

- Your local soil conservation district office can provide assistance with R Factors and other conservation-related issues. To find the office nearest you, look in the government section of the phone book under soil conservation district, conservation district, natural resource conservation district, etc.

For Additional Information

Reference Documents

- Storm Water Phase II Final Rule Fact Sheet Series
  - Internet: cfpub.epa.gov/npdes/stormwater/swfinal.cfm

- Storm Water Phase II Final Rule(64 *FR* 68722)
  - Internet: www.epa.gov/npdes/regulations/phase2.pdf
  - Contact the U.S. EPA Water Resource Center
    - Phone: (202) 564-9545

- *Agricultural Handbook Number 703, Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE)*, Chapter 2, pp. 21-64, January 1997.
  - Internet: www.epa.gov/npdes/pubs/ruslech2.pdf

Figure 1. Erosivity Index Zone Map

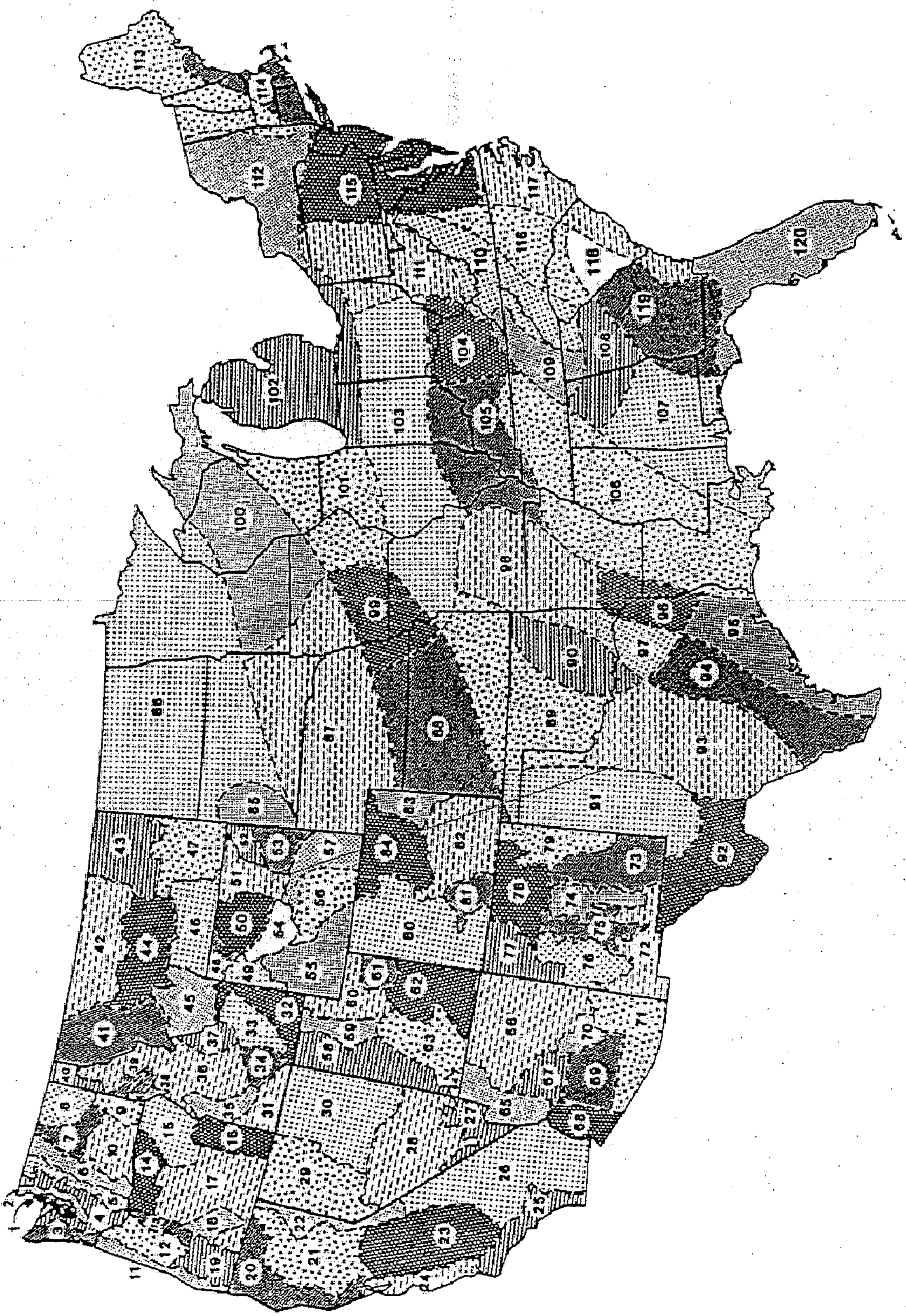
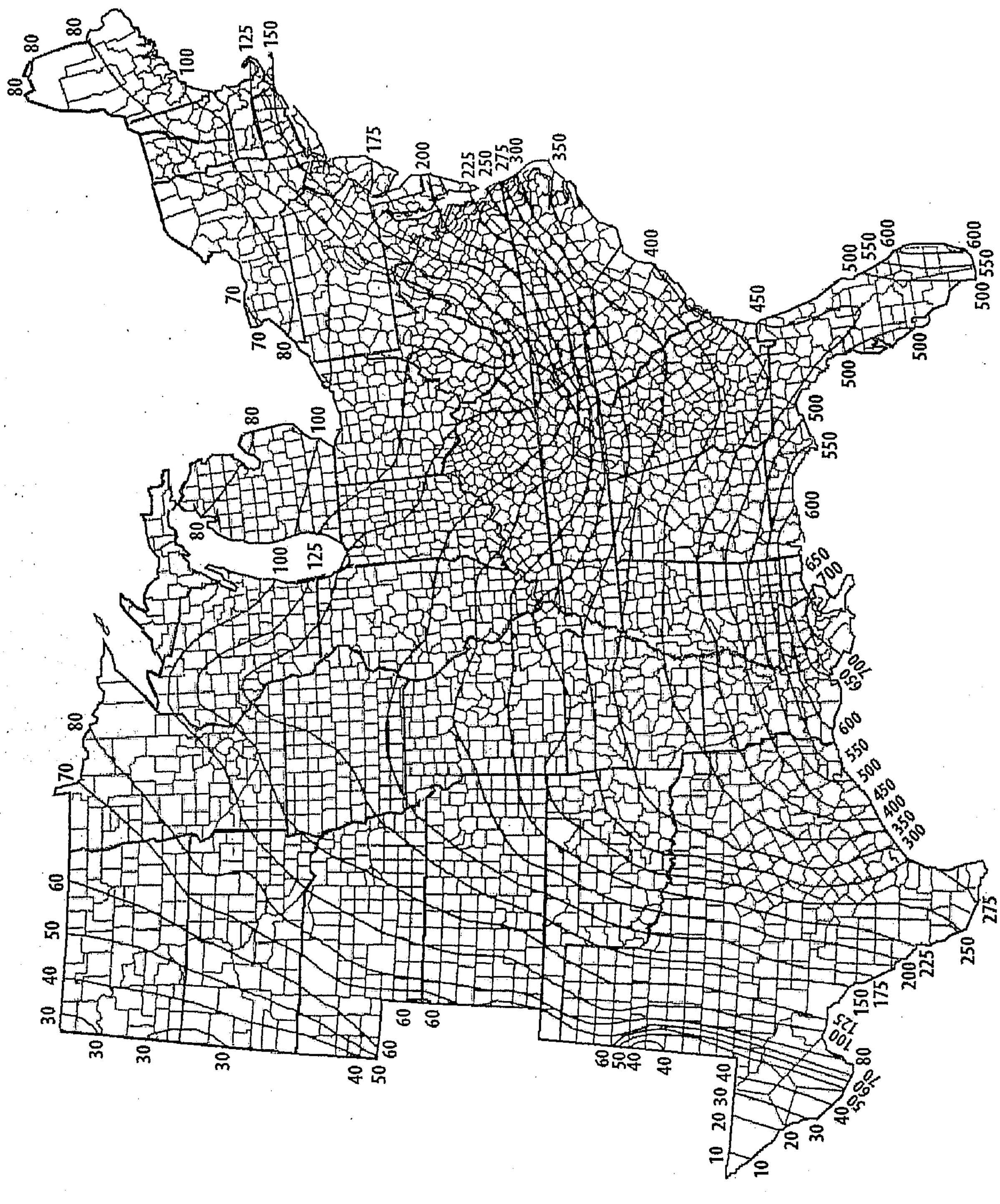
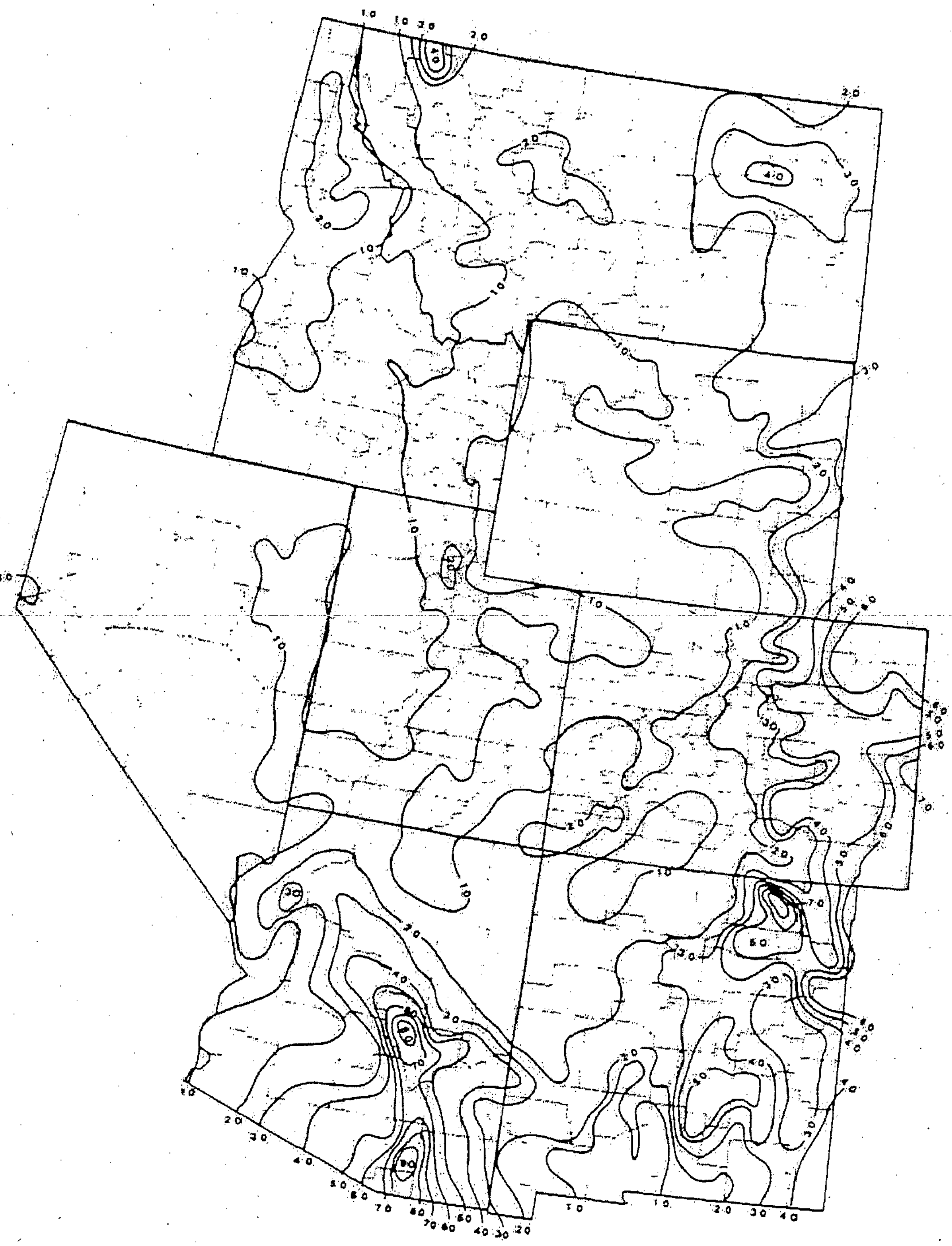


Figure 2. Isoerodent Map of the Eastern U.S.



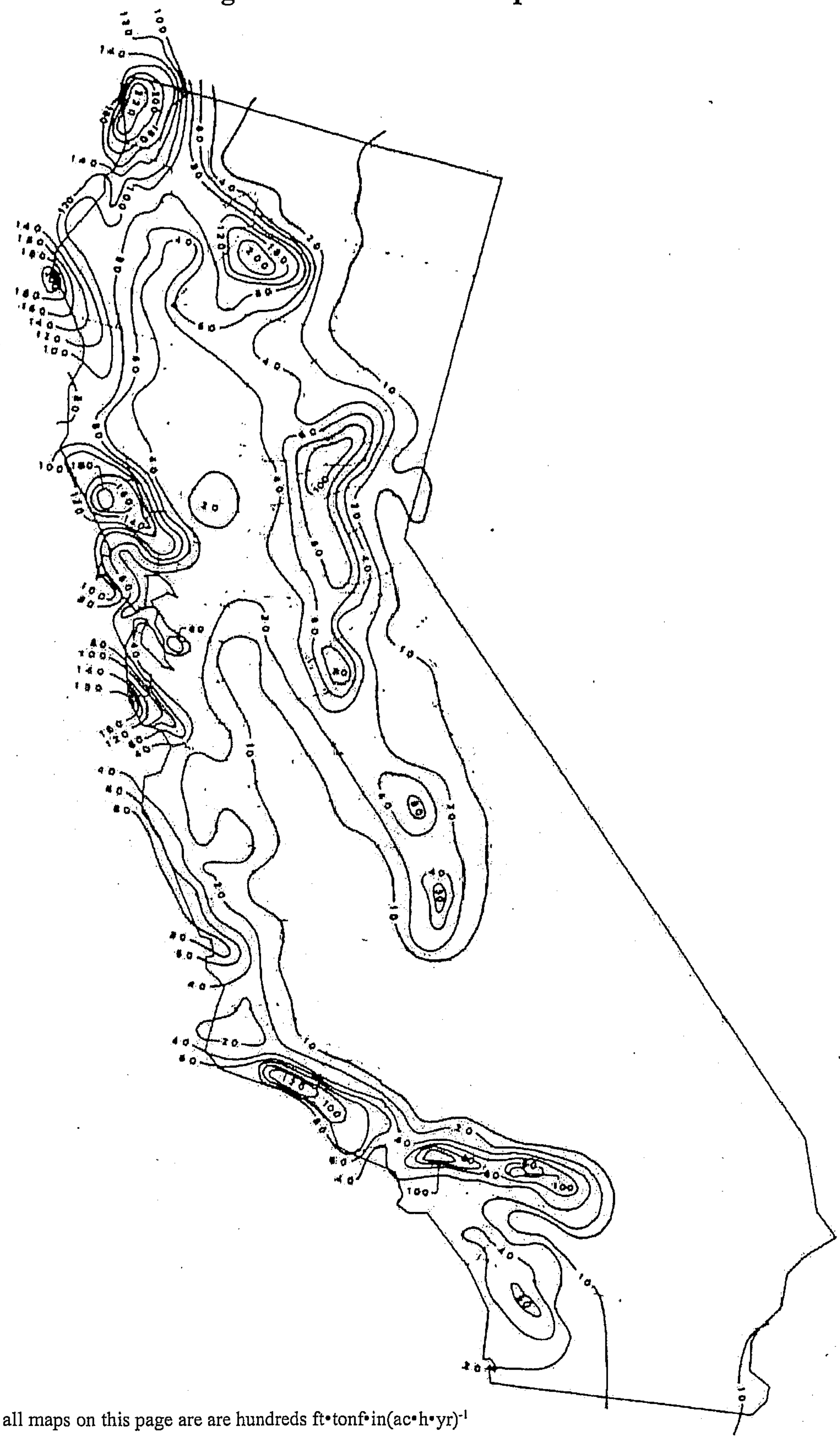
Note: Units for all maps on this page are are hundreds ft•tonf•in(ac•h•yr)$^{-1}$

Figure 3. Isoerodent Map of the Western U.S.



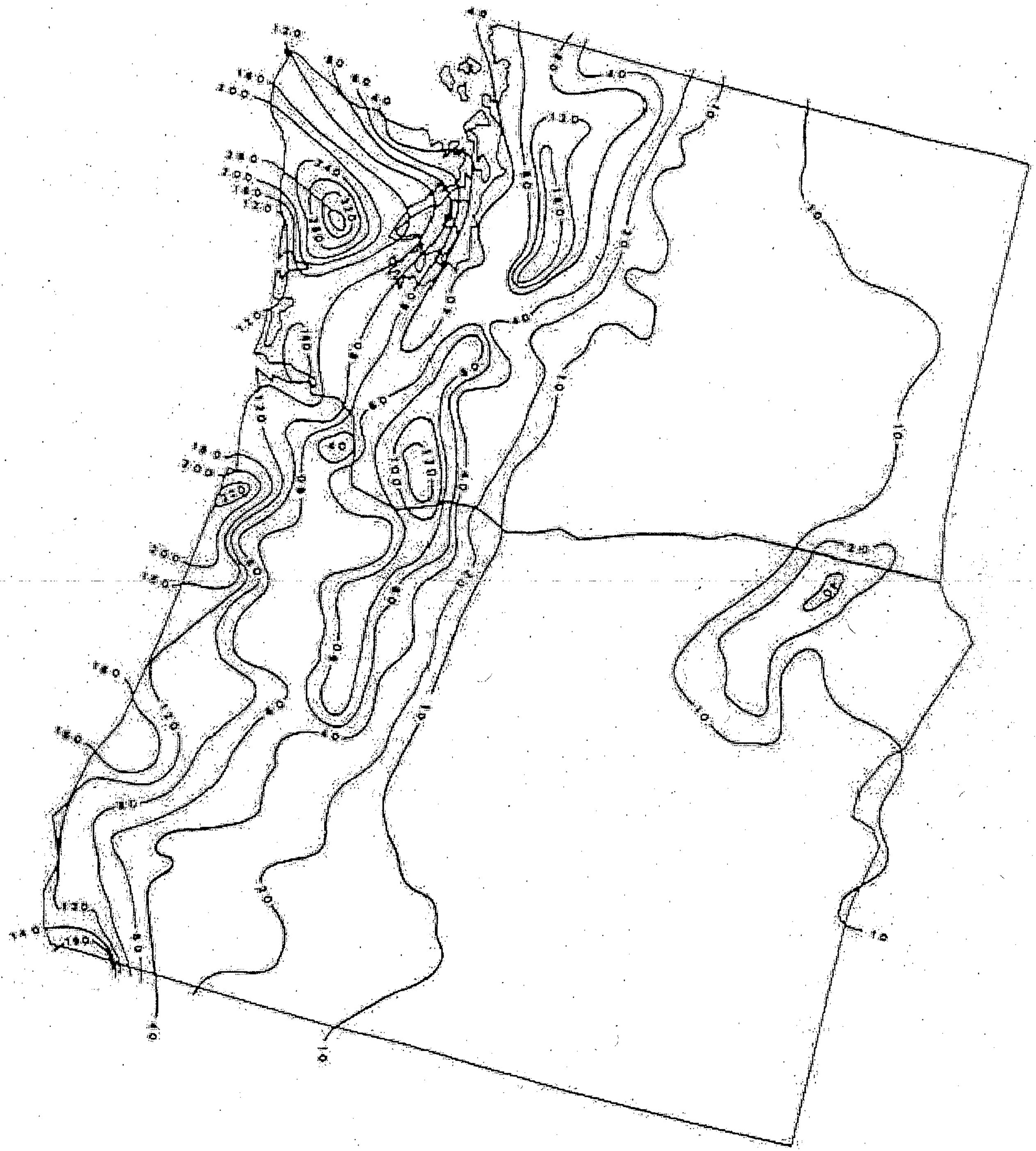
Note: Units for all maps on this page are are hundreds ft•tonf•in(ac•h•yr)$^{-1}$

Figure 4. Isoerodent Map of California



Note: Units for all maps on this page are are hundreds ft•tonf•in(ac•h•yr)$^{-1}$

Figure 5. Isoerodent Map of Oregon and Washington



Note: Units for all maps on this page are are hundreds ft•tonf•in(ac•h•yr)$^{-1}$

Table 1. Erosivity Index Table

EI as a percentage of Average Annual R Value Computed for Geographic Areas Shown in Figure 1

	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec
EI#	1-15	16-31	1-15	16-29	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31
1	0.0	4.3	8.3	12.8	17.3	21.6	25.1	28.0	30.9	34.9	39.1	42.6	45.4	48.2	50.8	53.0	56.0	60.8	66.8	71.0	75.7	82.0	89.1	95.2
2	0.0	4.3	8.3	12.8	17.3	21.6	25.1	28.0	30.9	34.9	39.1	42.6	45.4	48.2	50.8	53.0	56.0	60.8	66.8	71.0	75.7	82.0	89.1	95.2
3	0.0	7.4	13.8	20.9	26.5	31.8	35.3	38.5	40.2	41.6	42.5	43.6	44.5	45.1	45.7	46.4	47.7	49.4	52.8	57.0	64.5	73.1	83.3	92.3
4	0.0	3.9	7.9	12.6	17.4	21.6	25.2	28.7	31.9	35.1	38.2	42.0	44.9	46.7	48.2	50.1	53.1	56.6	62.2	67.9	75.2	83.5	90.5	96.0
5	0.0	2.3	3.6	4.7	6.0	7.7	10.7	13.9	17.8	21.2	24.5	28.1	31.1	33.1	35.3	38.2	43.2	48.7	57.3	67.8	77.9	86.0	91.3	96.9
6	0.0	0.0	0.0	0.5	2.0	4.1	8.1	12.6	17.6	21.6	25.5	29.6	34.5	40.0	45.7	50.7	55.6	60.2	66.5	75.5	85.6	95.9	99.5	99.9
7	0.0	0.0	0.0	0.0	0.0	1.2	4.9	8.5	13.9	19.0	26.1	35.4	43.9	48.8	53.9	64.5	73.4	77.5	80.4	84.8	89.9	96.6	99.2	99.7
8	0.0	0.0	0.0	0.0	0.0	0.9	3.6	7.8	15.0	20.2	27.4	38.1	49.8	57.9	65.0	75.6	82.7	86.8	89.4	93.4	96.3	99.1	100.0	100.0
9	0.0	0.8	3.1	4.7	7.4	11.7	17.8	22.5	27.0	31.4	36.0	41.6	46.4	50.1	53.4	57.4	61.7	64.9	69.7	79.0	89.6	97.4	100.0	100.0
10	0.0	0.3	0.5	0.9	2.0	4.3	9.2	13.1	18.0	22.7	29.2	39.5	46.3	48.8	51.1	57.2	64.4	67.7	71.1	77.2	85.1	92.5	96.5	99.0
11	0.0	5.4	11.3	18.8	26.3	33.2	37.4	40.7	42.5	44.3	45.4	46.5	47.1	47.4	47.8	48.3	49.4	50.7	53.6	57.5	65.5	76.2	87.4	94.8
12	0.0	3.5	7.8	14.0	21.1	27.4	31.5	35.0	37.3	39.8	41.9	44.3	45.6	46.3	46.8	47.9	50.0	52.9	57.9	62.3	69.3	81.3	91.5	96.7
13	0.0	0.0	0.0	1.8	7.2	11.9	16.7	19.7	24.0	31.2	42.4	55.0	60.0	60.8	61.2	62.6	65.3	67.6	71.6	76.1	83.1	93.3	98.2	99.6
14	0.0	0.7	1.8	3.3	6.9	16.5	26.6	29.9	32.0	35.4	40.2	45.1	51.9	61.1	67.5	70.7	72.8	75.4	78.6	81.9	86.4	93.6	97.7	99.3
15	0.0	0.0	0.0	0.5	2.0	4.4	8.7	12.0	16.6	21.4	29.7	44.5	56.0	60.8	63.9	69.1	74.5	79.1	83.1	87.0	90.9	96.6	99.1	99.8
16	0.0	0.0	0.0	0.5	2.0	5.5	12.3	16.2	20.9	26.4	35.2	48.1	58.1	63.1	66.5	71.9	77.0	81.6	85.1	88.4	91.5	96.3	98.7	99.6
17	0.0	0.0	0.0	0.7	2.8	6.1	10.7	12.9	16.1	21.9	32.8	45.9	55.5	60.3	64.0	71.2	77.2	80.3	83.1	87.7	92.6	97.2	99.1	99.8
18	0.0	0.0	0.0	0.6	2.5	6.2	12.4	16.4	20.2	23.9	29.3	37.7	45.6	49.8	53.3	58.4	64.3	69.0	75.0	86.6	93.9	96.6	98.0	100.0
19	0.0	1.0	2.6	7.4	16.4	23.5	28.0	31.0	33.5	37.0	41.7	48.1	51.1	52.0	52.5	53.6	55.7	57.6	61.1	65.8	74.7	88.0	95.8	98.7
20	0.0	9.8	18.5	25.4	30.2	35.6	38.9	41.5	42.9	44.0	45.2	48.2	50.8	51.7	52.5	54.6	57.4	58.5	60.1	63.2	69.6	76.7	85.4	92.4
21	0.0	7.5	13.6	18.1	21.1	24.4	27.0	29.4	31.7	34.6	37.3	39.6	41.6	43.4	45.4	48.1	51.3	53.3	56.6	62.4	72.4	81.3	88.9	94.7
22	0.0	1.2	1.6	1.6	1.6	1.6	1.6	2.2	3.9	4.6	6.4	14.2	32.8	47.2	58.8	69.1	76.0	82.0	87.1	96.7	99.9	99.9	99.9	99.9
23	0.0	7.9	15.0	20.9	25.7	31.1	35.7	40.2	43.2	46.2	47.7	48.8	49.4	49.9	50.7	51.8	54.1	57.7	62.8	65.9	70.1	77.3	86.8	93.5
24	0.0	12.2	23.6	33.0	39.7	47.1	51.7	55.9	57.7	58.6	58.9	59.1	59.1	59.2	59.2	59.3	59.5	60.0	61.4	63.0	66.5	71.8	81.3	89.6
25	0.0	9.8	20.8	30.2	37.6	45.8	50.6	54.4	56.0	56.8	57.1	57.1	57.2	57.6	58.5	59.8	62.2	65.3	67.5	68.2	69.4	74.8	86.6	93.0
26	0.0	2.0	5.4	9.8	15.6	21.5	24.7	26.6	27.4	28.0	28.7	29.8	32.5	36.6	44.9	55.4	65.7	72.6	77.8	84.4	89.5	93.9	96.5	98.4
27	0.0	0.0	0.0	1.0	4.0	5.9	8.0	11.1	13.0	14.0	14.6	15.3	17.0	23.2	39.1	60.0	76.3	86.1	89.7	90.4	90.9	93.1	96.6	99.1
28	0.0	0.0	0.0	0.0	0.2	0.5	1.5	3.3	7.2	11.9	17.7	21.4	27.0	37.1	51.4	62.3	70.6	78.8	84.6	90.6	94.4	97.9	99.3	100.0
29	0.0	0.6	0.7	0.7	0.7	1.5	3.9	6.0	10.5	17.9	28.8	36.6	43.8	51.5	59.3	68.0	74.8	80.3	84.3	88.8	92.7	98.0	99.8	99.9
30	0.0	0.0	0.0	0.0	0.0	0.2	0.8	2.8	7.9	14.2	24.7	35.6	45.4	52.2	58.7	68.5	77.6	84.5	88.9	93.7	96.2	97.6	98.3	99.6

Table 1. Erosivity Index Table (cont.)

	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec
EI#	1-15	16-31	1-15	16-29	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31
31	0	0	0	0	0	0.2	1	3.5	9.9	15.7	26.4	47.2	61.4	65.9	69	77.2	86	91.6	94.8	98.7	100	100	100	100
32	0	0.1	0.1	0.1	0.1	0.6	2.2	4.3	9	14.2	23.3	34.6	46.3	54.2	61.7	72.9	82.5	89.6	93.7	98.2	99.7	99.9	99.9	99.9
33	0	0	0	0	0	0.6	2.3	4.2	8.8	16.1	30	46.9	57.9	62.8	66.2	72.1	79.1	85.9	91.1	97	98.9	98.9	98.9	98.9
34	0	0	0	0	0	1.8	7.3	10.7	15.5	22	29.9	35.9	42	48.5	56.9	67	76.9	85.8	91.2	95.7	97.8	99.6	100	100
35	0	0	0	0	0	2.5	10.2	15.9	22.2	27.9	34.7	43.9	51.9	56.9	61.3	67.3	73.9	80.1	85.1	89.6	93.2	98.2	99.8	99.8
36	0	0	0	0	0	0.9	3.4	6.7	12.7	18.5	26.6	36.3	46	53.5	60.2	68.3	75.8	82.6	88.3	96.3	99.3	99.9	100	100
37	0	0	0	0	0	0	0	1	3.9	9.1	19.1	26.7	36.3	47.9	61.4	75.1	84.5	92.3	96	99.1	100	100	100	100
38	0	0	0	1.1	4.3	7.2	11	13.9	17.9	22.3	30.3	43.1	55.1	61.3	65.7	72.1	77.9	82.6	86.3	90.3	93.8	98.4	100	100
39	0	0	0	0	0	1.6	6.5	11	17.8	24.7	33.1	42.8	50.3	54.9	59.7	68.9	78.1	83.6	87.5	93	96.5	99.2	100	100
40	0	0	0	0	0	1.5	6.2	10.1	16.3	23.3	32.5	42.2	50.1	55.6	60.5	67.5	74.3	79.4	84.1	91.1	95.8	99.1	100	100
41	0	0.1	0.2	0.2	0.2	0.2	0.2	0.4	1.1	6.8	22.9	40.1	54.9	63.8	70.7	81.5	89.8	96.3	98.7	99.2	99.3	99.4	99.4	99.7
42	0	0	0	0	0	0	0	0.2	0.9	5.2	17.3	33.8	53.2	66.5	75.9	87.6	93.7	97.5	99	99.7	100	100	100	100
43	0	0	0	0	0	0	0	0.1	0.4	2.7	9.5	21.9	42.7	58.6	71.1	84.6	91.9	97.1	99	99.8	100	100	100	100
44	0	1.7	2.3	2.4	2.4	2.4	2.4	2.7	3.5	7.6	18.5	34.3	52.5	64	72.3	83.3	90	95.1	97.3	98.5	98.9	98.9	98.9	99.2
45	0	0.2	0.2	0.3	0.3	0.4	0.6	0.8	1.4	3.7	10.2	22.6	41.8	54	64.5	78.7	88.4	96	98.7	99.4	99.7	99.7	99.8	99.9
46	0	0	0	0	0	0	0	0.6	2.6	7.5	19.6	32.9	48.9	63	73.5	83.3	89.5	95.6	98.3	99.6	100	100	100	100
47	0	0	0	0	0	0	0	0.4	1.6	5.8	17	33	52.5	66.4	75.7	85.5	91.3	96.5	98.8	100	100	100	100	100
48	0	0	0	0	0	0	0	0	0	2	8.1	15.4	27.8	40.7	52.6	61.1	69.3	82.6	92	98	100	100	100	100
49	0	0	0	0	0	0	0	0.7	2.7	8.3	20	27.5	35.6	44.6	56	70.2	81.3	89.2	93.6	98.5	100	100	100	100
50	0	0	0	0	0	0.1	0.4	2.4	8.2	13.7	23.8	38.8	55.1	66.1	73.6	81.8	87.7	93.8	97	99.4	100	100	100	100
51	0	0	0	0	0	0.3	1	3.1	8.7	18.8	35.8	49.6	60.4	70.2	77	84	88.8	93.8	96.6	99.1	100	100	100	100
52	0	0	0	0	0	0	0	0.6	2.5	6.8	17.5	29.8	46.1	60.5	72.7	86	92.8	96.8	98.4	99.7	100	100	100	100
53	0	0	0	0	0	0	0	0.8	3	9.5	24.2	35.3	48	63.1	76.1	87.7	93.5	97.2	98.6	99.5	99.8	99.9	100	100
54	0	0	0	0	0	0.2	0.7	2.4	7.2	14.7	27.2	37.2	47.3	58.8	67.6	74	79.2	86.7	92.6	97.9	99.8	99.9	100	100
55	0	0	0	0	0	0	0	1.3	5.4	13.3	25.5	31.6	38.8	52.5	66.8	75.5	81.2	87.9	92.8	98.3	100	100	100	100
56	0	0	0	0	0	0	0	1.3	5.1	11.4	22.3	29.5	38.5	51.1	65.2	77.8	85.6	91.7	95	98.7	100	100	100	100
57	0	0	0	0	0	0	0.1	1	3.5	9.2	21.5	31	43.5	60.4	75.1	86.1	91.6	96.2	98.1	99.4	99.9	99.9	100	100
58	0	0	0	0	0	0.2	0.9	2.9	8	13.2	21	29.1	38	45.9	54.5	65.4	74.8	82.1	87.5	95.4	98.8	99.7	100	100
59	0	0	0	0	0	0	0	2.2	8.9	15.6	24.2	31.1	38.3	46	54.9	64.2	73.2	81.9	88.5	95.7	98.6	99.4	99.7	99.7
60	0	0	0	0	0	0	0	0.4	1.5	4	9.5	13.3	20.5	33.6	52.8	66.5	76.7	88.1	94.2	98.6	100	100	100	100

Table 1. Erosivity Index Table (cont.)

EI#	Jan 1-15	Jan 16-31	Feb 1-15	Feb 16-29	Mar 1-15	Mar 16-31	Apr 1-15	Apr 16-30	May 1-15	May 16-31	Jun 1-15	Jun 16-30	Jul 1-15	Jul 16-31	Aug 1-15	Aug 16-31	Sep 1-15	Sep 16-31	Oct 1-15	Oct 16-31	Nov 1-15	Nov 16-31	Dec 1-15	Dec 16-31
61	0	0	0	0	0	0	0	1.3	5	8.5	15.5	29.8	41.8	46	49.2	56	65.1	71.6	78.6	91.1	97.3	99.3	100	100
62	0	0	0	0.1	0.3	0.8	2.1	3.6	6.5	9.7	13.7	16.5	20.8	27.3	40.1	56.9	72.6	83.4	89.4	95.5	98.1	99.6	100	100
63	0	0	0	0	0	0	0	0.9	3.7	7.8	13.3	15.8	19.9	29	46.8	64.7	78.3	88.8	93.9	98.5	100	100	100	100
64	0	0	0	0.7	2.8	7.4	12.4	14.4	15.6	17.3	19.4	21	24.4	32.3	48	61.4	72.1	81.9	87	90.1	92.4	98.1	100	100
65	0	3.6	7	9.6	11.4	13	14.4	16.3	17.7	18.4	19.3	20.5	23.6	32	50	66.2	77.2	85.4	88.8	90.4	91.3	92.7	94.8	97
66	0	0	0	0	0	0.1	0.5	1.1	2.2	3.6	6	7.6	11.1	19.8	38.9	59.7	74.4	83.2	88.1	94.6	97.7	99.4	100	100
67	0	0	0	0	0	0.1	0.4	0.9	1.6	1.9	2.4	5	12.1	24.8	48.3	73.6	86.5	92	94.3	96.6	97.9	99.5	100	100
68	0	2.3	4.5	7.8	10.4	12	13.3	16.3	17.7	18.1	18.2	18.3	18.4	19.9	24.5	35	54.4	69.4	78.6	85.7	89.2	91.9	93.9	97
69	0	2	3.7	5.7	7.8	10.5	12.4	13.7	14.3	14.7	15.1	15.7	17.1	22.7	36.7	50.4	63.6	75	81.8	87.8	90.8	93.2	94.9	97.5
70	0	0.5	0.7	1	1.3	1.7	2.2	2.8	3.4	3.9	4.7	5.4	7.4	15.7	36.5	55.8	70.3	80.9	86.4	90.9	93.4	96.4	98.1	99.4
71	0	0.7	1.2	1.6	2.1	2.8	3.3	3.6	4	4.5	5.6	6.5	9.1	18.5	40.6	59.7	74	86.3	91.7	94.7	96	96.7	97.3	98.8
72	0	0	0	0	0	0	0.1	0.2	0.7	0.8	1.3	3.5	9.9	24.7	51.4	71.5	83.6	93.8	97.7	99.2	99.8	99.9	99.9	100
73	0	0	0.1	0.1	0.2	0.2	0.3	0.6	1.3	4.1	11.5	18.1	28.3	40.2	54.1	67	77.2	87.7	93.3	97.5	99.1	99.6	99.8	100
74	0	0	0	0	0	0.1	0.2	0.5	1.2	2.7	6.4	10.2	18.4	31	50.7	68.7	81.2	91.6	96.1	98.4	99.2	99.8	100	100
75	0	0.1	0.1	0.1	0.2	0.5	1.3	1.9	3	4.1	6.6	10	17.6	28.3	44.7	59.4	71.6	83.9	90.3	94.7	96.7	98.8	99.6	99.9
76	0	0	0	0	0	0.1	0.2	0.6	1.3	2	3.5	4.9	8.4	17.4	37.3	57.5	72.9	83.7	89.5	95.8	98.4	99.6	100	100
77	0	0.2	0.3	0.3	0.4	0.8	1.5	2	2.8	3.9	5.9	7.2	10.3	21.5	46.5	66.3	78.3	86.5	90.8	96	98.2	99.1	99.5	99.8
78	0	0	0	0	0	0	0.2	0.5	1.6	3.8	8.9	13.2	21.8	35.8	56.6	75.4	86	92.9	95.9	98.2	99.2	99.8	100	100
79	0	0	0	0	0	0.2	0.7	1.3	2.7	5.8	12.7	18.8	28.8	41.6	58.4	75.7	86.5	94.2	97.3	98.9	99.5	99.9	100	100
80	0	0.6	1.2	1.6	2.1	2.5	3.3	4.5	6.9	10.1	15.5	19.7	26.6	36.4	51.7	67.5	79.4	88.8	93.2	96.1	97.3	98.2	98.7	99.3
81	0	0.1	0.1	0.2	0.4	0.5	0.8	0.9	1.5	3.9	9.9	12.8	18.2	30.7	54.1	77.1	89	94.9	97.2	98.7	99.3	99.6	99.7	99.9
82	0	0	0.1	0.1	0.2	0.2	0.5	1.2	3.1	6.7	14.4	20.1	29.8	44.5	64.2	83.1	92.2	96.4	98.1	99.3	99.7	99.8	99.8	99.9
83	0	0	0.1	0.1	0.1	0.3	0.9	1.6	3.5	8.3	19.4	30	44	59.2	72.4	84.6	91.2	96.5	98.6	99.5	99.8	99.9	100	100
84	0	0	0.1	0.1	0.2	0.3	0.6	1.7	4.9	9.9	19.5	27.2	38.3	52.8	68.8	83.9	91.6	96.4	98.2	99.2	99.6	99.8	99.8	99.9
85	0	0	0	0	0	0	1	2	3	6	11	23	36	49	63	77	90	95	98	99	100	100	100	100
86	0	0	0	0	0	0	1	2	3	6	11	23	36	49	63	77	90	95	98	99	100	100	100	100
87	0	0	0	0	1	1	2	3	6	10	17	29	43	55	67	77	85	91	96	98	99	100	100	100
88	0	0	0	0	1	1	2	3	6	13	23	37	51	61	69	78	85	91	94	96	98	99	99	100
89	0	0	1	1	2	3	4	7	12	18	27	38	48	55	62	69	76	83	90	94	97	98	99	100
90	0	1	2	3	4	6	8	13	21	29	37	46	54	60	65	69	74	81	87	92	95	97	98	99

Table 1. Erosivity Index Table (cont.)

EI#	Jan 1-15	Jan 16-31	Feb 1-15	Feb 16-29	Mar 1-15	Mar 16-31	Apr 1-15	Apr 16-30	May 1-15	May 16-31	Jun 1-15	Jun 16-30	Jul 1-15	Jul 16-31	Aug 1-15	Aug 16-31	Sep 1-15	Sep 16-31	Oct 1-15	Oct 16-31	Nov 1-15	Nov 16-31	Dec 1-15	Dec 16-31
91	0	0	0	0	1	1	1	2	6	16	29	39	46	53	60	67	74	81	88	95	99	99	100	100
92	0	0	0	0	1	1	1	2	6	16	29	39	46	53	60	67	74	81	88	95	99	99	100	100
93	0	1	1	2	3	4	6	8	13	25	40	49	56	62	67	72	76	80	85	91	97	98	99	99
94	0	1	2	4	6	8	10	15	21	29	38	47	53	57	61	65	70	76	83	88	91	94	96	98
95	0	1	3	5	7	9	11	14	18	27	35	41	46	51	57	62	68	73	79	84	89	93	96	98
96	0	2	4	6	9	12	17	23	30	37	43	49	54	58	62	66	70	74	78	82	86	90	94	97
97	0	1	3	5	7	10	14	20	28	37	48	56	61	64	68	72	77	81	86	89	92	95	98	99
98	0	1	2	4	6	8	10	13	19	26	34	42	50	58	63	68	74	79	84	89	93	95	97	99
99	0	0	0	1	1	2	3	5	7	12	19	33	48	57	65	72	82	88	93	96	98	99	100	100
100	0	0	0	0	1	1	2	3	5	9	15	27	38	50	62	74	84	91	95	97	98	99	99	100
101	0	0	0	1	2	3	4	6	9	14	20	28	39	52	63	72	80	87	91	94	97	98	99	100
102	0	0	1	2	3	4	6	8	11	15	22	31	40	49	59	69	78	85	91	94	96	98	99	100
103	0	1	2	3	4	6	8	10	14	18	25	34	45	56	64	72	79	84	89	92	95	97	98	99
104	0	2	3	5	7	10	13	16	19	23	27	34	44	54	63	72	80	85	89	91	93	95	96	98
105	0	1	3	6	9	12	16	21	26	31	37	43	50	57	64	71	77	81	85	88	91	93	95	97
106	0	3	6	9	13	17	21	27	33	38	44	49	55	61	67	71	75	78	81	84	86	90	94	97
107	0	3	5	7	10	14	18	23	27	31	35	39	45	53	60	67	74	80	84	86	88	90	93	95
108	0	3	6	9	12	16	20	24	28	33	38	43	50	59	69	75	80	84	87	90	92	94	96	98
109	0	3	6	10	13	16	19	23	26	29	33	39	47	58	68	75	80	83	86	88	90	92	95	97
110	0	1	3	5	7	9	12	15	18	21	25	29	36	45	56	68	77	83	88	91	93	95	97	99
111	0	1	2	3	4	5	6	8	11	15	20	28	41	54	65	74	82	87	92	94	96	97	98	99
112	0	0	0	1	2	3	4	5	7	12	17	24	33	42	55	67	76	83	89	92	94	96	98	99
113	0	1	2	3	4	5	6	8	10	12	17	22	31	42	52	60	68	75	80	85	89	92	96	98
114	0	1	2	4	6	8	11	13	11	13	21	26	32	38	46	55	64	71	77	81	85	89	93	97
115	0	1	2	3	4	5	6	8	10	14	19	26	34	45	56	66	76	82	86	90	93	95	97	99
116	0	1	3	5	7	9	12	15	18	21	25	29	36	45	56	68	77	83	88	91	93	95	97	99
117	0	1	2	3	4	5	7	9	11	14	17	22	31	42	54	65	74	83	89	92	95	97	98	99
118	0	2	4	6	8	12	16	20	25	30	35	41	47	56	67	75	81	85	87	89	91	93	95	97
119	0	1	2	4	6	7	9	12	15	18	23	31	40	48	57	63	72	78	88	92	96	97	98	99
120	0	8	16	25	33	41	46	50	53	54	55	56	56.5	57	57.75	58	58.75	60	61	63	66.5	72	80	90

Table 1. Erosivity Index Table (cont.)

0	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	Jun	Jun	Jul	Jul	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec
EI#	1-15	16-31	1-15	16-29	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31	1-15	16-31
121	0	7	14	20	25.5	33.5	38	43	46	50	52.5	54.5	56	58	59	60	61.5	63	65	68	72	79	86	93
122	0	4	8	12	17	23	29	34	38	44	49	53	56	59	62	65	69	72	75	79	83	88	93	96
123	0	4	9	15	23	29	34	40	44	48	50	51	52	53	55	57	60	62	64	67	72	80	88	95
124	0	7	12	17	24	30	39	45	50	53	55	56	57	58	59	61	62	63	64	66	70	77	84	92
125	0	9	16	23	30	37	43	47	50	52	54	55	56	57	58	59	60	62	64	67	71	77	86	93
126	0	8	15	22	28	33	38	42	46	50	52	53	53	53	53	54	55	57	59	63	68	75	83	92
127	0	8	15	22	29	34	40	45	48	51	54	57	59	62	63	64	65	66	67	69	72	76	83	91
128	0	9	16	22	27	32	37	41	45	48	51	53	55	56	57	57	58	59	61	64	68	73	79	89
129	0	10	20	28	35	41	46	49	51	53	55	56	56	57	58	59	60	61	62	65	69	74	81	90
130	0	8	15	22	28	33	38	41	44	47	49	51	53	55	56	58	59	60	63	65	69	75	84	92
131	0	10	18	25	29	33	36	39	41	42	44	45	46	47	48	49	51	53	56	59	64	70	80	90
132	0	8	16	24	32	40	46	51	54	56	57	58	58	59	59	60	60	61	62	64	68	74	83	91
133	0	12	22	31	39	45	49	52	54	55	56	56	56	56	57	57	57	57	58	59	62	68	77	88
134	0	7	15	22	30	37	43	49	53	55	57	58	59	60	61	62	63	65	67	70	74	79	85	92
135	0	11	21	29	37	44	50	55	57	59	60	60	60	60	61	61	61	62	63	64	67	71	78	89
136	0	10	18	25	30	39	46	51	54	57	58	59	59	60	60	60	61	62	63	64	67	72	80	90
137	0	11	22	31	39	46	52	56	58	59	60	61	61	61	61	62	62	62	63	64	66	71	78	89
138	0	8	14	20	25	32	37	42	47	50	53	55	56	58	59	61	63	64	66	68	71	76	85	93
139	0	10.6	21.2	28.6	36	41.4	46.8	49.3	51.8	52.5	53.2	53.5	53.7	53.9	54	54.3	54.7	55.7	56.8	61.6	65.3	73.9	82.5	91.2
140	0	0.2	0.3	0.3	0.3	0.3	0.3	0.8	1.3	5.3	9.3	30.1	50.8	56.8	62.9	67.5	72.2	75.8	79.4	85.6	91.7	95.9	100	100
141	0	10.7	21.4	28.7	36	41.7	47.3	50.3	53.2	54.5	55.7	56.2	56.7	56.9	57	57.4	57.8	59	60.2	64.1	67.9	76.1	84.2	92.1
142	0	2.7	5.5	5.7	5.9	7.1	8.4	10	11.7	15.3	19	22.6	26.1	29	31.9	36.6	41.2	46	50.7	62.3	73.9	83.5	93.1	96.6
143	0	8.7	17.5	25.2	33	39.9	46.7	50.8	54.8	56.2	57.6	58	58.4	58.9	59.4	60.8	62.3	64.1	65.9	68.8	71.7	78.6	85.5	92.7
144	0	4.3	8.6	9.3	10.1	11.1	12	15.3	18.6	22.7	26.7	28.7	30.7	31.3	32	34	36	44.4	52.9	60.1	67.3	78.2	89.2	94.6
145	0	11.7	23.3	33.5	43.7	50.7	57.6	60.3	63	63.5	64.1	64.2	64.2	64.5	64.8	66.1	67.3	68.6	69.8	70.7	71.6	79.2	86.7	93.4
146	0	4.8	9.6	13.1	16.5	22.6	28.7	30.8	32.8	33.3	33.8	34	34.2	36.4	38.6	43	47.5	56	64.5	66.2	67.9	77.9	88	94
147	0	0	4.7	9.4	10.8	12.2	13.2	14.3	14.9	15.5	24.2	32.8	45.5	58.2	67.9	77.6	86.3	95.1	95.6	96.1	98	100	100	100
148	0	5.5	11	19.2	27.5	36.6	45.7	47.8	50	50.9	51.7	52.1	52.5	54.2	55.9	60.1	64.4	70.5	76.7	81.2	85.7	90.4	101	97.6
149	0	2.4	4.9	7.4	9.9	11.7	13.6	14.6	15.6	16.2	16.8	17.2	17.7	24.7	31.7	46.9	62.1	67	72	80.7	89.3	92.3	95.3	97.7

A003376

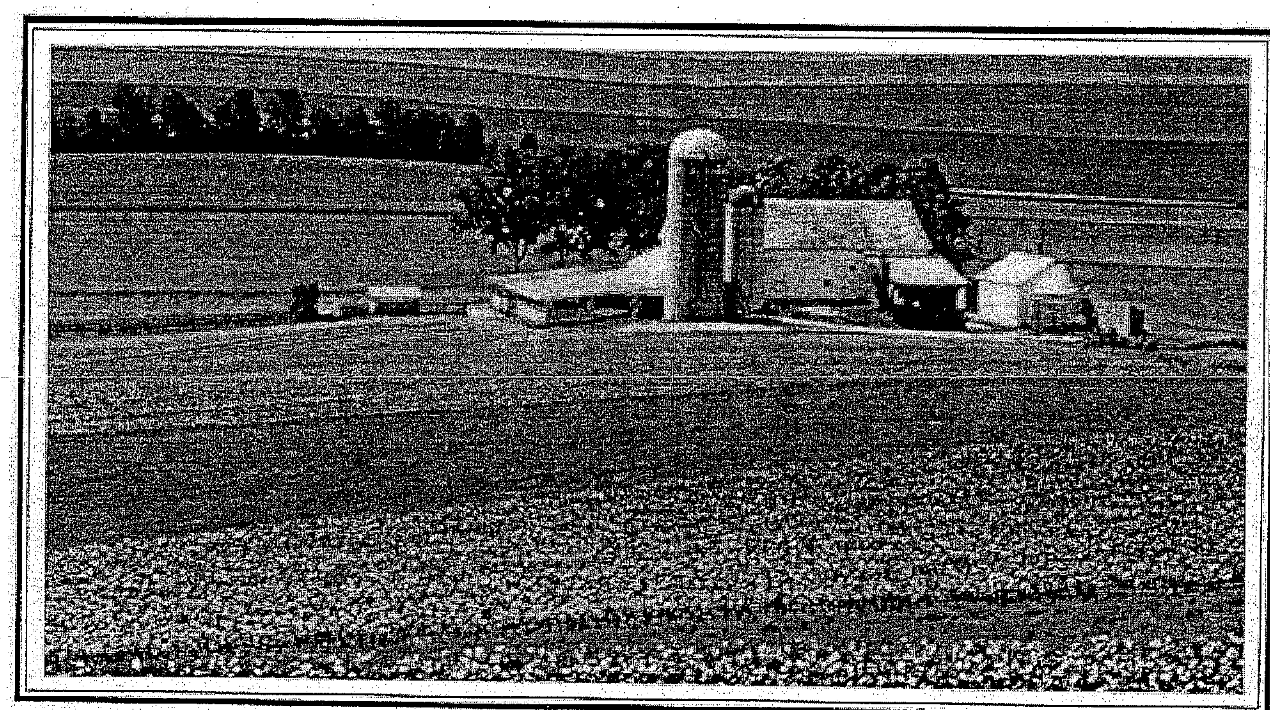
USDA

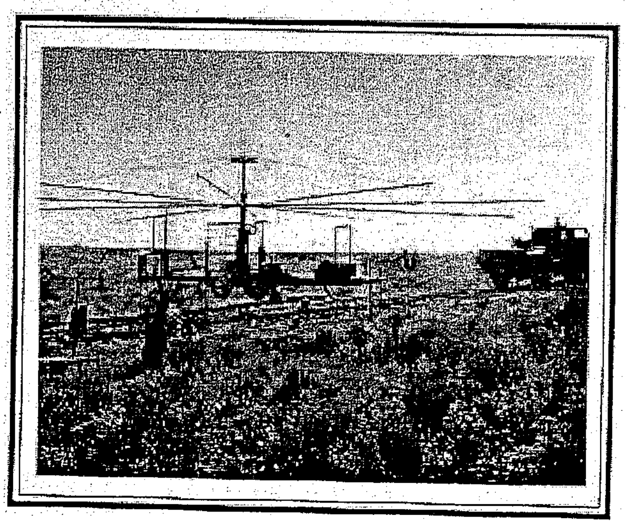
United States
Department of
Agriculture

Agricultural
Research
Service

Agriculture
Handbook
Number 703

Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE)





A003377

PREDICTING SOIL EROSION BY WATER: A GUIDE TO CONSERVATION PLANNING WITH THE REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)

K.G. Renard, G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, Coordinators*

*Renard (retired) was research hydraulic engineer, USDA-ARS, Southwest Watershed Research Center, 2000 East Allen Road, Tucson, AZ. Foster is director, USDA-ARS, Sedimentation Laboratory, Oxford, MS. Weesies is conservation agronomist, USDA-NRCS, National Soil Erosion Research Laboratory, Purdue University, Building SOIL, West Lafayette, IN. McCool is agricultural engineer, USDA-ARS, Washington State University, Pullman, WA. Yoder is assistant professor, Agricultural Engineering Department, University of Tennessee, Knoxville, TN.

For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328
ISBN 0-16-048938-5

ABSTRACT

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703, 404 pp.

The Revised Universal Soil Loss Equation (RUSLE) is an erosion model predicting longtime average annual soil loss (A) resulting from raindrop splash and runoff from specific field slopes in specified cropping and management systems and from rangeland. Widespread use has substantiated the RUSLE's usefulness and validity. RUSLE retains the six factors of Agriculture Handbook No. 537 to calculate A from a hillslope. Technology for evaluating these factor values has been changed and new data added. The technology has been computerized to assist calculation. Thus soil-loss evaluations can be made for conditions not included in the previous handbook using fundamental information available in three data bases: CITY, which includes monthly precipitation and temperature, front-free period, annual rainfall erosivity (R) and twice monthly distributions of storm erosivity (E); CROP, including below-ground biomass, canopy cover, and canopy height at 15-day intervals as well as information on crop characteristics; and OPERATION, reflecting soil and cover disturbances that are associated with typical farming operations.

KEYWORDS: soil erosion, cropland, rangeland, rill erosion, interrill erosion, rainfall-runoff erosivity, soil erodibility, slope length, slope steepness, prior land use, surface cover, crop canopy, surface roughness, soil moisture, contouring, stripcropping, terracing, personal computer, residue decomposition

While supplies last, single copies of this publication may be obtained at no cost from USDA-ARS, Southwest Watershed Research Center, 2000 East Allen Road, Tucson, AZ 85719.

Copies of this publication may be purchased from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

Issued January 1997

This publication supersedes Agriculture Handbook No. 537, titled "Predicting Rainfall Erosion Losses: A Guide to Conservation Planning."

CHAPTER 2. RAINFALL-RUNOFF EROSIVITY FACTOR (R)

Contributors:

K.G. Renard
D.K. McCool
K.R. Cooley
G.R. Foster
J.D. Istok
C.K. Mutchler

CHAPTER 2. CONTENTS

The rainfall and runoff factor (R) of the Universal Soil Loss Equation (USLE) was derived (Wischmeier 1959, Wischmeier and Smith 1958) from research data from many sources. The data indicate that when factors other than rainfall are held constant, soil losses from cultivated fields are directly proportional to a rainstorm parameter: the total storm energy (E) times the maximum 30-min intensity (I_{30}).

Rills and sediment deposits observed after an unusually intense storm have sometimes led to the conclusion that significant erosion is associated with only a few severe storms--that significant erosion is solely a function of peak intensities. However, more than 30 yr of measurements in many states have shown that this is not the case (Wischmeier 1962). The data show that a rainfall factor used to estimate average annual soil loss must include the cumulative effects of the many moderate-sized storms as well as the effects of the occasional severe ones.

The numerical value used for R in USLE and in RUSLE must quantify the effect of raindrop impact and must also reflect the amount and rate of runoff likely to be associated with the rain. The erosion index (R) derived by Wischmeier appears to meet these requirements better than any of the many other rainfall parameters and groups of parameters tested against the plot data. The local value of this index may be obtained directly from maps. However, the index does not include the erosive forces of runoff from snowmelt, rain on frozen soil, or irrigation. A procedure for evaluating R for locations where this type of runoff is significant is given in this chapter under "R Equivalent (R_{eq}) for Cropland in the Northwestern Wheat and Range Region."

In RUSLE, the computational scheme is identical to that used in USLE, with a few exceptions (as noted later).

EI PARAMETER

The value of EI for a given rainstorm equals the product of total storm energy (E) times the maximum 30-min intensity (I_{30}), where E is in hundreds · ft· tonf · acre^{-1}, and I_{30} is in in · h^{-1}. EI is an abbreviation for energy times intensity, and the term should *not* be considered simply an energy parameter. Data show that rainfall energy itself is not a good indicator of erosive potential. The storm energy indicates the volume of rainfall and runoff, but a long, slow rain may have the same E value as a shorter rain at much higher intensity. Raindrop erosion increases with intensity. The I_{30} component reflects the prolonged peak rates of detachment and runoff. The product term EI is a statistical interaction term that reflects how total energy and peak intensity are combined in each particular storm. Technically, the term indicates how particle detachment is combined with transport capacity. Appendix B illustrates how the calculations are made from recording-raingage data.

The relation of soil loss to the EI parameter is assumed to be linear, and the parameter's individual storm values are directly additive. The sum of the storm EI values for a given period is a numerical measure of the erosive potential of the rainfall within that period. The average annual total of the storm EI values in a particular locality is the rainfall erosion index (R) for that locality. Because of apparent cyclical patterns in rainfall data, early published values for rainfall erosion indices (for example, in Agriculture Handbook No. 537) were based on 22-yr station rainfall records. Longer records are advisable, especially when the coefficient of variation of annual precipitation is large.

Rain showers of less than 0.5 in were omitted from the erosion index computations, unless at least 0.25 in of rain fell in 15 min. Furthermore, a storm period with less than 0.05 in over 6 h was used to divide a longer storm period into two storms. Exploratory analyses showed that erosion from these light rains is usually too small for practical significance and that, collectively, they have little effect on the distribution of the annual EI or erosion. The cost of abstracting and analyzing 4,000 location-years of rainfall-intensity data used to develop the initial R-factor map was greatly reduced by adopting the threshold value of 0.5 in.

The energy of a rainstorm is a function of the amount of rain and of all the storm's component intensities. The median raindrop size generally increases with greater rain intensity (Wischmeier and Smith 1958), and the terminal velocities of free-falling waterdrops increase with larger drop size (Gunn and Kinzer 1949). Since the energy of a given mass in motion is proportional to velocity squared, rainfall energy is directly related to rain intensity. The relationship, based on the data of Laws and Parsons (1943), is expressed by the equation

$$e = 916 + 331 \log_{10} i, \qquad i \leq 3 \text{ in} \cdot \text{h}^{-1} \qquad [2\text{-}1]$$

$$e = 1074 \qquad i > 3 \text{ in} \cdot \text{h}^{-1} \qquad [2\text{-}2]$$

where e is kinetic energy in ft · tonf · $\text{acre}^{-1} \cdot \text{in}^{-1}$, and i is intensity in in · h^{-1} (Wischmeier and Smith 1958). A limit of 3 in · h^{-1} is imposed on i because median drop size does not continue to increase when intensities exceed 3 in · h^{-1} (Carter et al. 1974).

The corresponding SI metric-unit version of the equations are (Foster et al. 1981b, app. A)

$$e_m = 0.119 + 0.0873 \log_{10}(i_m) \qquad i_m \leq 76 \text{ mm} \cdot \text{h}^{-1} \qquad [2\text{-}3]$$

$$e_m = 0.283 \qquad i_m > 76 \text{ mm} \cdot \text{h}^{-1} \qquad [2\text{-}4]$$

where e_m has units of megajoule per hectare per millimeter of rainfall (MJ · $\text{ha}^{-1} \cdot \text{mm}^{-1}$).

Other investigators have also presented algorithms for computing the kinetic energy for drop distributions in other geographic areas of the continental United States [for example, McGregor and Mutchler (1977) in Mississippi, Carter et al. (1974) in the South Central United States, Tracy et al. (1984) in southeastern Arizona, and Rosewell (1983, 1986) in Australia].

Brown and Foster (1987) used a unit energy relationship of the form

$$e = e_{max} \left[1 - a \exp(-b \cdot i)\right] \qquad [2\text{-}5]$$

where

e_{max} = a maximum unit energy as intensity approaches infinity, and

a and b = coefficients.

Kinnell (1981, 1987) showed that this distribution described unit energy-intensity relationships in Zimbabwe and Florida. Additional work by Rosewell (1983, 1986) showed that the relationship also fit data in Australia, the McGregor and Mutchler (1977) data, and the Laws and Parsons (1943) data. Unfortunately, these applications showed some variability in the a and b coefficients. Brown and Foster stated in their analysis that they recommended

$$e_m = 0.29 \left[1 - 0.72 \exp(-0.05 i_m)\right] \qquad [2\text{-}6]$$

for calculating unit energy, where e_m has units of $MJ \cdot ha^{-1} \cdot mm^{-1}$ of rain and i_m has units of $mm \cdot h^{-1}$. Brown and Foster also stated that this equation is a superior analytical form by having a finite positive value at zero intensity as data show and approaching an asymptote at high intensities as a continuous function. The U.S. customary units equivalent of equation [2-6] is

$$e = 1099\left[1 - 0.72 \exp(-1.27\, i)\right] \qquad [2\text{-}7]$$

where i has units of $in \cdot h^{-1}$ and e has units of $ft \cdot tonf \cdot acre^{-1} \cdot in^{-1}$.

Then

$$R = \frac{\sum_{i-1}^{j} (EI_{30})_i}{N} \qquad [2\text{-}8]$$

where $(EI_{30})_i = EI_{30}$ for storm i, j = number of storms in an N year period.

These equations were used for developing the isoerodent maps of figures 2-1 to 2-4.

The isoerodent maps of figures 2-1 and 2-9 were developed from equations [2-1] and [2-2]. We recommend that all future calculations be made using equation [2-6] or equation [2-7], especially in other countries where RUSLE technology is being developed.

Sample calculations of EI_{30} are given in appendix B.

ISOERODENT MAPS

Local values of the rainfall erosion index may be taken directly from isoerodent maps or from the CITY database in the computer program as explained in chapter 7. The plotted lines on the maps are called isoerodents because they connect points of equal rainfall erosivity. Erosion index values for locations between the lines can be obtained by linear interpolation.

The original isoerodent map (Wischmeier and Smith 1965) was developed from 22-yr station rainfall records by computing the EI value for each storm that met the previously defined threshold criteria. Isoerodents were then located between these point values with the help of published rainfall intensity-frequency data (U.S. Weather Bureau 1958) and topographic maps. The 11 western states were omitted from the initial map because sufficient long-term recording-raingage records were not available for establishing lines of equal erosion index values.

The isoerodent map was extended with an estimation procedure to the Pacific Coast in 1976 and was printed in Agriculture Handbook No. 537. Results of investigations at the USDA-ARS National Soil Erosion Research Laboratory at Purdue University showed that the known erosion index values in the Western Plains States and the North Central States are approximated with reasonable accuracy by the equation $R = 27.38P^{2.17}$ where P is the 2-yr frequency, 6-h rainfall amount (Wischmeier 1974). Although the isoerodents developed were compatible with the few point values that had been established in the western United States, the isoerodents were not sufficiently accurate to reflect the known spatial variability of the mountain and valley topography of the region.

In an agreement between Oregon State University, U.S. Department of Agriculture's Soil Conservation Service (SCS) and Agricultural Research Service (ARS), and the National Weather Service, 713 stations were used to determine relationships between values of EI calculated on a 15-min measurement interval basis and on values of EI calculated for the same storm on a 60-min measurement interval basis. In contrast to the calculations in the eastern United States, all storms were included to calculate EI. Of these stations, 225 had record periods of 12 yr or longer and precipitation measurement resolutions of 0.01 in. Values of coefficient of determination (r^2) in excess of 0.8 were obtained by use of the model $(EI)_{15} = b[\ (EI)_{60}\ ]$.

Values of the regression parameter b ranged from 1.08 to 3.16, varying widely from one climatic zone to the next.

To supplement this work, 1,082 stations were used to calculate $(EI)_{60}$. Of these stations, 790 had 20-yr record lengths or longer. These data values were adjusted to a 15-min measurement interval using the correction cited above. Computed values of $(EI)_{60}$ for each 60-min station were multiplied by the average regression parameter b (computed for all 15-min stations in the climatic zone containing the 60-min station) to obtain equivalent 15-min values, $(EI)_{15}$. These values were then adjusted to an equivalent breakpoint basis by use of $R = 1.0667\ (R)_{15}$ (Weiss 1964). The resulting isoerodent map (R) was prepared by hand contouring the adjusted R values for stations with record periods of at least 20 yr. The resulting isoerodent maps for the West is a significant improvement over that available in Agriculture Handbook No. 537 (Wischmeier and Smith 1978). Seasonal EI distributions were developed for 84 climate zones in the western States. The maximum storm 10-yr-frequency EI values were calculated as part of the project. In this analysis, for areas where winter precipitation is predominantly snowfall, the snowfall months were excluded from the EI development. Thus, in the CITY database, the winter months show zero percent EI.

In Hawaii, isoerodent maps of figure 2-5 were computed by the use of class-A weather stations to compute R and by relating these values to National Weather Service intensity-frequency data for Hawaii. EI distribution data were also calculated for select Hawaiian stations to use in the calculation of seasonally weighted K values (ch. 3) and C values (ch. 5).

If the soil and topography were exactly the same everywhere, average annual soil losses from plots maintained in continuous fallow would be in direct proportion to these erosion index values.

R Values for Flat Slopes

Although the R factor is assumed to be independent of slope in the structure of RUSLE, splash erosion is less on low slopes. On flat surfaces, raindrops tend to be more buffered by water ponded on the soil surface than on steep slopes. Higher rainfall intensities that are correlated with higher R factors also tend to increase the depth of ponded surface water, which in turn protects the soil from rainfall impact (Mutchler 1970). To account for this soil protection by a ponded water layer on low slopes under high rainfall rates, the R factor should be adjusted using a relationship having the form (modified from Mutchler and Murphree 1985)

$$R_c = f\,(I,\ S) = f\,(R,\ S) \qquad [2\text{-}9]$$

where

R_c	=	rainfall erosivity adjustment factor,
f	=	function of ( ),
I	=	precipitation intensity,
S	=	slope steepness, and
R	=	RUSLE rainfall erosivity term.

To compute R_c assume that the 10-yr-frequency storm EI value provides an indication of storm intensity and therefore the amount of water ponded on the land surface. In this procedure, the 10-yr EI value of a CITY database is used with a runoff index (a constant CN = 78 was used) and Manning's equation to compute a flow depth ratio, y. This flow depth ratio is then used in the equation $R_c = \exp(-0.49 \cdot [y-1])$. Figure 2-6 is the result of such calculations for a variety of land slopes. For further discussion, refer to chapter 6.

EI DISTRIBUTION USED IN CALCULATION OF K FACTOR AND C FACTOR

To calculate the seasonal or average annual soil erodibility factor (K) and the seasonal or average annual cover-management factor (C), the distribution of EI is needed. In RUSLE, the EI distribution (as a percentage of the annual value) is used for twenty-four 15-d periods, corresponding with the 1st and 16th days of the month.

Figure 2-7 shows the 120 homogeneous climatic zones in the contiguous United States used in RUSLE. The EI distribution values for each of these zones have been determined and are available in the computer code. Table 2-1 shows the EI distributions for the 120 zones and 19 Hawaiian zones, as well as the equivalent EI distribution for the frozen soil area of the Northwestern Wheat and Range Region.

Most of the climatic zones in figure 2-7 also have a single station containing information on precipitation and temperature (by month), the frost-free period, and the annual R. For example, about 140 climate stations (including 19 in Hawaii) are in the computer files. A user of the computer files may want to enter additional climate data for a zone. In other instances, a user may have to enter a climate station into the program before making soil-loss estimates in that region. The climate zones of figure 2-7 represent uniform EI distributions rather than uniform precipitation data or temperature data or both. Thus, in the western United States, orographic trends may pose problems within many of the zones and the user may need to input the additional data to reflect the orographic differences.

Although 19 stations are included in the Hawaiian climatic data files, the tremendous variability in precipitation, R, and temperature are only partially included. Therefore, caution must be used when making soil-loss estimates with RUSLE in Hawaii.

EI DATA FOR 10-YR-FREQUENCY STORMS

In the P-factor calculation for contour farming (ch. 6), the 10-yr-frequency storm EI value is required. These 10-yr EI data are used to credit the effect of contour practices on the support practice value. The values were obtained from the data originally calculated for Agriculture Handbook No. 537 (Wischmeier and Smith 1978) involving 181 stations in the eastern United States and from about 1,000 stations used to develop the isoerodent values in the western United States. The maps of these isoerodent values are given in figures 2-9 to 2-12 for the eastern and western United States.

Site-specific data can be obtained by interpolation from these figures. In the RUSLE computer program (see ch. 7 for the subroutine CITY), these values are given for most stations or they can be obtained by interpolation using the figures.

R EQUIVALENT (R_{eq}) FOR CROPLAND IN THE NORTHWESTERN WHEAT AND RANGE REGION

In the dryfarmed cropland areas of the Northwestern Wheat and Range Region (Austin 1981) shown in figure 2-8, the effect of melting snow, rain on snow, and/or rain on thawing soil poses unique problems. Generally, measured soil-loss values in the regions devoted to winter wheat, spring wheat, spring barley, peas, and lentils are much greater than the value that might be expected from R values calculated with the conventional kinetic energy times maximum 30-min intensity (EI). Observations indicate that much of the soil loss occurs by rilling phenomena when the surface part of the soil profile thaws and snowmelt or rain occurs on the still partially frozen soil. To more accurately predict soil losses for this condition, an R_{eq} value has been calculated using the following procedures:

$$(R_{eq})_{wr} = \frac{A_{wr}}{K_{wr}\ (LS)_{wr}\ (SLR)_{wr}\ P_{wr}} \qquad [2\text{-}10]$$

where

$(R_{eq})_{wr}$ = equivalent R factor for winter rilling,
A_{wr} = soil loss over winter in rills alone (measured),
K_{wr} = rill soil erodibility for winter period (estimated),
$(LS)_{wr}$ = LS relationship,
$(SLR)_{wr}$ = soil loss ratio for rilling in winter period (estimated for field condition), and
P_{wr} = supporting practices factor.

The soil loss from rills (A_{wr}) was measured after the winter erosion season from strips on selected fields along a 45- to 50-mi transect across eastern Washington and northern Idaho for a period of 10 yr. This area was subsequently divided into four zones for presentation and interpretation. Similar soil-loss measurements were made in five counties in north-central Oregon for 5 yr (although data were not collected for each county every year). Soil-loss measurements in southeastern Idaho were made for 4 yr. Thus, the rill soil-loss measurements represent a potential of 10 data points.

The winter erodibility value might be obtained by use of the variable K procedure (ch. 3) and by use of the average value of K for the winter period.

However, in RUSLE, K_{av} (EI-weighted average annual K value) is used throughout the entire year; there is no provision for use of an average K value for a particular portion of the year. Therefore, for consistency, K_{av} was used to calculate $(R_{eq})_{wr}$.

The Northwestern Wheat and Range Region LS relationships in RUSLE (ch. 4) were developed from only the Palouse transect data (eastern Washington and northern Idaho). The following LS relationships were used for $(R_{eq})_{wr}$ calculation:

$$(LS)_{wr} = \left[\frac{\lambda}{72.6}\right]^{0.5} (10.8 \sin\theta + 0.03) \qquad s < 9\% \qquad [2\text{-}11]$$

$$(LS)_{wr} = \left[\frac{\lambda}{72.6}\right]^{0.5} \left[\frac{\sin\theta}{0.0896}\right]^{0.6} \qquad s \geq 9\% \qquad [2\text{-}12]$$

Values of $(LS)_{wr}$ were calculated for each segment of the measured slope based on the contributing area above the segment and the segment steepness.

The soil-loss ratio $(SLR)_{wr}$ was calculated from the following factors:

(1) The rotation was assigned a soil-moisture factor using (see ch. 5) ww/p = 0.88, ww/sf = 1.0, wr = 0.5, and ww/sb = 0.72.

(2) Surface residue effect was calculated from a residue effectiveness curve [exp (-0.05 · % cover)].

(3) Growing cover effect was obtained from [1 - fraction of land surface covered by canopy]. Growing cover was generally less than 10% and often less than 5%.

(4) Surface roughness effect was assigned values from 0.7 to 1.2 based on field observations. Most values used were about 1.1.

(5) Incorporated residue effect was obtained from [exp (-0.00045 · lb $acre^{-1}$ residue incorporated at a shallow depth)]. Shallow incorporated residue was assumed to be half of the residue incorporated less decomposition.

The soil-loss ratio $(SLR)_{wr}$ was then computed as the product of these five factors.

The winter support practices factor (P_{wr}) was assumed to be unity. Thus, $(R_{eq})_{wr}$ was calculated for each year for each zone or county by averaging all segment values.

The individual zone $(R_{eq})_{wr}$ was averaged over the years of record to obtain a zonal average value. The data points were reduced from 10 to 7 based on the number of segments and strips in a zone or county in a given year and on the number of years of data in a zone or county. The three points deleted were all from north-central Oregon. These average values were subsequently correlated against published annual precipitation for corresponding zones to obtain

$$\left(R_{eq}\right)_{wr} = -110.3 + 10.78\ P \qquad r^2 = 0.98 \tag{2-13}$$

where P = annual precipitation (in).

Adjustment for Interrill and Non-Winter Soil Loss

Measurements of the rill to interrill ratio soil loss in the Northwestern Wheat and Range Region vary greatly. For example, rill-erosion measurements near the Columbia Plateau Conservation Research Center near Pendleton, Oregon, indicate about a 95% rill soil loss. A rule of thumb based on the old Pullman Conservation Field Station (PCFS) plots near Pullman, Washington, was that 75% of the soil loss came from rill erosion. Recent measurements over a 4-yr period from continuous fallow plots at the PCFS indicate that 85-90% of the soil loss came from rill erosion. In other instances (and varying with treatments), the attempts to separate interrill losses from total soil loss have been essentially unsuccessful. Thus, a somewhat arbitrary ratio of 90% rill loss and 10% interrill soil loss was assumed to adjust the $(R_{eq})_{wr}$ to estimate the total winter equivalent R, $(R_{eq})_{wt}$.

Then

$$\left(R_{eq}\right)_{wt} = \left(R_{eq}\right)_{wr} \cdot \frac{100}{90} \tag{2-14}$$

The nonwinter component of soil loss was estimated in two ways, each of which gives a ratio of roughly 5% of the annual R_{eq} occurring during the nonwinter periods. Thus, we estimate total annual soil loss as

$$R_{eq} = (R_{eq})_{wr} \cdot \frac{100}{90} \cdot \frac{100}{95} \qquad [2\text{-}15]$$

and finally

$$R_{eq} = -129.0 + 12.61P \qquad [2\text{-}16]$$

For lower precipitation areas of the Northwest Wheat and Range Region with a frozen soil erosion problem, the following relationship will provide a smooth transition from the R_{eq} to the non-R_{eq} zone:

$$R_{eq} = 1.602 \exp(0.2418\ P) \qquad 7.5 < P < 15.0 \qquad [2\text{-}17]$$

Equation 2-17 should be used for $P \leq 15.0$.

The P and R_{eq} maps for the cultivated areas farmed with winter wheat, spring wheat, spring barley, peas, or lentils in the Northwestern Wheat and Range Region are shown in figures 2-13 to 2-16. The small-grain areas include higher elevation forest and grazing land as well as the cultivated valleys and lower slopes. In general, winter wheat is not grown where P is greater than about 35 in. Thus, no R_{eq} values greater than 320 (P = 35.6 in) are plotted in figures 2-15 and 2-16.

It was necessary to distribute the R_{eq} throughout the year. The nonwinter component (5% of the total) was distributed uniformly from April 1 through September 30. The winter component (95% of the total) was distributed from October 1 through March 31. Based on historical soil-loss data from PCFS, the period of major erosivity was assigned to late January and early February. Erosivity then tapered gradually to October 1 and more steeply to March 31 (see Pullman, WA, CITY database for the R_{eq} distribution data).

RAINFALL EROSIVITY IN A COLD MOUNTAINOUS CLIMATE

Data analysis from the precipitation network in southwestern Idaho indicate major problems in assessing the erosivity index. The problems are not uniquely different from those in the Northwestern Wheat and Range Region (area of winter wheat, spring barley, peas, and lentils). RUSLE (and also its predecessor USLE) was designed to account for the effects of raindrop impact and subsequent overland flow on soil erosion (Cooley et al. 1988). In much of the western United States, precipitation occurring as snow should also be accounted for if representative EI estimates are to be produced.

Cooley et al. (1988) found that snowfall accounted for only a minor portion (4%) of EI based on annual precipitation values at low-elevation valley sites. However, at high elevation sites, snowfall accounted for most (up to 71%) of the annual precipitation. Therefore, it is important to use only the rainfall portion of annual precipitation when determining EI in areas where snowfall is significant, rather than using total annual precipitation.

Elevation was observed to have a relatively minor influence on summer (rain) EI values. Summer storms are mainly produced by air-mass thunderstorms and tend to be more random in location and smaller in areal extent than are frontal storms.

The consideration of all storms in estimating EI, rather than only storms that result in more than 0.5 in rainfall [per Wischmeier and Smith (1978) procedure], increased EI by 28-59% on the Reynolds Creek watershed. However, runoff and erosion data for evaluating the significance of these increases were not available.

Cooley et al. (1988) also tested several methods of computing average annual R involving 2-yr-frequency, 6-h-duration precipitation for comparison with long-term breakpoint-data R values (table 2-2). In mountain and range topography like that of southwestern Idaho, caution must be exercised in selecting storm values because snow events can affect the value. Cooley et al. (1988) observed that the storm value decreased by 5-34% when snowfall was eliminated from the annual data set. R decreased by 4-42% when snowfall was removed; that is, summer values were used instead of annual values.

SOUTHWESTERN AIR-MASS THUNDERSTORM

Precipitation gages operated by ARS in Arizona and New Mexico were used to compute EI data for areas dominated by air-mass thunderstorms. Of particular interest is the fact that EI during the summer period amounted to 85-93% of the annual total, which was 50-81 hundreds · ft· tonf · (acre · in · yr)$^{-1}$ (Renard and Simanton 1975).

In still other efforts, Simanton and Renard (1982) calculated the EI for a storm on the 57.7-sq-mi Walnut Gulch Experimental watershed in southeastern Arizona. Figure 2-17 shows the isohyetal values of precipitation determined for the 100 recording raingages for the event of July 22, 1964, and the corresponding isoerodent map. It should be noted that the isoerodent lines have little correlation with the isohyetal lines. An intense air-mass thunderstorm near the upper end of the area caused nearly 100 units of EI whereas only a short distance away (about 5 mi), the EI was less than 50% of the storm maximum.

Figure 2-18 illustrates the annual isohyetal map and the annual isoerodent (R) map, including the data of figure 2-17 plus the other storms occurring during the year. The highly variable rainfall illustrated in figures 2-17 and 2-18 is very typical of air-mass-thunderstorm country as shown on the isoerodent map. The 1.9 ratio of maximum to minimum annual precipitation and the 4.0 ratio of maximum to minimum R are normal occurrences.

The significance of these illustrations is that a single raingage and the EI calculations from it may be inadequate indicators of the soil loss at any specific point unless the precipitation record is collected at that site.

LIMITATIONS IN WINTER R FACTORS

Agriculture Handbook No. 537 suggests that the rainfall erosivity value (R) might be adjusted by multiplying the precipitation falling in the form of snow by 1.5 and then adding the product to EI, the kinetic energy times maximum 30-min intensity. This calculation has been used in the past at some locations, but we currently do not support this approach in RUSLE. The redistribution of snow by drifting, sublimation, and reduced sediment concentrations in snowmelt confuses the problem tremendously. But data are not presently available to support this approximation. Therefore, the developers of RUSLE recognized the weakness of ignoring the problem (except in the cropland areas of the Northwestern Wheat and Range Region where the R_{eq} data are being used).

ACKNOWLEDGMENT

The authors appreciate the assistance of Joe M. Sheridan, ARS, in Tifton, GA, who assisted in preparing portions of the data in this chapter.

Table 2-1.
EI as percentage of average annual value computed for geographic areas shown in figure 2-7[1 2]

EI number	Periods 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	0.0	4.3	8.3	12.8	17.3	21.6	25.1	28.0	30.9	34.9	39.1	42.6	45.4	48.2	50.8	53.0	56.0	60.8	66.8	71.0	75.7	82.0	89.1	95.2
2	0.0	4.3	8.3	12.8	17.3	21.6	25.1	28.0	30.9	34.9	39.1	42.6	45.4	48.2	50.8	53.0	56.0	60.8	66.8	71.0	75.7	82.0	89.1	95.2
3	0.0	7.4	13.8	20.9	26.5	31.8	35.3	38.5	40.2	41.6	42.5	43.6	44.5	45.1	45.7	46.4	47.7	49.4	52.8	57.0	64.5	73.1	83.3	92.3
4	0.0	3.9	7.9	12.6	17.4	21.6	25.2	28.7	31.9	35.1	38.2	42.0	44.9	46.7	48.2	50.1	53.1	56.6	62.2	67.9	75.2	83.5	90.5	96.0
5	0.0	2.3	3.6	4.7	6.0	7.7	10.7	13.9	17.8	21.2	24.5	28.1	31.1	33.1	35.3	38.2	43.2	48.7	57.3	67.8	77.9	86.0	91.3	96.9
6	0.0	0.0	0.0	0.5	2.0	4.1	8.1	12.6	17.6	21.6	25.5	29.6	34.5	40.0	45.7	50.7	55.6	60.2	66.5	75.5	85.6	95.9	99.5	99.9
7	0.0	0.0	0.0	0.0	0.0	1.2	4.9	8.5	13.9	19.0	26.1	35.4	43.9	48.8	53.9	64.5	73.4	77.5	80.4	84.8	89.9	96.6	99.2	99.7
8	0.0	0.0	0.0	0.0	0.0	0.9	3.6	7.8	15.0	20.2	27.4	38.1	49.8	57.9	65.0	75.6	82.7	86.8	89.4	93.4	96.3	99.1	100.0	100.0
9	0.0	0.8	3.1	4.7	7.4	11.7	17.8	22.5	27.0	31.4	36.0	41.6	46.4	50.1	53.4	57.4	61.7	64.9	69.7	79.0	89.6	97.4	100.0	100.0
10	0.0	0.3	0.5	0.9	2.0	4.3	9.2	13.1	18.0	22.7	29.2	39.5	46.3	48.8	51.1	57.2	64.4	67.7	71.1	77.2	85.1	92.5	96.5	99.0
11	0.0	5.4	11.3	18.8	26.3	33.2	37.4	40.7	42.5	44.3	45.4	46.5	47.1	47.4	47.8	48.3	49.4	50.7	53.6	57.5	65.5	76.2	87.4	94.8
12	0.0	3.5	7.8	14.0	21.1	27.4	31.5	35.0	37.3	39.8	41.9	44.3	45.6	46.3	46.8	47.9	50.0	52.9	57.9	62.3	69.3	81.3	91.5	96.7
13	0.0	0.0	0.0	1.8	7.2	11.9	16.7	19.7	24.0	31.2	42.4	55.0	60.0	60.8	61.2	62.6	65.3	67.6	71.6	76.1	83.1	93.3	98.2	99.6
14	0.0	0.7	1.8	3.3	6.9	16.5	26.6	29.9	32.0	35.4	40.2	45.1	51.9	61.1	67.5	70.7	72.8	75.4	78.6	81.9	86.4	93.6	97.7	99.3
15	0.0	0.0	0.0	0.5	2.0	4.4	8.7	12.0	16.6	21.4	29.7	44.5	56.0	60.8	63.9	69.1	74.5	79.1	83.1	87.0	90.9	96.6	99.1	99.8
16	0.0	0.0	0.0	0.5	2.0	5.5	12.3	16.2	20.9	26.4	35.2	48.1	58.1	63.1	66.5	71.9	77.0	81.6	85.1	88.4	91.5	96.3	98.7	99.6
17	0.0	0.0	0.0	0.7	2.8	6.1	10.7	12.9	16.1	21.9	32.8	45.9	55.5	60.3	64.0	71.2	77.2	80.3	83.1	87.7	92.6	97.2	99.1	99.8
18	0.0	0.0	0.0	0.6	2.5	6.2	12.4	16.4	20.2	23.9	29.3	37.7	45.6	49.8	53.3	58.4	64.3	69.0	75.0	86.6	93.9	96.6	98.0	100.0
19	0.0	1.0	2.6	7.4	16.4	23.5	28.0	31.0	33.5	37.0	41.7	48.1	51.1	52.0	52.5	53.6	55.7	57.6	61.1	65.8	74.7	88.0	95.8	98.7
20	0.0	9.8	18.5	25.4	30.2	35.6	38.9	41.5	42.9	44.0	45.2	48.2	50.8	51.7	52.5	54.6	57.4	58.5	60.1	63.2	69.6	76.7	85.4	92.4
21	0.0	7.5	13.6	18.1	21.1	24.4	27.0	29.4	31.7	34.6	37.3	39.6	41.6	43.4	45.4	48.1	51.3	53.3	56.6	62.4	72.4	81.3	88.9	94.7
22	0.0	1.2	1.6	1.6	1.6	1.6	1.6	2.2	3.9	4.6	6.4	14.2	32.8	47.2	58.8	69.1	76.0	82.0	87.1	96.7	99.9	99.9	99.9	99.9
23	0.0	7.9	15.0	20.9	25.7	31.1	35.7	40.2	43.2	46.2	47.7	48.8	49.4	49.9	50.7	51.8	54.1	57.7	62.8	65.9	70.1	77.3	86.8	93.5
24	0.0	12.2	23.6	33.0	39.7	47.1	51.7	55.9	57.7	58.6	58.9	59.1	59.1	59.2	59.2	59.3	59.5	60.0	61.4	63.0	66.5	71.8	81.3	89.6
25	0.0	9.8	20.8	30.2	37.6	45.8	50.6	54.4	56.0	56.8	57.1	57.1	57.2	57.6	58.5	59.8	62.2	65.3	67.5	68.2	69.4	74.8	86.6	93.0

Table 2-1—Continued

EI number	Periods 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
26	0.0	2.0	5.4	9.8	15.6	21.5	24.7	26.6	27.4	28.0	28.7	29.8	32.5	36.6	44.9	55.4	65.7	72.6	77.8	84.4	89.5	93.9	96.5	98.4
27	0.0	0.0	0.0	1.0	4.0	5.9	8.0	11.1	13.0	14.0	14.6	15.3	17.0	23.2	39.1	60.0	76.3	86.1	89.7	90.4	90.9	93.1	96.6	99.1
28	0.0	0.0	0.0	0.0	0.2	0.5	1.5	3.3	7.2	11.9	17.7	21.4	27.0	37.1	51.4	62.3	70.6	78.8	84.6	90.6	94.4	97.9	99.3	100.0
29	0.0	0.6	0.7	0.7	0.7	1.5	3.9	6.0	10.5	17.9	28.8	36.6	43.8	51.5	59.3	68.0	74.8	80.3	84.3	88.8	92.7	98.0	99.8	99.9
30	0.0	0.0	0.0	0.0	0.0	0.2	0.8	2.8	7.9	14.2	24.7	35.6	45.4	52.2	58.7	68.5	77.6	84.5	88.9	93.7	96.2	97.6	98.3	99.6
31	0.0	0.0	0.0	0.0	0.0	0.2	1.0	3.5	9.9	15.7	26.4	47.2	61.4	65.9	69.0	77.2	86.0	91.6	94.8	98.7	100.0	100.0	100.0	100.0
32	0.0	0.1	0.1	0.1	0.1	0.6	2.2	4.3	9.0	14.2	23.3	34.6	46.3	54.2	61.7	72.9	82.5	89.6	93.7	98.2	99.7	99.9	99.9	99.9
33	0.0	0.0	0.0	0.0	0.0	0.6	2.3	4.2	8.8	16.1	30.0	46.9	57.9	62.8	66.2	72.1	79.1	85.9	91.1	97.0	98.9	98.9	98.9	98.9
34	0.0	0.0	0.0	0.0	0.0	1.8	7.3	10.7	15.5	22.0	29.9	35.9	42.0	48.5	56.9	67.0	76.9	85.8	91.2	95.7	97.8	99.6	100.0	100.0
35	0.0	0.0	0.0	0.0	0.0	2.5	10.2	15.9	22.2	27.9	34.7	43.9	51.9	56.9	61.3	67.3	73.9	80.1	85.1	89.6	93.2	98.2	99.8	99.8
36	0.0	0.0	0.0	0.0	0.0	0.9	3.4	6.7	12.7	18.5	26.6	36.3	46.0	53.5	60.2	68.3	75.8	82.6	88.3	96.3	99.3	99.9	100.0	100.0
37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.9	9.1	19.1	26.7	36.3	47.9	61.4	75.1	84.5	92.3	96.0	99.1	100.0	100.0	100.0	100.0
38	0.0	0.0	0.0	1.1	4.3	7.2	11.0	13.9	17.9	22.3	30.3	43.1	55.1	61.3	65.7	72.1	77.9	82.6	86.3	90.3	93.8	98.4	100.0	100.0
39	0.0	0.0	0.0	0.0	0.0	1.6	6.5	11.0	17.8	24.7	33.1	42.8	50.3	54.9	59.7	68.9	78.1	83.6	87.5	93.0	96.5	99.2	100.0	100.0
40	0.0	0.0	0.0	0.0	0.0	1.5	6.2	10.1	16.3	23.3	32.5	42.2	50.1	55.6	60.5	67.5	74.3	79.4	84.1	91.1	95.8	99.1	100.0	100.0
41	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.4	1.1	6.8	22.9	40.1	54.9	63.8	70.7	81.5	89.8	96.3	98.7	99.2	99.3	99.4	99.4	99.7
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.9	5.2	17.3	33.8	53.2	66.5	75.9	87.6	93.7	97.5	99.0	99.7	100.0	100.0	100.0	100.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	2.7	9.5	21.9	42.7	58.6	71.1	84.6	91.9	97.1	99.0	99.8	100.0	100.0	100.0	100.0
44	0.0	1.7	2.3	2.4	2.4	2.4	2.4	2.7	3.5	7.6	18.5	34.3	52.5	64.0	72.3	83.3	90.0	95.1	97.3	98.5	98.9	98.9	98.9	99.2
45	0.0	0.2	0.2	0.3	0.3	0.4	0.6	0.8	1.4	3.7	10.2	22.6	41.8	54.0	64.5	78.7	88.4	96.0	98.7	99.4	99.7	99.7	99.8	99.9
46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.6	7.5	19.6	32.9	48.9	63.0	73.5	83.3	89.5	95.6	98.3	99.6	100.0	100.0	100.0	100.0
47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.6	5.8	17.0	33.0	52.5	66.4	75.7	85.5	91.3	96.5	98.8	100.0	100.0	100.0	100.0	100.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	8.1	15.4	27.8	40.7	52.6	61.1	69.3	82.6	92.0	98.0	100.0	100.0	100.0	100.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.7	8.3	20.0	27.5	35.6	44.6	46.0	70.2	81.3	89.2	93.6	98.5	100.0	100.0	100.0	100.0
50	0.0	0.0	0.0	0.0	0.0	0.1	0.4	2.4	8.2	13.7	23.8	38.8	55.1	66.1	73.6	81.8	87.7	93.8	97.0	99.4	100.0	100.0	100.0	100.0

Table 2-1—Continued

EI number	Periods 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
51	0.0	0.0	0.0	0.0	0.0	0.3	1.0	3.1	8.7	18.8	35.8	49.6	60.4	70.2	77.0	84.0	88.8	93.8	96.6	99.1	100.0	100.0	100.0	100.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.5	6.8	17.5	29.8	46.1	60.5	72.7	86.0	92.8	96.8	98.4	99.7	100.0	100.0	100.0	100.0
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	3.0	9.5	24.2	35.3	48.0	63.1	76.1	87.7	93.5	97.2	98.6	99.5	99.8	99.9	100.0	100.0
54	0.0	0.0	0.0	0.0	0.0	0.2	0.7	2.4	7.2	14.7	27.2	37.2	47.3	58.8	67.6	74.0	79.2	86.7	92.6	97.9	99.8	99.9	100.0	100.0
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.4	13.3	25.5	31.6	38.8	52.5	66.8	75.5	81.2	87.9	92.8	98.3	100.0	100.0	100.0	100.0
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.1	11.4	22.3	29.5	38.5	51.1	65.2	77.8	85.6	91.7	95.0	98.7	100.0	100.0	100.0	100.0
57	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	3.5	9.2	21.5	31.0	43.5	60.4	75.1	86.1	91.6	96.2	98.1	99.4	99.9	99.9	100.0	100.0
58	0.0	0.0	0.0	0.0	0.0	0.2	0.9	2.9	8.0	13.2	21.0	29.1	38.0	45.9	54.5	65.4	74.8	82.1	87.5	95.4	98.8	99.7	100.0	100.0
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	8.9	15.6	24.2	31.1	38.3	46.0	54.9	64.2	73.2	81.9	88.5	95.7	98.6	99.4	99.7	99.7
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.5	4.0	9.5	13.3	20.5	33.6	52.8	66.5	76.7	88.1	94.2	98.6	100.0	100.0	100.0	100.0
61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	5.0	8.5	15.5	29.8	41.8	46.0	49.2	56.0	65.1	71.6	78.6	91.1	97.3	99.3	100.0	100.0
62	0.0	0.0	0.0	0.1	0.3	0.8	2.1	3.6	6.5	9.7	13.7	16.5	20.8	27.3	40.1	56.9	72.6	83.4	89.4	95.5	98.1	99.6	100.0	100.0
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	3.7	7.8	13.3	15.8	19.9	29.0	46.8	64.7	78.3	88.8	93.9	98.5	100.0	100.0	100.0	100.0
64	0.0	0.0	0.0	0.7	2.8	7.4	12.4	14.4	15.6	17.3	19.4	21.0	24.4	32.3	48.0	61.4	72.1	81.9	87.0	90.1	92.4	98.1	100.0	100.0
65	0.0	3.6	7.0	9.6	11.4	13.0	14.4	16.3	17.7	18.4	19.3	20.5	23.6	32.0	50.0	66.2	77.2	85.4	88.8	90.4	91.3	92.7	94.8	97.0
66	0.0	0.0	0.0	0.0	0.0	0.1	0.5	1.1	2.2	3.6	6.0	7.6	11.1	19.8	38.9	59.7	74.4	83.2	88.1	94.6	97.7	99.4	100.0	100.0
67	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.9	1.6	1.9	2.4	5.0	12.1	24.8	48.3	73.6	86.5	92.0	94.3	96.6	97.9	99.5	100.0	100.0
68	0.0	2.3	4.5	7.8	10.4	12.0	13.3	16.3	17.7	18.1	18.2	18.3	18.4	19.9	24.5	35.0	54.4	69.4	78.6	85.7	89.2	91.9	93.9	97.0
69	0.0	2.0	3.7	5.7	7.8	10.5	12.4	13.7	14.3	14.7	15.1	15.7	17.1	22.7	36.7	50.4	63.6	75.0	81.8	87.8	90.8	93.2	94.9	97.5
70	0.0	0.5	0.7	1.0	1.3	1.7	2.2	2.8	3.4	3.9	4.7	5.4	7.4	15.7	36.5	55.8	70.3	80.9	86.4	90.9	93.4	96.4	98.1	99.4
71	0.0	0.7	1.2	1.6	2.1	2.8	3.3	3.6	4.0	4.5	5.6	6.5	9.1	18.5	40.6	59.7	74.0	86.3	91.7	94.7	96.0	96.7	97.3	98.8
72	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.7	0.8	1.3	3.5	9.9	24.7	51.4	71.5	83.6	93.8	97.7	99.2	99.8	99.9	99.9	100.0
73	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.6	1.3	4.1	11.5	18.1	28.3	40.2	54.1	67.0	77.2	87.7	93.3	97.5	99.1	99.6	99.8	100.0
74	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.5	1.2	2.7	6.4	10.2	18.4	31.0	50.7	68.7	81.2	91.6	96.1	98.4	99.2	99.8	100.0	100.0
75	0.0	0.1	0.1	0.1	0.2	0.5	1.3	1.9	3.0	4.1	6.6	10.0	17.6	28.3	44.7	59.4	71.6	83.9	90.3	94.7	96.7	98.8	99.6	99.9

Table 2-1—Continued

EI	Periods																						
number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
76	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.3	2.0	3.5	4.9	8.4	17.4	37.3	57.5	72.9	83.7	89.5	95.8	98.4	99.6	100.0	100.0
77	0.0	0.2	0.3	0.3	0.4	0.8	1.5	2.0	2.8	3.9	5.9	7.2	10.3	21.5	46.5	66.3	78.3	86.5	90.8	96.0	98.2	99.1	99.5	99.8
78	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	1.6	3.8	8.9	13.2	21.8	35.8	56.6	75.4	86.0	92.9	95.9	98.2	99.2	99.8	100.0	100.0
79	0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.3	2.7	5.8	12.7	18.8	28.8	41.6	58.4	75.7	86.5	94.2	97.3	98.9	99.5	99.9	100.0	100.0
80	0.0	0.6	1.2	1.6	2.1	2.5	3.3	4.5	6.9	10.1	15.5	19.7	26.6	36.4	51.7	67.5	79.4	88.8	93.2	96.1	97.3	98.2	98.7	99.3
81	0.0	0.1	0.1	0.2	0.4	0.5	0.8	0.9	1.5	3.9	9.9	12.8	18.2	30.7	54.1	77.1	89.0	94.9	97.2	98.7	99.3	99.6	99.7	99.9
82	0.0	0.0	0.1	0.1	0.2	0.2	0.5	1.2	3.1	6.7	14.4	20.1	29.8	44.5	64.2	83.1	92.2	96.4	98.1	99.3	99.7	99.8	99.8	99.9
83	0.0	0.0	0.1	0.1	0.1	0.3	0.9	1.6	3.5	8.3	19.4	30.0	44.0	59.2	72.4	84.6	91.2	96.5	98.6	99.5	99.8	99.9	100.0	100.0
84	0.0	0.0	0.1	0.1	0.2	0.3	0.6	1.7	4.9	9.9	19.5	27.2	38.3	52.8	68.8	83.9	91.6	96.4	98.2	99.2	99.6	99.8	99.8	99.9
85	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	6.0	11.0	23.0	36.0	49.0	63.0	77.0	90.0	95.0	98.0	99.0	100.0	100.0	100.0	100.0
86	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	3.0	6.0	11.0	23.0	36.0	49.0	63.0	77.0	90.0	95.0	98.0	99.0	100.0	100.0	100.0	100.0
87	0.0	0.0	0.0	0.0	1.0	1.0	2.0	3.0	6.0	10.0	17.0	29.0	43.0	55.0	67.0	77.0	85.0	91.0	96.0	98.0	99.0	100.0	100.0	100.0
88	0.0	0.0	0.0	0.0	1.0	1.0	2.0	3.0	6.0	13.0	23.0	37.0	51.0	61.0	69.0	78.0	85.0	91.0	94.0	96.0	98.0	99.0	99.0	100.0
89	0.0	0.0	1.0	1.0	2.0	3.0	4.0	7.0	12.0	18.0	27.0	38.0	48.0	55.0	62.0	69.0	76.0	83.0	90.0	94.0	97.0	98.0	99.0	100.0
90	0.0	1.0	2.0	3.0	4.0	6.0	8.0	13.0	21.0	29.0	37.0	46.0	54.0	60.0	65.0	69.0	74.0	81.0	87.0	92.0	95.0	97.0	98.0	99.0
91	0.0	0.0	0.0	0.0	1.0	1.0	1.0	2.0	6.0	16.0	29.0	39.0	46.0	53.0	60.0	67.0	74.0	81.0	88.0	95.0	99.0	99.0	100.0	100.0
92	0.0	0.0	0.0	0.0	1.0	1.0	1.0	2.0	6.0	16.0	29.0	39.0	46.0	53.0	60.0	67.0	74.0	81.0	88.0	95.0	99.0	99.0	100.0	100.0
93	0.0	1.0	1.0	2.0	3.0	4.0	6.0	8.0	13.0	25.0	40.0	49.0	56.0	62.0	67.0	72.0	76.0	80.0	85.0	91.0	97.0	98.0	99.0	99.0
94	0.0	1.0	2.0	4.0	6.0	8.0	10.0	15.0	21.0	29.0	38.0	47.0	53.0	57.0	61.0	65.0	70.0	76.0	83.0	88.0	91.0	94.0	96.0	98.0
95	0.0	1.0	3.0	5.0	7.0	9.0	11.0	14.0	18.0	27.0	35.0	41.0	46.0	51.0	57.0	62.0	68.0	73.0	79.0	84.0	89.0	93.0	96.0	98.0
96	0.0	2.0	4.0	6.0	9.0	12.0	17.0	23.0	30.0	37.0	43.0	49.0	54.0	58.0	62.0	66.0	70.0	74.0	78.0	82.0	86.0	90.0	94.0	97.0
97	0.0	1.0	3.0	5.0	7.0	10.0	14.0	20.0	28.0	37.0	48.0	56.0	61.0	64.0	68.0	72.0	77.0	81.0	86.0	89.0	92.0	95.0	98.0	99.0
98	0.0	1.0	2.0	4.0	6.0	8.0	10.0	13.0	19.0	26.0	34.0	42.0	50.0	58.0	63.0	68.0	74.0	79.0	84.0	89.0	93.0	95.0	97.0	99.0
99	0.0	0.0	0.0	1.0	1.0	2.0	3.0	5.0	7.0	12.0	19.0	33.0	48.0	57.0	65.0	72.0	82.0	88.0	93.0	96.0	98.0	99.0	100.0	100.0
100	0.0	0.0	0.0	0.0	1.0	1.0	2.0	3.0	5.0	9.0	15.0	27.0	38.0	50.0	62.0	74.0	84.0	91.0	95.0	97.0	98.0	99.0	99.0	100.0

Table 2-1—Continued

EI number	Periods 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
101	0.0	0.0	0.0	1.0	2.0	3.0	4.0	6.0	9.0	14.0	20.0	28.0	39.0	52.0	63.0	72.0	80.0	87.0	91.0	94.0	97.0	98.0	99.0	100.0
102	0.0	0.0	1.0	2.0	3.0	4.0	6.0	8.0	11.0	15.0	22.0	31.0	40.0	49.0	59.0	69.0	78.0	85.0	91.0	94.0	96.0	98.0	99.0	100.0
103	0.0	1.0	2.0	3.0	4.0	6.0	8.0	10.0	14.0	18.0	25.0	34.0	45.0	56.0	64.0	72.0	79.0	84.0	89.0	92.0	95.0	97.0	98.0	99.0
104	0.0	2.0	3.0	5.0	7.0	10.0	13.0	16.0	19.0	23.0	27.0	34.0	44.0	54.0	63.0	72.0	80.0	85.0	89.0	91.0	93.0	95.0	96.0	98.0
105	0.0	1.0	3.0	6.0	9.0	12.0	16.0	21.0	26.0	31.0	37.0	43.0	50.0	57.0	64.0	71.0	77.0	81.0	85.0	88.0	91.0	93.0	95.0	97.0
106	0.0	3.0	6.0	9.0	13.0	17.0	21.0	27.0	33.0	38.0	44.0	49.0	55.0	61.0	67.0	71.0	75.0	78.0	81.0	84.0	86.0	90.0	94.0	97.0
107	0.0	3.0	5.0	7.0	10.0	14.0	18.0	23.0	27.0	31.0	35.0	39.0	45.0	53.0	60.0	67.0	74.0	80.0	84.0	86.0	88.0	90.0	93.0	95.0
108	0.0	3.0	6.0	9.0	12.0	16.0	20.0	24.0	28.0	33.0	38.0	43.0	50.0	59.0	69.0	75.0	80.0	84.0	87.0	90.0	92.0	94.0	96.0	98.0
109	0.0	3.0	6.0	10.0	13.0	16.0	19.0	23.0	26.0	29.0	33.0	39.0	47.0	58.0	68.0	75.0	80.0	83.0	86.0	88.0	90.0	92.0	95.0	97.0
110	0.0	1.0	3.0	5.0	7.0	9.0	12.0	15.0	18.0	21.0	25.0	29.0	36.0	45.0	56.0	68.0	77.0	83.0	88.0	91.0	93.0	95.0	97.0	99.0
111	0.0	1.0	2.0	3.0	4.0	5.0	6.0	8.0	11.0	15.0	20.0	28.0	41.0	54.0	65.0	74.0	82.0	87.0	92.0	94.0	96.0	97.0	98.0	99.0
112	0.0	0.0	0.0	1.0	2.0	3.0	4.0	5.0	7.0	12.0	17.0	24.0	33.0	42.0	55.0	67.0	76.0	83.0	89.0	92.0	94.0	96.0	98.0	99.0
113	0.0	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	13.0	17.0	22.0	31.0	42.0	52.0	60.0	68.0	75.0	80.0	85.0	89.0	92.0	96.0	98.0
114	0.0	1.0	2.0	4.0	6.0	8.0	11.0	13.0	15.0	18.0	21.0	26.0	32.0	38.0	46.0	55.0	64.0	71.0	77.0	81.0	85.0	89.0	93.0	97.0
115	0.0	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	14.0	19.0	26.0	34.0	45.0	56.0	66.0	76.0	82.0	86.0	90.0	93.0	95.0	97.0	99.0
116	0.0	1.0	3.0	5.0	7.0	9.0	12.0	15.0	18.0	21.0	25.0	29.0	36.0	45.0	56.0	68.0	77.0	83.0	88.0	91.0	93.0	95.0	97.0	99.0
117	0.0	1.0	2.0	3.0	4.0	5.0	7.0	9.0	11.0	14.0	17.0	22.0	31.0	42.0	54.0	65.0	74.0	83.0	89.0	92.0	95.0	97.0	98.0	99.0
118	0.0	1.0	2.0	3.0	5.0	7.0	10.0	14.0	18.0	22.0	27.0	32.0	37.0	46.0	58.0	69.0	80.0	89.0	93.0	94.0	95.0	96.0	97.0	97.0
119	0.0	2.0	4.0	6.0	8.0	12.0	16.0	20.0	25.0	30.0	35.0	41.0	47.0	56.0	67.0	75.0	81.0	85.0	87.0	89.0	91.0	93.0	95.0	97.0
120	0.0	1.0	2.0	4.0	6.0	7.0	9.0	12.0	15.0	18.0	23.0	31.0	40.0	48.0	57.0	63.0	72.0	78.0	88.0	92.0	96.0	97.0	98.0	99.0
[2]121	0.0	8.0	16.0	25.0	33.0	41.0	46.0	50.0	53.0	54.0	55.0	56.0	56.5	57.0	57.8	58.0	58.8	60.0	61.0	63.0	66.5	72.0	80.0	90.0
122	0.0	7.0	14.0	20.0	25.5	33.5	38.0	43.0	46.0	50.0	52.5	54.5	56.0	58.0	59.0	60.0	61.5	63.0	65.0	68.0	72.0	79.0	86.0	93.0
123	0.0	4.0	8.0	12.0	17.0	23.0	29.0	34.0	38.0	44.0	49.0	53.0	56.0	59.0	62.0	65.0	69.0	72.0	75.0	79.0	83.0	88.0	93.0	96.0
124	0.0	4.0	9.0	15.0	23.0	29.0	34.0	40.0	44.0	48.0	50.0	51.0	52.0	53.0	55.0	57.0	60.0	62.0	64.0	67.0	72.0	80.0	88.0	95.0
125	0.0	7.0	12.0	17.0	24.0	30.0	39.0	45.0	50.0	53.0	55.0	56.0	57.0	58.0	59.0	61.0	62.0	63.0	64.0	66.0	70.0	77.0	84.0	92.0

Table 2-1—Continued

EI number	Periods 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
126	0.0	9.0	16.0	23.0	30.0	37.0	43.0	47.0	50.0	52.0	54.0	55.0	56.0	57.0	58.0	59.0	60.0	62.0	64.0	67.0	71.0	77.0	86.0	93.0
127	0.0	8.0	15.0	22.0	28.0	33.0	38.0	42.0	46.0	50.0	52.0	53.0	53.0	53.0	53.0	54.0	55.0	57.0	59.0	63.0	68.0	75.0	83.0	92.0
128	0.0	8.0	15.0	22.0	29.0	34.0	40.0	45.0	48.0	51.0	54.0	57.0	59.0	62.0	63.0	64.0	65.0	66.0	67.0	69.0	72.0	76.0	83.0	91.0
129	0.0	9.0	16.0	22.0	27.0	32.0	37.0	41.0	45.0	48.0	51.0	53.0	55.0	56.0	57.0	57.0	58.0	59.0	61.0	64.0	68.0	73.0	79.0	89.0
130	0.0	10.0	20.0	28.0	35.0	41.0	46.0	49.0	51.0	53.0	55.0	56.0	56.0	57.0	58.0	59.0	60.0	61.0	62.0	65.0	69.0	74.0	81.0	90.0
131	0.0	8.0	15.0	22.0	28.0	33.0	38.0	41.0	44.0	47.0	49.0	51.0	53.0	55.0	56.0	58.0	59.0	60.0	63.0	65.0	69.0	75.0	84.0	92.0
132	0.0	10.0	18.0	25.0	29.0	33.0	36.0	39.0	41.0	42.0	44.0	45.0	46.0	47.0	48.0	49.0	51.0	53.0	56.0	59.0	64.0	70.0	80.0	90.0
133	0.0	8.0	16.0	24.0	32.0	40.0	46.0	51.0	54.0	56.0	57.0	58.0	58.0	59.0	59.0	60.0	60.0	61.0	62.0	64.0	68.0	74.0	83.0	91.0
134	0.0	12.0	22.0	31.0	39.0	45.0	49.0	52.0	54.0	55.0	56.0	56.0	56.0	56.0	57.0	57.0	57.0	57.0	58.0	59.0	62.0	68.0	77.0	88.0
135	0.0	7.0	15.0	22.0	30.0	37.0	43.0	49.0	53.0	55.0	57.0	58.0	59.0	60.0	61.0	62.0	63.0	65.0	67.0	70.0	74.0	79.0	85.0	92.0
136	0.0	11.0	21.0	29.0	37.0	44.0	50.0	55.0	57.0	59.0	60.0	60.0	60.0	60.0	61.0	61.0	61.0	62.0	63.0	64.0	67.0	71.0	78.0	89.0
137	0.0	10.0	18.0	25.0	30.0	39.0	46.0	51.0	54.0	57.0	58.0	59.0	59.0	60.0	60.0	60.0	61.0	62.0	63.0	64.0	67.0	72.0	80.0	90.0
138	0.0	11.0	22.0	31.0	39.0	46.0	52.0	56.0	58.0	59.0	60.0	61.0	61.0	61.0	61.0	62.0	62.0	62.0	63.0	64.0	66.0	71.0	78.0	89.0
139	0.0	8.0	14.0	20.0	25.0	32.0	37.0	42.0	47.0	50.0	53.0	55.0	56.0	58.0	59.0	61.0	63.0	64.0	66.0	68.0	71.0	76.0	85.0	93.0
[3]140	0.0	13.0	28.0	43.0	56.0	65.0	69.0	69.4	69.7	70.1	70.4	70.8	71.1	71.5	71.9	72.2	72.6	73.0	73.3	73.6	74.0	76.0	81.0	89.0

[1] Periods are 15-d beginning January 1.
[2] Zones 121-139 are for stations in Hawaii.
[3] Zone 140 is the R_{eq} distribution for Pullman, WA.

Table 2-2.
Average annual and summer EI and 2-yr-frequency 6-h-duration precipitation computed from actual data in southwestern Idaho. Data for EI are compared with data in methods of Wischmeier (1974), Simanton and Renard (1982), Cooley (1980), and Cooley et al. (1988).

	Precipitation 2-yr 6-h storm[2] (inches)		R (hundreds ft · tonf · acre^{-1} · yr^{-1}): Observed EI		Wischmeier (1974)[3] $27.38P^{2.17}$		Simanton and Renard (1982) $27.38P^{1.62}$		Cooley (1980)[4] $13.00P^{2.15}$		Cooley et al. (1988) $22.17P^{2.56}$	
Site[1]	Summer	Annual	Summer	Annual	Summer	Annual	Summer	Annual	Summer	Annual	Summer	Annual
057	0.71	0.75	10.5	10.9	12.6	14.3	15.6	17.0	6.2	6.9	9.2	10.6
127	.75	.83	9.5	11.3	14.3	17.7	17	20	6.9	8.6	10.6	13.8
116	.79	.91	10	14.6	16	21.7	18.5	23.2	7.8	10.5	12.1	17.4
155	.83	1.06	16	31	17.7	30.9	20	30.1	8.6	14.8	13.8	36.9
176	.83	1.22	14.2	45.3	17.7	41.8	20	37.7	8.6	19.9	13.8	36.9
163	.91	1.38	17.3	59.3	21.7	54.6	23.2	45.8	10.5	25.9	17.4	50.6

[1] Site elevation: 057 is 3,885; 127 is 5,410; 116 is 4,770; 155 is 5,410; 176 is 6,802, and 163 is 7,100 ft above m.s.l.
[2] Determined from actual gage data. NOAA Atlas 2 (Miller et al. 1973) would not permit defining the orographic results shown.
[3] Wischmeier (1974) and Ateshian (1974) agree within about 2%.
[4] Includes precipitation during winter periods in the form of snow, a questionable computation according to Cooley et al. (1988).

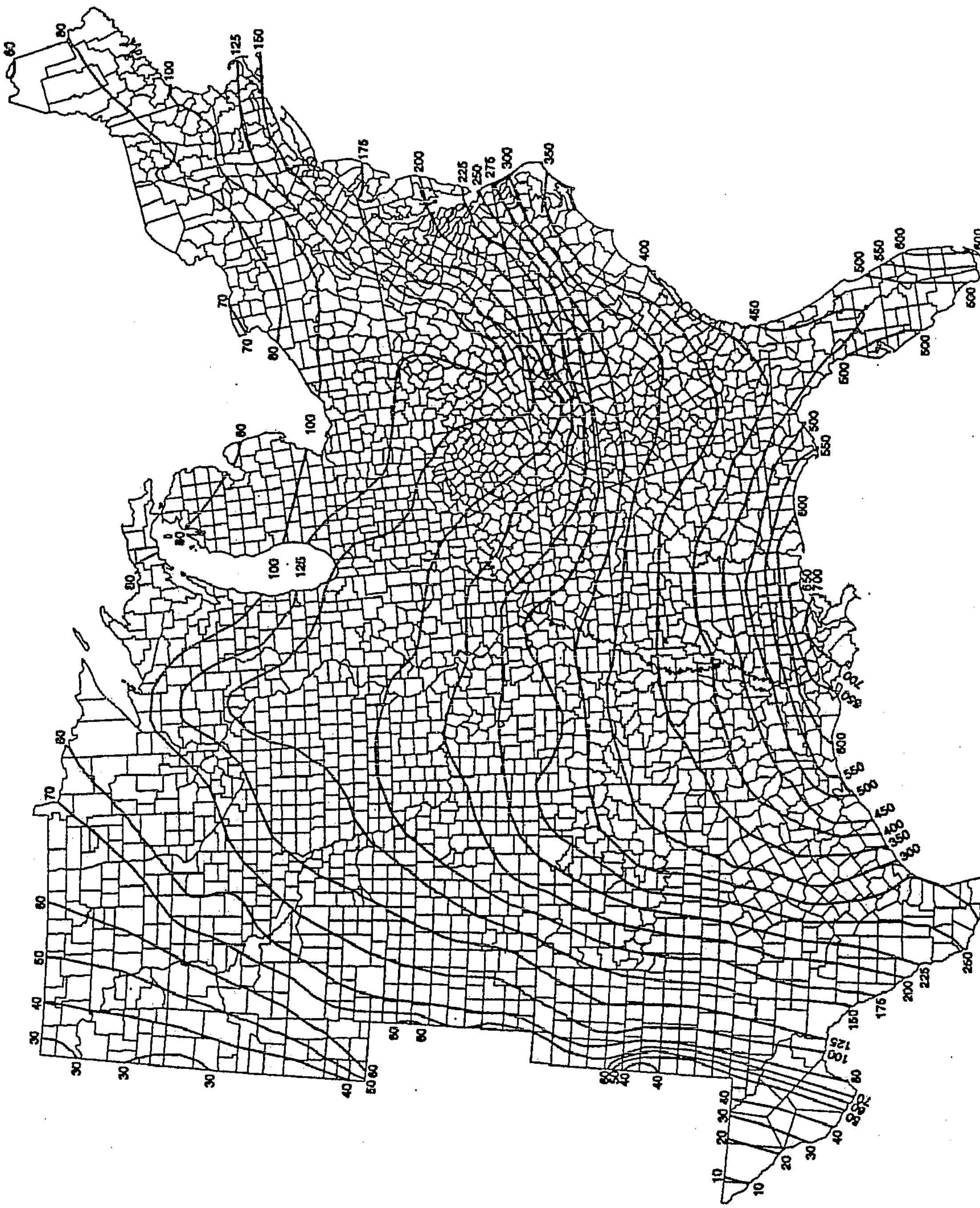


Figure 2-1. Isoerodent map of eastern United States. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

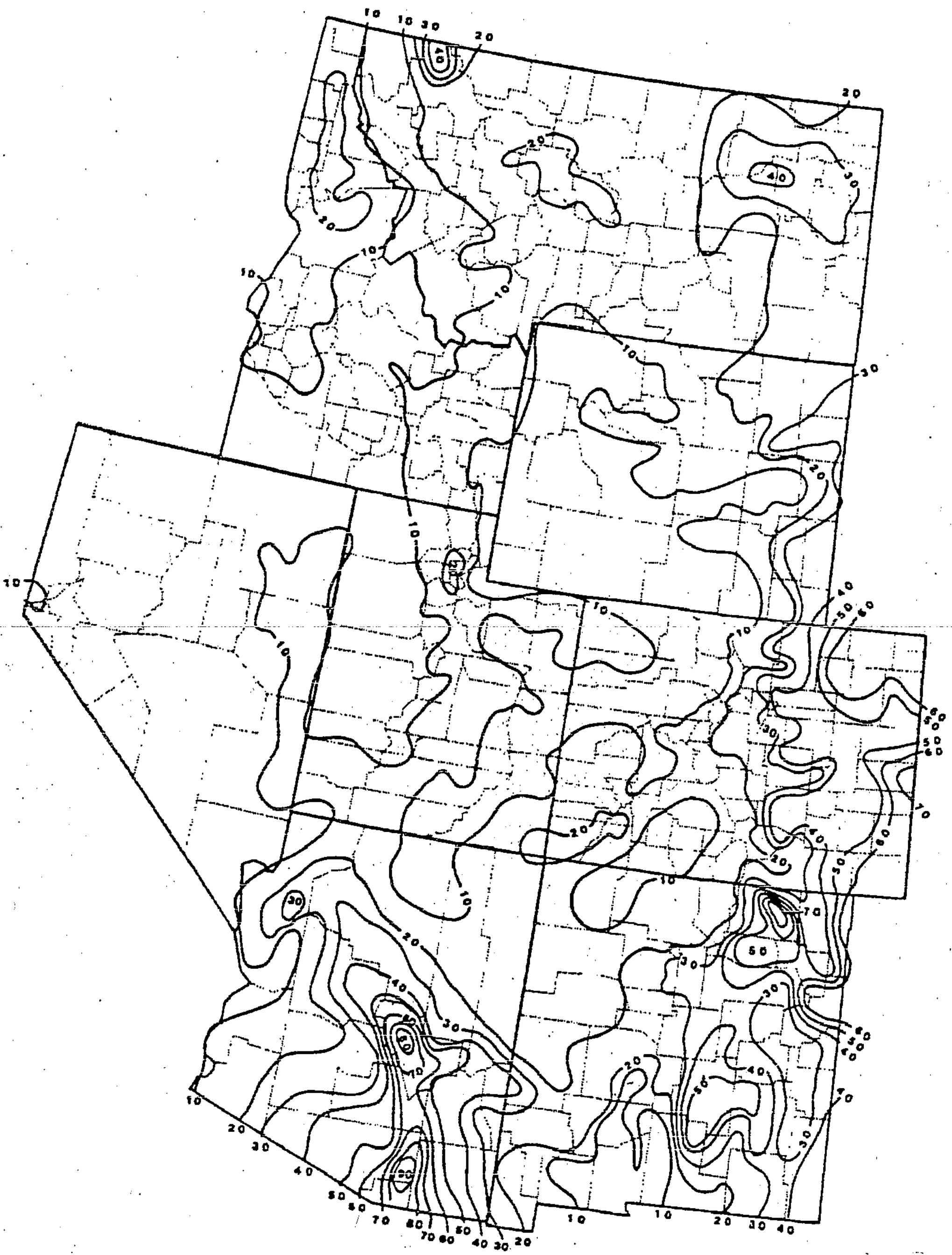


Figure 2-2. Isoerodent map of western United States. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

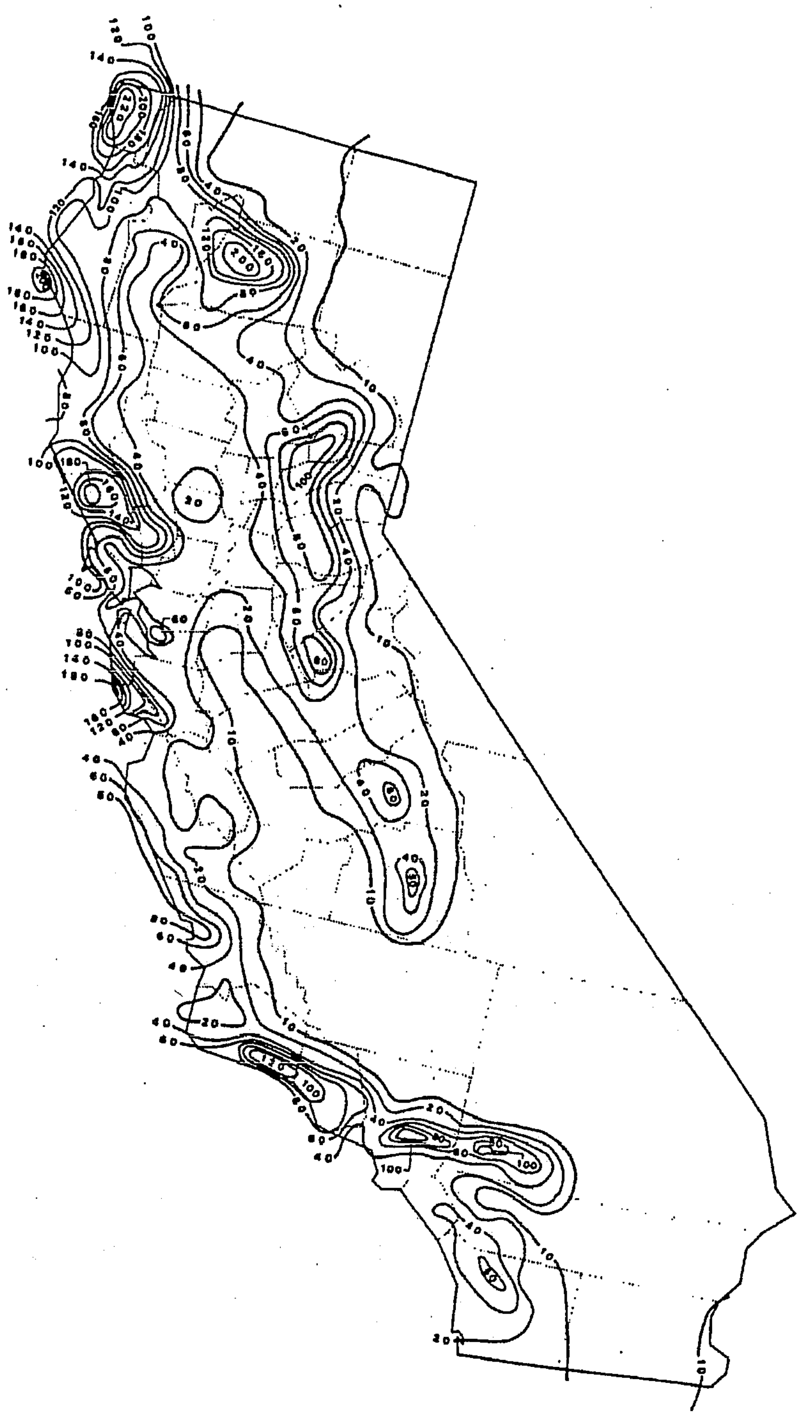


Figure 2-3. Isoerodent map of California. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

A003410

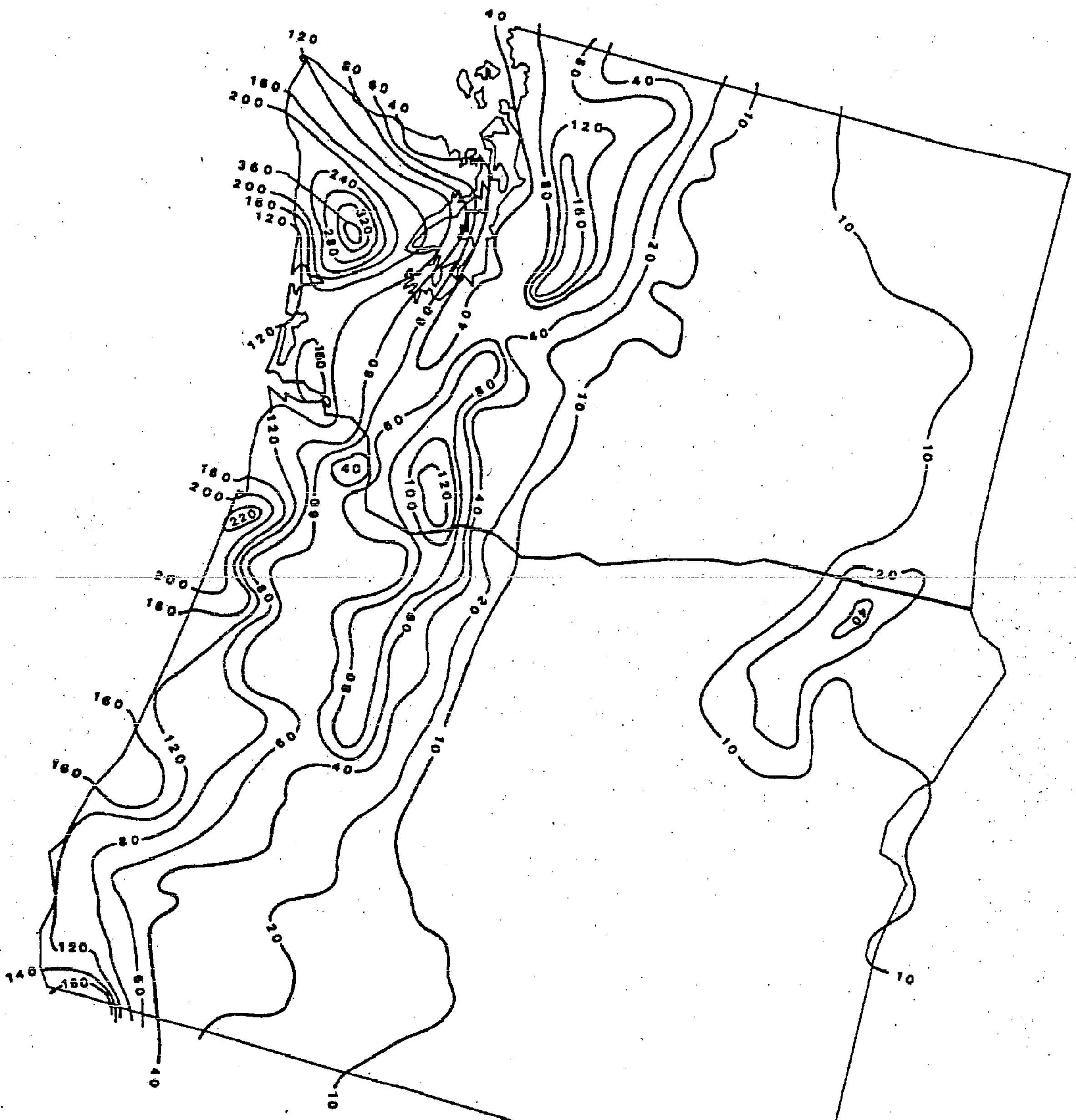


Figure 2-4. Isoerodent map of Oregon and Washington. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

A003411

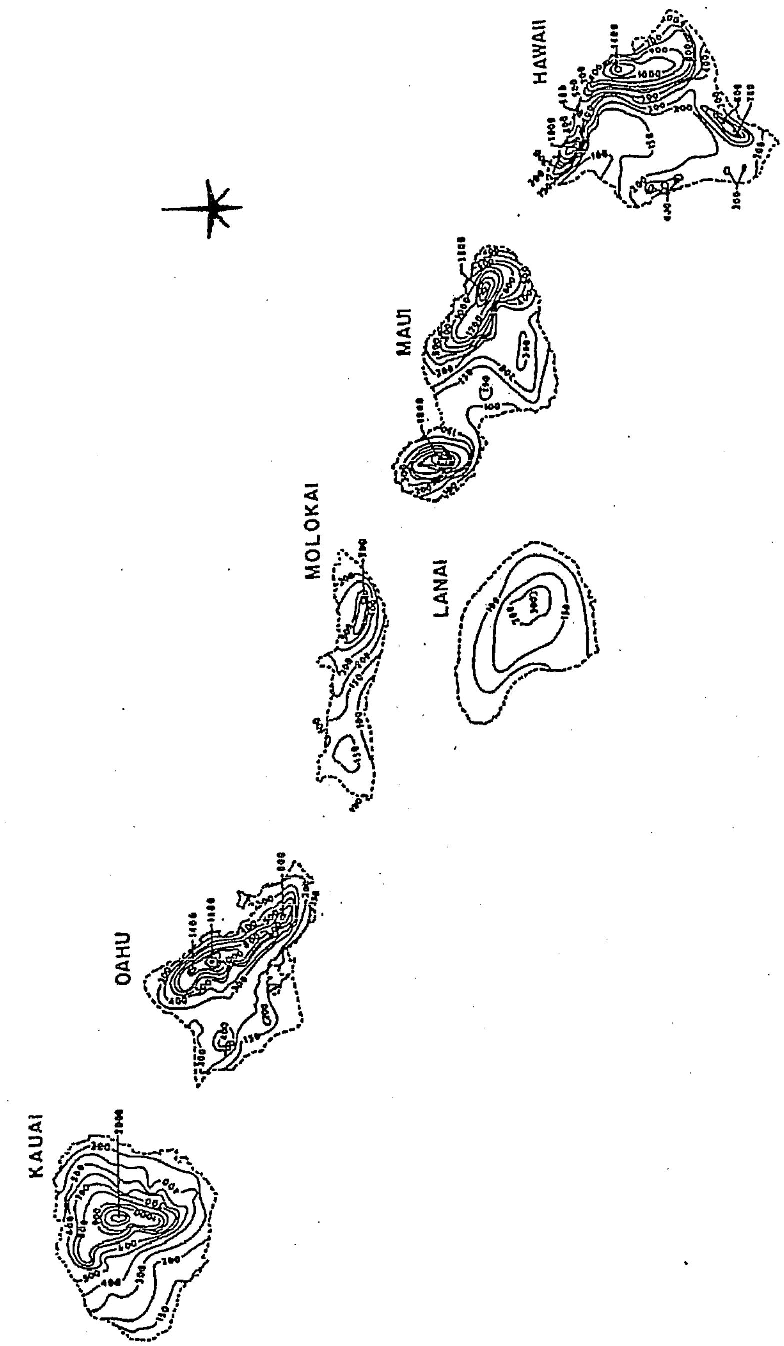


Figure 2-5. Isoerodent map of Hawaii. Units are hundreds ft·tonf·in(ac·h·yr)$^{-1}$.

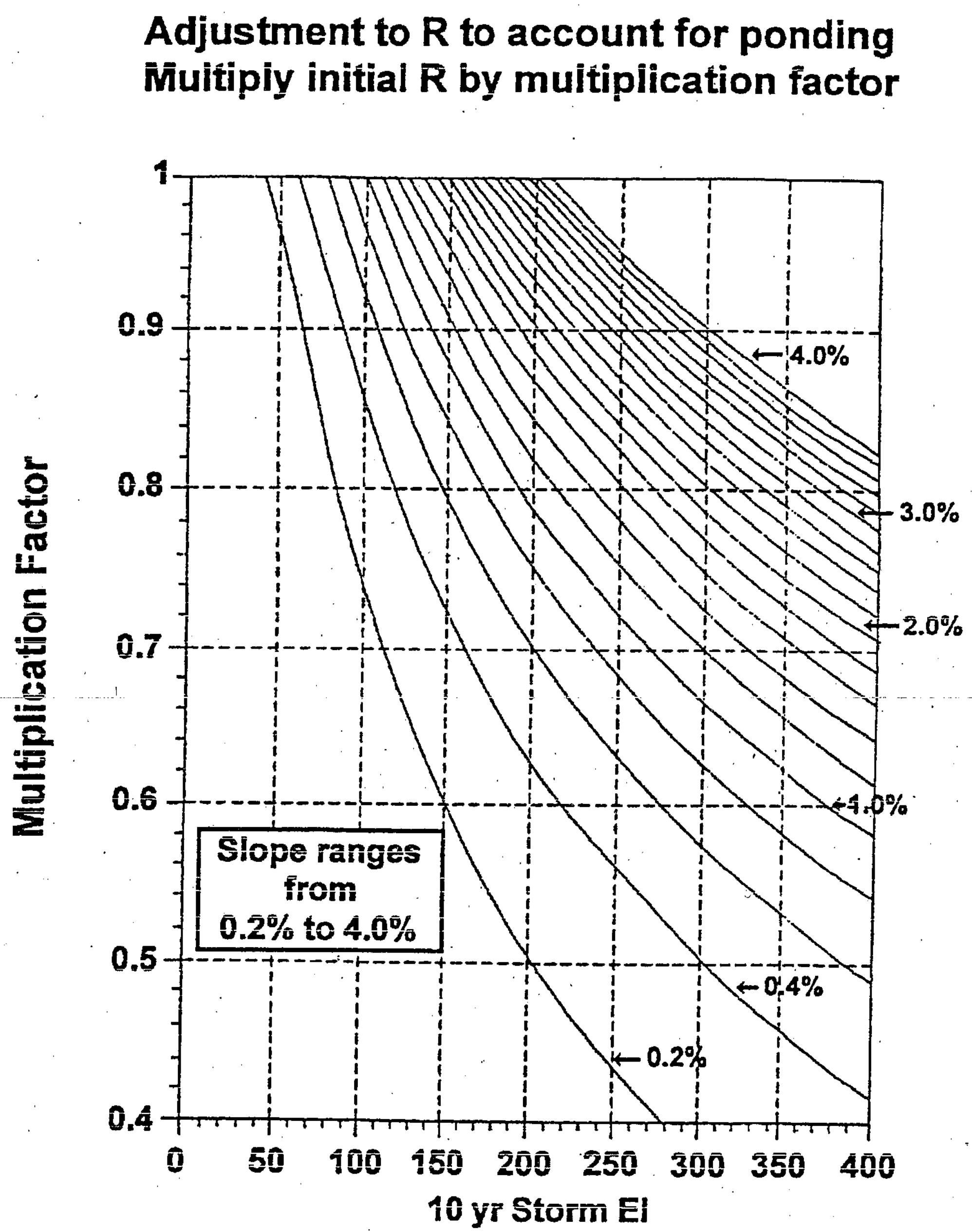


Figure 2-6. Corrections for R factor for flat slopes and large R values to reflect amount of rainfall on ponded water

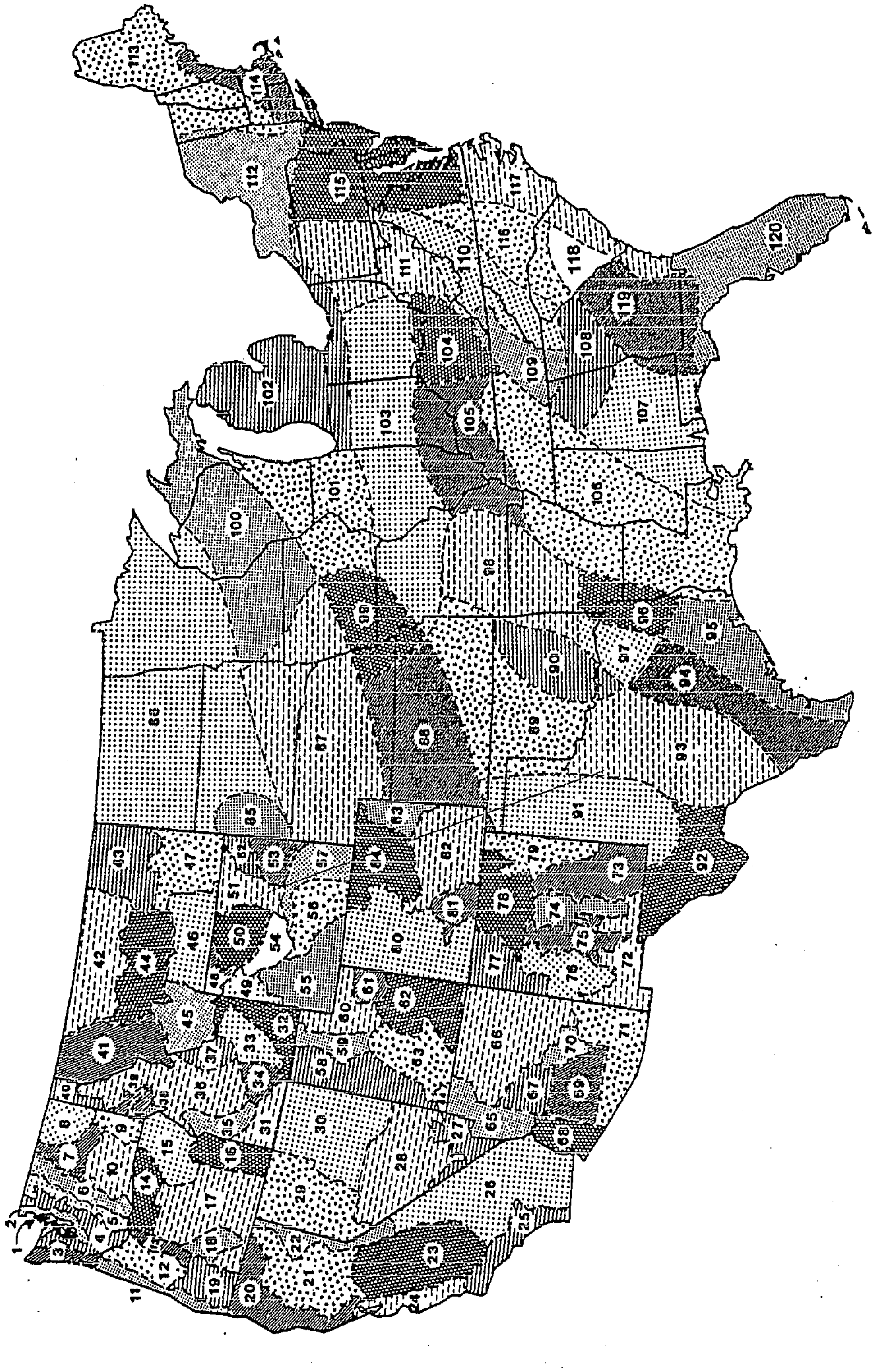


Figure 2-7: EI distribution zones for contiguous United States

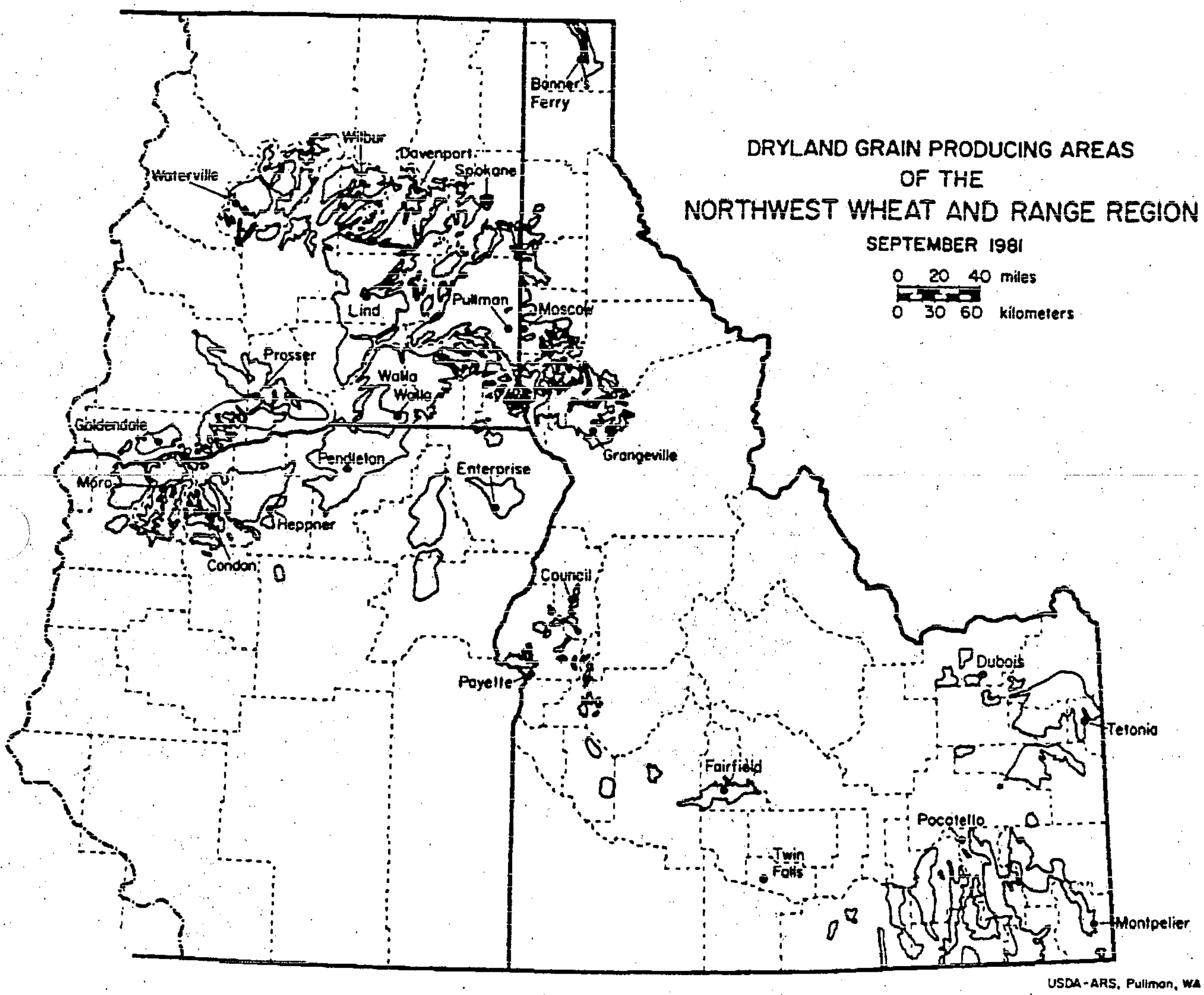


Figure 2-8. Location map of the cropland area of Northwestern Wheat and Range Region (adapted from Austin 1981)

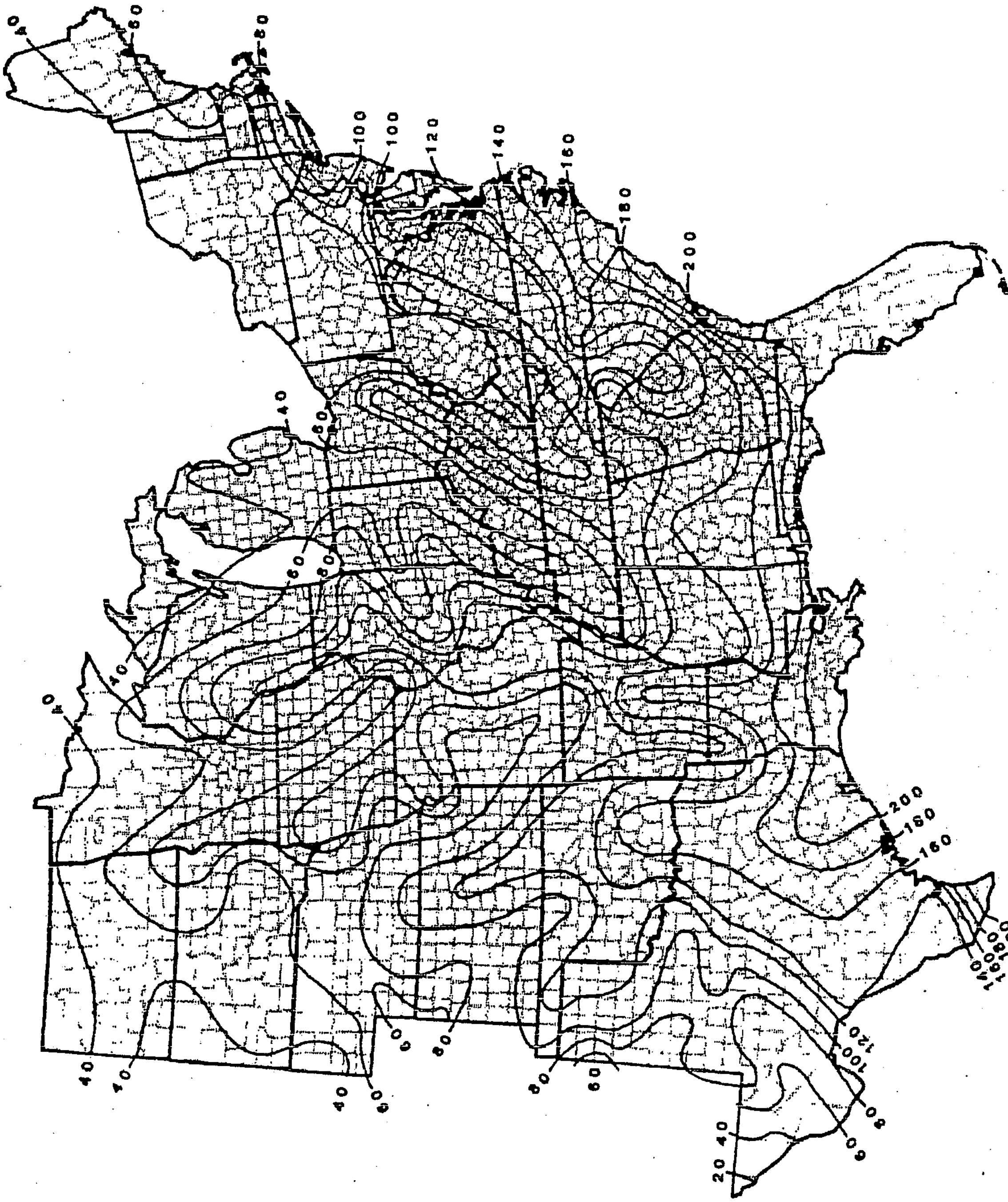


Figure 2-9. Ten-yr-frequency single-storm erosion index for eastern

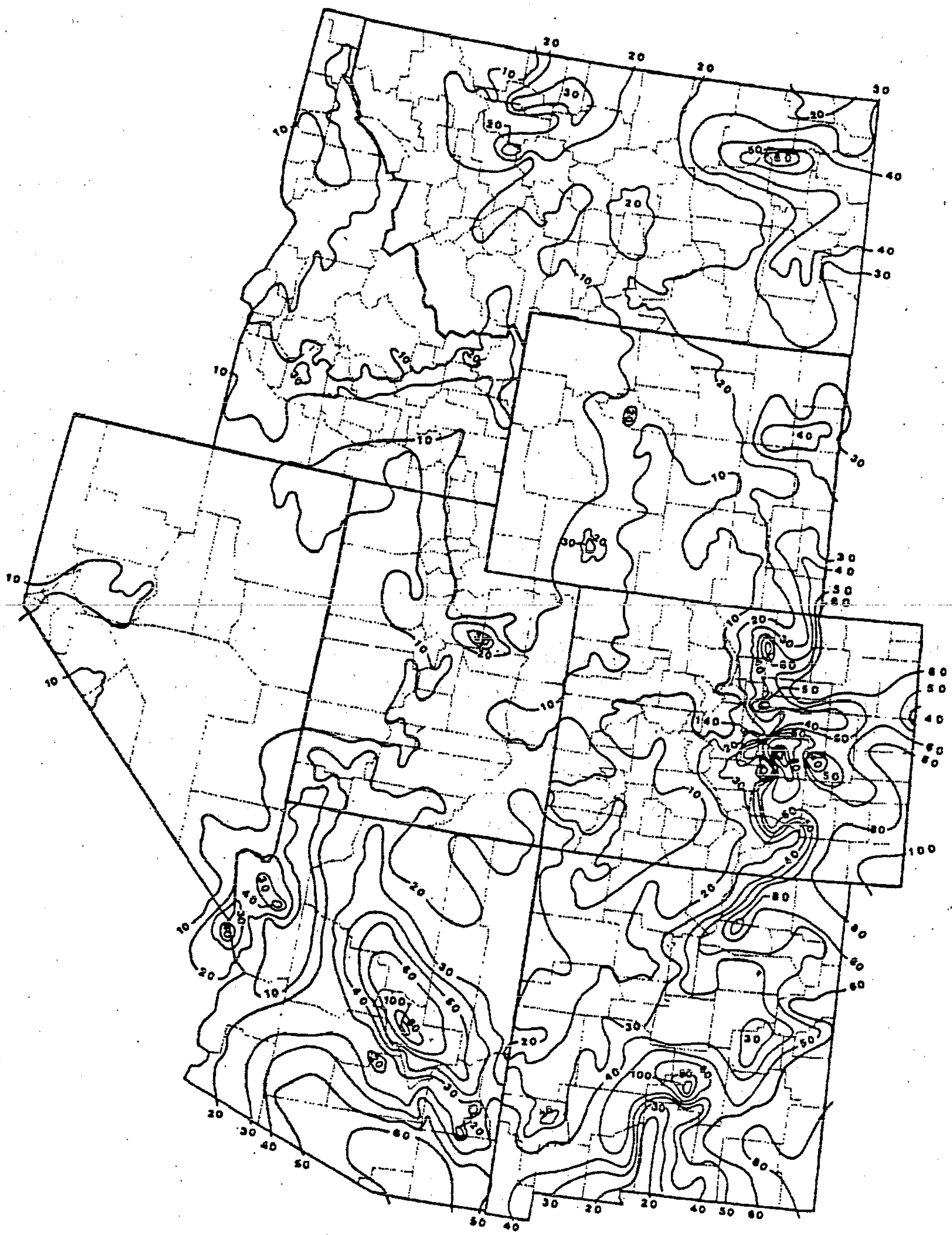


Figure 2-10. Ten-yr-frequency single-storm erosion index for western United States. Units are hundreds ft·tonf·in(ac·h)$^{-1}$.

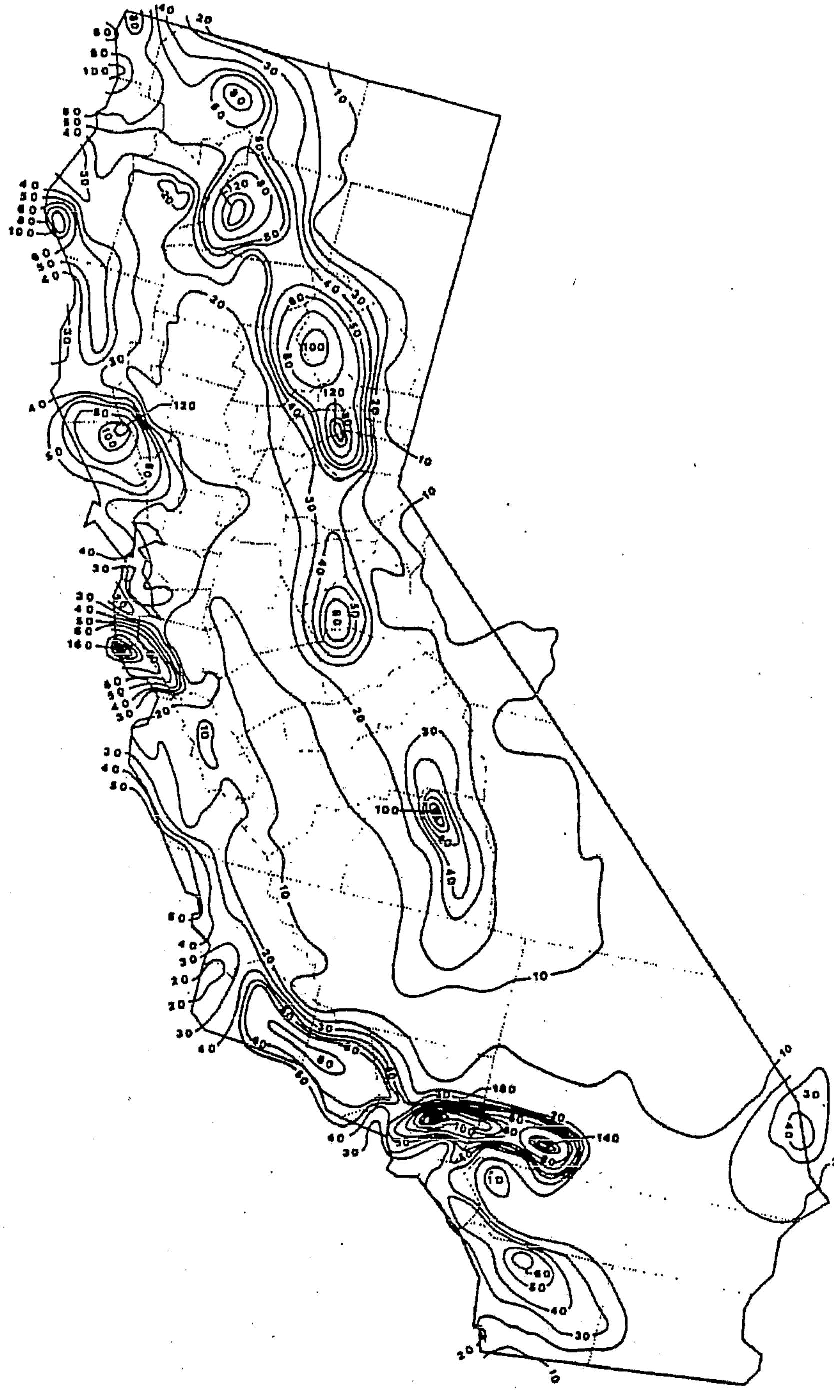


Figure 2-11. Ten-yr-frequency single-storm erosion index for California. Units are hundreds ft·tonf·in(ac· h)$^{-1}$.

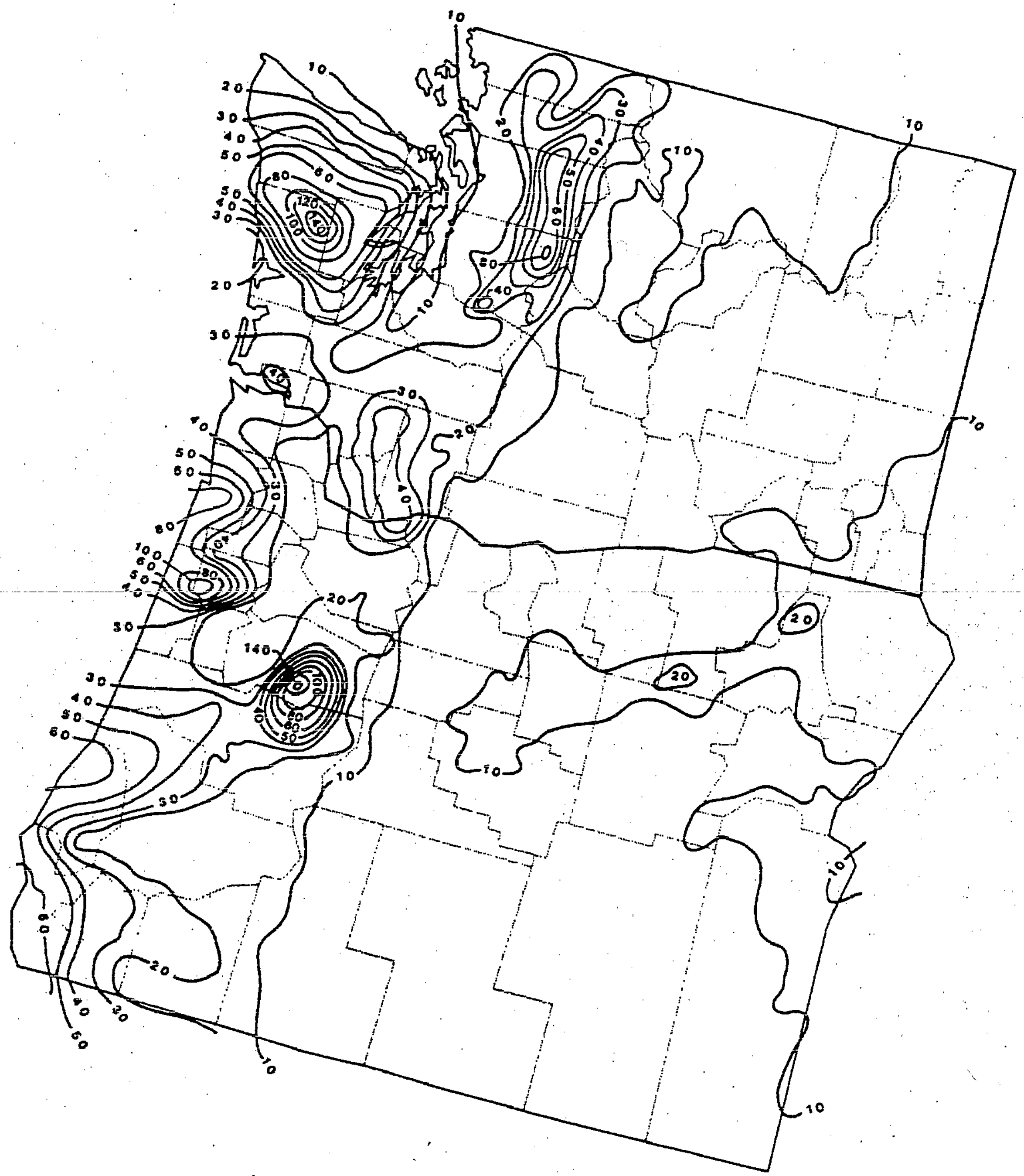


Figure 2-12. Ten-yr-frequency single-storm erosion index for Oregon and Washington. Units are hundreds ft·tonf·in(ac·h)$^{-1}$.

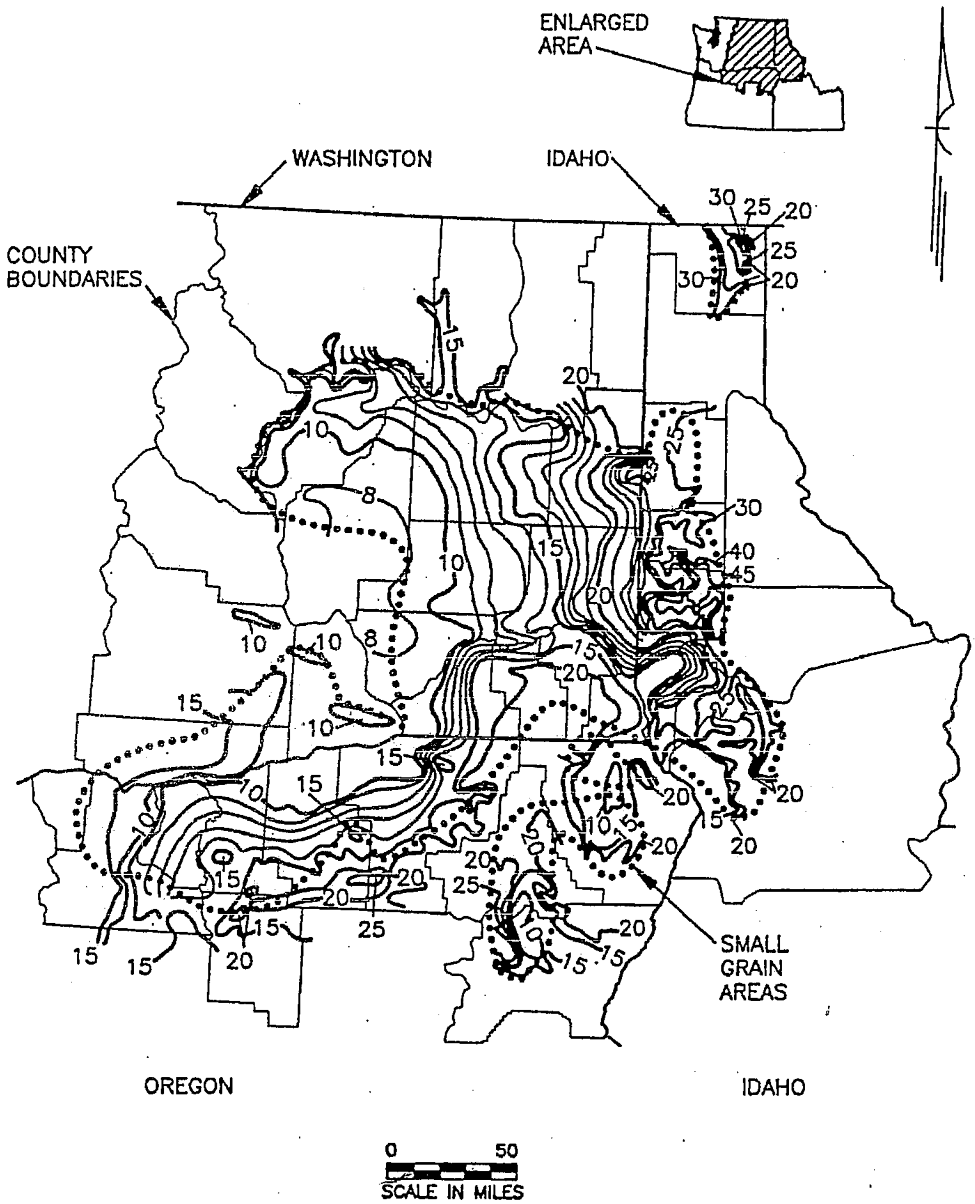


Figure 2-13. Precipitation map (inches) used to calculate R_{eq} in Washington, Oregon, and northern Idaho for small-grain areas of Northwestern Wheat and Range Region. Precipitation units are inches.

A003420

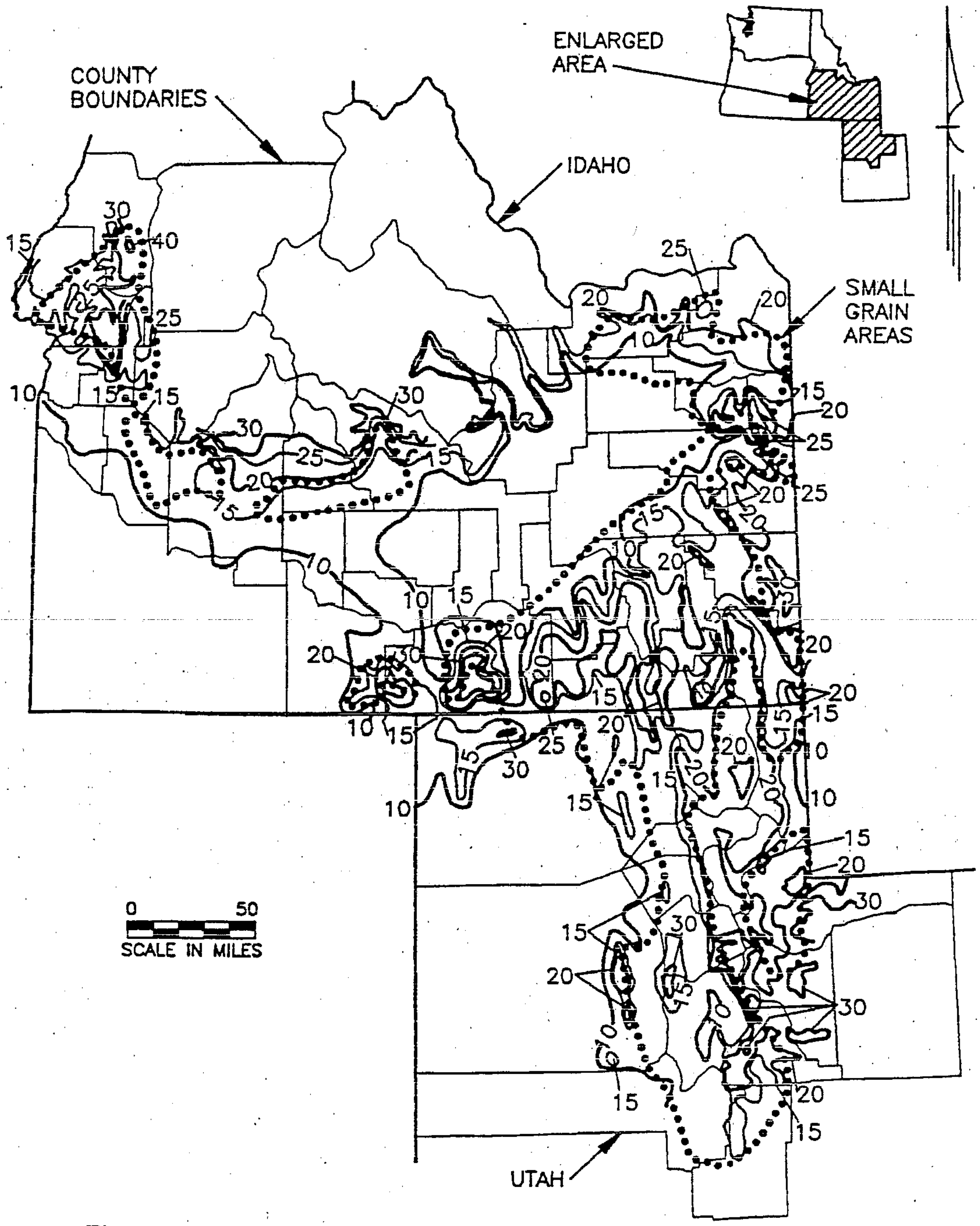


Figure 2-14. Precipitation map (inches) used to calculate R_{eq} in southern Idaho and Utah for small-grain areas of Northwestern Wheat and Range Region. Precipitation units are inches.

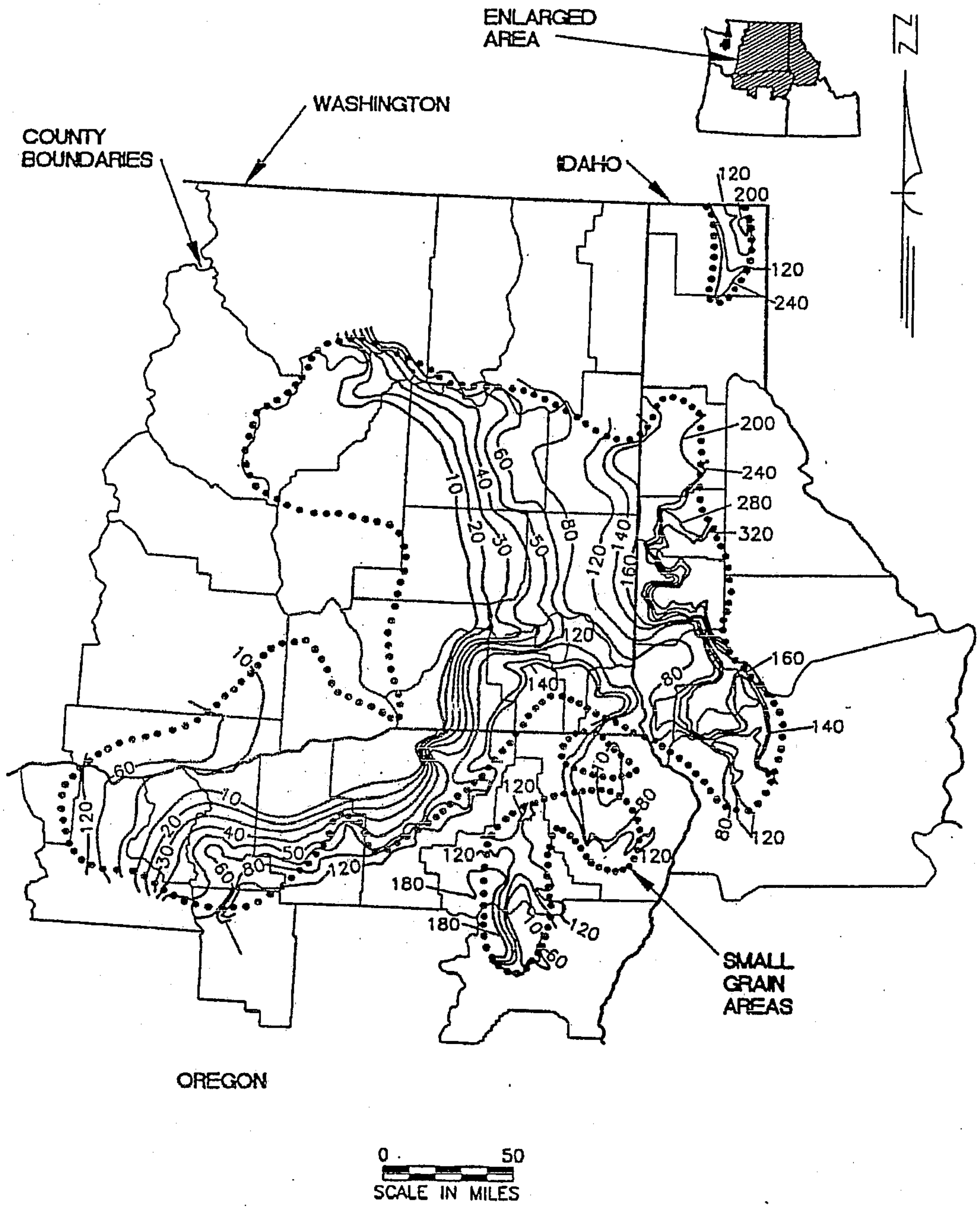


Figure 2-15. R_{eq} for cropland areas of Washington, Oregon, and northern Idaho in and adjacent to Northwestern Wheat and Range Region (Note: Some irregular contour intervals are used to preserve clarity). R_{eq} units are hundreds ft·tonf·in(ac·h)$^{-1}$.

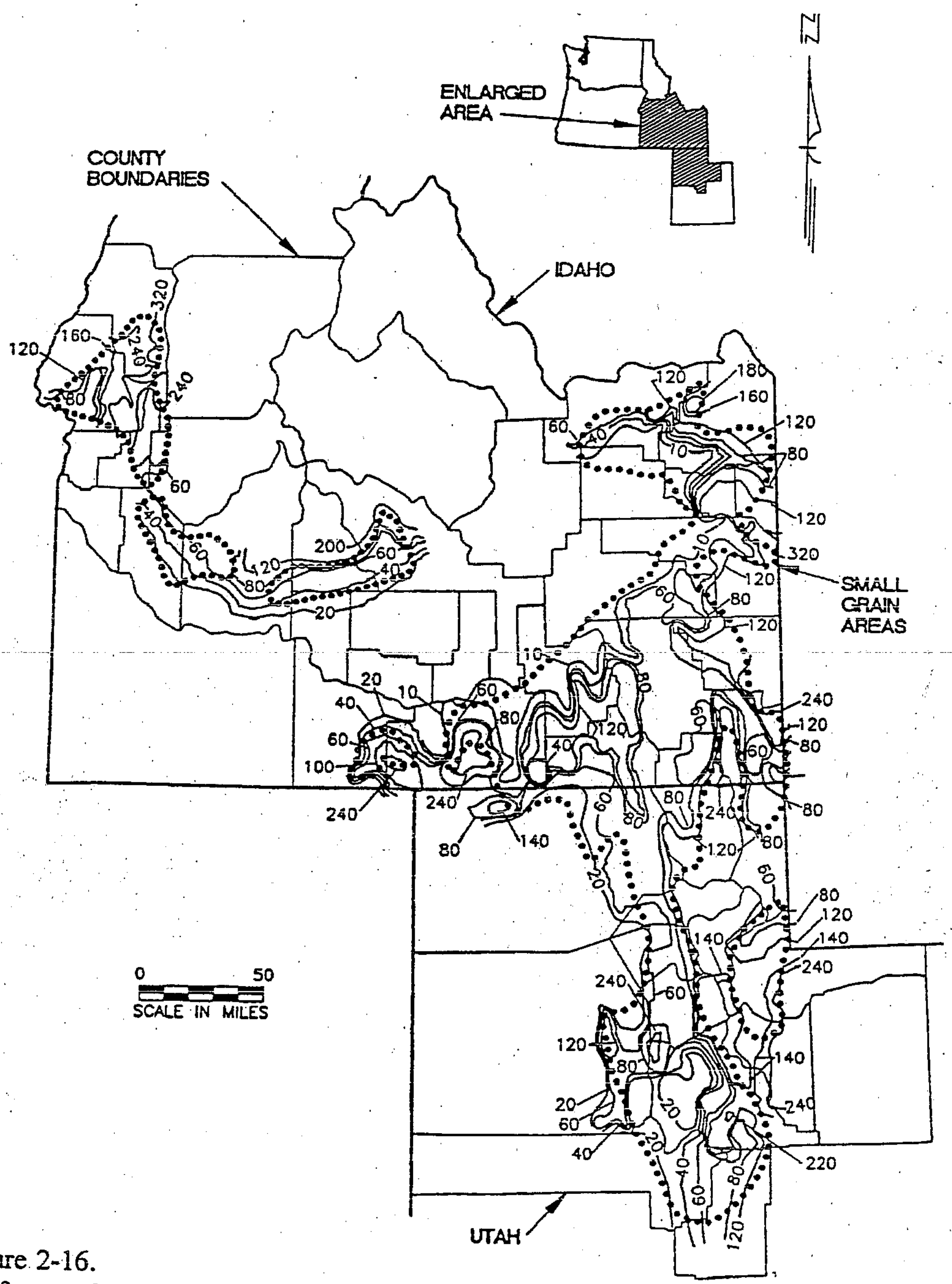


Figure 2-16.
R_{eq} for cropland areas of southern Idaho and Utah in and adjacent to Northwestern Wheat and Range Region (Note: Some irregular contour intervals are used to preserve clarity). R_{eq} units are hundreds ft·tonf·in(ac·h)$^{-1}$.

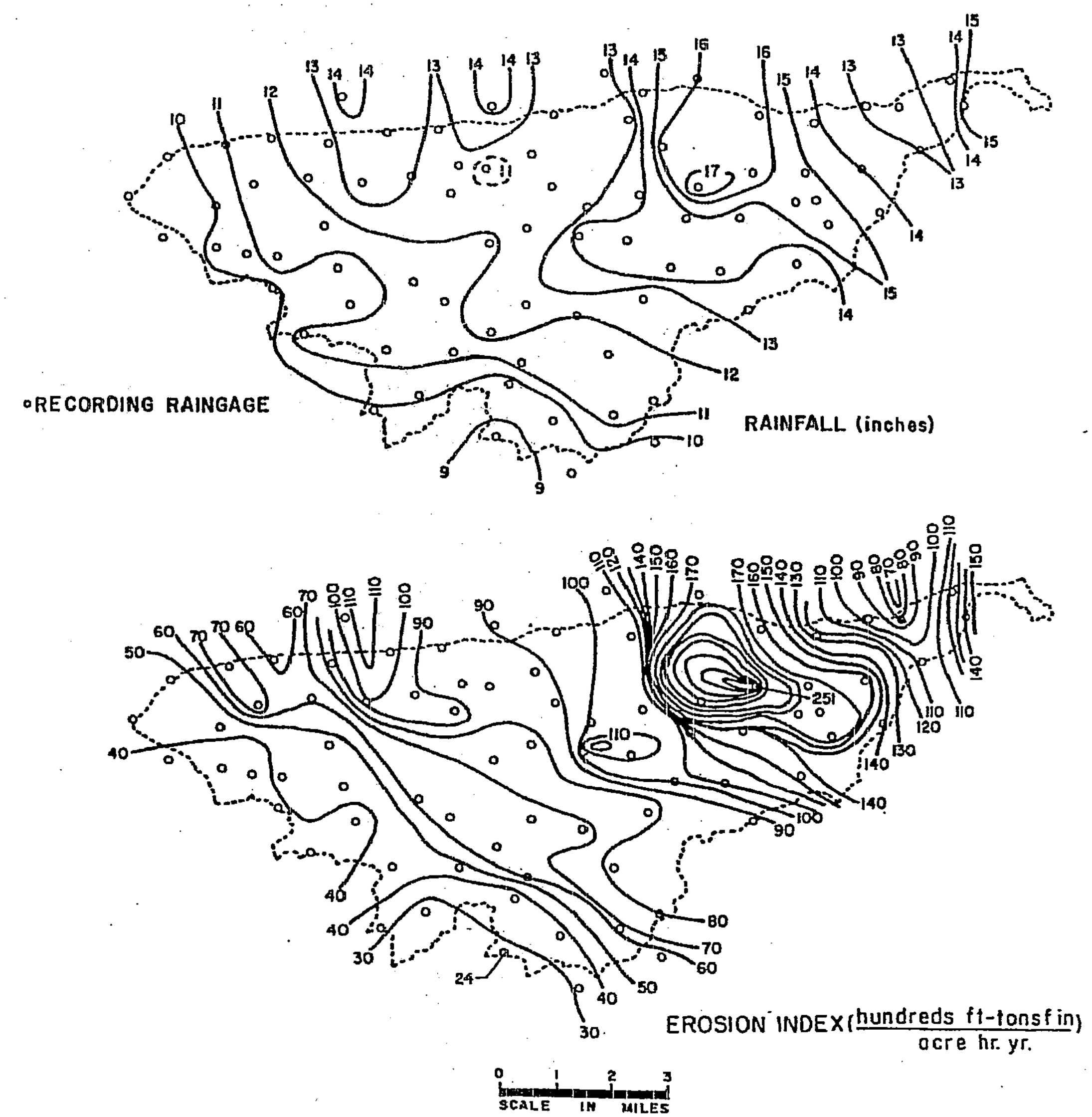


Figure 2-17. Storm precipitation (top) and i[illegible]odent (bottom) values for storm of 7/22/64 on

A003424

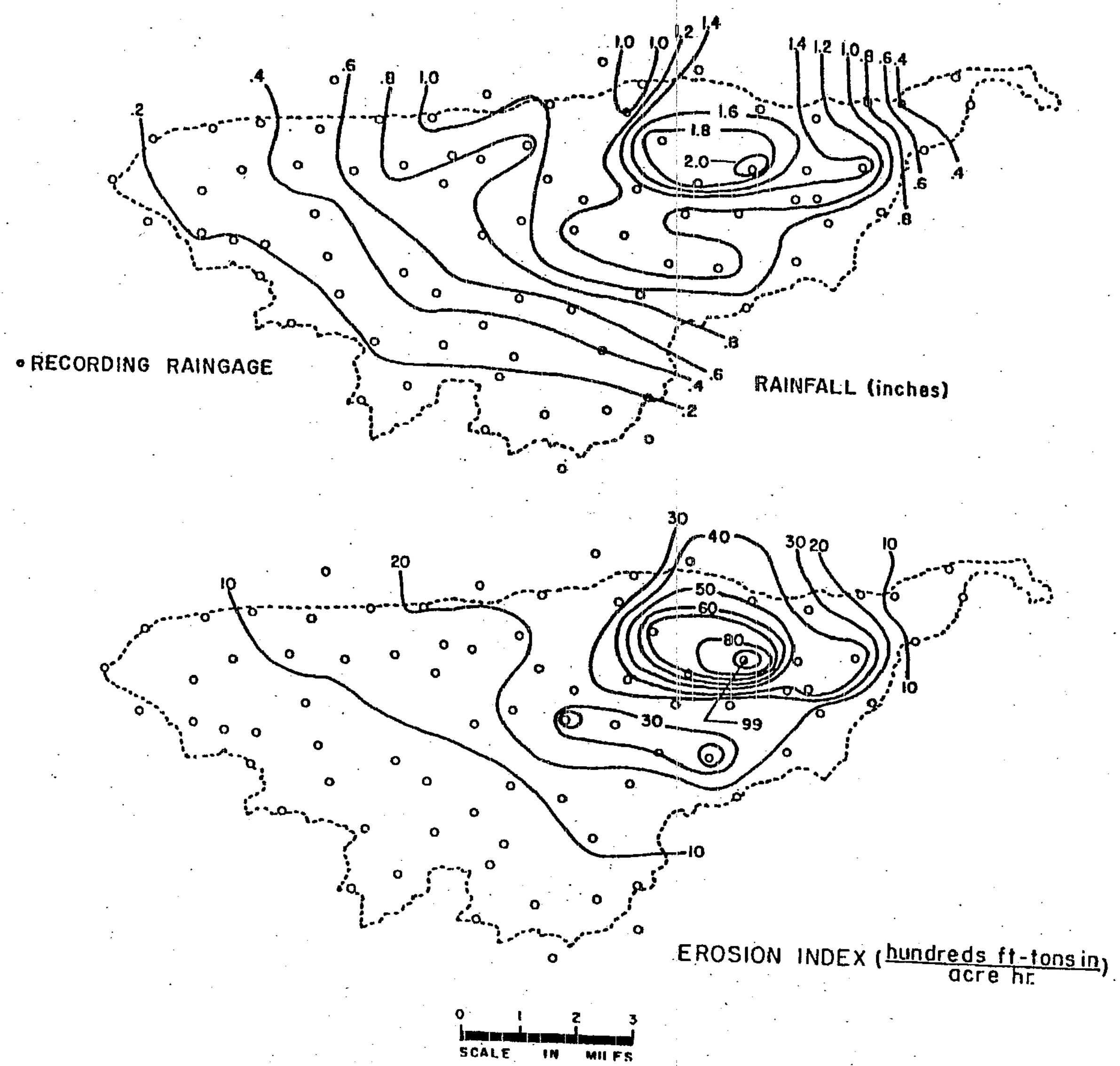


Figure 2-18. Annual precipitation (top) and isoerodent (bottom) maps for 1964 on Walnut Gulch Experimental Watershed

RUTAN & TUCKER, LLP
RICHARD MONTEVIDEO (State Bar No. 116051)
611 Anton Boulevard, Fourteenth Floor
Costa Mesa, California 92626-1950
Telephone: 714-641-5100
Facsimile: 714-546-9035

Attorneys for Petitioners

SUPERIOR COURT FOR THE STATE OF CALIFORNIA

COUNTY OF ORANGE , CENTRAL JUSTICE CENTER

THE CITIES OF ARCADIA, BELLFLOWER, CARSON, CERRITOS, CLAREMONT, COMMERCE, DOWNEY, DUARTE, GARDENA, GLENDORA, HAWAIIAN GARDENS, IRWINDALE, LAWNDALE, MONTEREY PARK, PARAMOUNT, SANTA FE SPRINGS, SIGNAL HILL, VERNON, WALNUT, WEST COVINA, and WHITTIER, municipal corporations, and BUILDING INDUSTRY LEGAL DEFENSE FOUNDATION, a non-profit corporation, Petitioners/Plaintiffs, vs. THE STATE WATER RESOURCES CONTROL BOARD; and THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LOS ANGELES REGION, Respondents/Defendants.	Case No. 06CC02974 Honorable Thierry Patrick Colaw Dept: CX-104 **PEREMPTORY WRIT OF MANDATE**

TO RESPONDENTS STATE WATER RESOURCES CONTROL BOARD

AND THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, LOS ANGELES REGION, AND TO THEIR BOARD MEMBERS, OFFICERS, AGENTS, ATTORNEYS, EMPLOYEES, AND TO ALL PERSONS ACTING ON THEIR BEHALF, OR THROUGH OR UNDER COLOR OF THEIR AUTHORITY:

Judgment having been entered in this action, ordering that a peremptory writ of mandate be issued from this Court,

YOU ARE HEREBY DIRECTED AND COMMANDED, UPON RECEIPT OF THIS WRIT, IN ACCORDANCE WITH YOUR RESPECTIVE OBLIGATIONS UNDER THE LAW:

(1) To void and set aside Los Angeles Regional Water Quality Control Board Resolution No. 2005-003, dated March 3, 2005, wherein the 2004 Triennial Review of the Water Quality Control Plan for the Los Angeles Region ("Basin Plan") was concluded;

(2) During the course of reopened 2004 Triennial Review, or if Respondents determine not to reopen the 2004 Triennial Review, then during the course of the next scheduled triennial review of the Water Quality Standards ("Standards")[1] in the Basin Plan:

(a) to review and, where appropriate, revise the Standards which apply or are to be applied to storm water and urban runoff (collectively "Stormwater"),[2] in light of the factors and requirements set forth under Water Code sections 13241 and 13000, including, but not limited to, the specific factors set forth under Water Code sections 13241(a) – (f), and the considerations provided under Water Code section 13000;

---

[1] As referenced herein, the term "Water Quality Standards" or "Standards" shall mean the designated beneficial uses of the waters, as well as the water quality objectives established to achieve such designated beneficial uses.

[2] Federal law defines "storm water" to include urban runoff, *i.e.*, "surface runoff and drainage." (*See* 40 C.F.R. § 122.26(b)(13).)

(b) to revise the Standards that apply or are to be applied to Stormwater, such that no "potential" use designations for such Standards remain in the Basin Plan; and

(c) to revise the Standards, as appropriate, during said triennial review process, consistent with subsections (a) and (b) above and State and federal law, after a full and fair public hearing or hearings, and before concluding the triennial review.

(3) to cease, desist, and suspend all activities relating to the implementation, application, and/or enforcement of all Standards in the Basin Plan established to achieve "potential" beneficial uses, as applied or to be applied to Stormwater, whether through Total Maximum Daily Loads ("TMDLs") or other Basin Plan amendments or regulations, or through National Pollutant Discharge Elimination System ("NPDES") permits, water quality policies or otherwise.

(4) To cease, desist and suspend all activities relating to the implementation, application and/or enforcement of the Standards in the Basin Plan, as applied or to be applied to Stormwater, whether through TMDLs or other Basin Plan amendments or regulations, or through NPDES permits, water quality policies or otherwise, until such time as Respondents have reviewed and, where appropriate, revised such Standards in light of the factors and requirements provided under Water Code sections 13241 and 13000, including, but not limited to, the specific factors set forth under Water Code subsections 13241(a)-(f) (*e.g.*, requiring that the Standards be developed to achieve water quality conditions "that could reasonably be achieved," and after a consideration of the "economic" impacts on the dischargers, as well as after a consideration of the other factors referenced in Water Code section 13241), and in light of the considerations required under Water Code section 13000 (requiring the regulation of state waters "to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible

and intangible"). Nothing contained in this Paragraph 4 shall prevent the enforcement of any term or provision in an NPDES Stormwater permit, except to the extent that any such term or provision is used or designed to implement or enforce (i) any element of a TMDL, or (ii) any numeric limit that may be included in any such NPDES permit as a means of enforcing a Standard outside of the TMDL process.

(5) To make and file a Return to this Writ within ninety (90) days from the date Respondents have taken all action necessary to comply with paragraphs (1)-(4), above.

WITNESS the Honorable Thierry Patrick Colaw, Judge of the Superior Court.

ATTEST my hand and the seal of this Court, this 2 day of JULY, 2008.

ORANGE COUNTY SUPERIOR COURT
CLERK ALAN SLATER

Dated: 7/2/08 By:

LET THE FOREGOING WRIT ISSUE.

Dated: 2 July 2008

The Honorable Thierry Patrick Colaw
Judge of the Superior Court of California

RESPECTFULLY SUBMITTED BY:
RUTAN & TUCKER, LLP

By:
Richard Montevideo
Attorney for Petitioners/Plaintiffs

Filed 11/6/06

CERTIFIED FOR PARTIAL PUBLICATION*

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA

SECOND APPELLATE DISTRICT

DIVISION FIVE

COUNTY OF LOS ANGELES et al., Plaintiffs and Appellants, v. CALIFORNIA STATE WATER RESOURCES CONTROL BOARD et al., Defendants and Respondents.	B184034 (Los Angeles County Super. Ct. No. BS080792) ORDER MODIFYING OPINION [CHANGE IN JUDGMENT]

The published portion of the opinion filed on October 5, 2006 is modified as follows.

1. On page 1, delete:

"Affirmed in part; reversed in part with directions."

In its place, insert:

"Affirmed."

2. After the first paragraph of page 2, insert the following sentence:

"We affirm the judgment in its entirety."

---

* Pursuant to California Rules of Court, rules 976(b) and 976.1, this opinion is certified for publication with the exception of part IV (G)-(L).

3. Delete in its entirety the second paragraph on page 2 beginning with "We agree with plaintiffs . . . ."

4. Delete: the second paragraph on page 21, beginning with "We agree that Water Code . . . "; all of page 22 including the footnote; and all of pages 23 through 25. In its place, insert:

"Chapter 3 of the California Environmental Quality Act was originally adopted in 1970. (Stats. 1970, ch. 1433, § 1, pp. 2781-2782.) The original chapter 3 of the California Environmental Quality Act required all state agencies, boards, and commissions, that proposed a project which would have a significant effect on the environment to prepare a "detailed statement" setting forth the environmental effect of the contemplated undertaking.[1] (See *Russian Hill Improvement Assn. v. Board of Permit Appeals* (1974) 44 Cal.App.3d 158, 166; *City of Orange v. Valenti* (1974) 37 Cal.App.3d 240, 246.) Water Code section 13389 was adopted as urgency legislation to comply with certain provisions of the Clean Water Act provisions establishing the National Pollution Discharge Elimination System. (Stats. 1972, ch. 1256, § 3, p. 2490.) Expressly for that purpose, the California Legislature enacted chapter 5.5, the "Water Quality" division, which includes Water Code section 13389. (Wat. Code, § 13370[2]; *City of Brentwood v.*

---

1 Public Resources Code section 21100 as enacted in 1970 stated: "All state agencies, boards, and commissions shall include in any report on any project they propose to carry out which could have a significant effect on the environment of the state, a detailed statement by the responsible state official setting forth the following: [¶] (a) The environmental impact of the proposed action. [¶] (b) Any adverse environmental effects which cannot be avoided if the proposal is implemented. [¶] (c) Mitigation measures proposed to minimize the impact. [¶] (d) Alternatives to the proposed action. [¶] (e) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. [¶] (f) Any irreversible environmental changes which would be involved in the proposed action should it be implemented." (Stats. 1970, ch. 1433, § 1, pp. 2781-2782.)

2 Water Code section 13370 states: "The Federal Water Pollution Control Act (33 U.S.C. Sec. 1251 et seq.), as amended, provides for permit systems to regulate the

Central Valley Regional Water Quality Control Bd. (2004) 123 Cal.App.4th 714, 723; *Sierra Club v. Union Oil Co. of California* (9th Cir.1987) 813 F.2d 1480, 1483.) When Water Code section 13389 became effective on December 19, 1972, chapter 2.6 of the California Environmental Quality Act had just been enacted, also as urgency legislation, and it consisted of Public Resources Code sections 21080 through 21090. The new chapter 2.6 of the California Environmental Quality Act became effective on December 5, 1972. (Stats. 1972, ch. 1154, § 19, p. 2280.) Chapter 3 of the California Environmental Quality Act was also amended effective December 5, 1972, and it which applied to all environmental assessments by state agencies, boards, and commissions. Former Public Resource Code section 21100, the core provision of the 1972 version of the California Environmental Quality Act as it related to state agencies, boards, and commissions, stated: "All state agencies, boards, and commissions shall prepare, or cause to be prepared . . . and certify the completion of an environmental impact report on any project they propose to carry out or approve which may have a significant effect on the environment." (Stats. 1972, ch. 1154, § 2.5, p. 2274; see *Desert Environment Conservation Assn. v. Public Utilities Com.* (1973) 8 Cal.3d 739, 742; *San Francisco Ecology Center v. City and County of San Francisco* (1975) 48 Cal.App.3d 584, 594, fn. 8.) Beyond question, the Legislature intended that chapter 3 of the California

---

discharge of pollutants and dredged or fill material to the navigable waters of the United States and to regulate the use and disposal of sewage sludge. [¶] (b) The Federal Water Pollution Control Act, as amended, provides that permits may be issued by states which are authorized to implement the provisions of that act. [¶] (c) It is in the interest of the people of the state, in order to avoid direct regulation by the federal government of persons already subject to regulation under state law pursuant to this division, to enact this chapter in order to authorize the state to implement the provisions of the Federal Water Pollution Control Act and acts amendatory thereof or supplementary thereto, and federal regulations and guidelines issued pursuant thereto, provided, that the state board shall request federal funding under the Federal Water Pollution Control Act for the purpose of carrying out its responsibilities under this program."

Environmental Quality Act not apply to National Pollution Discharge Elimination System permits—in that respect Water Code section 13389 is entirely clear.

But on December 19, 1972, when Water Code section 13389 was enacted, chapter 2.6 of the California Environmental Quality Act, which contains generalized requirements for the preparation of environmental impact reports for discretionary projects, had just been adopted effective December 5, 1972. Chapter 2.6 of the California Environmental Quality Act applies to discretionary projects proposed by public agencies. (Former Pub. Resources Code, § 21080.) Pursuant to new chapter 2.6 of the California Environmental Quality Act, all public agencies were required to adopt by ordinance, resolution, or the like procedures for preparation of environmental impact reports. (Former Pub. Resources Code, § 21082.) The Office of Planning and Research was directed to adopt proposed guidelines for the preparation of environmental impact reports including a listing of projects determined not to have a significant impact on the environment. (Former Pub. Resources Code, §§ 21083-21088.) Finally, chapter 2.6, as adopted in 1972, allowed a public agency to charge fees for the preparation an environmental impact report and defined public and private developments pursuant to a redevelopment plan as a single project. (Former Pub. Resources Code, §§ 21089-21090.)

It can be argued that even though chapter 3 with its environmental impact preparation requirement for state agencies, boards, and commissions was not to apply to National Pollution Discharge Elimination System permits, the discretionary projects requirements in chapter 2.6 of the California Environmental Quality Act mandated environmental review. Hence, the argument would be that the Legislature in enacting Water Code section 13389 did not intend to obviate the duty pursuant to chapter 2.6 of the California Environmental Quality Act to prepare an environmental impact report. We are unpersuaded by this analysis. Former Public Resources Code section 20180, subdivision (a), the core provision relating to discretionary projects, stated: "(a) Except as otherwise provided in this division, this division shall apply to discretionary projects proposed to be carried out or approved by public agencies including, but not limited to, the enactment and amendment of zoning ordinances, the issuance of zoning variances, the issuance of conditional use permits and the approval of tentative subdivision maps (except where such a project is exempt from the preparation of an environmental impact report pursuant to Section 21166)." (Stats. 1972, ch. 1154, § 2.3, p. 2272; see *People v. County of Kern* (1974) 39 Cal.App.3d 830, 839; *Friends of Lake Arrowhead v. Board of Supervisors* (1974) 38 Cal.App.3d 497, 510.) As can be noted, Public Resources Code section 21080, subdivision (a) established that a discretionary project was subject to the environmental impact requirement. But the requirement that a state agency, board, and commission prepare an environmental report was found in Public Resources Code section 21110 which was, and is now, located in chapter 3 of the California Environmental Quality Act. The obligation imposed on a state agency, board, and commission to prepare an environmental impact report existed in chapter 3 before the adoption of Water Code section 13389 and it remained there after the 1972 amendments to the California Environmental Quality Act. No doubt, since 1972 when the Legislature adopted Water Code section 13389 and the then new chapter 2.6, the California Environmental Quality Act has been repeatedly amended. But defendants cite no evidence the Legislature ever intended to: impose a duty on regional boards to prepare environmental impact reports; require regional boards to engage in any other form of environmental review specified in the California Environmental Quality Act; or to otherwise modify Water Code section 13389.

Defendants rely on the analysis of our colleague Presiding Justice Judith D. McConnell of Division One of the Fourth Appellate District in *City of Arcadia v. State Water Resources Control Bd.*, *supra*, 135 Cal.App.4th at pages 1420-1430 that regional board basin plans are subject to limited California Environmental Quality Act review. The *City of Arcadia* decision does not involve the issuance of a National Pollution Discharge Elimination System permit. Rather, it involves the development of a basin plan. (*Ibid.*) We agree with the Attorney General that a basin plan is subject to limited environmental review pursuant to Public Resources Code section 21080.5. Public

Resources Code section 21080.5, subdivision (a) vests the Secretary of the Resources Agency with the authority to require limited environmental review: "(a) Except as provided in Section 21158.1, when the regulatory program of a state agency requires a plan or other written documentation containing environmental information and complying with paragraph (3) of subdivision (d) to be submitted in support of an activity listed in subdivision (b), the plan or other written documentation may be submitted in lieu of the environmental impact report required by this division if the Secretary of the Resources Agency has certified the regulatory program pursuant to this section." The secretary's authority extends to requiring limited environmental review when an agency adopts "standards, rules, regulations, or plans for use" in a regulatory program. (Pub. Resources Code, § 21080.5, subd. (b)(2).) The secretary has certified the regional boards' basin plan program as requiring limited environmental review. (*City of Arcadia v. State Water Resources Control Bd.*, *supra*, 135 Cal.App.4th at p. 1422; Cal. Code Regs. tit.14, § 15251, subd. (g).[3]) The resources secretary has never identified the National Pollution Discharge Elimination System permit system as a Public Resources Code section 21080.5 certified program. Thus, *City of Arcadia* does not require California Environmental Quality Act review prior to the issuance of a National Pollution Discharge Elimination System permit.

[The portions of the opinion that follow, parts IV (G)-(L) are deleted from publication.
See *post* at part V, where publication is to resume.]"

---

3 California Code of Regulations, title 14, section 15251, subdivision (g) states: "The following programs of state regulatory agencies have been certified by the Secretary for Resources as meeting the requirements of Section 21080.5: [¶] . . . (g) The Water Quality Control (Basin)/208 Planning Program of the State Water Resources Control Board and the Regional Water Quality Control Boards."

5. On page 46, delete the first four sentences under DISPOSITION. In their place, insert:

"The judgment is affirmed. "

The unpublished portion of the opinion filed October 5, 2006, is modified as follows:

1. On page 29, line 3, delete:

"is permitted" and insert in its place "may not"

2. On page 29, line 5, delete: "136" and insert in its place "135"

Renumber all subsequent footnotes affected by the insertion of the new footnotes.

TURNER, P. J.	ARMSTRONG, J.	KRIEGLER, J.

Filed 1/26/06

CERTIFIED FOR PUBLICATION

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA

FOURTH APPELLATE DISTRICT

DIVISION TWO

CITY OF RANCHO CUCAMONGA, Plaintiff and Appellant, v. REGIONAL WATER QUALITY CONTROL BOARD-SANTA ANA REGION et al., Defendants and Respondents; COUNTY OF SAN BERNARDINO et al., Real Parties in Interest and Respondents.	E037079 (Super.Ct.No. RCV 071613) OPINION

APPEAL from the Superior Court of San Bernardino County. Shahla Sabet, Judge. Affirmed.

James L. Markman; Richards, Watson & Gershon, John J. Harris and Evan J. McGinley, for Plaintiff and Appellant.

Bill Lockyer, Attorney General, Mary E. Hackenbracht, Senior Assistant Attorney General, Richard Magasin, Supervising Deputy Attorney General, and Jennifer F. Novak, Deputy Attorney General, for Defendants and Respondents.

1. Introduction

This case involves environmental regulation of municipal storm sewers that carry excess water runoff to the Santa Ana River as it passes through San Bernardino County on its way to the Pacific Ocean. Federal and state laws impose regulatory controls on storm sewer discharges. Municipalities are required to obtain and comply with a federal regulatory permit limiting the quantity and quality of water runoff that can be discharged from these storm sewer systems.

In this instance, the Regional Water Quality Control Board for the Santa Ana Region (the Regional Board) conducted public hearings and then issued a comprehensive 66-page municipal storm sewer permit governing 18 local public entities. Two permittees, the City of Rancho Cucamonga and the City of Upland, among others, filed an administrative appeal with the State Water Resources Control Board (the State Board.) The State Board summarily dismissed the appeal. The Cities of Rancho Cucamonga and Upland[1] then filed a petition for writ of mandate and complaint against the State Board and the Regional Board.

The trial court sustained without leave to amend the demurrer of the State Board to the entire action. It sustained the demurrer as to four causes of action and granted the

[1] Upland is not a party to this appeal.

motion to strike of the Regional Board. After a hearing, the trial court denied the petition for writ of mandate.

Both procedurally and substantively, the City of Rancho Cucamonga challenges the conditions imposed by the NPDES[2] Permit and Waste Discharge Requirements (the 2002 permit). It contends the procedure by which the 2002 permit was adopted was not legal, that the 2002 permit's conditions are not appropriate for the area, and that the permit's requirements are too expensive. Because we conclude the permit was properly adopted and its conditions and requirements are appropriate, we reject these contentions.

2. The National Pollutant Discharge Elimination System

California cases have repeatedly explained the complicated web of federal and state laws and regulations concerning water pollution, especially storm sewer discharge into the public waterways. (*City of Burbank v. State Water Resources Control Bd.* (2005) 35 Cal.4th 613, 619-621 (*Burbank*); *Building Industry Assn. of San Diego County v. State Water Resources Control Board* (2004) 124 Cal.App.4th 866, 872-875 (*Building Industry*); *Communities for a Better Environment v. State Water Resources Control Board* (2003) 109 Cal.App.4th 1089, 1092-1094 (*Communities*); *WaterKeepers Northern California v. State Water Resources Control Board* (2002) 102 Cal.App.4th 1448, 1451-1453 (*WaterKeepers*).

For purposes of this case, the important point is described by the California Supreme Court in *Burbank*: "Part of the federal Clean Water Act [33 U.S.C. § 1251 et

[2] The National Pollutant Discharge Elimination System.

seq.] is the National Pollutant Discharge Elimination System (NPDES), '[t]he primary means' for enforcing effluent limitations and standards under the Clean Water Act. (*Arkansas v. Oklahoma* [(1992) 503 U.S. 91, 101.]) The NPDES sets out the conditions under which the federal EPA or a state with an approved water quality control program can issue permits for the discharge of pollutants in wastewater. (33 U.S.C. § 1342(a) & (b).) In California, wastewater discharge requirements established by the regional boards are the equivalent of the NPDES permits required by federal law. (§ 13374.)" (*Burbank, supra,* 35 Cal.4th at p. 621.)

California's Porter-Cologne Act (Wat. Code, § 13000 et seq.) establishes a statewide program for water quality control. Nine regional boards, overseen by the State Board, administer the program in their respective regions. (Wat. Code, §§ 13140, 13200 et seq., 13240, and 13301.) Water Code sections 13374 and 13377 authorize the Regional Board to issue federal NPDES permits for five-year periods. (33 U.S.C. § 1342, subd. (b)(1)(B).)

As discussed more fully in section 6 below, the state-issued NPDES permits are subject to the informal hearing procedures set forth for administrative adjudications. (Gov. Code, § 11445.10 et seq.; 23 C.C.R., § 647 et seq.) The issuance of permits is specifically excluded from the procedures for administrative regulations and rulemaking. (Gov. Code, § 11340 et seq. and § 11352.)

3. <u>Factual and Procedural Background</u>

The Regional Board issued the first NPDES permit for San Bernardino County in 1990. The principal permittee was the San Bernardino Flood Control District (the

District). The 1990 permit required the permittees to develop and implement pollution control measures, using "best management practices" and monitoring programs, to eliminate illegal discharges and connections, and to obtain any necessary legal authority to do so. The management programs could be existing or new.

In 1993, the District developed the NPDES Drain Area Management Program (DAMP).

The second NPDES permit was issued in 1996 and was based on the Report of Waste Discharge (ROWD) prepared by the principal permittee and co-permittees, including Rancho Cucamonga. The 1996 permit proposed extending the existing program, which included inspections of industrial and commercial sources; policies for development and redevelopment; better public education; and implementation of a monitoring program. It offered a commitment to reduce pollutants to the "maximum extent practicable."

In 2000, the permittees submitted another ROWD to renew their NPDES permit. The 2000 ROWD proposed continuing to implement and develop water quality management and monitoring programs.

Based on the 2000 ROWD, the Regional Board staff created five successive drafts of the 2002 permit, incorporating written comments by Rancho Cucamonga and others and comments made during two public workshops. Some of the comments addressed the economic considerations of anticipated prohibitive compliance costs.

The notice of the public hearing to consider adoption of the 2002 permit hearing announced: "relevant Regional Board files are incorporated into the record;" the governing procedures were those for an informal hearing procedure as set forth in "Title 23, California Code of Regulations, Section 647 et seq.;" and "Hearings before the Regional Water Board are not conducted pursuant to Government Code section 11500 et seq.," the alternative formal hearing procedure for administrative adjudication. The notice was mailed to all permittees. The accompanying "fact sheet," which was publicly circulated, offered further information about the conduct and nature of the hearing and the legal and factual grounds for the Regional Board's recommendation to adopt the 2002 permit.

The informal public hearing was conducted on April 26, 2002. Neither Rancho Cucamonga nor any of the permittees objected to the form or substance of the hearing. Ultimately, after a staff presentation and testimony, including a statement from Rancho Cucamonga's counsel, the Regional Board adopted the 2002 permit. After the State Board dismissed their administrative appeal, Rancho Cucamonga and Upland filed the instant action.

The operative pleading is the second amended petition for writ of mandate and complaint. The petition alleges that the State Board and the Regional Board acted illegally and in excess of their jurisdiction in developing, adopting and implementing the 2002 permit. Based on 26 pages of general allegations, the petition asserts eight causes of action, alleging the State Board and the Regional Board violated sections 13241, 13263, and 13360 of the Water Code (the Porter-Cologne Act); the California Environmental Quality Act (CEQA); the California Administrative Procedure Act (Gov.

Code, §§ 11340 through 11529); the California Constitution; and the Federal Clean Water Act; and seeking declaratory and injunctive relief.

The State Board successfully opposed the action on demurrer. The Regional Board eliminated four causes of action, the fourth, fifth, seventh, and eighth by demurrer and motion to strike. On the remaining four causes of action, the trial court found in favor of the Regional Board.

4. State Board's Demurrer

Rancho Cucamonga maintains the trial court should not have sustained the demurrer of the State Board without leave to amend because the State Board is the ultimate authority on state-issued NPDES permits, and, therefore, was properly joined as a party: "Because the State Board has for all intents and purposes adopted the rules and policies of general application upon which the Permit is based, it is clearly a proper party to this action."

The difficulty with Rancho Cucamonga's theory of liability against the State Board is, to quote Gertrude Stein about the City of Oakland, "There is no there there." (Gertrude Stein, *Everybody's Autobiography*.) In other words, Rancho Cucamonga's allegations against the State Board lack any substance. Instead, Rancho Cucamonga launches an unspecific attack on the State Board without identifying any particular problems. The petition makes the unexceptional allegation that the State Board formulates general water control policy which it implements and enforces through regional boards. It also alleges the State Board has not complied with the Administrative Procedures Act but it does not identify any objectionable policies or how there is no compliance. Instead the petition complains about a State Board letter directing that all NPDES permits follow consistent principles regarding Standard Urban Storm Water Mitigation Plans. Additionally, the petition maintains the 2002 permit included new reporting requirements and increased costs of compliance.

But the foregoing allegations did not articulate any improper State Board conduct. The 2002 permit, issued by the Regional Board and not by the State Board, is not subject to formal rule-making procedures. (Gov. Code, § 11352, subd. (b).) The State Board's letter, explaining a precedential decision concerning mitigation plans, is not an example of formal rule-making. (Gov. Code, § 11425.60, subd. (b).) By dismissing Rancho Cucamonga's administrative appeal concerning the 2002 permit, the State Board declined to become involved and the Regional Board's decision to issue the permit became final and subject to judicial review. (*People ex rel Cal. Regional Wat. Quality Control Bd. v. Barry* (1987) 194 Cal.App.3d 158, 177 (*Barry*).) But the State Board was not made a proper party by reason of its dismissal of the administrative appeal.

Furthermore, even if Rancho Cucamonga had identified any cognizable claim against the State Board, it would have been barred by the 30-day statute of limitations for challenging an improperly-adopted State Board policy or regulation. (Wat. Code, § 13330; Gov. Code, § 11350.)

We hold the trial court properly sustained without leave to amend the State Board's demurrer to the second amended petition for writ of mandate and complaint.

5. Standard of Review for Petition for Writ of Mandate

In deciding a petition for writ of mandate, the trial court exercises its independent judgment. (Code Civ. Proc., § 1094.5, subd. (c); Wat. Code, § 13330, subd. (d); *Building Industry, supra,* 124 Cal.App.4th at p. 879.) But, "[i]n exercising its independent judgment, a trial court must afford a strong presumption of correctness concerning the administrative findings, . . . Because the trial court ultimately must exercise its own independent judgment, that court is free to substitute its own findings after first giving due respect to the agency's findings." (*Fukuda v. City of Angels* (1999) 20 Cal.4th 805, 817-818.)

On appeal, the reviewing court determines whether substantial evidence supports the trial court's factual determinations. (*Fukuda, supra,* 20 Cal.4th at p. 824; *Building Industry, supra,* 124 Cal.App.4th at p. 879.) The trial court's legal determinations receive a de novo review with consideration being given to the agency's interpretations of its own statutes and regulations. (*Building Industry, supra,* at p. 879; *Nasha L.L.C. v. City of Los Angeles* (2004) 125 Cal.App.4th 470, 482.)

6. Rancho Cucamonga's Objections to the Administrative Record and Lack of Notice

The notice of the administrative hearing for adoption of the 2002 permit included the statement that the Regional Board's files would be incorporated as part of the record. Before trial on the writ petition, Rancho Cucamonga attempted to raise an omnibus objection to the entire administrative record and a specific objection to four documents, three studies about marine pollution and one economic study. The trial court ruled the objections had been waived by not making them before or at the time of the hearing. Applying the presumption of administrative regularity, we affirm the trial court's evidentiary ruling. (*Mason v. Office of Administrative Hearings* (2001) 89 Cal.App.4th 1119, 1131.)

The reasons given by Rancho Cucamonga as to why the trial court should have sustained its objections to all or part of the administrative record are that it did not waive its objections to the record because Rancho Cucamonga did not know the hearing was adjudicative; the Regional Board did not provide notice of an informal hearing (Gov. Code, § 11445.30); and Rancho Cucamonga never had an opportunity to object to the administrative record.

As noted previously, Government Code section 11352, subdivision (b), makes the issuance of an NPDES permit exempt from the rulemaking procedures of the Administrative Procedures Act. Permit issuance is a quasi-judicial, not a quasi-legislative, rule-making, proceeding: "The exercise of discretion to grant or deny a license, permit or other type of application is a quasi-judicial function." (*Sommerfield v. Helmick* (1997) 57 Cal.App.4th 315, 320; *City of Santee v. Superior Court* (1991) 228 Cal.App.3d 713, 718.)

Instead, the Regional Board correctly followed the administrative adjudication procedures (Gov. Code, § 11445.10 et seq.) and the companion regulations at Code of Regulations, Title 23, sections 647-648.8 for informal adjudicative public hearings. These procedures were announced in the notice of hearing which also stated that Government Code section 11500 et seq., governing formal administrative adjudication hearings, would not apply, thus satisfying Government Code section 11445.30 requiring notice of an informal hearing procedure. At the time of the hearing, Rancho Cucamonga did not object to the informal procedure. Rancho Cucamonga's effort to argue that federal notice requirements (40 C.F.R. § 124.8, subd. (b)(6)(ii)) should also have been followed fails because this involved a state-issued NPDES permit adopted according to California procedures.

Because Rancho Cucamonga was given notice that the hearing on the permit would proceed as an informal administrative adjudication, it cannot successfully argue it was relieved of the obligation to object to the administrative record at the time of the hearing. An informal administrative adjudication contemplates liberality in the introduction of evidence. (23 C.C.R. §§ 648, subd. (d) and 648.5.1.) If Rancho Cucamonga wished to object to the informal hearing procedures, including the liberal introduction of evidence, it should have raised its objections as provided by statute and regulation before or at the time of the hearing (Gov. Code, §§ 11445.30, 11445.40, and 11445.50; 23 C.C.R. § 648.7), not a year later in the subsequent civil proceeding.

7. <u>Economic Considerations for Issuance of NPDES Permit</u>

Rancho Cucamonga's next assignment of error is the Regional Board failed to consider the economic impact of the requirements of the 2002 permit by not conducting a cost/benefit analysis. Rancho Cucamonga relies on the California Supreme Court's *Burbank* opinion, in which the court held: "When . . . a regional board is considering whether to make the pollutant restrictions in a wastewater discharge permit *more stringent* than federal law requires, California law allows the board to take into account economic factors, including the wastewater discharger's cost of compliance." (*Burbank, supra,* 35 Cal.4th at p. 618.) Rancho Cucamonga contends that the 2002 permit exceeds federal requirements and that, therefore, this case should be remanded for a consideration of economic factors. (*Ibid.*, Wat. Code, § 13241, subd. (d).)

The two problems with this argument are the trial court found there was no evidence that the 2002 permit exceeded federal requirements and Rancho Cucamonga does not explain now how it does so. There was also evidence that the 2002 permit was based on a fiscal analysis and a cost/benefit analysis. In the absence of the foundational predicate and in view of evidence that cost was considered, Rancho Cucamonga's contention on this point fails.

We also reject Rancho Cucamonga's related procedural argument that the Regional Board's motion to strike was impermissible as piecemeal adjudication. (*Regan Roofing v. Superior Court* (1994) 24 Cal.App.4th 425, 4326-436; *Lilienthal & Fowler v. Superior Court* (1993) 12 Cal.App.4th 1848, 1851-1855.) It is well recognized a court may strike all or part of a pleading as it did in this instance. (Code Civ. Proc., §§ 431.10 and 436; *PH II, Inc. v. Superior Court* (1995) 33 Cal.App.4th 1680, 1682-1683.)

8. Substantial Evidence

Rancho Cucamonga also challenges the trial court's independent factual determination that sufficient evidence supports the findings of the Regional Board. Rancho Cucamonga's main contention is that the 2002 permit was not distinctively crafted for San Bernardino County but, instead, copied a similar permit for other counties without identifying any particular water quality impairment in San Bernardino County caused by the permittees. In other words, no evidence in the record supports issuance of the 2002 permit and the trial court did not identify any such evidence in its statement of decision.

One problem with Rancho Cucamonga's foregoing argument is that the Clean Water Act requires an NPDES permit to be issued for *any* storm sewer discharge whether there is any actual impairment in a particular region. (33 U.S.C. § 1342; *Communities, supra,* 109 Cal.App.4th at pp. 1092-1093.) Therefore, Rancho Cucamonga's contention that the permit fails to identify impaired water bodies in the region is beside the point.

In its statement of decision, the trial court discussed the inadequacy of the arguments and evidence cited by Rancho Cucamonga and concluded: "The San Bernardino Permit is based in part on the Basin Plan for this region. It is also based on the permittees' own reports and monitoring within this region . . . . It incorporates the permittees' management program, which is unique to these cities and county." The trial court included a citation to the 1993 DAMP report's "Geographic Description of the Drainage Area," which discusses the specific conditions present in San Bernardino County.

On appeal, Rancho Cucamonga faults the trial court for not presenting a more detailed description of the evidence supporting the issuance of the permit. We do not think the trial court, or this court, must bear that burden.

First, "[a]n agency may . . . rely upon the opinion of its staff in reaching decisions, and the opinion of staff has been recognized as constituting substantial evidence. (*Coastal Southwest Dev. Corp. v. California Coastal Zone Conservation Com.* (1976) 55

Cal.App.3d 525, 535-536.)" (*Browning-Ferris Industries v. City Council* (1986) 181 Cal.App.3d 852, 866.) Here the Regional Board adopted the recommendation of its staff in issuing the permit. And, as the record shows, the staff's recommendation was based on the previous 1990 and 1996 permits, the 1993 DAMP report and the 2000 ROWD, the permittees' application for renewal of the 1996 permit, as well as more general water quality factors. The evidence contradicts Rancho Cucamonga's assertion, that "the Regional Board simply copied verbatim the NPDES Permit for North Orange County, a coastal region with markedly different water quality conditions and problems."

As part of the trial court's consideration of the petition for writ of mandate, Rancho Cucamonga and the Regional Board directed the court to review specific items of evidence contained in the administrative record. In its opposing brief, the Regional Board offered a detailed account of the evidence supporting the issuance of the permit. The trial court indicated it had reviewed the parties' submissions before ruling. It discussed the evidence at the hearing on the petition and referred to it in its statement of decision. (*Lala v. Maiorana* (1959) 166 Cal.App.2d 724, 731.) Rancho Cucamonga had the burden of showing the Board abused its discretion or its findings were not supported by the facts. (*Building Industry, supra,* 124 Cal.App.4th at pp. 887-888.) To the extent it attempted to do so at the trial court level, it was not successful.

This court has independently reviewed the record with particular attention to the evidence as emphasized by the parties. We do not, however, find it incumbent upon us or the trial court to review the many thousands of pages submitted on appeal and identify the particular evidence that constitutes substantial evidence. Instead, we deem the trial court's findings sufficient and not affording any grounds for reversal. (*Building Industry, supra,* 124 Cal.App.4th at p. 888; see *Weisz Trucking Co., Inc. v. Emil R. Wohl Construction* (1970) 13 Cal.App.3d 256, 264, citing *Perry v. Jacobsen* (1960) 184 Cal.App.2d 43, 50.)

9. Safe Harbor Provision

As it did repeatedly below, Rancho Cucamonga maintains the 2002 permit violates section 402(k) of the Clean Water Act, 33 U.S.C. § 1342, subd. (k), because the permit does not include "safe harbor" language, providing that, if a permittee is in full compliance with the terms and conditions of its permit, it cannot be found in violation of the Clean Water Act. (*United States Public Interest Research Group v. Atlantic Salmon of Maine, LLC* (1st Cir. 2003) 339 F.3d 23, 26; *EPA v. State Water Resources Control Bd.* (1976) 426 U.S. 200, 205.) The trial court found there was no statutory right to a "safe harbor" provision to be included as the term of the permit. We agree.

This seems like much ado about nothing because 33 U.S.C. § 1342, subdivision (k), already affords Rancho Cucamonga the protection it seeks: "Compliance with a permit issued pursuant to this section shall be deemed compliance, for purposes of sections 1319 and 1365 of this title, with sections 1311, 1312, 1316, 1317, and 1343 of this title, except any standard imposed under section 1317 of this title for a toxic pollutant injurious to human health." Rancho Cucamonga does not cite any persuasive authority as to why this statutory protection had to be duplicated as a provision in the 2002 permit.

Furthermore, the 2002 permit complied with the State Board's Water Quality Order 99-05, a precedential decision requiring NPDES permits to omit "safe harbor" language used in earlier permits. A permit without "safe harbor" language was upheld in *Building Industry, supra*, 124 Cal.App.4th at p. 877. The trial court did not err.

10. Maximum Extent Practicable

Rancho Cucamonga protests that the 2002 permit's discharge limitations/prohibitions exceed the federal requirement that storm water dischargers should "reduce the discharge of pollutants to the maximum extent practicable." (33 U.S.C. § 1342, subd. (p)(3)(B)(iii).) The trial court, however, found there was no evidence presented that the 2002 permit exceeded federal requirements. Because there is no evidence, the issue presented is hypothetical and, therefore, premature. (*Building Industry, supra,* 124 Cal.App.4th at p. 890.)

Additionally, as Rancho Cucamonga recognizes, *Building Industry* rejected the contention that a "regulatory permit violates federal law because it allows the Water Boards to impose municipal storm sewer control measures more stringent than a federal standard known as 'maximum extent practicable.' [Citation.] [Fn. omitted.] [W]e . . . conclude the Water Boards had the authority to include a permit provision requiring compliance with state water quality standards." (*Building Industry, supra,* 124 Cal.App.4th at p. 871.) The *Burbank* case, allowing for consideration of economic factors when federal standards are exceeded, does not alter the analysis in this case where there was no showing that federal standards were exceeded and where there was evidence that economic factors were considered. Furthermore, like the permit in *Building Industries*, the 2002 permit contemplates controlling discharge of pollutants to the maximum extent practicable through a "cooperative iterative process where the Regional

Water Board and Municipality work together to identify violations of water quality standards." (*Buildings, supra,* at p. 889.) The 2002 permit does not exceed the maximum extent practicable standard.

11. <u>The Requirements of the 2002 Permit</u>

Rancho Cucamonga lastly complains the requirements of the 2002 permit are "overly prescriptive," illegally dictating the manner of compliance and improperly delegating to the permittees the inspection duties of the State Board and the Regional Board. Rancho Cucamonga's arguments contradict the meaning and spirit of the Clean Water Act.

In creating a permit system for dischargers from municipal storm sewers, Congress intended to implement actual programs. (*National Resources Defense Council, Inc. v. Costle* (D.C. Cir. 1977) 568 F.2d 1369, 1375.) The Clean Water Act authorizes the imposition of permit conditions, including: "management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator of the State determines appropriate for the control of such pollutants." (33 U.S.C. § 1342, subd. (p)(3)(B)(iii).) The Act authorizes states to issue permits with conditions necessary to carry out its provisions. (33 U.S.C. § 1342, subd. (a)(1).) The permitting agency has discretion to decide what practices, techniques, methods and other provisions are appropriate and necessary to control the discharge of pollutants. (*NRDC v. EPA* (1992) 966 F.2d 1292, 1308.) That is what the Regional Board has created in the 2002 permit.

Rancho Cucamonga's reliance on Water Code section 13360 is misplaced because that code section involves enforcement and implementation of state water quality law, (Wat. Code, § 13300 et seq.) not compliance with the Clean Water Act (Wat. Code, § 13370 et seq.) The federal law preempts the state law. (*Burbank, supra,* 35 Cal.4th at p. 312.) The Regional Board must comply with federal law requiring detailed conditions for NPDES permits.

Furthermore, the 2002 permit does afford the permittees discretion in the manner of compliance. It is the permittees who design programs for compliance, implementing best management practices selected by the permittees in the DAMP report and approved by the Regional Board. Throughout the permit, the permittees are granted considerable autonomy and responsibility in maintaining and enforcing the appropriate legal authority; inspecting and maintaining their storm drain systems according to criteria they develop; establishing the priorities for their own inspection requirements; and establishing programs for new development. The development and implementation of programs to control the discharge of pollutants is left largely to the permittees.

More particularly, we agree with the Regional Board that the permit properly allocated some inspection duties to the permittees. As part of their ROWD application for a permit, the permittees proposed to "Conduct Inspection, Surveillance, and Monitoring. Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with permit conditions including the prohibition on illicit discharges to the municipal storm drain system." The ROWD also discussed continuing existing inspection programs.

Water Code section 13383 provides that as part of compliance with the Clean Water Act, the Regional Board may establish inspection requirements for any pollutant discharger. Federal law, either expressly or by implication, requires NPDES permittees to perform inspections for illicit discharge prevention and detection; landfills and other waste facilities; industrial facilities; construction sites; certifications of no discharge; non-stormwater discharges; permit compliance; and local ordinance compliance. (40 C.F.R. 122.26, subds. (d) and (g); 33 U.S.C. § 1342, subd. (p)(3)(B)(ii).) Permittees must report annually on their inspection activities. (40 C.F.R. § 122.42, subd. (c)(6).)

Rancho Cucamonga claims it is being required to conduct inspections for facilities covered by other state-issued general permits. Rancho Cucamonga and the other permittees are responsible for inspecting construction and industrial sites and commercial facilities within their jurisdiction for compliance with and enforcement of local municipal ordinances and permits. But the Regional Board continues to be responsible under the 2002 NPDES permit for inspections under the general permits. The Regional Board may conduct its own inspections but permittees must still enforce their own laws at these sites. (40 C.F.R. § 122.26, subd. (d)(2).)

12. Disposition

Rancho Cucamonga is the only of the original 18 permittees still objecting to the 2002 NPDES permit. It has not successfully demonstrated that substantial evidence does not support the trial court's factual determinations or the trial court erred in its interpretation and application of state and federal law.

We affirm the judgment and order the prevailing parties to recover their costs on appeal.

CERTIFIED FOR PUBLICATION

s/Gaut
J.

We concur:

s/Hollenhorst
Acting P. J.

s/Richli
J.

NATURAL
RESOURCES
DEFENSE
COUNCIL

Cc

March 26, 1999

RECEIVED MAR 30 1999

Deb Smith
Environmental Program Manager
California Regional Water Quality Control Board
101 Centre Plaza Drive
Monterey Park, CA 91754

Dear Deb:

We wanted to let you know that the court approved the Consent Decree in Heal the Bay, Inc.; Santa Monica BayKeeper, Inc. v. Browner, Case No. 98-4825 SBA on March 22, 1999.

We have enclosed a copy with attachments. If you have any questions, please feel to call either one of us.

Sincerely,

David S. Beckman
Alex N. Helperin

53?? San Vicente Boulevard
?0
[illegible]geles, CA 90048
[illegible]34-6900
Fax 213 934-1210
www.nrdc.org

71 Stevenson Street
Suite 1825
San Francisco, CA 94105
415 777-0220
Fax 415 495-5996

1200 New York Ave., N.W.
Suite 400
Washington, DC 20005
202 289-6868
Fax 202 289-1060

40 West 20th Street
New York, NY 10011
212 727-2700
Fax 212 727-1773

A003457

100% Postconsumer Recycled

UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA

ORIGINAL
FILED
MAR 23 1999
RICHARD W. WIEKING
CLERK, U.S. DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
OAKLAND

RECEIVED MAR 30 1999

HEAL THE BAY, INC., SANTA MONICA BAYKEEPER, INC., and TERRY TAMMINEN, Plaintiffs, v. CAROL BROWNER, Administrator of the United States Environmental Protection Agency, FELICIA MARCUS, Regional Administrator of the United States Environmental Protection Agency, Region IX, and the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Defendants.	No. C 98-4825 SBA

AMENDED CONSENT DECREE

A. WHEREAS, Heal the Bay, Inc., Santa Monica BayKeeper, Inc., and Terry Tamminen (collectively, "Plaintiffs") filed a complaint in this action ("Complaint") against Defendants Carol Browner, in her official capacity as the Administrator of the United States Environmental Protection Agency; Felicia Marcus, in her official capacity as Regional Administrator of the United States Environmental Protection Agency, Region IX; and the United States Environmental Protection Agency (collectively, "EPA"), pursuant to, inter alia, Section 303(d) of the Clean Water Act ("Act" or "CWA"), 33 U.S.C. 1313(d);

B. WHEREAS, Section 303(d) of the Act and EPA's implementing regulations, 40 CFR 130.7(b)-(e), provide for, among other things: (1) identification of waters for which applicable technology-based effluent limitations and other required controls are not stringent enough to implement water quality standards; (2) establishment of a priority ranking for such waters; and (3) establishment of total maximum daily loads ("TMDLs") for those waters;

C. WHEREAS, the subject of this action concerns EPA's alleged duty to either approve or disapprove TMDLs submitted to EPA by the State of California ("State") for waters in that region of the State administered by the Los Angeles Regional Water Quality Control Board (hereinafter referred to as the "Los Angeles Region"), and certain related claims, as set forth in the Complaint filed herewith. The geographic boundaries of the Los Angeles Region are set forth in Attachment 1 hereto;

D. WHEREAS, overall, storm water and urban runoff constitute the most significant sources of pollution to the waters of the Los Angeles Region. However, these sources of pollution have not been sufficiently controlled to date;

E. WHEREAS, storm water and urban runoff in the Los Angeles Region contain high levels of pollutants of concern, including, but not limited to, heavy metals, sediment, nutrients, and pathogens;

F. WHEREAS, the establishment of total maximum daily loads must account for, among other things, all significant sources of pollutants, including pollutants in storm water and urban runoff, and, accordingly, the parties agree to direct attention to reducing these significant sources of pollutants to the waters of the Los Angeles Region;

G. WHEREAS, "water quality standards" ("WQS") has the meaning provided at 40 CFR 130.2(d) and 130.3 as codified as of the Effective Date of this Amended Consent Decree ("Consent Decree") or as subsequently amended;

H. WHEREAS, 40 CFR 130.7(b)(3) states that the terms "water quality standard applicable to such waters" and "applicable water quality standards" refer to those water quality standards established under Section 303 of the Act, including numeric criteria, narrative criteria, waterbody uses and anti-degradation requirements;

I. WHEREAS, 40 CFR 122.26(b)(13) defines "storm water" to mean "storm water runoff, snow melt runoff, and surface runoff and drainage."

J. WHEREAS, 40 CFR 122.1(b)(2) provides, in part, that "[d]ischarges of storm water as set forth in § 122.26" are "point sources requiring NPDES permits for discharges;"

K. WHEREAS, 40 CFR 130.2(h) defines "Wasteload allocation (WLA)," in part, as "[t]he portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution."

L. WHEREAS, in order to resolve this lawsuit, the parties also have entered into an Amended Settlement Agreement ("Settlement Agreement") which has been filed separately with the Court; its terms are not incorporated into this Consent Decree;

M. WHEREAS, the parties have agreed to a settlement of this action without an admission of fact or law, which they consider to be a just, fair, adequate and equitable resolution of the claims raised in this action;

N. WHEREAS, in particular, Plaintiffs state that their consent to this Consent Decree is predicated upon facts including, without limitation, that the Consent Decree provides for remedies that will be implemented without delay, including the near-term establishment of TMDLs to remedy critical water-quality related environmental and public health problems;

O. WHEREAS, therefore, the parties understand that, notwithstanding any other provision herein, if the Consent Decree is not approved for any reason within 90 days of submission, Plaintiffs may withdraw their consent to entry of the Consent Decree; thereafter, neither the Consent Decree nor Plaintiffs' agreement to lodge it shall preclude Plaintiffs from litigating claims including those asserted in the Complaint and seeking whatever remedy may be consistent with law. In any such litigation, EPA reserves all of its defenses, and the parties agree that the Consent Decree may not be used in support of any fact or matter of law.

P. WHEREAS, it is in the interest of the public, the parties and judicial economy to resolve the issues in this action without protracted litigation, including a trial; and

Q. WHEREAS, the Court finds that this Consent Decree represents a just, fair, adequate and equitable resolution of the claims raised in this action.

NOW, THEREFORE, it is hereby ORDERED, ADJUDGED AND DECREED as follows:

GENERAL TERMS

1. The obligations arising under this Consent Decree are to be performed by EPA and not by Carol Browner or Felicia Marcus in their respective individual capacities. This Consent Decree applies to, is binding upon, and inures to the benefit of Plaintiffs (and their successors, assigns, and designees) and of EPA.

2. For the purposes of this Consent Decree,

a. "Water Quality Limited Segment" ("WQLS") has the meaning provided at 40 CFR 130.2(j), as codified as of the

Effective Date of this Consent Decree or as subsequently amended;

b. "Total Maximum Daily Load" ("TMDL") has the meaning provided at 33 U.S.C. Section 1313(d) and 40 CFR 130.2(i), as codified as of the Effective Date of this Consent Decree or as subsequently amended. A TMDL shall be established with "a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality", pursuant to 33 U.S.C. 1313(d)(1)(C). A TMDL "shall be established at a level necessary to implement the applicable water quality standards with seasonal variations", pursuant to 33 U.S.C. 1313(d)(1)(C);

c. "TMDL Analytical Unit" means a group, listed in Attachment 2, of related WQLSs and associated pollutants for which TMDLs will be developed;

d. "Effective Date" means the date upon which this Consent Decree is entered by the Court; and

e. "Continuing planning process" ("CPP") has the meaning provided at Section 303(e) of the CWA, 33 U.S.C. 1313(e), and at 40 CFR 130.5, as codified as of the Effective Date of this Consent Decree or as subsequently amended.

ESTABLISHMENT OF TMDLS

3. The parties understand that California has the initial opportunity pursuant to Section 303(d) of the Act to adopt and submit to EPA for approval TMDLs to be established under this Consent Decree. However, EPA agrees to ensure that a TMDL will be completed for each and every pairing of a WQLS and an associated pollutant in the Los Angeles Region set forth in

Attachment 2 (incorporated herein as if set forth in full, and referred to herein as "the List of Waters and Pollutants Covered by the Consent Decree") by completing the following:

(a) <u>Schedule for Specified Waters</u>. With respect to each and every pairing of a WQLS and an associated pollutant set forth in each TMDL Analytical Unit identified in the "Schedule for Specified Waters" (Attachment 3, incorporated herein as if set forth in full), EPA shall either:

(i) approve a TMDL submitted by the State by the date identified in Attachment 3, or

(ii) if EPA has not approved a TMDL by the date identified in Attachment 3, establish a TMDL within one (1) year after the date identified in Attachment 3, unless the State submits and EPA approves a TMDL prior to EPA establishing the TMDL within EPA's one year backstop period; and

(b) <u>Minimum Pace Requirement</u>. EPA shall assure that a minimum pace for TMDL development is achieved by either, (i) approving, by the following deadlines, a TMDL for each and every pairing of a WQLS and an associated pollutant set forth in the following aggregate number of "TMDL Analytical Units" (Attachment 2) submitted by the State:

Date	Cumulative TMDL Analytical Units
1 year after the Effective Date	1
2 years " " " "	4
3 years " " " "	9
4 years " " " "	14

5 years	"	"	"	"	19
6 years	"	"	"	"	24
7 years	"	"	"	"	29
8 years	"	"	"	"	34
9 years	"	"	"	"	39
10 years	"	"	"	"	44
11 years	"	"	"	"	53
12 years	"	"	"	"	58;

or, (ii) establishing, within one (1) year of each deadline set forth above, a TMDL for each and every pairing of a WQLS and an associated pollutant needed to complete the aggregate number of TMDL Analytical Units required for that deadline, unless the State submits and EPA approves a TMDL prior to EPA establishing the TMDL within EPA's one year backstop period; and

(c) Final Deadline. By thirteen (13) years after the Effective Date, approve or establish a TMDL for each and every remaining pairing of a WQLS and an associated pollutant in the Los Angeles Region set forth in the List of Waters and Pollutants Covered by the Consent Decree (Attachment 2). If EPA finds it necessary to utilize year thirteen (13) of this schedule to satisfy this obligation, EPA shall assure that TMDLs approved or established in year thirteen (13) are for low priority WQLSs covered by this Consent Decree, TMDLs for higher priority WQLSs covered by this Consent Decree having been approved or established in years one (1) through twelve (12) of the schedule. "Low priority" and "higher priority" herein refer to priorities set forth in the California 1998 Section 303(d) List, as approved by EPA, October, 1998, although the inclusion of one or more "low" priority WQLS(s) and associated pollutant(s) in an Analytical Unit contained in Attachment 3 is not intended to affect, nor affects, the schedule required therein.

4. Where the parties mutually consent to any revision of Attachments 2 and/or 3, such revision shall be effected by written agreement submitted to the Court for approval, except for extensions of sixty (60) days or less, which revision may be effected by written agreement of the parties and notice to the Court.

MEASURING COMPLIANCE WITH TMDL DEADLINES

5. The approval or establishment by EPA of a TMDL for each and every pairing of a WQLS and an associated pollutant listed within any TMDL Analytical Unit counts as completion of that TMDL Analytical Unit for purposes of compliance with subparagraph 3(b), above. By way of illustration and example, credit under paragraph 3(b) of the Consent Decree for completion of TMDL Analytical Unit # 7 accrues when EPA approves or establishes 5 TMDLs: one TMDL for PCBs for each of the 5 listed WQLSs in TMDL Analytical Unit # 7. Where a deadline for a specified TMDL Analytical Unit is provided in Attachment 3, the approval or establishment by EPA of a TMDL for each and every pairing of a WQLS and an associated pollutant listed within that specified TMDL Analytical Unit counts as completion of the specified TMDL Analytical Unit for purposes of subparagraph 3(a), above, and also for purposes of the milestones required by paragraph 3(b). By way of illustration and example, credit under paragraph 3(a)

of the Consent Decree for completion of TMDL Analytical Unit # 56 accrues when EPA approves or establishes 3 TMDLs: 1 TMDL for lead (Pb), 1 TMDL for copper (Cu), and 1 TMDL for zinc (Zn) for the listed WQLS, Marina del Rey Harbor - Back Basins. Thereafter, this TMDL Analytic Unit also counts toward the milestones required by paragraph 3(b).

6. EPA and the Plaintiffs understand that future Section 303(d) Lists for the Los Angeles Region may include additional WQLSs or pollutants ("Additional WQLSs or Pollutants") that may warrant TMDL development prior to TMDL development for some WQLSs or pollutants listed in Attachment 2. EPA's obligation, if any, with respect to such Additional WQLSs or Pollutants is not within the scope of this Consent Decree. However, to the extent that EPA seeks credit under the Consent Decree for completing a TMDL for an Additional WQLS or Pollutant, it must follow the procedure described in Paragraph 7 to obtain such credit.

7. After obtaining Plaintiffs' written agreement, which consent Plaintiffs may at their sole discretion withhold, EPA may, after Court approval, substitute one or more such Additional WQLSs or Pollutants for an agreed upon number of WQLSs or pollutants set forth in Attachment 2 and, after approving or establishing a TMDL for each such Additional WQLS or Pollutant, EPA may count that approved or established TMDL, in accordance with the parties' agreement, for purposes of compliance with the milestones contained in this Consent Decree. No implication

shall be drawn as a result of Plaintiffs' rejection of a request to substitute Additional WQLSs or Pollutants.

8. In fulfilling its obligations under this Consent Decree, EPA is under no obligation to establish TMDLs for any pairing of a WQLS and a pollutant that EPA determines for purposes of this Decree only, consistent with Section 303(d) of the Act and its implementing regulations, including 40 CFR 130.7(b), as codified as of the Effective Date of this Consent Decree or as subsequently amended, does not require a TMDL or which has been removed after the Effective Date from an EPA approved California Section 303(d) list of waters requiring TMDLs pursuant to Section 303(d)(1) of the Act, consistent with the provisions of the Act and EPA's implementing regulations. Accordingly, if it complies with the notification procedure required by paragraph 9 of this Consent Decree, for the purposes of measuring EPA's compliance with the milestones described in paragraph 3, EPA may also count toward TMDL development any pairing of a WQLS and a pollutant set forth in Attachments 2: (i) after it is removed from a Section 303(d) list of waters requiring a TMDL pursuant to Section 303(d)(1) (approved by EPA after the Effective Date); or (ii) after EPA determines for purposes of this Decree only, consistent with Section 303(d) and 40 CFR 130.7, as codified as of the Effective Date or this Consent Decree or as subsequently amended, that a TMDL is not required.

9. If EPA makes a determination pursuant to paragraph 8(ii) of the Consent Decree that a TMDL is not required for any

pairing of a WQLS and a pollutant, EPA shall notify Plaintiffs within thirty (30) days of EPA's determination and provide Plaintiffs with the basis for its determination. EPA's determination under paragraph 8(ii) is not a final agency action subject to review independent of this Consent Decree. However, if Plaintiffs do not concur with EPA's determination under paragraph 8(ii), EPA agrees that the Court may solely for purposes of determining EPA's compliance with the requirements of paragraph 3 of this Consent Decree, and pursuant to a request by Plaintiffs under paragraph 23 of the Consent Decree ("Dispute Resolution"), review the record of EPA's determination under paragraph 8(ii) and decide whether or not EPA's determination is consistent with the Clean Water Act and its implementing regulations, including 40 CFR 130.7, as codified as of the Effective Date of this Consent Decree or as subsequently amended. If the Court disapproves EPA's determination under paragraph 8(ii), then within six (6) months after that ruling (or if the pairing of a WQLS and an associated pollutant is listed on Attachment 3, then the later of six (6) months after the ruling or the date the TMDL is scheduled to be complete), EPA shall either: (i) approve a state established TMDL for each pairing of a WQLS and an associated pollutant at issue or (ii) establish a TMDL for each pairing of a WQLS and an associated pollutant at issue.

<u>TMDL PROGRESS REPORTS AND DOCUMENTATION</u>

10. Beginning one year after the Effective Date and continuing every year thereafter until fourteen (14) years after

the Effective Date, EPA shall provide Plaintiffs, and any interested party upon written request, with an annual written progress report covering the one-year period just ended. Each report shall be provided within ninety (90) days after the end of the period that is the subject of the progress report, and with respect to the Los Angeles Region shall identify:

a. the TMDLs submitted by the State during the reporting period, the date of each submission, EPA action taken on each submission and the date of the action taken;

b. the TMDLs that EPA established during the reporting period; and

c. all WQLSs, and pollutants associated with each WQLS, that are on the 1998 Section 303(d) list that are not included on the most recent EPA approved Section 303(d) lists or which EPA determined consistent with Section 303(d) and 40 CFR 130.7, as codified as of the Effective Date of this Consent Decree or as subsequently amended, do not need a TMDL.

11. Six (6) months after the Effective Date, and annually thereafter for each of the next three (3) years, EPA shall by conference call inform Plaintiffs of the general status of actions to comply with the Consent Decree, including TMDLs submitted, EPA action taken on each submission and the date of that action, TMDLs approved or established by EPA, and all WQLSs (and pollutants associated with those WQLSs) that are on the 1998 Section 303(d) list that are not included on the most recent EPA approved Section 303(d) list or which EPA determined consistent with Section 303(d) and 40 CFR 130.7, as codified as of the

Effective Date of this Consent Decree or as subsequently amended, do not need TMDLs.

12. These provisions do not limit Plaintiffs' rights under the Freedom of Information Act or other public information provisions of law.

CONTINUING PLANNING PROCESS

13. By three (3) months from the Effective Date:

a. EPA will provide Plaintiffs a copy of the State's Continuing planning process ("CPP");

b. EPA will keep at EPA Region IX a copy of the most recent State CPP reviewed by EPA for public review during the pendency of this Consent Decree; and

c. EPA will publish in the Federal Register a notice informing the public that: the CPP is available for public review; that by six months from entry of the Consent Decree EPA will prepare and make available to interested parties upon request for their review and comment EPA's preliminary written summary of its review of that portion of the CPP related to the Section 303(d) program; and interested parties may request copies of the CPP and EPA's preliminary written summary when available.

14. By six (6) months from the Effective Date, EPA will: (a) review that portion of the CPP related to the Section 303(d) program to determine whether it is consistent with Section 303(e) of the Act, 33 U.S.C. 1313(e), and EPA's implementing regulations at 40 CFR 130.5, as codified as of the Effective Date or as subsequently amended; (b) prepare a preliminary written summary of its review, including any recommendations for improvement;

(c) provide the preliminary written summary to the Plaintiffs and the State for comment; and (d) make the preliminary written summary available for comment to other parties upon written request. EPA will consider any comments on the preliminary written summary submitted not later than forty-five (45) days after the preliminary written summary is provided to the Plaintiffs and the State for comment.

15. By nine (9) months from the Effective Date, EPA will determine whether that portion of the CPP related to the Section 303(d) program is consistent with the Act and its implementing regulations, and it will provide Plaintiffs and the State, and any other interested persons upon request, with a final written summary of EPA's review of the CPP that will include any recommendations for improvement.

16. If the State does not modify its CPP to be consistent with any EPA recommendations, the Act and its implementing regulations, EPA shall take appropriate action as provided under the Act and accompanying regulations.

<u>REPORT REGARDING MONITORING, ASSESSMENT AND LISTING</u>

17. By one (1) year from the Effective Date, EPA will develop a final report evaluating and making any recommendations regarding the Los Angeles Regional Water Quality Control Board's water quality monitoring and assessment program and Section 303(d) listing process. At least sixty (60) days prior to finalizing the report, EPA will provide a preliminary copy of the report to Plaintiffs and the Los Angeles Regional Water Quality Control Board for comment. At that same time EPA will

make a copy available for comment to other interested parties upon prior written request. EPA will consider any comments on the preliminary report submitted not later than forty-five (45) days after the preliminary report is provided to Plaintiffs and the Los Angeles Regional Water Quality Control Board for comment.

18. EPA will consider the final report, among other things, to be existing and readily available water quality-related information to be used in reviewing the next State Section 303(d) list for the Los Angeles Region submitted after the Effective Date of this Decree and for determining whether that list can be approved under CWA Section 303(d) and EPA's implementing regulations.

FORCE MAJEURE

19. The possibility exists that circumstances outside the reasonable control of EPA could delay compliance with the timetables contained in this Consent Decree. Such circumstances may include, but are not limited to, catastrophic environmental events requiring immediate and/or time-consuming response by EPA. In addition, the parties recognize that the performance of the Consent Decree is subject to fiscal and procurement laws and regulations of the United States, which include, but are not limited to, the Anti-Deficiency Act, 31 U.S.C. §§ 1341, *et seq.* ("ADA"). Circumstances where the expenditure of funds may violate the ADA and/or fiscal and procurement laws and regulations of the United States include, but are not limited to, sufficient funds not being appropriated as requested or appropriated funds not being available for expenditure. Should a delay occur due to

force majeure circumstances, any resulting failure to meet the timetables set forth herein shall not constitute a failure to comply with the Consent Decree. EPA will provide notice to the Plaintiffs after EPA becomes aware of the need for such delay, and will provide Plaintiffs with an explanation of EPA's basis for invoking this term. Plaintiffs may challenge the invocation of this term of the Consent Decree under the dispute resolution terms of this Consent Decree, and EPA shall bear the burden of justifying its invocation of this term.

MODIFICATIONS AND EXTENSIONS

20. Any dates set forth in this Consent Decree may be extended by written agreement of the parties and notice to the Court. To the extent the parties are not able to agree to an extension, either party may seek a modification to the Consent Decree for good cause shown and in accordance with the procedures specified below:

a. If a party files a motion requesting modification of a date or dates established by the Consent Decree and provides notice to the other party at least thirty (30) days prior to filing such motion, and files the motion at least sixty (60) days prior to the date for which modification is sought, then the filing of such motion shall, upon request, automatically extend the date for which modification is sought. Such extension shall remain in effect until the earlier to occur of (i) a dispositive ruling by the Court on such motion, (ii) the date sought in the modification, or (iii) sixty (60) days after the original date for which modification is sought. The party may move the Court for a longer extension. In the absence of a dispositive ruling from the Court, only one such automatic stay shall be permitted for each deadline for which modification is sought.

b. If a party files a motion requesting modification of a date or dates established by the Consent Decree totaling thirty (30) days or less, provides notice to the other party at least thirty (30) days prior to the filing of such motion, and files the motion at least seven (7) days prior to the date for which modification is sought, then the filing of such motion shall, upon request, stay the date for which modification is sought. Such stay shall remain in effect until the earlier to occur of (i) a dispositive ruling by this Court on such motion, or (ii) the date sought in the modification. In the absence of a dispositive ruling from the Court, only one such automatic stay shall be permitted for each deadline for which modification is sought.

c. If a party seeking modification does not provide notice pursuant to subparagraphs a. or b., above, that party may move the Court for a stay of the date for which modification is sought. The party seeking modification under this subparagraph shall give notice to the other party as soon as possible of its intent to seek a modification and/or stay of the date sought to be modified.

d. Any motion to modify the schedule established in this Consent Decree shall be accompanied by a motion for expedited consideration.

21. Nothing in this Consent Decree shall be construed to limit the equitable powers of the Court to modify the Consent Decree's terms upon a showing of good cause by any party. Good cause may include, but is not limited to, changes in the law, including implementing regulations, affecting EPA's actions under this Consent Decree.

CONTINUING JURISDICTION

22. The Court retains jurisdiction for the purposes of resolving any disputes arising under this Consent Decree, and issuing such further orders or directions as may be necessary or appropriate to construe, implement, modify or enforce the terms of this Consent Decree, and for granting any further relief as the interests of justice may require.

DISPUTE RESOLUTION

23. In the event of a disagreement between the parties concerning the interpretation or performance of any aspect of the Consent Decree (including requirements related to the CPP), the dissatisfied party shall provide the other party with written notice of the dispute and a request for negotiations. The parties shall meet and confer in order to attempt to resolve the dispute within thirty (30) days of the written notice, or such time thereafter as is mutually agreed upon. If the parties are unable to resolve the dispute within sixty (60) days of such meeting, or such time thereafter as may be mutually agreed, then either party may petition the Court to resolve the dispute.

JUDICIAL REVIEW, AND COMPLIANCE WITH OTHER LAWS

24. Nothing in the Consent Decree shall be construed to confer upon this Court jurisdiction to review any decision, either procedural or substantive, to be made by EPA pursuant to the Consent Decree, except for the purpose of determining EPA's compliance with the Consent Decree. Plaintiffs reserve their rights to challenge, where necessary in a separate lawsuit, the merits of any action taken by EPA pursuant to this Decree. EPA reserves all of its rights and defenses to any such action. Except as provided herein, nothing in the Consent Decree shall limit or modify the discretion accorded EPA by the Clean Water Act or by general principles of administrative law, including EPA's discretion to alter, amend, or revise from time to time any actions taken by EPA pursuant to the Consent Decree, or to promulgate superseding regulations. Plaintiffs reserve their rights to challenge, where necessary in a separate lawsuit, such exercise of discretion or promulgation of superseding regulations by EPA. EPA reserves all of its rights and defenses to any such action.

25. Nothing in the Consent Decree relieves EPA of the obligation to act in a manner consistent with other applicable Federal, State or local law, including the notice and comment and other provisions of the Administrative Procedure Act, 5 U.S.C. §§ 551-599, 701-706. No provision of the Consent Decree shall constitute a commitment that EPA obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, and other applicable appropriations law or regulation.

NOTICE

26. Any notice required or made with respect to the Consent Decree shall be in writing and shall be effective upon receipt. For any matter relating to the Consent Decree, the contact persons are:

For the Plaintiffs:

David S. Beckman
Alex N. Helperin
Natural Resources Defense Council, Inc.
6310 San Vicente Blvd., Suite 250
Los Angeles, CA 90048

Mark Gold, Executive Director
Steve Fleischli, Law and Policy Analyst
Heal the Bay
2701 Ocean Park Blvd., Suite 150
Santa Monica, CA 90405

Terry Tamminen, Executive Director
Santa Monica BayKeeper
P.O. Box 10096
Marina del Rey, CA 90295

For the United States:

Associate General Counsel, Water Law Office
Office of General Counsel, 2355
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Director
Water Division
U.S. Environmental Protection Agency,
Region 9
75 Hawthorne St.
San Francisco, CA 94105

Regional Counsel
EPA Region 9
U.S. Environmental Protection Agency,
Region 9
75 Hawthorne St.
San Francisco, CA 94105

and

Chief
Environmental Defense Section
Environment & Natural Resources Division
United States Department of Justice
P.O. Box 23986
Washington, D.C. 20026-3986

Upon written notice to the other parties, any party may designate a successor contact person for any matter relating to the Consent Decree.

REPRESENTATIVE AUTHORITY

27. Each undersigned representative of a party to the Consent Decree certifies that he or she is fully authorized by the party to enter into and execute the terms and conditions of the Consent Decree, and to legally bind such party to the Consent Decree. By the signatures below, all of the Plaintiffs and EPA consent to entry of this Consent Decree.

SECURING COURT APPROVAL

28. Upon signature of each undersigned representative of each party to this Consent Decree, Plaintiffs and EPA agree to join in and support such legal proceedings as necessary to secure the Court's timely approval and entry of this Consent Decree.

SEVERABILITY

29. If any provision of the Consent Decree is deemed invalid or unenforceable, the balance of the Consent Decree shall remain in full force and effect.

ENTIRE AGREEMENT

30. This Consent Decree and the Settlement Agreement are the entire agreement between Plaintiffs and EPA in this case. All prior conversations, meetings, discussions, drafts and writings of any kind are specifically superseded by this Consent Decree and the Settlement Agreement.

MUTUAL DRAFTING

31. It is hereby expressly understood and agreed that this Consent Decree was jointly drafted by Plaintiffs and EPA. Accordingly, the parties hereby agree that any and all rules of construction to the effect that ambiguity is construed against the drafting party shall be inapplicable in any dispute concerning the terms, meaning, or interpretation of this Consent Decree.

COUNTERPARTS

32. This Consent Decree may be executed in any number of counterpart originals, each of which shall be deemed to constitute an original agreement, and all of which shall constitute one agreement. The execution of one counterpart by a party's undersigned representative shall have the same force and effect as if that undersigned representative had signed all other counterparts.

EFFECTIVE DATE

33. This Consent Decree shall become effective upon the date of its entry by the Court; however, the obligation to join in and support such legal proceedings as necessary to secure the Court's timely approval and entry of this Consent Decree accrues upon signature of the agreement by each undersigned representative of each party. If for any reason the Court does not enter this Consent Decree, this Consent Decree shall not become effective.

RELEASE BY PLAINTIFFS

34. Upon entry by the Court of the Consent Decree, the Consent Decree and accompanying Settlement Agreement shall constitute a final resolution between Plaintiffs and EPA of all counts of the Complaint. Except for claims which may arise under the provisions of the Consent Decree and/or the Settlement Agreement, and/or claims that are reserved by provisions of the Consent Decree (including without limitation paragraph 35) and/or the Settlement Agreement, Plaintiffs hereby release, discharge, and covenant not to assert (by way of the commencement of an action, the joinder of EPA in an existing action or in any other fashion) any and all claims, causes of action, suits or demands of any kind whatsoever in law or in equity which it may have had, or may now or hereafter have, against EPA based upon matters which have been asserted in the Complaint.

RESERVATION OF RIGHTS

35. This Consent Decree and the Settlement Agreement do not waive or limit in any way Plaintiffs' rights except as expressly provided therein. Nothing in the Consent Decree or Settlement Agreement shall be construed to waive or limit any right to challenge or file suit on matters including, but not limited to, (1) California's 1998 or subsequent Section 303(d) Lists, whether such Section 303(d) Lists are prepared by California or by EPA; (2) any TMDLs, whether such TMDLs are established by California or by EPA, and/or TMDL implementation; (3) non-TMDL CWA obligations, such as the issuance, reissuance, modification, or revocation and reissuance of NPDES permits; or (4) the failure to establish TMDLs for waters and/or pollutants outside the Los Angeles Region or for Additional WQLSs or Pollutants in the Los Angeles Region. EPA reserves all of its claims and defenses in any such action.

USE OF CONSENT DECREE

36. This Consent Decree shall not constitute an admission or evidence of any fact, wrongdoing, misconduct, or liability on the part of the United States, its officers, or any person affiliated with it.

APPLICABLE LAW

37. This Consent Decree shall be governed and construed under the laws of the United States.

THIRD-PARTY BENEFICIARIES

38. Nothing in this Consent Decree shall be construed to make any other person or entity not executing the Consent Decree a third-party beneficiary to the Consent Decree.

TERMINATION OF CONSENT DECREE AND DISMISSAL OF CLAIMS

39. The Consent Decree shall terminate after fulfillment of all the obligations of EPA under the Consent Decree. Upon termination of the Consent Decree, this case shall be dismissed with prejudice. EPA and Plaintiffs shall jointly file the appropriate notice with the Court so that the Clerk of the Court may close the file.

COSTS

40. EPA agrees that Plaintiffs are entitled to reasonable attorneys' fees and costs accrued as of the Effective Date of the Consent Decree and fees reasonably incurred in obtaining those fees. The parties shall make a good faith effort to reach agreement as to the appropriate amount of the recovery. If the parties cannot reach agreement, Plaintiffs shall file any request for attorneys' fees within ninety (90) days of the Effective Date of the Consent Decree. EPA shall have forty-five (45) days to respond to Plaintiffs' fee request. Nothing herein limits the right of Plaintiffs to seek recovery of reasonable attorneys' fees and costs for monitoring or enforcement of this Consent Decree after the Effective Date to the extent permitted by law, nor limits EPA's right to oppose any such request.

On behalf of the party or parties designated below, the undersigned agree to the foregoing Consent Decree, and consent to its entry as an order of the Court forthwith.

For: SANTA MONICA BAYKEEPER, INC., and TERRY TAMMINEN

Date: 2/19/99

DAVID S. BECKMAN
ALEX N. HELPERIN
Natural Resources Defense Council
6301 San Vicente Blvd., Suite 250
Los Angeles, CA 90048

Counsel for PLAINTIFFS SANTA MONICA BAYKEEPER, INC., and TERRY TAMMINEN

For: HEAL THE BAY, INC.

Date: 2/19/99

STEVEN FLEISCHLI
Heal the Bay, Inc.
2701 Ocean Park Blvd., Suite 150
Santa Monica, CA 90405

Counsel for Plaintiff HEAL THE BAY, INC.

FOR CAROL BROWNER, FELICIA MARCUS, and THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY:

LOIS J. SCHIFFER
Assistant Attorney General
Environmental and Natural
Resources Division
U.S. Department of Justice
Washington, D.C. 20530

Date: 2/19/99

S. Randall Humm

S. RANDALL HUMM
Environmental Defense Section
Department of Justice
P.O. Box 23986
Washington, D.C. 20026-3986

Counsel for Carol Browner, Felicia Marcus, and the United States Environmental Protection Agency

ORDER

UPON CONSIDERATION OF THE FOREGOING, the Court hereby finds that this Amended Consent Decree is fair and reasonable, both procedurally and substantively, consistent with applicable law, in good faith, and in the public interest. THE FOREGOING Amended Consent Decree is hereby APPROVED AND ENTERED AS FINAL JUDGMENT.

SIGNED and ENTERED this 22nd day of March, 1999.

SAUNDRA BROWN ARMSTRONG
JUDGE, UNITED STATES DISTRICT COURT

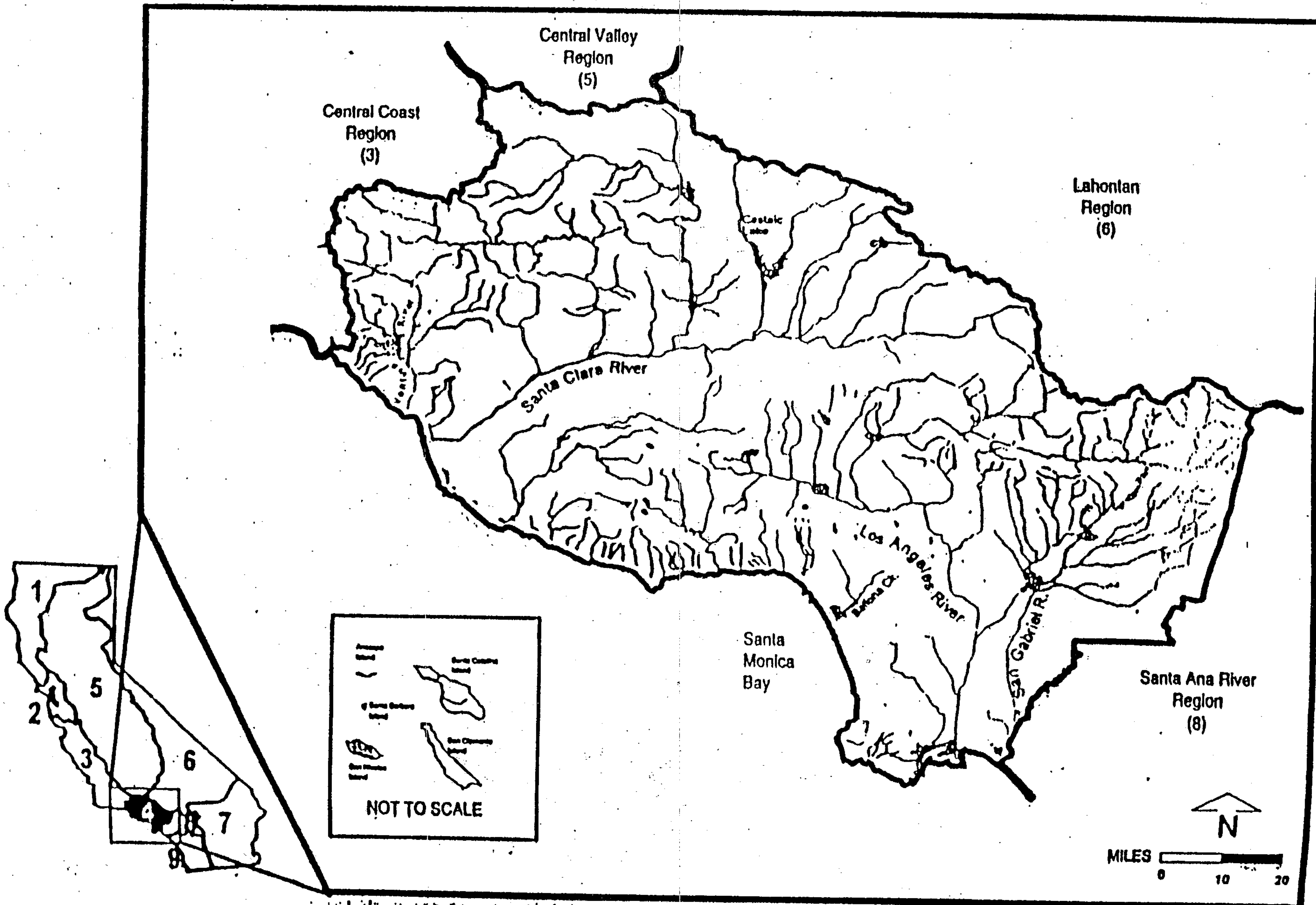


Figure 1-1. Regional Map: Regional Water Quality Control Board, Los Angeles Region.

ATTACHMENT 2
LIST OF WATERS AND POLLUTANTS COVERED BY THE CONSENT DECREE[1]

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
1	Calleguas Creek	Fox Barranca	nitrate + nitrite
		Arroyo Las Posas Reach 1 (Lewis/Somis Rd. to Fox Barranca)	NH3
		Arroyo Las Posas Reach 1 (Lewis/Somis Rd. to Fox Barranca)	nitrate + nitrite
		Arroyo Las Posas Reach 2 (Fox Barranca to Moorpark Fwy (23))	NH3
		Arroyo Las Posas Reach 2 (Fox Barranca to Moorpark Fwy (23))	nitrate + nitrite
		Arroyo Simi Reach 1 (Moorpark Fwy (23) to Brea Cyn)	NH3
		Calleguas Creek Reach 1 (estuary to 0.5 mi. S. of Broome Rd.)	NH3
		Calleguas Creek Reach 1 (estuary to 0.5 mi. S. of Broome Rd.)	nitrogen
		Calleguas Creek Reach 2(0.5 mi. S. of Broome Rd. to Potrero Rd.)	NH3
		Calleguas Creek Reach 2(0.5 mi. S. of Broome Rd. to Potrero Rd.)	nitrogen
		Calleguas Creek Reach 3 (Potrero to Somis Rd.)	nitrate + nitrite
		Conejo Creek/Arroyo Conejo N. Fork	NH3
		Conejo Creek Reach 1 (confl. Calleguas to Santa Rosa Rd)	NH3
		Conejo Creek Reach 1 (confl. Calleguas to Santa Rosa Rd)	algae
		Conejo Creek Reach 1 (confl. Calleguas to Santa Rosa Rd)	low DO/org. enrichment
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	NH3
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	algae
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	low DO/org. enrichment
		Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd.)	NH3
		Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd.)	algae
		Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd.)	low DO/org. enrichment
		Conejo Creek Reach 4 (above Lynn Rd.)	NH3
		Conejo Creek Reach 4 (above Lynn Rd.)	algae
		Conejo Creek Reach 4 (above Lynn Rd.)	Low DO/org. enrichment
		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	nitrogen
		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	algae
		Beardsley Channel (above Central Ave.)	nitrogen
		Beardsley Channel (above Central Ave.)	algae
		Mugu Lagoon	nitrogen
		Duck pond agric. drain/Mugu Drain/Oxnard Drain #2	nitrogen

A003488

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
2		Conejo Creek Reach 1 (confl. Calleguas to Santa Rosa Rd)	toxicity
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	toxicity
		Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd)	toxicity
		Conejo Creek Reach 4 (above Lynn Rd.)	toxicity
		Calleguas Creek Reach 1 (estuary to 0.5 mi. S. of Broome Rd.)	toxicity
		Calleguas Creek Reach 2(0.5 mi. S. of Broome Rd. to Potrero Rd.)	toxicity
		Duck pond agric. drain/Mugu Drain/Oxnard Drain #2	toxicity
		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	toxicity
		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	chlorpyrifos
		Beardsley Channel (above Central Ave.)	toxicity
		Beardsley Channel (above Central Ave)	chlorpyrifos
3		Tapo Canyon Reach 1	chloride
		Arroyo Simi Reach 1 (Moorpark Fwy (23) to Brea Cyn)	chloride
		Arroyo Las Posas Reach 2 (Fox Barranca to Moorpark Fwy (23))	chloride
		Arroyo Las Posas Reach 1 (Lewis/Somis Rd. to Fox Barranca)	chloride
		Calleguas Creek Reach 3 (Potrero to Somis Rd.)	chloride
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	chloride
		Conejo Creek Reach 4 (above Lynn Rd.)	chloride
4		Fox Barranca	Boron, sulfate, TDS
		Tapo Canyon Reach 1	Boron, sulfate, TDS
		Arroyo Simi Reach 1 (Moorpark Fwy (23) to Brea Cyn)	Boron, sulfate, TDS
		Arroyo Simi Reach 2 (above Brea Canyon)	Boron, sulfate, TDS
		Arroyo Las Posas Reach 1 (Lewis/Somis Rd. to Fox Barranca)	sulfate, TDS
		Arroyo Las Posas Reach 2 (Fox Barranca to Moorpark Fwy (23))	sulfate, TDS
		Calleguas Creek Reach 3 (Potrero to Somis Rd.)	TDS
		Conejo Creek/Arroyo Conejo N. Fork	sulfate, TDS
		Conejo Creek Reach 1 (confl. Calleguas to Santa Rosa Rd)	sulfate, TDS
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	sulfate, TDS
		Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd.)	sulfate, TDS
		Conejo Creek Reach 4 (above Lynn Rd.)	sulfate, TDS

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
5		Arroyo Las Posas Reach 1 (Lewis/Somis Rd. to Fox Barranca)	DDT
		Arroyo Las Posas Reach 2 (Fox Barranca to Moorpark Fwy (23))	DDT
		Conejo Creek/Arroyo Conejo N. Fork	chlordane, DDT
		Conejo Creek Reach 1 (confl. Calleguas to Santa Rosa Rd)	ChemA, dacthal, DDT, endosulfan, toxaphene
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	ChemA, dacthal, DDT, endosulfan, toxaphene
		Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd.)	ChemA, dacthal, DDT, endosulfan, toxaphene
		Conejo Creek Reach 4 (above Lynn Rd.)	ChemA, dacthal, DDT, endosulfan, toxaphene
		Calleguas Creek Reach 1 (estuary to 0.5 mi. S. of Broome Rd.)	sediment toxicity
		Calleguas Creek Reach 1 (estuary to 0.5 mi. S of Broome Rd.)	ChemA, chlordane, DDT, endosulfan, toxaphene
		Calleguas Creek Reach 2(0.5 mi. S. of Broome Rd. to Potrero Rd.)	sediment toxicity
		Calleguas Creek Reach 2 (0.5 mi. S of Broome Rd. to Potrero Rd.)	ChemA, chlordane, dacthal, DDT, endosulfan, toxaphene
		Duck pond agric. drain/Mugu Drain/Oxnard Drain #2	ChemA, DDT, chlordane, toxaphene
		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	ChemA, chlordane, dacthal, DDT, dieldrin, endosulfan, toxaphene
		Beardsley Channel (above Central Ave.)	ChemA, chlordane, dacthal, DDT, dieldrin, endosulfan, toxaphene
		Mugu Lagoon	siltation
		Mugu Lagoon	sediment toxicity
		Duck pond agric. drain/Mugu Drain/Oxnard Drain #2	sediment toxicity
		Mugu Lagoon	Chlordane, dacthal, DDT, endosulfan, toxaphene
6		Arroyo Simi Reach 1 (Moorpark Fwy (23) to Brea Cyn)	Cr, Ni, Ag, Zn
		Conejo Creek Reach 3 (Tho. Oaks city limit to Lynn Rd.)	Cd, Cr, Ni, Ag
		Conejo Creek Reach 2 (Santa Rosa Rd. to Tho. Oaks city limit)	Cd, Cr, Ni, Ag
		Conejo Creek Reach 1 (confl. Calleguas to Santa Rosa Rd)	Cd, Cr, Ni, Ag
		Mugu Lagoon	Hg
		Mugu Lagoon	Cu, Ni, Zn
		Arroyo Simi Reach 1 (Moorpark Fwy (23) to Brea Cyn)	Se
		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	Se
7		Calleguas Creek Reach 1 (estuary to 0.5 mi. S of Broome Rd.)	PCBs
		Calleguas Creek Reach 2 (0.5 mi. S of Broome Rd. to Potrero Rd.)	PCBs
		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	PCBs
		Beardsley Channel (above Central Ave.)	PCBs
		Mugu Lagoon	PCBs

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
8		Rio de Santa Clara/Oxnard Drain #3	PCBs
		Rio de Santa Clara/Oxnard Drain #3	ChemA, chlordane, DDT, toxaphene
		Rio de Santa Clara/Oxnard Drain #3	sediment toxicity
9		Revolon Slough Main Branch (Mugu Lagoon to Central Ave.)	trash
		Beardsley Channel (above Central Ave.)	trash
10		Rio de Santa Clara/Oxnard Drain #3	nitrogen
	Los Angeles River		
11		Tujunga Wash (d/s Hansen Dam to Los Angeles River)	NH3
		Tujunga Wash (d/s Hansen Dam to Los Angeles River)	scum, odors
		Los Angeles River Reach 5 (within Sepulveda Basin)	NH3
		Los Angeles River Reach 5 (within Sepulveda Basin)	scum, odors
		Los Angeles River Reach 5 (within Sepulveda Basin)	nutrients (algae)
		Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	NH3
		Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	scum, odors
		Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	nutrients (algae)
		Los Angeles River Reach 3 (Riverside Dr. to Figueroa St.)	NH3
		Los Angeles River Reach 3 (Riverside Dr. to Figueroa St.)	odors, scum
		Los Angeles River Reach 3 (Riverside Dr. to Figueroa St.)	nutrients (algae)
		Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	NH3
		Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	odors, scum
		Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	nutrients (algae)
		Los Angeles River Reach 1(u/s Carson St. to estuary)	NH3
		Los Angeles River Reach 1(u/s Carson St. to estuary)	pH
		Los Angeles River Reach 1(u/s Carson St. to estuary)	scum
		Los Angeles River Reach 1(u/s Carson St. to estuary)	nutrients (algae)
		Burbank Western Channel	NH3
		Burbank Western Channel	Algae
		Burbank Western Channel	odors, scum
		Verdugo Wash (Reaches 1 & 2)	algae

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Arroyo Seco Rch 1 (d/s Devil's Gate Dam) & Rch 2 (W. Holly Ave. to Devil's Gate)	algae
		Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	NH3
		Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	pH
		Rio Hondo Reach 2 (from Whittier Narrows Flood Control Basin to Spreading Grounds)	NH3
		Compton Creek	pH
12		Tujunga Wash (d/s Hansen Dam to Los Angeles River)	trash
		Los Angeles River Reach 5 (within Sepulveda Basin)	trash
		Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	trash
		Los Angeles River Reach 3 (Riverside Dr. to Figueroa St.)	trash
		Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	trash
		Los Angeles River Reach 1(u/s Carson St. to estuary)	trash
		Burbank Western Channel	trash
		Verdugo Wash (Reaches 1 & 2)	trash
		Arroyo Seco Reach 1 (d/s Devil's Gate Dam) & Reach 2 (W. Holly Ave. to Devil's Gate)	trash
		Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	trash
13		Tujunga Wash (d/s Hansen Dam to Los Angeles River)	Cu
		Compton Creek	Cu, Pb
		Burbank Western Channel	Cd
		Los Angeles River Reach 1(u/s Carson St. to estuary)	Pb
		Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	Pb
		Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	Pb
		Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	Cu, Zn
		Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	Pb
		Monrovia Cyn Creek	Pb
		Aliso Canyon Wash	Se
14		Los Angeles River Reach 5 (within Sepulveda Basin)	chlorpyrifos
15		Tujunga Wash (d/s Hansen Dam to Los Angeles River)	coliform
		Los Angeles River Reach 6 (u/s of Sepulveda Basin)	coliform

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Los Angeles River Reach 4 (Sepulveda Dam to Riverside Dr.)	coliform
		Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	coliform
		Los Angeles River Reach 1 (u/s Carson St. to estuary)	coliform
		Verdugo Wash (Reaches 1 & 2)	Coliform
		Arroyo Seco Rch 1 (d/s Devil's Gate Dam) & Rch 2 (W. Holly Ave. to Devil's Gate)	Coliform
		Rio Hondo Reach 1 (Santa Ana Fwy to Los Angeles River)	coliform
		Rio Hondo Reach 2 (from Whittier Narrows Flood Control Basin to Spreading Grounds)	coliform
		Compton Creek	coliform
		Bell Creek	coliform
16		Peck Rd Lake	trash
		Echo Park Lake	trash
		Lincoln Park Lake	trash
17		Peck Rd Lake	low DO, org. enrichment
		Peck Rd Lake	odors
		Lincoln Park Lake	NH3
		Lincoln Park Lake	Low DO/org. enrichment
		Lincoln Park Lake	Eutroph.
		Lincoln Park Lake	odors
		Echo Park Lake	pH
		Echo Park Lake	Eutroph., NH3, algae
		Echo Park Lake	odors
		Lake Calabasas	NH3
		Lake Calabasas	Eutroph.
		Lake Calabasas	Low DO, org. enrichment
		Lake Calabasas	pH
		Lake Calabasas	odors
18		Los Angeles River Reach 5 (within Sepulveda Basin)	ChemA
19		Echo Park Lake	PCBs
		Peck Rd Lake	DDT, chlordane

A003493

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Lake Calabasas	DDT
20		Peck Rd Lake	Pb
		Lincoln Park Lake	Pb
		Echo Park Lake	Cu, Pb
		Lake Calabasas	Cu, Zn
21		Los Angeles River Reach 5 (within Sepulveda Basin)	oil
		Los Angeles River Reach 2 (Figueroa St. to u/s Carson St.)	oil
22		Los Angeles River Reach 6 (u/s of Sepulveda Basin)	Volatile organics
	Miscellaneous Ventura Coastal Waters WMA		
23		McGrath Beach	Coliform
		McGrath Beach	beach closures
		Mandalay Beach	beach closures
		Santa Clara River Estuary Beach/Surfers Knoll)	coliform
24		Ventura Harbor: Ventura Keys	Coliform
25		McGrath Lake	chlordane, DDT, other pesticides
		McGrath Lake	sediment toxicity
26		Port Hueneme Harbor	DDT, PCBs
27		Port Hueneme Harbor	PAHs
28		Port Hueneme Harbor	Zn
29		Channel Islands Harbor	Pb, Zn
30		Port Hueneme Harbor	TBT

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
	Santa Clara River		
31		Santa Clara River Reach 3 (Dam to abv Sp. Crk./blw Timber Cyn)	chloride
32		Wheeler Canyon/Todd Barranca	nitrate + nitrite
		Torrey Canyon Creek	nitrate + nitrite
		Brown Barranca/Long Canyon	nitrate + nitrite
		Mint Canyon Creek Reach 1	nitrate + nitrite
		Santa Clara River Reach 9 (Bouquet Cyn Rd to abv Lang Gaging)	org. enrichment/lowDO
		Santa Clara River Reach 8 (W Pier Hwy 99 to Bouquet Cyn Rd Bridge)	NH3, nitrate + nitrite
		Santa Clara River Reach 8 (W Pier Hwy 99 to Bouquet Cyn Rd Bridge)	org. enrichment/lowDO
		Santa Clara River Reach 7 (Blue Cut to West Pier Hwy 99)	NH3
		Santa Clara River Reach 3 (Dam to abv Sp. Crk./blw Timber Cyn)	NH3
		Santa Clara River Reach 7 (Blue Cut to West Pier Hwy 99)	nitrate + nitrite
33		Santa Clara River Estuary	ChemA, toxaphene
34		Santa Clara River Reach 8 (W Pier Hwy 99 to Bouquet Cyn Rd Bridge)	coliform
		Santa Clara River Estuary	Coliform
35		Elizabeth Lake	Eutroph.
		Elizabeth Lake	DO, pH
		Lake Hughes	Eutroph.
		Lake Hughes	fish kills
		Lake Hughes	algae
		Lake Hughes	odors
		Munz Lake	Eutroph.
36		Elizabeth Lake	trash
		Munz Lake	trash
		Lake Hughes	trash

A003495

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
	San Gabriel River Watershed		
37		San Gabriel River Reach 3 (Whittier Narrows to Ramona)	toxicity
		San Gabriel River Reach 2 (Firestone to Whittier Narrows Dam)	NH3
		San Gabriel River Reach 1 (Estuary to Firestone)	NH3
		San Gabriel River Reach 1 (Estuary to Firestone)	algae
		San Gabriel River Reach 1 (Estuary to Firestone)	toxicity
		San Jose Creek Reach 2 (Temple to I-10 at White Ave.)	NH3
		San Jose Creek Reach 2 (Temple to I-10 at White Ave.)	algae
		San Jose Creek Reach 1 (SG confluence to Temple St.)	NH3
		San Jose Creek Reach 1 (SG confluence to Temple St.)	algae
		Coyote Creek	NH3
		Coyote Creek	algae
		Walnut Creek	toxicity
		Walnut Creek	pH
38		San Gabriel River East Fork	trash
39		San Jose Creek Reach 2 (Temple to I-10 at White Ave.)	Pb
		San Gabriel River Estuary	As
		Coyote Creek	Ag
40		Legg Lake	trash
41		Puddingstone Reservoir	DDT, PCBs, chlordane
42		El Dorado Lakes	Hg
		El Dorado Lakes	Cu, Pb
		Puddingstone Reservoir	Hg
		Legg Lake	Cu, Pb
		Santa Fe Dam Park Lake	Pb, Cu
43		Coyote Creek	abnormal fish histology
		San Gabriel River Reach 1 (Estuary to Firestone)	abnormal fish histology

A003496

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		San Gabriel River Estuary	abnormal fish histology
44		El Dorado Lakes	algae, NH3, eutroph.
		El Dorado Lakes	pH
		Crystal Lake	org. enrichment/low DO
		Legg Lake	NH3
		Legg Lake	pH
		Legg Lake	odors
		Puddingstone Reservoir	low DO, org. enrichment
		Santa Fe Dam Park Lake	pH
45		San Jose Creek Reach 1 (SG confluence to Temple St.)	coliform
		San Jose Creek Reach 2 (Temple to I-10 at White Ave.)	coliform
		San Gabriel River Reach 2 (Firestone to Whittier Narrows Dam)	coliform
		San Gabriel River Reach 1 (Estuary to Firestone)	coliform
		Coyote Creek	coliform
	Santa Monica Bay WMA		
46		Marina Del Rey Harbor Beach	beach closures
		Marina Del Rey Harbor Beach	coliform
		Marine del Rey Harbor - Back Basins	coliform
47		Medea Creek Reach 2 (abv. confl. with Lindero)	coliform
		Medea Creek Reach 1 (lake to confl. with Lindero)	coliform
		Las Virgenes Creek	coliform
		Malibu Lagoon	swimming restrictions
		Malibu Lagoon	coliform, enteric viruses
		Malibu Lagoon	shellfish harvesting ad.
		Malibu Creek: lagoon to Malibu Lake	coliform
		Stokes Creek	Coliform
		Lindero Creek Reach 1	coliform
		Lindero Creek Reach 2 (above lake)	coliform
		Palo Comado	Coliform

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
48		Malibu Beach	beach closures
		Malibu Lagoon Beach (Surfrider)	beach closures
		Malibu Lagoon Beach (Surfrider)	coliform
		Dockweiler Beach	beach closures
		Dockweiler Beach	coliform
		Redondo Beach	beach closures
		Redondo Beach	coliform
		Santa Monica Beach	beach closures
		Santa Monica Beach	coliform
		Paradise Cove Beach	beach closures
		Paradise Cove Beach	coliform
		Topanga Beach	beach closures
		Topanga Beach	coliform
		Las Flores Beach	coliform
		Torrance Beach	beach closures
		Torrance Beach	coliform
		Trancas Beach (Broad Beach)	beach closures
		Trancas Beach (Broad Beach)	coliform
		Will Rogers Beach	beach closures
		Will Rogers Beach	coliform
		Big Rock Beach	coliform
		Big Rock Beach	beach closures
		Cabrillo Beach (Outer)	beach closures
		Cabrillo Beach (Outer)	coliform
		Venice Beach	beach closures
		Venice Beach	coliform
		Manhattan Beach	beach closures
		Hermosa Beach	beach closures
		Dan Blocker Memorial Beach	coliform
		Leo Carillo Beach (south of County line)	Beach closures
		Leo Carillo Beach (south of County line)	coliform
		Long Point Beach	coliform
		Whites Point Beach	beach closures

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Point Dume Beach	beach closures
		Las Tunas Beach	beach closures
		Point Vicente Beach	beach closures
		Malaga Cove Beach	beach closures
		Lunada Bay Beach	beach closures
		Zuma (Westward Beach)	beach closures
		Point Fermin Park Beach	beach closures
		Puerco Beach	beach closures
		Portugese Bend Beach	beach closures
		Royal Palms Beach	beach closures
		Sea Level Beach	beach closures
		Rocky Point Beach	beach closures
		Resort Point Beach	beach closures
		Robert H. Meyer Memorial Beach	beach closures
		Abalone Cove Beach	beach closures
		Flat Rock Point Beach Area	beach closures
		Escondido Beach	beach closures
		Carbon Beach	beach closures
		Castlerock Beach	beach closures
		La Costa Beach	beach closures
		Bluff Cove Beach	beach closures
		Inspiration Point Beach	beach closures
		Nicholas Canyon Beach	beach closures
		Palos Verdes Shoreline Point Beach	Beach closures
		Santa Monica Canyon	pathogens
		Ashland Avenue Drain	coliform
		Sepulveda Canyon	coliform
		Pico Kenter Drain	coliform
			coliform, enteric viruses
49		Ballona Creek Estuary	coliform
		Ballona Creek Estuary	shellfish harvesting adv.
		Ballona Creek	coliform, enteric viruses
50		Malibu Lagoon	eutroph.

A003499

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Malibu Creek: Lagoon to Malibu Lake	nutrients (algae)
		Malibu Creek: lagoon to Malibu Lake	unnatural scum/foam
		Las Virgenes Creek	nutrients (algae)
		Las Virgenes Creek	unnatural scum/foam
		Las Virgenes Creek	low DO, org. enrichment
		Lindero Creek Reach 2 (above lake)	unnatural scum/foam
		Lindero Creek Reach 2 (above lake)	algae
		Medea Creek Reach 2 (abv. confl. with Lindero)	algae
		Medea Creek Reach 1 (lake to confl. with Lindero)	algae
		Lindero Creek Reach 1	unnatural scum/foam
		Lindero Creek Reach 1	algae
		Malibou Lake	algae, eutroph.
		Malibou Lake	low DO, org. enrichment
		Lake Lindero	eutroph., algae
		Lake Lindero	odors
		Westlake Lake	NH3
		Westlake Lake	eutroph., algae
		Westlake Lake	low DO, org. enrichment
		Lake Sherwood	NH3
		Lake Sherwood	Eutroph., algae
		Lake Sherwood	low DO, org. enrichment
51		Ballona Wetland	trash
		Ballona Creek	trash
52		Santa Monica Bay Nearshore and Offshore Zone	Hg
		Santa Monica Bay Nearshore and Offshore Zone	Cd, Cu, Pb, Ni, Ag, Zn
53		Santa Monica Bay Nearshore and Offshore Zone	chlordane
54		Marina del Rey Harbor - Back Basins	DDT, PCBs, chlordane
		Marina del Rey Harbor - Back Basins	dieldrin
		Marina del Rey Harbor - Back Basins	benthic comm. effects
		Marina del Rey Harbor - Back Basins	fish consumption advisory

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Marina del Rey Harbor - Back Basins	sediment toxicity
55		Ballona Creek	PCBs, DDT, ChemA, chlordane, dieldrin
		Ballona Creek	sediment toxicity
		Ballona Creek Estuary	PCBs, DDT, chlordane, PAHs
		Ballona Creek Estuary	sediment toxicity
56		Marina del Rey Harbor - Back Basins	Pb
		Marina del Rey Harbor - Back Basins	Cu, Zn
57		Ballona Creek	Pb, Ag
		Ballona Creek	As, Cu, Cd
		Ballona Creek	toxicity
		Ballona Creek Estuary	Pb, Zn
		Ballona Wetland	As
58		Santa Monica Bay Nearshore and Offshore Zone	DDT, PCBs, PAHs
		Santa Monica Bay Nearshore and Offshore Zone	sediment toxicity
		Santa Monica Bay Nearshore and Offshore Zone	fish consumption advisory
		Nicholas Canyon Beach	DDT, PCBs
		Paradise Cove Beach	DDT, PCBs
		Robert H. Meyer Memorial Beach	DDT, PCBs
		Point Dume Beach	DDT, PCBs
		Sea Level Beach	DDT, PCBs
		Whites Point Beach	DDT, PCBs
		Trancas Beach (Broad Beach)	DDT, PCBs
		Topanga Beach	DDT, PCBs
		Royal Palms Beach	DDT, PCBs
		Point Fermin Park Beach	DDT, PCBs
		Redondo Beach	DDT, PCBs
		Puerco Beach	DDT, PCBs
		Portugese Bend Beach	DDT, PCBs
		Amarillo Beach	DDT, PCBs
		Zuma (Westward Beach)	DDT, PCBs

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Malibu Lagoon Beach (Surfrider)	DDT, PCBs
		La Costa Beach	DDT, PCBs
		Big Rock Beach	DDT, PCBs
		Bluff Cove Beach	DDT, PCBs
		Cabrillo Beach (Outer)	DDT, PCBs
		Carbon Beach	DDT, PCBs
		Castlerock Beach	DDT, PCBs
		Escondido Beach	DDT, PCBs
		Flat Rock Point Beach Area	DDT, PCBs
		Inspiration Point Beach	DDT, PCBs
		Las Tunas Beach	DDT, PCBs
		Abalone Cove Beach	DDT, PCBs
		Malaga Cove Beach	DDT, PCBs
		Las Flores Beach	DDT, PCBs
		Long Point Beach	DDT, PCBs
		Malibu Beach	DDT
		Palos Verdes Shoreline Point Beach	pesticides
59		Sepulveda Canyon	NH3
		Pico Kenter Drain	NH3
60		Topanga Cyn Creek	Pb
		Sepulveda Canyon	Pb
		Pico Kenter Drain	Pb
		Pico Kenter Drain	Cu
		Pico Kenter Drain	toxicity
		Santa Monica Canyon	Pb
61		Westlake Lake	chlordane
		Malibou Lake	chlordane, PCBs
62		Ashland Avenue Drain	low DO, org. enrichment
63		Medea Creek Reach 2 (abv. confl. with Lindero)	trash

A003502

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Medea Creek Reach 1 (lake to confl. with Lindero)	trash
		Lake Lindero	trash
		Lindero Creek Reach 2 (above lake)	trash
		Lindero Creek Reach 1	trash
		Malibu Creek: lagoon to Malibu Lake	trash
		Las Virgenes Creek	trash
64		Pico Kenter Drain	trash
65		Ballona Wetland	exotic vegetation
		Ballona Wetland	habitat alteration, hydromodification, reduced tidal flushing
66		Santa Monica Bay Nearshore and Offshore Zone	debris
67		Lake Lindero	chloride, spec. cond.
68		Westlake Lake	Pb
		Westlake Lake	Cu
		Malibou Lake	Cu
		Lake Sherwood	Hg
		Lake Calabasas	Zn
		Lake Calabasas	Cu
		Lake Lindero	Se
		Triunfo Cyn Creek Reach 1	Pb, Hg
		Triunfo Cyn Creek Reach 2	Pb, Hg
		Medea Creek Reach 2 (abv. confl. with Lindero)	Se
		Medea Creek Reach 1 (lake to confl. with Lindero)	Se
		Las Virgenes Creek	Se
		Lindero Creek Reach 2 (above lake)	Se
		Lindero Creek Reach 1	Se
69		Ashland Avenue Drain	toxicity

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
70		Ballona Creek	TBT
		Marina del Rey Harbor - Back Basins	TBT
71		Malibu Lagoon	benthic comm. effects
	Dominguez Channel and LA/LB Harbors WMA		
72		Los Angeles Harbor (part. Main Ch., Fish Hbr, and breakwater)	beach closure
		Cabrillo Beach (Inner) LA Harbor	beach closures
73		Dominguez Channel Estuary (to Vermont)	benthic comm. effects
		Dominguez Channel Estuary (to Vermont)	ChemA, chlordane, DDT, PCBs
		Dominguez Channel Estuary (to Vermont)	aldrin, dieldrin
		Dominguez Channel (above Vermont)	ChemA, chlordane, DDT, PCBs
		Dominguez Channel (above Vermont)	aldrin, dieldrin
		Los Angeles Harbor: Consolidated Slip	benthic comm. effects
		Los Angeles Harbor: Consolidated Slip	DDT, PCBs
		Los Angeles Harbor: Consolidated Slip	sediment toxicity
		Los Angeles Harbor: Consolidated Slip	chlordane
		Los Angeles Harbor (part. Main Ch., Fish Hbr, and breakwater)	DDT, PCBs
		Los Angeles Harbor (part. Main Ch., Fish Hbr, and breakwater)	sediment toxicity
		Los Angeles Harbor: Southwest Slip	DDT, PCBs
		Los Angeles Harbor: Southwest Slip	sediment toxicity
		San Pedro Bay nearshore and offshore zone: Cabrillo Pier area	DDT, PCBs
		San Pedro Bay nearshore and offshore zone: Cabrillo Pier area	sediment toxicity
		Cabrillo Beach (Inner) LA Harbor	DDT, PCBs
		Long Beach Harbor (part. Main Ch., SE Basin, West Basin, Pier J, and breakwater)	benthic comm. effects
		Long Beach Harbor (part. Main Ch., SE Basin, West Basin, Pier J, and breakwater)	DDT, PCBs
		Long Beach Harbor (part. Main Ch., SE Basin, West Basin, Pier J, and breakwater)	sediment toxicity
		Machado Lake (Harbor Lake)	ChemA, chlordane, DDT, PCBs, dieldrin
74		Dominguez Channel (above Vermont)	PAHs

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Dominguez Channel Estuary (to Vermont)	PAHs
		Los Angeles Harbor: Consolidated Slip	PAHs
		Los Angeles Harbor (part. Main Ch., Fish Hbr, and breakwater)	PAHs
		Long Beach Harbor (part. Main Ch., SE Basin, West Basin, Pier J, and breakwater)	PAHs
		San Pedro Bay nearshore and offshore zone: Cabrillo Pier area	PAHs
75		Torrance Carson Channel	Cu, Pb
		Wilmington Drain	Cu, Pb
		Dominguez Channel (above Vermont)	Cu, Pb
		Dominguez Channel (above Vermont)	Cr
		Dominguez Channel (above Vermont)	Zn
		Dominguez Channel Estuary (to Vermont)	Cu, Pb
		Dominguez Channel Estuary (to Vermont)	Cr
		Dominguez Channel Estuary (to Vermont)	Zn
		Los Angeles Harbor: Consolidated Slip	Pb
		Los Angeles Harbor: Consolidated Slip	Cr, Zn
		Los Angeles Harbor (part. Main Ch., Fish Hbr and breakwater)	Cu, Zn
76		Machado Lake (Harbor Lake)	algae, eutroph.
		Machado Lake (Harbor Lake)	NH3
		Machado Lake (Harbor Lake)	odors
77		Wilmington Drain	NH3
		Dominguez Channel (above Vermont)	NH3
		Dominguez Channel Estuary (to Vermont)	NH3
78		San Pedro Bay nearshore and offshore zone: Cabrillo Pier area	Zn, Cu, Cr
79		Los Angeles Harbor: Consolidated Slip	TBT
		Los Angeles Harbor (part. Main Ch., Fish Hbr, and breakwater)	TBT
80		Dominguez Channel (above Vermont)	coliform
		Dominguez Channel Estuary (to Vermont)	coliform

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Torrance Carson Channel	coliform
		Wilmington Drain	coliform
81		Machado Lake (Harbor Lake)	trash
	Los Cerritos Channel and Alamitos Bay WMA		
82		Colorado Lagoon	DDT, PCBs, chlordane
		Colorado Lagoon	dieldrin
		Colorado Lagoon	sediment toxicity
83		Colorado Lagoon	PAHs
		Colorado Lagoon	Pb, Zn
84		Los Cerritos Channel	Zn
		Los Cerritos Channel	Cu, Pb
85		Los Cerritos Channel	NH3
86		Los Cerritos Channel	coliform
	Ventura River Watershed		
87		Ventura River Estuary	DDT
88		Ventura River Reach 2 (Main St. to Weldon Canyon)	algae
		Ventura River Reach 1 (estuary to Main St.)	algae
		Ventura River Estuary	algae, eutroph.
89		Ventura River Reach 4 (Coyote Creek to Camino Cielo Rd.)	pumping, water diversions
		Ventura River Reach 3 (Weldon Canyon to confl. w/ Coyote Cr.)	pumping, water diversions
90		Ventura River Reach 2 (Main St. to Weldon Canyon)	Cu, Zn
		Ventura River Reach 2 (Main St. to Weldon Canyon)	Ag

A003506

TMDL ANALYTICAL UNIT#	Watershed	List of Water Quality Limited Segments Requiring TMDL(s)	Associated 303(d) Listed Pollutant(s) for which TMDL(s) shall be completed
		Ventura River Reach 1 (estuary to Main St.)	Cu, Zn
		Ventura River Reach 1 (estuary to Main St.)	Ag
91		Ventura River Estuary	trash
92		Ventura River Reach 2 (Main St. to Weldon Canyon)	Se

Note:

[1] Generated from information contained in the State of California's 1998 303(d) List, as approved by EPA, October 1998.

A003507

Attachment 3: SCHEDULE FOR SPECIFIED WATERS

TMDL Analytical Unit Number	REQUIRED COMPLETION DATE OF TMDLs FOR ALL WQLS AND POLLUTANTS WITHIN GIVEN TMDL ANALYTICAL UNIT						
	1 year after E.D.	2 yrs. after E.D.	3 yrs. after E.D.	4 yrs. after E.D.	5 yrs. after E.D.	6 yrs. After E.D.	7 yrs. after E.D.
50			X				
47			X				
54						X	
56						X	
46				X			
48			X				
52					X		
53							X
11				X			
13					X		
12		X					
14							X
57					X		
55					X		
49							X
51		X					
38	X						
37				X			
39							X
2						X	

5						X	
3		X					
1			X				
7						X	
6							X
See Note 3			X				
32				X			
72					X		
23				X			

Notes:

1. "TMDL Analytical Unit" has the meaning provided in Paragraph 2(c) of the Consent Decree. The WQLSs and pollutants within each TMDL Analytical Unit are set forth in Attachment 2, and are incorporated by reference herein.

2. "E.D." has that meaning provided in Paragraph 2(d) of the Consent Decree.

3. In order to comply with the minimum pace requirements of Paragraph 3(b) of the Consent Decree, a TMDL for each pairing of a WQLS and pollutant contained in an additional Analytical Unit which is not described in this Attachment must be established within 3 years after the Effective Date. EPA shall, at its discretion, select such Analytical Unit no later than six months prior to the deadline of three years after the Effective Date and shall notify Plaintiffs of such selection.

PROOF OF SERVICE

STATE OF CALIFORNIA)
) SS.
COUNTY OF LOS ANGELES)

I am employed in the County of Los Angeles, State of California. I am over the age of 18 and not a party to the within action. My business address is: 6310 San Vicente Boulevard, Suite 250, Los Angeles, California 90048.

On March 25, 1999 I served the following document described as **AMENDED CONSENT DECREE** on the interested parties in said action by placing a true copy thereof in the United States mail enclosed in a sealed envelope with postage prepaid addressed as follows:

Gary Hess
Office of Regional Counsel
United States Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

S. Randall Humm
United States Department of Justice
Environment & Natural Resources Division
Environment Defense Section
P.O. Box 23986
Washington, D.C. 20026-3986

I am "readily familiar" with the firm's practice of collection and processing correspondence for mailing. It is deposited with U.S. postal service on that same day in the ordinary course of business. I am aware that on motion of party served, service is presumed invalid if postal cancellation date or postage meter date is more than 1 day after date of deposit for mailing in affidavit.

I declare that I am employed in the office of a member of the bar of this Court at whose direction the service was made.

Executed on March 25, 1999 at Los Angeles, California.

Virginia Calvano

Virginia Calvano

This Page Intentionally
Left Blank

BILL LOCKYER. Attorney General
of the State of California
MARY E. HACKENBRACHT
Senior Assistant Attorney General
HELEN G. ARENS, State Bar No. 150572
JENNIFER F. NOVAK, State Bar No. 183882
Deputy Attorneys General
300 South Spring Street, Suite 1702
Los Angeles, California 90013-1204
Telephone: (213) 897-2607
Facsimile: (213) 897-2802

Attorneys for Respondent/Defendant Regional
Water Quality Control Board, Los Angeles Region

SUPERIOR COURT OF THE STATE OF CALIFORNIA

COUNTY OF LOS ANGELES - CENTRAL CIVIL WEST COURTHOUSE

In Re LOS ANGELES COUNTY MUNICIPAL STORM WATER PERMIT LITIGATION	Lead Case No. **BS 080548** Related Cases: BS 080753, BS 080758 BS 080791, BS 080792, and 080807 Judge: Hon. Victoria Gerrard Chaney-D. 324 STIPULATIONS CONCERNING DISPOSITION OF PHASE II ISSUES 7, 8, 10, 11, 12, AND 13 [PROPOSED ORDER] Statement of Decision Hearing: Oct. 28, 2004 Time: 8:30 a.m. Department: 324-Central Civil West Date Actions Filed: January 15 & 17, 2003

Subsequent to trial of the Phase II issues, Respondent/Defendant California Regional Water Quality Control Board, Los Angeles Region ("Regional Board"), Intervenors Natural Resources Defense Council, Santa Monica BayKeeper and Heal The Bay ("Intervenors"), Petitioners County of Los Angeles and the Los Angeles County Flood Control District ("*County* Petitioners"), Petitioners the Cities of Arcadia, Baldwin Park, Bell Gardens, Bellflower, Cerritos, Claremont, Commerce, Covina, Diamond Bar, Downey, Gardena, Hawaiian Gardens, Irwindale, Lawndale, Montebello, Paramount, Pico Rivera, Pomona, Rosemead, San Gabriel, Santa Fe Springs, Sierra Madre, Signal Hill, South Pasadena, Temple City, Vernon, Walnut, West Covina, Whittier, Building Industry Legal Defense Foundation, and Construction Industry Coalition on

Water Quality ("*Arcadia* Petitioners"), Petitioners Cities of Monrovia, Norwalk, Rancho Palos Verdes, Artesia, Beverly Hills, Carson, La Mirada, Westlake Village, Agoura Hills, Hidden Hills, San Fernando, and San Marino ("*Monrovia* Petitioners"), Petitioner City of Alhambra ("*Alhambra*") and Petitioners Los Angeles County Economic Development Corporation, the Cities of Industry, Lakewood, Santa Clarita and Torrance ("*LAEDC* Petitioners") engaged in discussions to resolve certain outstanding issues. Based on those discussions, the parties have collectively agreed to stipulate to certain interpretations of the permit with respect to certain issues raised in Phase II challenging the municipal storm water permit issued by the Regional Board.

The Regional Board, Intervenors, *County* Petitioners, *Arcadia* Petitioners, *Monrovia* Petitioners, *Alhambra*, and *LAEDC* Petitioners (collectively "the Parties") agree and stipulate as follows:

ISSUE 7

1. Petitioners' Phase II Trial Brief framed Issue Seven as: *The Regional Board acted in excess of its authority and abused its discretion in imposing Permit terms that require the permittees under the Permit to regulate and control the "potential contribution" and the "potential to discharge" pollutants in the storm water.*

2. The briefing for the Phase II trial on Issue Seven was joined by the *Arcadia* Petitioners and *Monrovia* Petitioners.

3. As to Issue Seven, the Parties stipulate that in implementing the legal authority requirements under Permit Parts 3.G.2.c-d, the permittees may exercise their discretion to determine what is necessary to meet these provisions, including the determination of "potential contribution" and "potential to discharge." The Parties further stipulate that "potential contribution" and "potential to discharge," as used in Parts 3.G.2.c-d, means adequate legal authority to prevent an actual discharge of pollutants to the municipal separate storm sewer system.

ISSUE 8

4. Petitioners' Phase II Trial Brief framed Issue Eight as: *Part 3.C of the Permit*

violates federal and state law in that it allows the Executive Officer to modify the Permit without notice or public hearing.

5. The briefing for the Phase II trial on Issue Eight was joined by all Petitioners.

6. As to Issue Eight, the Parties stipulate that Part 3.C of the Permit is interpreted to mean that revisions to the storm water quality management plan directed by the Executive Officer pursuant to Part 3.C are not elements of the Permit unless and until the Permit is modified to incorporate them pursuant to appropriate notice and hearing.

ISSUE 10

7. Petitioners' Phase II Trial Brief framed Issue Ten as: *The Regional Board acted contrary to law and abused its discretion in adopting the sanitary sewer maintenance overflow and spill prevention provisions of the Permit.*

8. The briefing for the Phase II trial on Issue 10 was joined by the *Arcadia* Petitioners, *Monrovia* Petitioners, *Alhambra*, and *LAEDC* Petitioners.

9. As to Issue Ten, the Parties stipulate that on April 12, 2004, a letter issued from Dennis Dickerson, Executive Officer of the Regional Board, addressed to Rufus Young in response to a Request for Clarification as to Part 4.F.1, subdivision (a) of the Permit. The Court has previously incorporated that five-page letter into the record by reference, and it is attached as Exhibit "A" hereto. The Parties agree that the letter sets forth how Part 4.F.1, subdivision (a) is to be construed.

ISSUE 11

10. Petitioners' Phase II Trial Brief framed Issue Eleven as: *The Regional Board acted contrary to law and abused its discretion in failing to exempt certain discharges from the Permit.*

11. The briefing for the Phase II trial on Issue Eleven was joined by *Alhambra* and the *LAEDC* Petitioners.

12. As to Issue Eleven, the Regional Board and Petitioners stipulate that Part 3.E of the Permit should be read in light of Findings D.1 and D.2, so that a permittee is not responsible for discharges from facilities over which it has no legal jurisdiction, or for agricultural return

E-SERVED 10/21/04 06:15 PM ET LA County Stormwater

flows which are not included under the Clean Water Act. For the purposes of the resolution of this case, Intervenors do not object to this clarification for purposes of the stipulation and entry of judgment.

ISSUE 12

13. Petitioners' Phase II Trial Brief framed Issue Twelve as: *The Permit's requirement that Peak Flow is the parameter that should be controlled (Permit, Part 4.D.1) is not supported by evidence in the record.*

14. The briefing for the Phase II trial on Issue Twelve was joined by the *County* Petitioners, *Arcadia* Petitioners, and *Monrovia* Petitioners.

15. As to Issue Twelve, the Parties stipulate that Part 4.D.1 requires the principal permittee to conduct a study to develop numeric peak flow criteria for application in six areas. The County has indicated that its peak flow study is expected to be completed in December 2004. The Regional Board will consider the results of the County's study in evaluating the permittees' determination of appropriate numeric peak flow criteria for the natural drainage systems identified in Part 4.D.1. This stipulation shall not be construed as a waiver of the petitioners' right to comment on and object to future basin plan amendments related to hydromodification or peak flow or the right to comment on and object to the hydromodification resolution pending before the Regional Board.

16. The Parties recognize that the stipulation set forth in Paragraph 15 does not resolve certain Petitioners' challenge to the Regional Board's legal authority to regulate peak flow through a municipal storm water permit, an issue the Court will address in its statement of decision on Phase II, Issue 6. This stipulation shall not be construed as a waiver or an estoppel, now or in the future, as to any Party's contentions, or rights to pursue those contentions, on other issues litigated in Phases I and II of this litigation.

ISSUE 13

17. Petitioners' Phase II Trial Brief framed Issue Thirteen as: *Requiring Permittees to initiate investigations of facilities within one business day (Permit, Part 4.C.3.D(3)) is arbitrary, capricious and unsupported by evidence in the record.*

18. The briefing for the Phase II trial on Issue Thirteen was joined by the *County* Petitioners.

19. As to Issue Thirteen, the Parties stipulate that Part 4.C.3.d.3 is intended to apply only to critical sources and requires that permittees initiate an investigation at critical sources within one business day of referral by the Regional Board. The Permit provision identifies certain core components of an investigation, but it does not require that these components be completed within that one business day. Permittees can comply with the Permit by taking initial steps (such as logging, prioritizing, and tasking) to "initiate" the investigation within that one business day. However, the Regional Board would expect that the initial investigation, including a site visit, to occur within four business days. If the Regional Board identifies an emergency condition when referring a matter under Part 4.C.3.d.3, the Executive Officer would expect the permittee to respond appropriately.

20. The Parties' stipulation regarding Part 4.C.3.d.3 shall not preclude, in future municipal storm water permit revisions, any party from challenging a successor provision to Part 4.C.3.d.3 or revising this interpretation of Part 4.C.3.d.3.

ISSUES 7, 8, 10, 11, 12, AND 13

21. The Parties agree that the foregoing stipulations represent their collective agreement on the interpretation of the Permit as to the issues set forth above except where otherwise noted. As such, no Party prevailed on any of the foregoing issues, and the stipulations shall not serve as a basis for a motion for fees or costs.

22. The Parties agree that these stipulations and Order will have binding effect on the implementation and enforcement of the Permit, and that the stipulations shall be incorporated into the statement of decision and the judgment. These stipulations are binding on the Parties and may be used by the Parties to determine what is required under the Permit or to support or to defend an enforcement action against a permittee or entity regulated directly or indirectly pursuant to the Permit. Except as set forth below, no Party is waiving any rights or arguments they have or may have on the appropriateness of the Petitioners' request and/or claims for declaratory relief in this action, or in any other action or proceeding. These written stipulations

E-SERVED 10/21/04 06:15 PM ET LACounty Stormwater

(including as incorporated into the statement of decision and judgment) shall not be used (1) as the basis for arguing the propriety or appropriateness of a declaratory relief claim, or the lack thereof, as to issues other than those contained herein, or (2) as the basis for pursuing, asserting, or establishing a declaratory relief claim, absent a controversy as between the Regional Board and Petitioners arising from a future Regional Board action relating to issues set forth herein, as to any interpretation of the stipulated issues set forth herein. No inference may be drawn from these written stipulations as to the propriety of declaratory relief; however, if a court determines that a cause of action for declaratory relief against the Regional Board interpreting the Permit is appropriate, then, without waiving the right to challenge or to appeal the decision to allow declaratory relief, these stipulations shall be binding on the Parties in accordance with the resolution of the issues as set forth herein.

Dated: October 21, 2004

BILL LOCKYER, Attorney General
of the State of California
HELEN G. ARENS
JENNIFER F. NOVAK
Deputy Attorneys General

By: Jennifer Novak
Jennifer F. Novak
Attorneys for Respondent/Defendant California Regional Water Quality Control Board, Los Angeles Region

Dated: October 21, 2004

NATURAL RESOURCES DEFENSE COUNCIL
DAVID S. BECKMAN, ESQ.
ANJALI I. JAISWAL, ESQ.

By: AJal for
David S. Beckman
Attorneys for Respondent-Intervenor Natural Resources Defense Council, Santa Monica Baykeeper, and Heal the Bay

E-SERVED 10/21/04 06:15 PM ET LA County Stormwater

Dated: October 21, 2004

OFFICE OF THE COUNTY COUNSEL
RICHARD WEISS
Assistant County Counsel
PETER J. GUTIERREZ
Senior Deputy County Counsel

BURHENN & GEST LLP
HOWARD GEST
DAVID W. BURHENN

By: ______________________
Howard Gest
Attorneys for Petitioners County of Los Angeles and Los Angeles County Flood Control District

Dated: October __, 2004

BURKE, WILLIAMS & SORENSEN, LLP
LELAND C. DOLLEY
RUFUS C. YOUNG, JR.
AMY E. MORGAN

By: ______________________
Amy E. Morgan
Attorneys for Petitioner/Plaintiff City of Alhambra and Los Angeles County Economic Development Corporation, Cities of Industry, Lakewood, Santa Clarita, and Torrance

Dated: October __, 2004

RICHARDS, WATSON & GERSHON
a Professional Corporation
JOHN J. HARRIS
EVAN J. MCGINLEY

By: ______________________
John J. Harris
Attorneys for Petitioners Cities of Artesia, Beverly Hills, Carson, La Mirada, Monrovia, Norwalk, Rancho Palos Verdes and Westlake Village

Dated: October __, 2004

RUTAN & TUCKER, LLP
RICHARD MONTEVIDEO

By: ______________________
Richard Montevideo
Attorneys for Petitioners and Plaintiffs The Cities of Arcadia, Baldwin Park, Bell Gardens, Bellflower, Cerritos, Claremont, Commerce, Covina, Diamond

E-SERVED 10/21/04 06:15 PM ET LA County Stormwater

Dated: October __, 2004

Respectfully submitted,
LLOYD W. PELLMAN
County Counsel
PETER J. GUTIERREZ
Senior Deputy County Counsel

BURHENN & GEST LLP
HOWARD GEST
DAVID W. BURHENN

By: ______________________
Howard Gest
Attorneys for Petitioners County of Los Angeles and Los Angeles County Flood Control District

Dated: October 20, 2004

BURKE, WILLIAMS & SORENSEN, LLP
LELAND C. DOLLEY
RUFUS C. YOUNG, JR.
AMY E. MORGAN

By: Amy E. Morgan
Amy E. Morgan
Attorneys for Petitioner/Plaintiff City of Alhambra and Los Angeles County Economic Development Corporation, Cities of Industry, Lakewood, Santa Clarita, and Torrance

Dated: October __, 2004

RICHARDS, WATSON & GERSHON
a Professional Corporation
JOHN J. HARRIS
EVAN J. MCGINLEY

By: ______________________
John J. Harris
Attorneys for Petitioners Cities of Artesia, Beverly Hills, Carson, La Mirada, Monrovia, Norwalk, Rancho Palos Verdes and Westlake Village

Dated: October __, 2004

RUTAN & TUCKER, LLP
RICHARD MONTEVIDEO

By: ______________________
Richard Montevideo
Attorneys for Petitioners and Plaintiffs The Cities of Arcadia, Baldwin Park, Bell Gardens, Bellflower, Cerritos, Claremont, Commerce, Covina, Diamond

Dated: October__, 2004

Respectfully submitted,
LLOYD W. PELLMAN
County Counsel
PETER J. GUTIERREZ
Senior Deputy County Counsel

BURHENN & GEST LLP
HOWARD GEST
DAVID W. BURHENN

By: ______________________
Howard Gest
Attorneys for Petitioners County of Los Angeles and Los Angeles County Flood Control District

Dated: October__, 2004

BURKE, WILLIAMS & SORENSEN, LLP
LELAND C. DOLLEY
RUFUS C. YOUNG, JR.
AMY E. MORGAN

By: ______________________
Amy E. Morgan
Attorneys for Petitioner/Plaintiff City of Alhambra and Los Angeles County Economic Development Corporation, Cities of Industry, Lakewood, Santa Clarita, and Torrance

Dated: October__, 2004

RICHARDS, WATSON & GERSHON
a Professional Corporation
JOHN J. HARRIS
EVAN J. MCGINLEY

By: John J Harris / E
John J. Harris
Attorneys for Petitioners Cities of Artesia, Beverly Hills, Carson, La Mirada, Monrovia, Norwalk, Rancho Palos Verdes and Westlake Village

Dated: October__, 2004

RUTAN & TUCKER, LLP
RICHARD MONTEVIDEO

By: ______________________
Richard Montevideo
Attorneys for Petitioners and Plaintiffs The Cities of Arcadia, Baldwin Park, Bell Gardens, Bellflower, Cerritos, Claremont, Commerce, Covina, Diamond

E-SERVED 10/21/04 06:15 PM ET LA County Stormwater

Dated: October__, 2004

Respectfully submitted,
LLOYD W. PELLMAN
County Counsel
PETER J. GUTIERREZ
Senior Deputy County Counsel

BURHENN & GEST LLP
HOWARD GEST
DAVID W. BURHENN

By: ______________________
Howard Gest
Attorneys for Petitioners County of Los Angeles and Los Angeles County Flood Control District

Dated: October__, 2004

BURKE, WILLIAMS & SORENSEN, LLP
LELAND C. DOLLEY
RUFUS C. YOUNG, JR.
AMY E. MORGAN

By: ______________________
Amy E. Morgan
Attorneys for Petitioner/Plaintiff City of Alhambra and Los Angeles County Economic Development Corporation, Cities of Industry, Lakewood, Santa Clarita, and Torrance

Dated: October__, 2004

RICHARDS, WATSON & GERSHON
a Professional Corporation
JOHN J. HARRIS
EVAN J. MCGINLEY

By: ______________________
John J. Harris
Attorneys for Petitioners Cities of Artesia, Beverly Hills, Carson, La Mirada, Monrovia, Norwalk, Rancho Palos Verdes and Westlake Village

Dated: October__, 2004

RUTAN & TUCKER, LLP
RICHARD MONTEVIDEO

By: Rick Montevideo
Richard Montevideo
Attorneys for Petitioners and Plaintiffs The Cities of Arcadia, Baldwin Park, Bell Gardens, Bellflower, Cerritos, Claremont, Commerce, Covina, Diamond

A003521

Bar, Downey, Gardena, Hawaiian Gardens, Irwindale, Lawndale, Montebello, Monterey Park, Paramount, Pico Rivera, Pomona, Rosemead, San Gabriel, Santa Fe Springs, Sierra Madre, Signal Hill, South Gate, South Pasadena, Temple City, Vernon, Walnut, West Covina, and Whittier, and the Building Industry Legal Defense Foundation and the Construction Industry Coalition on Water Quality

IT IS SO ORDERED.

Dated: October ____, 2004

VICTORIA GERRARD CHANEY
JUDGE OF THE SUPERIOR COURT

E-SERVED 10/21/04 06:15 PM ET LACounty Stormwater

PROOF OF SERVICE

Re: IN RE L.A. COUNTY MUNICIPAL STORM WATER PERMIT LITIGATION [Cities Of Arcadia, et al. v. RWQCB, LASC Case No. BS080548; City of Los Angeles v. RWQCB, LASC Case No. BS080753; County of Los Angeles v. RWQCB; LASC Case No. BS080758; City of Alhambra v. RWQCB, LASC Case No. BS080791; Los Angeles County EDC v. RWQCB, LASC Case No. BS080792; City of Monrovia, et al. v. RWQCB, LASC Case No. BS 080807]

I declare as follows:

I am employed in the County of Los Angeles, California. I am 18 years of age or older and not a party to the within entitled cause. My business address is 300 South Spring Street, 11th Floor-North, Los Angeles, California 90013.

On October 21, 2004, at my place of business, at Los Angeles, California, I served the attached:

STIPULATIONS CONCERNING DISPOSITION OF PHASE II ISSUES 7, 8, 10, 11, 12, AND 13 [PROPOSED ORDER]

on the interested parties in this action.

[X] **By Verilaw** - a true and correct copy of the document was electronically served to counsel of record by electronic transfer of the document file via the Internet to Verilaw on October 21, 2004 [Pursuant to "Order Authorizing Electronic Service of Court-filed Documents" entered in this litigation on June 18, 2003].

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed on October 21, 2004October 21, 2004, at Los Angeles, California.

JENNIFER F. NOVAK
Attorney for Respondent/Defendant California Regional Water Quality Control Board, Los Angeles Region

FOR PUBLICATION

UNITED STATES COURT OF APPEALS FOR THE NINTH CIRCUIT

ENVIRONMENTAL DEFENSE CENTER, INC., *Petitioner,* NATURAL RESOURCES DEFENSE COUNCIL, INC., *Petitioner-Intervenor,* v. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, *Respondent,*	No. 00-70014 EPA No. Clean Water 40 CFR
AMERICAN FOREST & PAPER ASSOCIATION; NATIONAL ASSOCIATION OF HOME BUILDERS, *Petitioners,* v. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, *Respondent,* NATURAL RESOURCES DEFENSE COUNCIL, INC., *Applicant-Intervenor.*	No. 00-70734 EPA No. Clean Water 40 CFR

TEXAS CITIES COALITION ON STORMWATER; TEXAS COUNTIES STORM WATER COALITION, *Petitioners,* v. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, *Respondent,* NATURAL RESOURCES DEFENSE COUNCIL, INC., *Respondent-Intervenor.*	No. 00-70822 EPA No. Clean Water 40 CFR ORDER AND OPINION

On Petition for Review of an Order of the Environmental Protection Agency

Argued and Submitted
December 3, 2001—Pasadena, California

Filed September 15, 2003

Before: James R. Browning, Stephen Reinhardt, and Richard C. Tallman, Circuit Judges.

Opinion by Judge Browning;
Partial Concurrence and Partial Dissent by Judge Tallman

COUNSEL

Victoria Clark, Environmental Defense Center, Santa Barbara, California, for petitioner Environmental Defense Center, Inc.

Andrew G. Frank and Arlene Yang, Paul, Weiss, Rifkind, Wharton & Garrison, New York, New York, and Nancy K. Stoner, Natural Resources Defense Council, Washington, D.C., for intervenor National Resources Defense Council, Inc.

R. Timothy McCrum, Ellen B. Steen, and Donald J. Kochan, Crowell & Moring, Washington, D.C., for petitioners American Forest & Paper Association and National Association of Home Builders.

Steven P. Quarles and J. Michael Klise, Crowell & Moring, Washington, D.C., and William R. Murray, American Forest

& Paper Association, Washington, D.C., for petitioner American Forest & Paper Association.

Jim Mathews and Clarence Joe Freeland, Mathews & Freeland, Austin, Texas, for petitioner Texas Cities Coalition on Stormwater.

Sydney W. Falk, Jr. and William D. Dugat III, Bickerstaff, Heath, Smiley, Pollan, Kever & McDaniel, Austin, Texas, for petitioner Texas Counties Storm Water Coalition.

John C. Cruden, Daniel M. Flores and Kent E. Hanson, United States Department of Justice, Washington, D.C., and Stephen J. Sweeny, United States Environmental Protection Agency, Washington, D.C., for respondent United States Environmental Protection Agency.

ORDER

The opinion and dissent filed in this case on January 14, 2003, and published at 319 F.3d 398, are vacated. They are replaced by the Opinion and Dissent filed today.

With the filing of the new Opinion and Dissent, the panel has voted to deny the petitions for rehearing and the petition for rehearing en banc. (Judge Tallman would grant the petition for rehearing filed by the Environmental Protection Agency.) The full court has been advised of the new Opinion, new Dissent, and petition for rehearing en banc. No judge has requested a vote on the petition for rehearing en banc. Fed. R. App. P. 35.

The petitions for rehearing and the petition for rehearing en banc are DENIED. The clerk is instructed not to accept for filing any new petitions for rehearing or petitions for rehearing en banc in this case.

Each party shall bear its own costs in this appeal.

OPINION

BROWNING, Circuit Judge:

Petitioners challenge a rule issued by the United States Environmental Protection Agency pursuant to the Clean Water Act, 33 U.S.C. §§ 1251-1387, to control pollutants introduced into the nation's waters by storm sewers.

Storm sewers drain rainwater and melted snow from developed areas into water bodies that can handle the excess flow. Draining stormwater picks up a variety of contaminants as it filters through soil and over pavement on its way to sewers. Sewers are also used on occasion as an easy (if illicit) means for the direct discharge of unwanted contaminants. Since storm sewer systems generally channel collected runoff into federally protected water bodies, they are subject to the controls of the Clean Water Act.

In October of 1999, after thirteen years in process, the Environmental Protection Agency ("EPA") promulgated a final administrative rule (the "Phase II Rule"[1] or "the Rule") under § 402(p) of the Clean Water Act, 33 U.S.C. § 1342(p), mandating that discharges from small municipal separate storm sewer systems and from construction sites between one and five acres in size be subject to the permitting requirements of the National Pollutant Discharge Elimination System ("NPDES"), 33 U.S.C. §§ 1311(a), 1342. EPA preserved

[1]The "Phase II Rule" reviewed here is the product of the second stage of EPA's two-phase stormwater rulemaking effort. The "Phase I Rule," governing larger-scale stormwater discharges, was issued in 1990 and reviewed by this court in *Natural Res. Def. Council v. EPA*, 966 F.2d 1292 (9th Cir. 1992).

authority to regulate other harmful stormwater discharges in the future.

In the three cases consolidated here, petitioners and intervenors challenge the Phase II Rule on twenty-two constitutional, statutory, and procedural grounds. We remand three aspects of the Rule concerning the issuance of notices of intent under the Rule's general permitting scheme, and a fourth aspect concerning the regulation of forest roads. We affirm the Rule against all other challenges.

I.

BACKGROUND

A. The Problem of Stormwater Runoff

Stormwater runoff is one of the most significant sources of water pollution in the nation, at times "comparable to, if not greater than, contamination from industrial and sewage sources."[2] Storm sewer waters carry suspended metals, sediments, algae-promoting nutrients (nitrogen and phosphorus), floatable trash, used motor oil, raw sewage, pesticides, and other toxic contaminants into streams, rivers, lakes, and estuaries across the United States.[3] In 1985, three-quarters of the States cited urban stormwater runoff as a major cause of waterbody impairment, and forty percent reported construction site runoff as a major cause of impairment.[4] Urban runoff has been named as the foremost cause of impairment of sur-

[2]Richard G. Cohn-Lee and Diane M. Cameron, *Urban Stormwater Runoff Contamination of the Chesapeake Bay: Sources and Mitigation*, THE ENVIRONMENTAL PROFESSIONAL, Vol. 14, p. 10, at 10 (1992); *see also Natural Res. Def. Council*, 966 F.2d at 1295 (citing a study by the Nationwide Urban Runoff Program).

[3]Regulation for Revision of the Water Pollution Control Program Addressing Storm Water, 64 Fed. Reg. 68,722, 68,724, 68,727 (Dec. 8, 1999) (codified at 40 C.F.R. pts. 9, 122, 123, and 124).

[4]*Id.* at 68,726.

veyed ocean waters.[5] Among the sources of stormwater contamination are urban development, industrial facilities, construction sites, and illicit discharges and connections to storm sewer systems.[6]

B. Stormwater and the Clean Water Act

Congress enacted the Clean Water Act in 1948 to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a) (originally codified as the Federal Water Pollution Control Act, 62 Stat. 1155). The Clean Water Act prohibits the discharge of pollutants from a "point source"[7] into the waters of the United States without a permit issued under the terms of the National Pollutant Discharge Elimination System, 33 U.S.C. §§ 1311(a), 1342, which requires dischargers to comply with technology-based pollution limitations (generally according to the "best available technology economically achievable," or "BAT" standard). 33 U.S.C. § 1311(b)(2)(A). NPDES permits are issued by EPA or by States that have been authorized by EPA to act as NPDES permitting authorities. 33 U.S.C. § 1342(a)-(b). The permitting authority must make copies of all NPDES permits and permit applications available to the public, 33 U.S.C. §§ 1342(j), 1342(b)(3); state permitting authorities must provide EPA notice of each permit application, 33 U.S.C. § 1342(b)(4); and a permitting authority must provide an opportunity for a public hearing before issuing any permit, 33 U.S.C. §§ 1342(a)(1), 1342(b)(3); *cf.* 33 U.S.C. § 1251(e) (requiring public participation).

---

[5] *Id.*

[6] *Id.* at 68,725-31.

[7] A point source is "any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged." 33 U.S.C. § 1362(14).

Storm sewers are established point sources subject to NPDES permitting requirements. *Natural Res. Def. Council v. Costle*, 568 F.2d 1369, 1379 (D.C. Cir. 1977) (holding unlawful EPA's exemption of stormwater discharges from NPDES permitting requirements); *Natural Res. Def. Council v. EPA*, 966 F.2d 1292, 1295 (9th Cir. 1992).[8] In 1987, to better regulate pollution conveyed by stormwater runoff, Congress enacted Clean Water Act § 402(p), 33 U.S.C. § 1342(p), "Municipal and Industrial Stormwater Discharges." Sections 402(p)(2) and 402(p)(3) mandate NPDES permits for stormwater discharges "associated with industrial activity," discharges from large and medium-sized municipal storm sewer systems, and certain other discharges. Section 402(p)(4) sets out a timetable for promulgation of the first of a two-phase overall program of stormwater regulation. *Id.* at § 1342(p)(2)-(4); *Natural Res. Def. Council*, 966 F.2d at 1296. In 1990, pursuant to § 402(p)(4), EPA issued the Phase I Rule regulating large discharge sources.[9]

C. The Phase II Stormwater Rule

In Clean Water Act § 402(p), Congress also directed a second stage of stormwater regulation by ordering EPA to identify and address sources of pollution not covered by the Phase I Rule. Section 402(p)(1) placed a temporary moratorium

[8]Diffuse runoff, such as rainwater that is not channeled through a point source, is considered nonpoint source pollution and is not subject to federal regulation. *Oregon Natural Desert Ass'n v. Dombek*, 172 F.3d 1092, 1095 (9th Cir. 1998).

[9]National Pollutant Discharge Elimination System Permit Application Regulations for Stormwater Discharges, 55 Fed. Reg. 47,990 (Nov. 16, 1990) (codified at 40 C.F.R. pt. 122-124). The Phase I rule was challenged in this court in *Natural Res. Def. Council*, 966 F.2d at 1292. We held, *inter alia*, that EPA must impose deadlines for permit approvals, *id.* at 1300, that EPA's decision to regulate construction sites only over five acres in size was arbitrary and capricious, *id.* at 1306, and that EPA did not act capriciously in defining "municipal," *id.* at 1304, or in placing differently-sized municipalities on different permitting schedules, *id.* at 1301.

(expiring in 1994) on the permitting of other stormwater discharges pending the results of studies mandated in § 402(p)(5) to identify the sources and pollutant content of such discharges and to establish procedures and methods to control them as "necessary to mitigate impacts on water quality." 33 U.S.C. § 1342(p)(5). Section 402(p)(6) required that EPA establish "a comprehensive program to regulate" these stormwater discharges "to protect water quality," following the studies mandated in § 402(p)(5) and consultation with state and local officials. *Id.* at § 1342(p)(6).

EPA proposed the Phase II Rule in January of 1998.[10] In October, 1999, Congress passed legislation precluding EPA from promulgating the new Rule until EPA submitted an additional report to Congress supporting certain anticipated aspects of the Rule.[11] EPA was also required to publish its report in the Federal Register for public comment. Pub. L. No. 106-74, § 431(c), 113 Stat. at 1097. Later that month, EPA submitted the required ("Appropriations Act") study and promulgated the Rule.[12]

Under the Phase II Rule, NPDES permits are required for discharges from small municipal separate storm sewer systems ("small MS4s") and stormwater discharges from construction activity disturbing between one and five acres ("small construction sites"). 40 C.F.R. §§ 122.26(a)(9)(i)(A)-(B). Small MS4s may seek permission to discharge by submitting an individualized set of best-management plans in six

[10]Proposed Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges, 63 Fed. Reg. 1536 (proposed Jan. 9, 1998).

[11]Pub. L. No. 106-74, § 431(a), 113 Stat. 1047, 1096 (1999) ("Appropriations, 2000 — Department of Veterans Affairs and Housing and Urban Development, and Independent Agencies").

[12]Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges, 64 Fed. Reg. 68,722 (Dec. 8, 1999) (codified at 40 C.F.R. pts. 9, 122, 123, and 124).

specified categories, *id.* at § 122.34, either in the form of an individual permit application, or in the form of a notice of intent to comply with a general permit. *Id.* at § 122.33(b). Small MS4s may also seek permission to discharge through an alternative process, under which a permit may be sought without requiring the operator to regulate third parties, *id.* at §§ 122.33(b)(2)(ii), 122.26(d).[13] Small construction sites may apply for individual NPDES permits or seek coverage under a promulgated general permit. *Id.* at § 122.26(c). EPA also preserved authority to regulate other categories of harmful stormwater discharges on a regional, as-needed basis. *Id.* at § 122.26(a)(9)(i)(C)-(D).

D. Facial Challenges to the Phase II Rule

The Rule was challenged in the Fifth, Ninth, and D.C. Circuits in three separate actions ultimately consolidated before the Ninth Circuit.

The Texas Cities Coalition on Stormwater and the Texas Counties Stormwater Coalition (collectively, "the Municipal Petitioners") assert that EPA lacked authority to require permitting, that its promulgation of the Rule was procedurally defective, that the Rule establishes categories that are arbitrary and capricious, and that the Rule impermissibly requires municipalities to regulate their own citizens in contravention of the Tenth Amendment and to communicate a federally mandated message in contravention of the First Amendment. The Natural Resources Defense Council ("NRDC") intervened on behalf of EPA.

Environmental Defense Center, joined by petitioner-intervenor NRDC ("the Environmental Petitioners"), asserts that the regulations fail to meet minimum Clean Water Act

[13]The Rule also allows a small MS4 to be regulated under an individual NPDES permit covering a nearby large or medium MS4, with provisions adapted to address the small MS4. 40 C.F.R. § 122.33(b)(3).

statutory requirements because they constitute a program of impermissible self-regulation, fail to provide required avenues of public participation, and neglect to address stormwater runoff associated with forest roads and other significant sources of runoff pollution.

The American Forest & Paper Association ("AF&PA") and the National Association of Home Builders ("the Industrial Petitioners") assert that promulgation of the Rule was procedurally defective and violated the Regulatory Flexibility Act, that EPA's retention of authority to regulate future sources of runoff pollution is *ultra vires*, and that the decision to regulate discharge from construction sites one to five acres in size is arbitrary and capricious. NRDC again intervened on behalf of EPA.

We have jurisdiction pursuant to section 509(b)(1) of the Clean Water Act, 33 U.S.C. § 1369(b)(1) (assigning review of EPA effluent and permitting regulations to the Federal Courts of Appeals).

II.

DISCUSSION

A. The Permit Requirements

The Municipal Petitioners' primary contention is that the Phase II Rule compels small MS4s to regulate citizens as a condition of receiving a permit to operate, and that EPA lacks both statutory and constitutional authority to impose such a requirement. Because we avoid considering constitutionality if an issue may be resolved on narrower grounds, *Greater New Orleans Broadcasting Ass'n v. United States*, 527 U.S. 173, 184 (1999), we first ask whether the Phase II Rule is supported by statutory authority.

1. *Statutory Authority*

The Municipal Petitioners assert that the statutory command in Clean Water Act § 402(p)(6) that EPA develop a "comprehensive program to regulate" small MS4s did not authorize a program based on NPDES permits. Petitioners argue that because § 402(p)(6) explicitly indicates elements that the program may contain (performance standards, guidelines, etc.) without mentioning "permits," Congress must have intended that the program exclude permitting.[14]

The fact that "permitting" is not included on a statutory list of elements that the program "may" include is not determinative, because the list is manifestly nonexclusive. The only constraints are that the § 402(p)(6) regulations be based on the § 402(p)(5) studies, that they be issued in consultation with state and local officials, and that—"at a minimum"—they establish priorities, requirements for state stormwater management programs, and expeditious deadlines, and constitute a comprehensive program "to protect water quality." 33 U.S.C. § 1342(p)(6). EPA was free to adopt any regulatory program, including a permitting program, that included these elements. *See Chevron, U.S.A. v. Natural Res. Def. Council*, 467 U.S. 837, 842-43 (1984) (deference to an agency's reasonable interpretation is required unless Congress expressed its intent unambiguously). It is more reasonable to interpret

[14] The text of that section reads: "Not later than October 1, 1993, [EPA], in consultation with state and local officials, shall issue regulations (based on the results of the studies conducted under paragraph (5)) which designate stormwater discharges, other than those discharges described in paragraph (2), to be regulated to protect water quality and shall establish a comprehensive program to regulate such designated sources. The program shall, at a minimum, (A) establish priorities, (B) establish requirements for State stormwater management programs, and (C) establish expeditious deadlines. The program may include performance standards, guidelines, guidance, and management practices and treatment requirements, as appropriate." 33 U.S.C. § 1342(p)(6).

congressional silence about permits as an indication of EPA's flexibility not to use them than as an outright prohibition.[15]

The Municipal Petitioners further contend that their interpretation is supported by the structure of § 402(p), which expressly requires permits for large and medium sized MS4s in a separate section, § 402(p)(3)(B).[16] However, as EPA counters, the language in § 402(p)(3) requiring permits for municipal storm sewers may be interpreted to apply both to Phase I *and* Phase II MS4s. Moreover, as respondent-intervenor NRDC notes, the mere existence of the § 402(p)(1) permitting moratorium, designed to apply only to Phase II dischargers, necessarily implies that EPA has the authority to require permits from these sources after the 1994 expiration of the moratorium.

Since there would have been no need to establish a permitting moratorium for these sources if the sources could *never* be subject to permitting requirements, petitioners' interpretation violates the bedrock principle that statutes not be interpreted to render any provision superfluous. *See Burrey v. Pacific Gas & Elec. Co.*, 159 F.3d 388, 394 (9th Cir. 1998). EPA's interpretation of its mandate under § 402(p)(6) was reasonable and EPA acted within its statutory authority in formulating the Phase II Rule as a permitting program.

2. *The Tenth Amendment*

The Municipal Petitioners contend that the Phase II Rule on its face compels operators of small MS4s to regulate third parties in contravention of the Tenth Amendment. We conclude

[15]The lesser category of "permits" may also be implied by the inclusion of "performance standards" in the list of possible program features.

[16]"Where Congress includes particular language in one section of a statute but omits it in another section of the same Act, it is generally presumed that Congress acts intentionally and purposely in the disparate inclusion or exclusion." *Bates v. United States*, 522 U.S. 23, 29-30 (1997).

that the Rule does not violate the Tenth Amendment, because it directs no unconstitutional coercion.

The Phase II Rule contemplates several avenues through which a small MS4 may obtain permission to discharge. First, if the NPDES Permitting Authority overseeing the small MS4 has issued an applicable general permit, the small MS4 may submit a notice of intent wherein the small MS4 agrees to comply with the terms of the general permit and specifies plans for implementing six "Minimum Measures" designed to protect water quality. 40 C.F.R. §§ 122.33(b)(1), 122.34(d)(1)(i), 122.34(b). Second, the small MS4 may apply for an individual permit under 40 C.F.R. § 122.34, which would again require compliance with the six Minimum Measures. *Id.* at §§ 122.33(b)(2)(i), 122.34(a), 122.34(b). Third, under an "Alternative Permit" option, the small MS4 may apply for an individualized permit under 40 C.F.R. § 122.26(d), the permitting program established by the Phase I Rule for large and medium-sized MS4s. *Id.* at §§ 122.33(b)(2)(ii), 122.26(d).[17]

The Minimum Measures mentioned above require small MS4s to implement programs for: (1) conducting public education and outreach on stormwater impacts, *id.* at § 122.34(b)(1); (2) engaging public participation in the development of stormwater management programs, *id.* at § 122.34(b)(2); (3) detecting and eliminating illicit discharges to the MS4, *id.* at § 122.34(b)(3); (4) reducing pollution to the MS4 from construction activities disturbing one acre or more, *id.* at § 122.34(b)(4); (5) minimizing water quality impacts from development and redevelopment activities that disturb one acre or more, *id.* at § 122.34(b)(5); and (6) preventing or reducing pollutant runoff from municipal activities, *id.* at § 122.34(b)(6).[18]

[17]The Phase II Rule also allows a small MS4 to be regulated under an NPDES permit covering a nearby large or medium-sized MS4, with provisions adapted to address the small MS4. 40 C.F.R. § 122.33(b)(3).

[18]The Municipal Petitioners argue that the Minimum Measures exceed EPA's statutory authority under § 402(p) of the Clean Water Act. We dis-

The Municipal Petitioners contend that the measures regulating illicit discharges, small construction sites, and development activities unconstitutionally compel small MS4 operators to regulate third parties, *i.e.*, upstream dischargers. The Illicit Discharge Detection and Elimination measure requires that a permit seeker prohibit non-stormwater discharges to the MS4 and implement appropriate enforcement procedures. 40 C.F.R. § 122.34(b)(3)(ii)(B).[19] The Construc-

agree. The list of elements for a regulatory program that appears in § 402(p)(6) is nonexclusive, and EPA's adoption of the Minimum Measures represents a permissible interpretation of its authority under § 402(p)(6). *See Chevron*, 467 U.S. at 843-44.

The Municipal Petitioners argue that EPA is not entitled to *Chevron* deference, and that the Minimum Measures must be rejected absent a clear statement of congressional intent that EPA enact the Minimum Measures. The Municipal Petitioners argue that this clear statement requirement arises because there are "significant constitutional questions" about the permissibility of the Minimum Measures under the Tenth Amendment, and because the Minimum Measures alter "the federal-state framework by permitting federal encroachment upon a traditional state power." *Solid Waste Agency of N. Cook County v. Army Corps of Eng'rs*, 531 U.S. 159, 173 (2001).

As we explain, because the Phase II Rule includes at least one alternative to the Minimum Measures, *i.e.* the option of seeking a permit under 40 C.F.R. § 122.26(d), the Minimum Measures do not present significant Tenth Amendment problems demanding a clear statement of congressional intent. Nor does the Phase II Rule alter the federal-state balance. To the contrary, the option of seeking a permit under 40 C.F.R. § 122.26(d) maintains precisely the same federal-state balance as existed prior to the Phase II Rule. *See, e.g., Natural Res. Def. Council v. EPA*, 966 F.2d 1292 (9th Cir. 1992) (reviewing Phase I Rule); *Natural Res. Def. Council v. Costle*, 568 F.2d 1369, 1379 (D.C. Cir. 1977) (denying EPA authority to exempt MS4s from regulation under the Clean Water Act). Furthermore, even if a clear statement of congressional intent were necessary, § 402(p) of the Clean Water Act is replete with clear statements that Congress intended EPA to require MS4s either to obtain NPDES permits or to stop discharging stormwater.

[19]This subsection provides that permit seekers must, "[t]o the extent allowable under State, Tribal, or local law, effectively prohibit, through ordinance or other regulatory mechanism, non-stormwater discharges into your storm sewer systems and implement appropriate enforcement procedures and actions. . . ." 40 C.F.R. § 122.34(b)(3)(ii)(B).

tion Site Stormwater Runoff Control measure requires a permit seeker to implement and enforce a program to reduce stormwater pollutants from small construction sites. *Id.* at §§ 122.34(b)(4)(i)-(ii).[20] It mandates erosion and sedimentation controls, site plan reviews that take account of water quality impacts, site inspections, and the consideration of public comment, and requires that construction site operators implement erosion, sedimentation, and waste management best management practices. *Id.* The Post-Construction/New Development measure requires permit seekers to address post-construction runoff from new development and redevelopment projects disturbing one acre or more. *Id.* at § 122.34(b)(5)(ii)(B).[21]

Noting that most MS4s are operated by municipal governments, and that "[t]he drainage of a city in the interest of the public health and welfare is one of the most important purposes for which the police power can be exercised," *New*

[20]This subsection provides that permit seekers "must develop, implement, and enforce a program to reduce pollutants in any storm water runoff to your small MS4 from construction activities that result in a land disturbance of greater than or equal to one acre. . . . [The] program must include the development and implementation of, at a minimum: (A) An ordinance or other regulatory mechanism to require erosion and sediment controls, as well as sanctions to ensure compliance, to the extent allowable under State, Tribal, or local law; (B) Requirements for construction site operators to implement appropriate erosion and sediment control best management practices; (C) Requirements for construction site operators to control waste such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at the construction site that may cause adverse impacts to water quality; (D) Procedures for site plan review which incorporate consideration of potential water quality impacts; (E) Procedures for receipt and consideration of information submitted by the public, and (F) Procedures for site inspection and enforcement control measures." 40 C.F.R. §§ 122.34(b)(4)(i)-(ii).

[21]This subsection provides that permit seekers must "[u]se an ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects [disturbing one acre or more] to the extent allowable under State, Tribal or local law." 40 C.F.R. §§ 122.34(b)(5)(ii)(B).

Orleans Gaslight Co. v. Drainage Comm'n, 197 U.S. 453, 460 (1905), the Municipal Petitioners argue that requiring operators of small MS4s to implement "through ordinance or other regulatory mechanism" the regulations required by the Minimum Measures contravenes the Tenth Amendment. *See, e.g., New York v. United States*, 505 U.S. 144, 188 (1992).

EPA counters that the Phase II Rule does not violate the Tenth Amendment because operators of small MS4s may opt to avoid the Minimum Measures by seeking a permit under the Alternative Permit option, 40 C.F.R. § 122.33(b)(2)(ii).[22]

[1] Under the Tenth Amendment, "the Federal Government may not compel States to implement, by legislation or executive action, federal regulatory programs." *Printz v. United States*, 521 U.S. 898, 925 (1997); *see also New York*, 505 U.S. at 188. Similarly, the federal government may not force the States to regulate third parties in furtherance of a federal program. *See Reno v. Condon*, 528 U.S. 141, 151 (2000) (upholding a federal statutory scheme because it "does not require the States in their sovereign capacity to regulate their own citizens"). These protections extend to municipalities. *See, e.g., Printz* at 931 n.15.

[2] However, while the federal government may not *compel* them to do so, it may *encourage* States and municipalities to implement federal regulatory programs. *See New York*, 505 U.S. at 166-68. For example, the federal government may make certain federal funds available only to those States or municipalities that enact a given regulatory regime. *See, e.g., South Dakota v. Dole*, 483 U.S. 203, 205-08 (1987) (uphold-

[22]EPA and NRDC also argue that the Minimum Measures are facially constitutional, and that the Phase II Rule presents no Tenth Amendment difficulties because operators of small MS4s may avoid stormwater regulation entirely by electing not to discharge stormwater into federal waters in the first place. In light of our holding with regard to the Alternative Permit option, we do not consider these arguments.

ing federal statute conditioning state receipt of federal highway funds on state adoption of minimum drinking age of twenty-one). The crucial proscribed element is coercion; the residents of the State or municipality must retain "the ultimate decision" as to whether or not the State or municipality will comply with the federal regulatory program. *New York*, 505 U.S. at 168. However, as long as "the alternative to implementing a federal regulatory program does not offend the Constitution's guarantees of federalism, the fact that the alternative is difficult, expensive or otherwise unappealing is insufficient to establish a Tenth Amendment violation." *City of Abilene v. EPA*, 325 F.3d 657, 662 (5th Cir. 2003).

With the Phase II Rule, EPA gave the operators of small MS4s a choice: either implement the regulatory program spelled out by the Minimum Measures described at 40 C.F.R. § 122.34(b), or pursue the Alternative Permit option and seek a permit under the Phase I Rule as described at 40 C.F.R. § 122.26(d). Thus, unless § 122.26(d) itself offends the Constitution's guarantees of federalism, the Phase II Rule does not violate the Tenth Amendment.

Pursuing a permit under the Alternative Permit option does require permit seekers, in their application for a permit to discharge, to propose management programs that address substantive concerns similar to those addressed by the Minimum Measures. *See* 40 C.F.R. § 122.26(d). However, § 122.26(d) lists the requirements for an *application* for a permit to discharge, not the requirements of the permit itself. Therefore, nothing in § 122.26(d) requires the operator of an MS4 to implement a federal regulatory program in order to receive a permit to discharge, because nothing in § 122.26(d) specifies the contents of the permit that will result from the application process.

City of Abilene, 325 F.3d 657, provides a helpful illustration. The cities of Abilene and Irving, Texas, have populations between 100,000 and 250,000, and so were required to apply for permits under the Phase I Rule, 40 C.F.R. § 122.26(d). *City of Abilene*, 325 F.3d at 659-60. Under § 122.26(d) the cities were required to submit proposed stormwater management programs. *Id.* at 660. They negotiated the terms of those programs with EPA, and EPA eventually presented the cities with proposed management permits that contained conditions requiring the implementation of stormwater regulatory programs, and potentially requiring the regulation of third parties. *Id.* But, as the Fifth Circuit noted, this did not mean that the cities had no choice but to implement a federal regulatory program. Instead:

> The Cities filed comments objecting to those conditions, and negotiations continued until the EPA offered the Cities the option of pursuing numeric end-of-pipe permits, which would have required the Cities to satisfy specific effluent limitations rather than implement management programs. The Cities declined this offer, electing to continue negotiations on the management permits.

Id. The Fifth Circuit rejected the cities' contention that the resulting permits violated the Tenth Amendment by requiring the cities to regulate third parties according to federal standards. *Id.* at 661-63. Because the cities chose to pursue the management permits despite the fact that EPA provided them with an option for obtaining permits that would not have involved implementing a management program or regulating third parties, no unconstitutional coercion occurred. *Id.* at 663. The ultimate decision to implement the federal program remained with the cities.

[3] Any operator of a small MS4 that wishes to avoid the Minimum Measures may seek a permit under § 122.26(d), and, as *City of Abilene* demonstrates, nothing in § 122.26(d) will compel the operator of a small MS4 to implement a federal regulatory program or regulate third parties, because § 122.26(d) specifies application requirements, not permit

requirements. Therefore, by presenting the option of seeking a permit under § 122.26(d), the Phase II Rule avoids any unconstitutional coercion. The Municipal Petitioners' claim that the Phase II Rule violates the Tenth Amendment therefore fails.

3. *The First Amendment and the Minimum Measures*

The Municipal Petitioners contend that the Public Education and Illicit Discharge Minimum Measures compel municipalities to deliver EPA's political message in violation of the First Amendment. The Phase II Rule's "Public Education and Outreach" Minimum Measure directs regulated small MS4s to "distribute educational materials to the community . . . about the impacts of stormwater discharges on water bodies and the steps the public can take to reduce pollutants in stormwater runoff." 40 C.F.R. § 122.34(b)(1)(i). The "Illicit Discharge Detection and Elimination" measure requires regulated small MS4s to "[i]nform public employees, businesses, and the general public of hazards associated with illegal discharges and improper disposal of waste." 40 C.F.R. § 122.34(b)(3)(ii)(D).

The Municipal Petitioners argue that the First Amendment prohibits EPA from compelling small MS4s to communicate messages that they might not otherwise wish to deliver. They further contend that EPA's interpretation of § 402(p) as authorizing these Measures does not warrant *Chevron* deference because it raises serious constitutional issues, but that even if deference were given, the resulting rule is unconstitutional because neither Congress nor EPA may dictate the speech of MS4s. They contend that municipalities are protected by the First Amendment, *Pacific Gas & Elec. v. Public Utilities Comm'n*, 475 U.S. 1, 8 (1986) ("Corporations and other associations, like individuals, contribute to the [discourse] that the First Amendment seeks to foster . . . ."), which applies as much to compelled statements of "fact" as to those of "opinion." *Riley v. Nat'l Fed. of the Blind*, 487 U.S. 781, 797-98 (1988).

We conclude that the purpose of the challenged provisions is legitimate and consistent with the regulatory goals of the overall scheme of the Clean Water Act, *cf. Glickman v. Wileman Bros. & Elliott, Inc.*, 521 U.S. 457, 476 (1997), and does not offend the First Amendment.[23] The State may not constitutionally require an individual to disseminate an ideological message, *Wooley v. Maynard*, 430 U.S. 705, 713 (1976), but requiring a provider of storm sewers that discharge into national waters to educate the public about the impacts of stormwater discharge on water bodies and to inform affected parties, including the public, about the hazards of improper waste disposal falls short of compelling such speech.[24] These broad requirements do not dictate a specific message. They require appropriate educational and public information activities that need not include any specific speech at all. A regulation is facially unconstitutional only when every possible reading compels it, *Meinhold v. U.S. Dep't of Def.*, 34 F.3d 1469, 1476 (9th Cir. 1994),[25] but this is clearly not the case here.

[23]We decline to address two further arguments raised by EPA: first, that municipalities do not receive full First Amendment protections, under *Muir v. Alabama Educational Television Commission*, 688 F.2d 1033, 1038 n.12 (5th Cir. 1982) (*en banc*) ("Government expression, being unprotected by the First Amendment, may be subject to legislative limitation which would be impermissible if sought to be applied to private expression . . . ."), and *Aldrich v. Knab*, 858 F. Supp. 1480, 1491 (W.D. Wash. 1994) (holding that "unlike private broadcasters, the state itself does not enjoy First Amendment rights"), and second, that even if the First Amendment were fully applicable, the Phase II regulations would satisfy them because MS4s may avoid the compulsion to speak by seeking a permit under the Alternative option, 40 C.F.R. § 122.26(d)(2)(iv), rather than under the Minimum Measures.

[24]As a subsidiary matter, we note that it also falls short of compelling the MS4 to "regulate" third parties in contravention of the Tenth Amendment. Dispensing information to facilitate public awareness about safe disposal of toxic materials constitutes "encouragement," not regulation.

[25]"When the constitutional validity of a statute or regulation is called into question, it is a cardinal rule that courts must first determine whether a construction is possible by which the constitutional problem may be avoided." *Meinhold*, 34 F.3d at 1476.

As in *Zauderer v. Office of Disciplinary Counsel of the Sup. Ct. of Ohio*, 471 U.S. 626 (1985), where the Supreme Court upheld certain disclosure requirements in attorney advertising, "[t]he interests at stake in this case are not of the same order as those discussed in *Wooley* [invalidating a law requiring that drivers display the motto "Live Free or Die" on New Hampshire license plates] . . . and *Barnette* [forbidding the requirement that public school students salute the flag because the State may not impose on the individual "a ceremony so touching matters of opinion and political attitude"]." *Id.* at 651. EPA has not attempted to "prescribe what shall be orthodox in politics, nationalism, religion, or other matters of opinion or force citizens to confess by word or act their faith therein." *West Virginia State Bd. of Ed. v. Barnette*, 319 U.S. 624, 642 (1943).

Informing the public about safe toxin disposal is non-ideological; it involves no "compelled recitation of a message" and no "affirmation of belief." *Pruneyard Shopping Ctr. v. Robins*, 447 U.S. 74, 88 (1980) (upholding state law protecting petitioning in malls and noting that "*Barnette* is inapposite because it involved the compelled recitation of a message containing an affirmation of belief"). It does not prohibit the MS4 from stating its own views about the proper means of managing toxic materials, or even about the Phase II Rule itself. Nor is the MS4 prevented from identifying its dissemination of public information as required by federal law, or from making available federally produced informational materials on the subject and identifying them as such.

Even if such a loosely defined public information requirement could be read as compelling speech, the regulation resembles another regulation that the Supreme Court has held permissible. In *Glickman*, 521 U.S. 457, the Court upheld a generic advertising assessment promulgated by the Department of Agriculture on behalf of California tree fruit growers because the order was consistent with an overall regulatory program that did not abridge protected speech:

> Three characteristics of the regulatory scheme at issue distinguish it from laws that we have found to abridge the freedom of speech protected by the First Amendment. First, the marketing orders impose no restraint on the freedom of any producer to communicate any message to any audience. Second, they do not compel any person to engage in any actual or symbolic speech. Third, they do not compel the producers to endorse or to finance any political or ideological views. Indeed, since all of the respondents are engaged in the business of marketing California nectarines, plums, and peaches, it is fair to presume that they agree with the central message of the speech that is generated by the generic program.

Id. at 469-70 (footnotes omitted). Here, as in *Glickman*, the Phase II regulations impose no restraint on the freedom of any MS4 to communicate any message to any audience. They do not compel any specific speech, nor do they compel endorsement of political or ideological views. And since all permittees are engaged in the handling of stormwater runoff that must be conveyed in reasonably unpolluted form to national waters, it is similarly fair to presume that they will agree with the central message of a public safety alert encouraging proper disposal of toxic materials.[28] The Phase II regulation

[28]In its most recent treatment of compelled speech, the Supreme Court held that a generic advertising campaign violated free speech where the message was specific and antagonistic to the preferred advertising message of the plaintiff, and the regulation compelling participation was not part of a broader regulatory apparatus already constraining the plaintiff's autonomy in the relevant arena. *United States Dep't. of Agriculture v. United Foods*, 533 U.S. 405, 410-17 (2001). The court distinguished this advertising program from the one in *Glickman* on the latter point: "[t]he program sustained in *Glickman* differs from the one under review in a most fundamental respect. In *Glickman* the mandated assessments for speech were ancillary to a more comprehensive program restricting market autonomy." *Id.* at 411. Although the Phase II Rule is not an advertising or marketing regulation, it constitutes a "comprehensive program" restricting the autonomy of MS4s in the relevant arena of controlling toxic discharges to storm sewers that drain to U.S. waters.

departs only from the second element in the *Glickman* analysis, because the public information requirement may compel a regulated party to engage in some speech at some time; but unlike the offensive messages in *Maynard* and *Barnette* (and even the inoffensive advertising messages at issue in *Glickman*) that speech is not specified by the regulation.[27]

The public information requirement does not impermissibly compel speech, and nothing else in the Phase II Rule offends the First Amendment.[28] The Rule does not compel a recitation of a specific message, let alone an affirmation of belief. To the extent MS4s are regulated by the public information requirement, the regulation is consistent with the overall regulatory program of the Clean Water Act and the responsibilities of point source dischargers.

[27]In deciding the similar question of whether a regulation impermissibly compelled speech by requiring manufacturers of mercury-containing products to inform consumers how to dispose safely of the toxic material, the Second Circuit held that "mandated disclosure of accurate, factual, commercial information does not offend the core First Amendment values of promoting efficient exchange of information or protecting individual liberty interests." *Nat'l Elec. Mfrs. Ass'n v. Sorrell*, 272 F.3d 104, 114 (2d Cir. 2001). What speech may follow from the Phase II directive will not be "commercial" in the same sense that manufacturer labeling is, but it will be similar in substance to *Sorrell* to the extent that it informs the public how to dispose safely of toxins. We think the policy considerations underlying the commercial speech treatment of labeling requirements, *see, e.g.*, the Federal Cigarette Labeling and Advertising Act, 15 U.S.C. §§ 1333-39, apply similarly in the context of the market-participant municipal storm sewer provider.

[28]The Alternative option contains a public education requirement that is similar but even less specific, and therefore even less burdensome, than the requirements in the Minimum Measures. *See* § 122.26(d)(2)(iv)(B)(6) (requiring permit seekers to propose programs to counter illicit discharges, including a "description of educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials").

4. *Notice and Comment on the Alternative Permit Option*

The Municipal Petitioners contend that, in adopting the Alternative Permit option, EPA did not comply with the minimum notice and comment procedures required in informal rulemaking by the Administrative Procedures Act ("APA"), 5 U.S.C. § 553. The APA requires an agency to publish notice of a proposed rulemaking that includes "either the terms or substance of the proposed rule or a description of the subjects and issues involved." *Id.* at 553(b)(3).

We have held that a "final regulation that varies from the proposal, even substantially, will be valid as long as it is 'in character with the original proposal and a logical outgrowth of the notice and comments.' " *Hodge v. Dawson*, 107 F.3d 705, 712 (9th Cir. 1997). In determining whether notice was adequate, we consider whether the complaining party should have anticipated that a particular requirement might be imposed. The test is whether a new round of notice and comment would provide the first opportunity for interested parties to offer comments that could persuade the agency to modify its rule. *Am. Water Works Ass'n v. EPA*, 40 F.3d 1266, 1274 (D.C. Cir. 1994).

The Municipal Petitioners argue that the Alternative Permit option is not a logical outgrowth of EPA's proposed rule because, although numerous alternatives were discussed in the Preamble to the proposed rule, 63 Fed. Reg. at 1554-1557, the Alternative Permit option eventually adopted was not. EPA counters that the proposed rule included a supplementary alternative permitting system based on concepts similar to those in the Minimum Measures, including "simplified individual permit application requirements."[29] EPA contends that

[29]Municipal Petitioners concede that "simplified individual permit application requirements" were discussed, but they contend that the permit requirements discussed are not sufficiently similar to those promulgated to establish a logical outgrowth.

the Alternative Permit option was a logical outgrowth of the comments it received on the proposal expressing concern that the Minimum Measures might violate the Tenth Amendment. 64 Fed. Reg. at 68,765.

The Alternative Permit option passes the *Hodge* test. The proposed rule suggested an individualized permitting option to be developed in response to comments during the notice and comment period. The Alternative option contains no elements that were not part of the original rule, even if they are configured differently in the final rule. Petitioners had, and took, their opportunity to object to the aspects of the Rule that they did not support in their comments on the Minimum Measures.

B. The General Permit Option and Notices of Intent

The Environmental Petitioners contend that the general permitting scheme of the Phase II Rule allows regulated small MS4s to design stormwater pollution control programs without adequate regulatory and public oversight, and that it contravenes the Clean Water Act because it does not require EPA to review the content of dischargers' notices of intent and does not contain express requirements for public participation in the NPDES permitting process.

[4] In reviewing a federal administrative agency's interpretation of a statute it administers, we first determine whether Congress has expressed its intent unambiguously on the question before the court. *See Chevron*, 467 U.S. 837, 842-44 ("If the intent of Congress is clear, that is the end of the matter; for the court, as well as the agency, must give effect to the unambiguously expressed intent of Congress."). "If, instead, Congress has left a gap for the administrative agency to fill, we proceed to step two. At step two, we must uphold the administrative regulation unless it is arbitrary, capricious, or manifestly contrary to the statute." *Defenders of Wildlife v.*

Browner, 191 F.3d 1159, 1162, *amended by* 197 F.3d 1035 (9th Cir. 1999) (citations and internal quotations omitted).

We conclude that the Phase II General Permit option violates the Clean Water Act's requirement that permits for discharges "require controls to reduce the discharge of pollutants to the maximum extent practicable," 33 U.S.C. § 1342(p)(3)(B)(iii). We also conclude that the Phase II General Permit option violates the Clean Water Act because it does not contain express requirements for public participation in the NPDES permitting process. We remand these aspects of the Phase II Rule.[30]

1. *Phase II General Permits and Notices of Intent*

[5] Primary responsibility for enforcement of the requirements of the Clean Water Act is vested in the Administrator of the EPA. 33 U.S.C. § 1251(d); *see also* 33 U.S.C. § 1361(a) ("The Administrator [of EPA] is authorized to prescribe such regulations as are necessary to carry out his functions under this chapter."). The Clean Water Act renders illegal any discharge of pollutants not specifically authorized by a permit. 33 U.S.C. § 1311(a) ("Except in compliance with this section and [other sections detailing permitting requirements] of this title, the discharge of any pollutant by any person shall be unlawful."). Under the Phase II Rule, dischargers

[30]EPA argues that the Environmental Petitioner's challenge is not ripe for review because "the question of whether some general permit somewhere might fail to assure that pollutants are reduced to the maximum extent practicable is not ripe for review." But we are not addressing the merits of any specific permit. Rather, the question before us "is purely one of statutory interpretation that would not benefit from further factual development of the issues presented." *Whitman v. American Trucking*, 531 U.S. 457, 479 (2001). Specifically, we are addressing whether EPA, in promulgating the Phase II Rule, has accomplished the substantive controls for municipal stormwater that Congress mandated in § 402(p) of the Clean Water Act. As we held in *Natural Resources Defense Council v. EPA*, 966 F.2d at 1296-97, 1308, this question is ripe for review.

may apply for an individualized permit with the relevant permitting authority, or may file a "Notice of Intent" ("NOI") to seek coverage under a "general permit." 40 C.F.R. § 122.33(b).

[6] A general permit is a tool by which EPA regulates a large number of similar dischargers. Under the traditional general permitting model, each general permit identifies the output limitations and technology-based requirements necessary to adequately protect water quality from a class of dischargers. Those dischargers may then acquire permission to discharge under the Clean Water Act by filing NOIs, which embody each discharger's agreement to abide by the terms of the general permit. Because the NOI represents no more than a formal acceptance of terms elaborated elsewhere, EPA's approach does not require that permitting authorities review an NOI before the party who submitted the NOI is allowed to discharge. General permitting has long been recognized as a lawful means of authorizing discharges. *Natural Res. Def. Council v. Costle*, 568 F.2d 1369 (D.C. Cir. 1977).

[7] The Phase II general permitting scheme differs from the traditional general permitting model. The Clean Water Act requires EPA to ensure that operators of small MS4s "reduce the discharge of pollutants to the maximum extent practicable." 40 U.S.C. § 1342(p)(3)(B). To ensure that operators of small MS4s achieve this "maximum extent practicable" standard, the Phase II Rule requires that each NOI contain information on an individualized pollution control program that addresses each of the six general criteria specified in the Minimum Measures; thus, according to the Phase II Rule, submitting an NOI and implementing the Minimum Measures it contains "constitutes compliance with the standard of reducing pollutants to the 'maximum extent practicable.'" 40 C.F.R. § 122.34(a).

[8] Because a Phase II NOI establishes what the discharger will do to reduce discharges to the "maximum extent practica-

ble," the Phase II NOI crosses the threshold from being an item of procedural correspondence to being a substantive component of a regulatory regime. The text of the Rule itself acknowledges that a Phase II NOI is a permit application that is, at least in some regards, functionally equivalent to a detailed application for an individualized permit. *See, e.g.*, 40 C.F.R. § 122.34(d)(1) ("In your permit application (either a notice of intent for coverage under a general permit or an individual permit application), you must identify and submit to your NPDES permitting authority the following information . . . ."). For this reason, EPA rejected the possibility of providing a "form NOI" to Phase II permittees, explaining that "[w]hat will be required on an MS4's NOI . . . is more extensive than what is usually required on an NOI, so a 'form' NOI for MS4s may be impractical." 64 Fed. Reg. at 68,764.

2. *Failure to Regulate*

The Environmental Petitioners argue that, by allowing NPDES authorities to grant dischargers permits based on unreviewed NOIs, the Rule creates an impermissible self-regulatory system.[31] Petitioners contend the Rule impermissibly fails to require that the permitting authority review an NOI to assure compliance with Clean Water Act standards, including the standard that municipal stormwater pollution be reduced to "the maximum extent practicable." 33 U.S.C. § 1342(p)(3)(B)(iii). *See* 40 C.F.R. § 123.35 (setting out

[31]Petitioners suggest that EPA should be held to the standard it espoused to procure judicial approval for the Phase I program. In 1991, responding to NRDC's assertion that the Phase I Rule failed to set "hard criteria" for review of MS4 stormwater programs, EPA responded that "inadequate proposals will result in the denial of permit applications." Respondent's Brief at 67, *Natural Res. Def. Council v. EPA*, 966 F.2d 1292 (9th Cir. 1992) (Nos. 91-70200, 91-70176, & 90-70671). Petitioners contend that this court relied on that representation in ruling for EPA on that issue. *Natural Res. Def. Council v. EPA*, 966 F.2d at 1308 n.17 ("Individual NPDES permit writers . . . will decide whether application proposals are adequate . . . .").

requirements for permitting authorities, but not requiring review of NOI); 64 Fed. Reg. at 68,764 ("EPA disagrees that formal approval or disapproval by the permitting authority is needed").

EPA maintains that the Phase II permit system is fully consistent with the authorizing statute. It contends that § 402(p)(6) granted EPA flexibility in designing the Phase II "comprehensive program," and notes that while the statute does not require general permits, neither does it preclude them. EPA contends that Congress delegated the task of designing the program to EPA, and that EPA reasonably adopted a "flexible version" of the NPDES permit program to suit the unique needs of the Phase II program. It disputes that the general permit program creates "paper tigers," especially since EPA, States, and citizens may initiate enforcement actions. Finally, EPA argues that the Rule does not create a self-regulatory program, but that even if it did, nothing in § 402(p)(6) precludes such a program.

Reviewing the Phase II Rule under the first step of *Chevron*, we note that the plain language of § 402(p) of the Clean Water Act, 33 U.S.C. § 1342(p), expresses unambiguously Congress's intent that EPA issue no permits to discharge from municipal storm sewers unless those permits "require controls to reduce the discharge of pollutants to the maximum extent practicable."

Phase II general permits will likely impose requirements that ensure that operators of small MS4s comply with many of the standards of the Clean Water Act. Thus, general permits issued under Phase II will ordinarily contain numerous substantive requirements, just as did the permits issued under Phase I. *See* 40 C.F.R. §§ 123.35 & 123.35(a) ("§123.35 As the NPDES Permitting Authority for regulated small MS4s, what is my role? (a) You must comply with the requirements for all NPDES permitting authorities under Parts 122, 123, 124 and 125 of this chapter."); *see also* 40 C.F.R. § 122.28

(outlining requirements for NPDES authorities issuing general permits). And every operator of a small MS4 who files an NOI under Phase II "must comply with other applicable NPDES permit requirements, standards, and conditions established in the . . . general permit." *See* 40 C.F.R. §§ 122.34 & 122.34(f).

However, while each Phase II general permit will likely ensure that operators of small MS4s comply with certain standards of the Clean Water Act, they will not "require controls to reduce the discharge of pollutants to the maximum extent practicable." According to the Phase II Rule, the operator of a small MS4 has complied with the requirement of reducing discharges to the "maximum extent practicable" when it implements its stormwater management program, i.e., when it implements its Minimum Measures. 40 C.F.R. § 122.34(a); *see also* 64 Fed. Reg. at 68753 (stating EPA's anticipation that limitations more stringent that the minimum control measures "will be unnecessary"). Nothing in the Phase II regulations requires that NPDES permitting authorities review these Minimum Measures to ensure that the measures that any given operator of a small MS4 has decided to undertake will *in fact* reduce discharges to the maximum extent practicable.[32]

[32]That the Rule allows a permitting authority to review an NOI is not enough; every permit must comply with the standards articulated by the Clean Water Act, and unless every NOI issued under a general permit is reviewed, there is no way to ensure that such compliance has been achieved.

The regulations do require NPDES permitting authorities to provide operators of small MS4s with "menus" of management practices to assist in implementing their Minimum Measures, *see* 40 C.F.R. § 123.35(g), but again, nothing requires that the combination of items that the operator of a small MS4 selects from this "menu" will have the combined effect of reducing discharges to the maximum extent practicable.

Nor is the availability of citizen enforcement actions a substitute for EPA's enforcement responsibility, especially because, as discussed below, the Rule does not require that NOIs be publically available. Absent review on the front end of permitting, the general permitting regulatory program loses meaning even as a procedural exercise.

See 40 C.F.R. § 123.35 ("As the NPDES Permitting Authority for regulated small MS4s, what is my role?"). Therefore, under the Phase II Rule, nothing prevents the operator of a small MS4 from misunderstanding or misrepresenting its own stormwater situation and proposing a set of minimum measures for itself that would reduce discharges by far less than the maximum extent practicable.

[9] In fact, under the Phase II Rule, in order to receive the protection of a general permit, the operator of a small MS4 needs to do nothing more than decide for itself what reduction in discharges would be the maximum practical reduction. No one will review that operator's decision to make sure that it was reasonable, or even good faith.[33] Therefore, as the Phase II Rule stands, EPA would allow permits to issue that would do less than *require* controls to reduce the discharge of pollutants to the maximum extent practicable.[34] *See* 64 Fed. Reg.

[33]EPA identifies no other general permitting program that leaves the choice of substantive pollution control requirements to the regulated entity, and we are not persuaded by the analogy it urges to the traditional model of general permitting (where NOIs routinely are not reviewed), because, as we have noted, the Phase II general permit model is substantially dissimilar.

[34]In its petition for rehearing, EPA argues for the first time that because the regulations require NPDES Permitting Authorities to include in general permits "any additional measures necessary" to ensure that the maximum extent practicable standard is met, 40 C.F.R. §§ 123.35(h)(1), 123.35(f) (incorporating by reference the "maximum extent practicable" requirement of 40 C.F.R. §§ 122.34(a)), 122.34(f) (requiring small MS4s to comply with additional measures), the Phase II Rule ensures that discharges will be reduced to the maximum extent practicable.

The trouble with EPA's reasoning is that the Phase II Rule defines the "maximum extent practicable" standard in such a way that no "additional measures" will ever be necessary under § 123.35(h)(1). While a Permitting Authority may impose additional measures, nothing compels it to do so because, merely by implementing the best management practices that the operator of a small MS4 has chosen for itself, that small MS4 will already have met the "maximum extent practicable" standard. *See* 40 C.F.R. § 122.34(a).

at 68753 (explaining that the minimum control measures will protect water quality if they are "properly implemented"). We therefore must reject this aspect of the Phase II Rule as contrary to the clear intent of Congress. *Cf. Natural Res. Def. Council*, 966 F.2d at 1305 (rejecting as arbitrary and capricious a permitting system that allowed regulated industrial stormwater dischargers to "self-report" whether they needed permit coverage).

[10] Involving regulated parties in the development of individualized stormwater pollution control programs is a laudable step consistent with the directive to consult with state and local authorities in the development of the § 402(p)(6) comprehensive program. But EPA is still required to ensure that the individual programs adopted are consistent with the law. Our holding should not prevent the Phase II general permitting program from proceeding mostly as planned. Our holding does not preclude regulated parties from designing aspects of their own stormwater management programs, as contemplated under the Phase II Rule. However, stormwater management programs that are designed by regulated parties must, in every instance, be subject to meaningful review by an appropriate regulating entity to ensure that each such program reduces the discharge of pollutants to the maximum extent practicable. We therefore remand this aspect of the Rule.

3. *Public Participation*

The Environmental Petitioners contend that the Phase II Rule fails to provide for public participation as required by the Clean Water Act, because the public receives neither notice nor opportunity for hearing regarding an NOI. The EPA replies on the one hand by arguing that NOIs are not "permits" and therefore are not subject to the public availability and public hearing requirements of the Clean Water Act, and on the other hand by arguing that the combination of the public involvement minimum measure, 40 C.F.R. § 122.34(b)(2), the Federal Freedom of Information Act, 5

U.S.C. § 552, and state freedom of information acts would fulfill any such requirements if NOIs were permits.

[11] Reviewing the Phase II Rule under *Chevron* step one, we conclude that clear Congressional intent requires that NOIs be subject to the Clean Water Act's public availability and public hearings requirements. The Clean Water Act requires that "[a] copy of each permit application and each permit issued under [the NPDES permitting program] shall be available to the public," 33 U.S.C. § 1342(j), and that the public shall have an opportunity for a hearing before an permit application is approved, 33 U.S.C. § 1342(a)(1). Congress identified public participation rights as a critical means of advancing the goals of the Clean Water Act in its primary statement of the Act's approach and philosophy. *See* 33 U.S.C. § 1251(e); *see also Costle v. Pacific Legal Found.*, 445 U.S. 198, 216 (1980) (noting the "general policy of encouraging public participation is applicable to the administration of the NPDES permit program"). EPA has acknowledged that technical issues relating to the issuance of NPDES permits should be decided in "the most open, accessible forum possible, and at a stage where the [permitting authority] has the greatest flexibility to make appropriate modifications to the permit." 44 Fed. Reg. 32,854, 32,885 (June 7, 1979).

[12] As we noted above, under the Phase II Rule it is the NOIs, and not the general permits, that contain the substantive information about how the operator of a small MS4 will reduce discharges to the maximum extent practicable. Under the Phase II Rule, NOIs are functionally equivalent to the permit applications Congress envisioned when it created the Clean Water Act's public availability and public hearing requirements. Thus, if the Phase II Rule does not make NOIs "available to the public," and does not provide for public hearings on NOIs, the Phase II Rule violates the clear intent of Congress. EPA's first argument—that NOIs are not subject to the public availability and public hearings requirements of the Clean Water Act—therefore fails.

[13] We therefore reject the Phase II Rule as contrary to the clear intent of Congress insofar as it does not provide for public hearings on NOIs as required by 33 U.S.C. § 1342(a)(1). However, Congress has not directly addressed the question of what would constitute an NOI being "available to the public" as required by 33 U.S.C. § 1342(j). Under *Chevron* step two, we must defer to EPA's interpretation of "available to the public" unless it is arbitrary, capricious, or manifestly contrary to the statute.

EPA argues that the NOIs are "available to the public" as a result of the combined effects of the public participation minimum measures, and of federal and state freedom of information acts. This argument is unconvincing. First, the public participation Minimum Measure only requires dischargers to design a program minimally consistent with State, Tribal, and local requirements. 40 C.F.R. § 122.34(b)(2). Second, the federal Freedom of Information Act only applies to documents that are actually in EPA's possession, not to documents that are in the possession of state or tribal NPDES authorities, *see* 40 C.F.R. § 2 (providing EPA's policy for releasing documents under the federal Freedom of Information Act), and nothing in the Phase II Rule provides that EPA obtain possession of every NOI that is submitted to a NPDES permitting authority. *See* 40 C.F.R. § 123.41(a) (making information provided to state NPDES authorities available to EPA only *upon request*). Thus, under the Phase II Rule, NOIs will only "be available to the public" subject to the vagaries of state and local freedom of information acts. We conclude that EPA's interpretation of 33 U.S.C. § 1342(j), as embodied in the provisions of the Phase II Rule providing for the public availability of NOIs, is manifestly contrary to the Clean Water Act, which contemplates greater scope, greater certainty, and greater uniformity of public availability than the Phase II Rule provides. We therefore reject this aspect of the Phase II Rule.[35]

[35]EPA argues for the first time in its petition for rehearing that NOIs will be publically available under 40 C.F.R. § 122.34(g)(2). Addressing

[14] In sum, we conclude that EPA's failure to require review of NOIs, which are the functional equivalents of permits under the Phase II General Permit option, and EPA's failure to make NOIs available to the public or subject to public hearings contravene the express requirements of the Clean Water Act. We therefore vacate those portions of the Phase II Rule that address these procedural issues relating to the issuance of NOIs under the Small MS4 General Permit option, and remand so that EPA may take appropriate action to comply with the Clean Water Act.

C. Failure to Designate

We reject the Environmental Petitioners' contention that EPA's failure to designate for Phase II regulation serious sources of stormwater pollution, including certain industrial ("Group A") sources and forest roads, was arbitrary and capricious. *See Marsh v. Oregon Natural Res. Council*, 490 U.S. 360, 378 (1989).[36]

operators of regulated small MS4s, this section provides: "You must make your records, including a description of your storm water management program, available to the public at reasonable times during regular business hours." While this section does seem to provide for the public availability of a small MS4's records, we are troubled that nothing in EPA's initial briefs indicated that EPA considered NOIs to be subject to this section. We normally defer to an agency's interpretations of its own regulations, but we may decline to defer to the *post hoc* rationalizations of appellate counsel. *See, e.g., Martin v. Occupational Safety and Heath Review Commission*, 499 U.S. 144, 150, 156 (1991). If EPA intends this section to provide for the public availability of NOIs—for example because it intends NOIs to be among the records subject to this section—it may clarify on remand.

[36]Agency determinations based on the record are reviewed under the "arbitrary and capricious" standard. 5 U.S.C. § 706(2)(A). The standard is narrow and the reviewing court may not substitute its judgment for that of the agency. *Marsh*, 490 U.S. at 378. However, the agency must articulate a rational connection between the facts found and the conclusions made. *Washington v. Daley*, 173 F.3d 1158, 1169 (9th Cir. 1999). The reviewing court must determine whether the decision was based on a consideration

1. "Group A" Facilities

In addition to the small MS4s and construction sites ultimately designated for regulation under the Phase II Rule, EPA evaluated a variety of other point-source discharge categories for potential Phase II regulation. One group of dischargers (referred to as the "Group A" facilities) included sources that "are very similar, or identical" to regulated stormwater discharges associated with industrial activity that were not designated for Phase I regulation for administrative reasons unrelated to their environmental impacts.[37] 64 Fed. Reg. at 68,779. EPA estimates that Group A includes approximately 100,000 facilities, including auxiliary facilities and secondary activities ("*e.g.*, maintenance of construction equipment and vehicles, local trucking for an unregulated facility such as a grocery store," *id.*) and facilities intentionally omitted from Phase I designation ("*e.g.*, publicly owned treatment works with a design flow of less than 1 million gallons per day, landfills that have not received industrial waste," *id.*).

---

of the relevant factors and whether there has been a clear error of judgment. *Marsh*, 490 U.S. at 378. The court may reverse under the "arbitrary and capricious" standard only if the agency:

> has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.

Motor Vehicle Mfrs. Ass'n, 463 U.S. at 43.

[37]EPA explains that the Group A facilities were not regulated with the other Phase I sources because EPA used Standard Industrial Classification Index (SIC) codes in defining the universe of regulated industrial activities: "By relying on SIC codes, a classification system created to identify industries rather than environmental impacts from these industries [sic] discharges, some types of storm water discharges that might otherwise be considered 'industrial' were not included in the existing NPDES storm water program." 64 Fed. Reg. at 68,779.

The Environmental Petitioners contend that EPA should have designated the Group A facilities for categorical Phase II regulation after finding (1) that stormwater discharges from these facilities are the same as those from the industrial sources regulated under Phase I, and (2) that such discharges may cause "adverse water quality impacts." *Id.* Petitioners argue that these findings, and EPA's failure to provide individualized analysis regarding whether any specific source category within Group A requires regulation, render EPA's decision not to regulate any of these sources under the Rule arbitrary and capricious. They maintain that EPA's "line-drawing," which regulates some pollution sources but leaves nearly identical sources unregulated without any persuasive rationale, is necessarily arbitrary and capricious. *See Natural Res. Def. Council*, 966 F.2d at 1306 (EPA's decision not to regulate construction sites smaller than five acres was arbitrary when EPA provided no data to justify the five-acre threshold and admitted that unregulated sites could have significant water quality impacts).

Petitioners argue that § 402(p)(6) at least required EPA to make findings with respect to individual Group A categories, and that data collected from Phase I permit applications could be used to evaluate the pollutant potential of the identical Group A sources. They contend that these findings should have sufficed as a basis for designating at least some Group A sources, and that EPA's conclusion that it lacked adequate nationwide data upon which to designate any of these sources is not supported by the record evidence. Comparing EPA's identification of the serious polluting potential of some of these sources with its statutory mandate under § 402(p)(6) "to protect water quality," they argue that EPA fails even the forgiving standard of arbitrary and capricious review in that it has "offered an explanation for its decision that runs counter to the evidence before [it]" and "is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *See Motor Vehicle Mfrs.*, 463 U.S. at 43.

EPA maintains that it considered Group A facilities' similarity to already regulated sources as only one of several criteria that it used in designating sources for regulation under Phase II, 64 Fed. Reg. at 68,780, and that sources that appear "similarly situated" under one criterion are not necessarily similarly situated under all. EPA asserts that nothing in § 402(p)(6) implied a responsibility to make individualized findings regarding each Group A subcategory, and it maintains that it simply lacked sufficient data to support nationwide designation of the Group A facilities. EPA notes that, after failing to receive requested comment providing such data, it proposed instead "to protect water quality" by allowing regional regulation of problem Group A facilities under the residual designation authority. EPA contends that agencies must be afforded deference in determining the data necessary to support regulatory decisionmaking and that it reasonably determined the quantum of data it would need to support the designation of additional sources on a nationwide basis. *See Sierra Club v. EPA*, 167 F.3d 658, 662 (D.C. Cir. 1999).

We conclude that sufficient evidence supports EPA's decision not to designate Group A sources on a nationwide basis, and instead to establish local and regional designation authority to account for these sources and protect water quality. Although we are troubled by the purely administrative basis for the distinction between facilities regulated under the Phase I Rule and the Group A facilities that remain unregulated under Phase II,[38] EPA's choice of the Phase I standard for designation is not the issue before us. Before us is whether EPA acted arbitrarily in declining to designate the Group A sources on a nationwide basis under the Phase II Rule, and we cannot say that it did.

[38]As discussed in footnote 37, Group A facilities were not regulated with other Phase I industrial sources based on a government coding system used to distinguish different types of industry (without reference to their similar environmental impacts). *See* 64 Fed. Reg. at 68,779.

EPA has articulated a rational connection between record facts indicating insufficient data to categorically regulate Group A facilities and its corresponding conclusion not to do so, and we defer to that decision. *See Washington v. Daley*, 173 F.3d 1158, 1169 (9th Cir. 1999). In the text of the Rule, EPA explains that the process behind its decision not to nationally designate Group A sources for Phase II regulation focused not only on the likelihood of contamination from a source category, but also on the sufficiency of national data about each category and whether pollution concerns were adequately addressed by existing environmental regulations.[39] We cannot say that EPA relied on factors Congress had not intended it to consider, that it failed to consider an important aspect of the problem, or that its rationale is implausible. *See Motor Vehicle Mfrs.*, 463 U.S. at 43. Nor did EPA's decision

[39]"In identifying potential categories of sources for designation in today's notice, EPA considered designation of discharges from Group A and Group B facilities. EPA applied three criteria to each potential category in both groups to determine the need for designation: (1) The likelihood for exposure of pollutant sources included in that category, (2) whether such sources were adequately addressed by other environmental programs, and (3) whether sufficient data were available at this time on which to make a determination of potential adverse water quality impacts for the category of sources. As discussed previously, EPA searched for applicable nationwide data on the water quality impacts of such categories of facilities. . . .

"EPA's application of the first criterion showed that a number of Group A and B sources have a high likelihood of exposure of pollutants. . . . Application of the second criterion showed that some categories were likely to be adequately addressed by other programs.

"After application of the third criterion, availability of nationwide data on the various storm water discharge categories, EPA concluded that available data would not support any such nationwide designations. While such data could exist on a regional or local basis, EPA believes that permitting authorities should have flexibility to regulate only those categories of sources contributing to localized water quality impairments. . . . If sufficient regional or nationwide data become available in the future, the permitting authority could at that time designate a category of sources or individual sources on a case-by-case basis." 64 Fed. Reg. at 68,780.

run counter to the evidence before it. *Id.* The Environmental Petitioners allege that its decision not to regulate Group A facilities runs counter to evidence that similar sources are highly polluting, but as EPA considered evidence beyond those similarities that persuaded it not to regulate, we cannot say that EPA's decision is unsupported by the record. Nothing in § 402(p)(6) unambiguously requires EPA to evaluate the Group A source categories individually, and we defer to EPA's interpretation of the statute it is charged with administering. *See Royal Foods Co. v. RJR Holdings*, 252 F.3d 1102, 1106 (9th Cir. 2001).

2. ***Forest Roads***

The Environmental Petitioners also contend that EPA arbitrarily failed to regulate forest roads under the Rule despite clear evidence in the record documenting the need for stormwater pollution control of drainage from these roads. Petitioners again contend that this agency action is arbitrary, because EPA has offered an explanation for its decision that runs counter to the evidence before it.

Petitioners point to EPA's own conclusion that forest roads "are considered to be the major source of erosion from forested lands, contributing up to 90 percent of the total sediment production from forestry operations."[40] They note that both unimproved forest roads and construction sites create large expanses of non-vegetated soil subject to stormwater erosion, and argue that construction site data thus also support regulation of forest roads. Petitioners observe that EPA has cited no contrary evidence indicating that forest roads are not sources of stormwater pollutant discharges to U.S. waters, and they argue that Phase II regulation is necessary "to protect water

[40] *Guidance Specifying Management Measures For Sources of Nonpoint Pollution in Coastal Waters*, EPA guidance paper 840-B-93-001c (Jan. 1993), *available at* http://www.epa.gov/owow/nps/mmgi/index.html (last visited Sept. 18, 2002) ("Coastal Waters").

quality," because proper planning and road design can minimize erosion and prevent stream sedimentation. Petitioners note that this court has previously held that, in the absence of such "supportable facts," EPA is not entitled to the usual assumption that it has "rationally exercised the duties delegated to it by Congress." *Natural Res. Def. Council*, 966 F.2d at 1305.

EPA's response is that we have no jurisdiction to hear this challenge, chiefly because, it believes, the challenge is time-barred by Clean Water Act § 509(b)(1), 33 U.S.C. § 1369(b)(1) (providing that "application for review shall be made within 120 days from the date of [agency action]"). EPA promulgated silviculture regulations in 1976 that exclude from NPDES permit requirements certain silvicultural activities that EPA determined constitute non-point source activities, including "surface drainage, or road construction and maintenance from which there is natural runoff." 40 C.F.R. § 122.27(b)(1).[41] EPA asserts that the exclusion applies to forest roads in general, not only to "construction" and "maintenance"—an assertion disputed by Petitioners—and that any challenge to the decision not to reg-

[41]The provision provides in full as follows:

> Silvicultural point source means any discernible, confined and discrete conveyance related to rock crushing, gravel washing, log sorting, or log storage facilities which are operated in connection with silvicultural activities and from which pollutants are discharged into waters of the United States. The term does not include non-point source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance from which there is natural runoff. However, some of these activities (such as stream crossing for roads) may involve point source discharges of dredged or fill material which may require a CWA section 404 permit (See 33 CFR 209.120 and part 233).

40 C.F.R. § 122.27(b)(1).

ulate forest roads should have been brought within 120 days of the promulgation of that rule. *See* 33 U.S.C. § 1369(b)(1).

EPA's argument might be more persuasive if Petitioners' contention could be understood essentially as a direct challenge to the 1976 silviculture regulations, but this is not the case. Even were we to assume that EPA exempted forest roads from NPDES permit requirements in 1976 under 40 C.F.R. § 122.27(b)(1), that would not resolve the question whether EPA should have addressed forest roads in its "comprehensive program . . . to protect water quality" under § 402(p)(6), because § 402(p)(6) was not enacted until 1987. Petitioners challenge EPA's decision not to regulate under the new portion of the statute, not the decision not to regulate under other provisions that were in effect earlier.

EPA argues in the alternative that Petitioners should have sought judicial review when EPA considered amending § 122.27(b)(1)—to delete the language that it asserts renders forest roads non-point sources—but then determined not to make the amendment. However, we are aware of no statute or legal doctrine providing that a party's failure to challenge an agency's decision *not* to amend its rules in one proceeding deprives the party of the right to challenge, in a contemporaneous proceeding, the promulgation of an entire new rule which could have, but did not, provide the full relief the party seeks. Assuming that EPA is correct that § 122.27(b)(1) defines forest roads as non-point sources, both the Phase II Rule proceedings and the proceedings in which the proposed amendment to § 122.27(b)(1) was considered and rejected were proper proceedings in which to raise the issue whether discharges from forest roads should be regulated. Petitioners chose to raise the issue in their comments to the proposed Phase II Rule, because they believed that Clean Water Act § 402(p)(6) mandates the regulation of forest roads. They did not lose their right to challenge the final Phase II Rule's failure to regulate forest roads simply because they did not also raise a challenge to EPA's failure to adopt an amendment to

§ 122.27(b)(1) that the agency initially proposed. (We note, incidentally, that it appears that even a successful challenge to § 122.27(b)(1) would likely not have achieved the objective the Environmental Petitioners sought: it would only have allowed case-by-case coverage for forest roads, and not for overall coverage.)

Finally, EPA suggests that Petitioners' comments during the Phase II rulemaking process were too short to create jurisdiction in this court to hear this challenge. However, EPA exaggerates the slightness of those comments, which comprised two paragraphs, with footnotes, stating objections and providing support. We also agree with Petitioners that EPA was aware of the forest road sedimentation problem at the time of the rulemaking.[42] Indeed, EPA responded to the comments without disputing that the problem is serious. 3 EPA, *Response to Public Comments* 8 (Oct. 29, 1999). Rather, the agency relied on 40 C.F.R. § 122.27(b)(1), indicating that it was barred from acting under the Phase II Rule by § 122.27(b)(1).

EPA does not seriously address the merits of Petitioners' objections to the Rule in its brief to this court. Instead, EPA relies almost entirely on its assertion that we lack jurisdiction to decide this question. It does, however, strongly imply that its failure to adopt its own proposed amendment in the proceeding pertaining to § 122.27(b)(1) relieves it of its obligation to consider including forest roads in the Phase II Rule proceedings. We reject any such contention. Petitioners' assertion that § 402(p)(6) requires that the Phase II Rule contain provisions regulating forest roads necessitates a response from EPA on the merits.

[42]Nonpoint Source Pollution: The Nation's Largest Water Quality Problem, EPA841-F-96-004A ("Pointer #1") ("The latest *National Water Quality Inventory* indicates that agriculture is the leading contributor to water quality impairments, degrading 60 percent of the impaired river miles and half of the impaired lake acreage surveyed by states, territories, and tribes.").

Having concluded that the objections of the Environmental Petitioners are not time-barred, and that we have jurisdiction to hear them, but that EPA failed to consider those objections on the merits, we remand this issue to the EPA, so that it may consider in an appropriate proceeding Petitioners' contention that § 402(p)(6) requires EPA to regulate forest roads. EPA may then either accept Petitioners' arguments in whole or in part, or reject them on the basis of valid reasons that are adequately set forth to permit judicial review.

Volume 2 of 2

D. AF&PA's Standing

The American Forestry & Paper Association (AF&PA), a national trade association representing the forest, pulp, paperboard, and wood products industry, is one of the two Industry Petitioners asserting the remaining claims.[43] Before considering these challenges, however, we consider whether AF&PA has standing to raise them.

EPA argues that AF&PA lacks standing because it cannot show that it represents entities that suffer a cognizable injury under the Phase II Rule as promulgated. EPA argues that the interests of AF&PA entities might have supported standing had EPA decided to regulate forest roads as Phase II stormwater dischargers, but since EPA declined to do so, none of AF&PA's members are currently subject to the Rule. AF&PA contends that its members have a cognizable legal interest in the Rule because they risk becoming subject to regulation at any future time under the continuing designation authority.

We agree that AF&PA lacks standing. A claimant meeting Article III standing requirements must show that "(1) it has suffered an 'injury in fact' . . . ; (2) the injury is fairly traceable to the challenged action of the defendant; and (3) it is likely, as opposed to merely speculative, that the injury will be redressed by a favorable decision." *Friends of the Earth v. Laidlaw Envtl. Servs. (TOC)*, 528 U.S. 167, 180-81 (2000). Standing requires an injury that is "actual or imminent, not 'conjectural or hypothetical.'" *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560 (1992). AF&PA's interest in avoiding future regulation of forest roads is not actually or imminently threatened by any potential result in this case. No ripe claim about misuse of the residual authority to regulate forest road discharge, or any other kind of discharge, is before the court. Should members of AF&PA become subject to Phase II regu-

[43]The Municipal Petitioners join in asserting the "regulatory basis" claim at Part II(F)(1).

lation through subsequent administrative action, it will have standing to challenge those actions at that time. In the meanwhile, we proceed to the merits of the remaining claims on behalf of AF&PA's co-petitioner, the National Association of Home Builders, which has established its standing to raise them.

E. Consultation with State and Local Officials

The Industry Petitioners contend that EPA failed to consult with the States on the Phase II Rule as required by § 402(p)(5), which instructs EPA to conduct studies "in consultation with the States," and § 402(p)(6), which instructs the Administrator to issue regulations based on these studies "in consultation with State and local officials." 33 U.S.C. §§ 1342(p)(5)-(6). We conclude that EPA satisfied its statutory duty of consultation. *See Marsh*, 490 U.S. at 378.

Petitioners concede several instances in which EPA circulated drafts of the Phase II Rule to state and local authorities, but argue that these consultations were meaningless because (1) the reports were circulated too far in advance of the actual rulemaking, (2) the rulemaking wrongfully proceeded based on other sources of input, (3) standard APA notice and comment procedures could not suffice because Congress must have intended something more when it added the consultation requirements to the language of § 402, and (4) consultation at the final stage of rulemaking was inadequate because comment was sought on the final report only after it had been submitted to Congress and the Phase II Rule had been promulgated. Petitioners provide examples of state feedback that allegedly went unheeded by EPA in its promulgation of the final Rule.

EPA maintains that it consulted extensively with States and localities in developing the Phase II Rule, discharging its obligations under §§ 402(p)(5) & (6). EPA contends that the comments Petitioners cite as unheeded by EPA demonstrate that

EPA *did* consult with States concerning the Rule, even if some States did not concur in EPA's ultimate conclusion, and that the final rule adopted a good measure of the flexibility sought by state representatives. EPA argues that Industry Petitioners cannot complain that consultation was inadequate simply because it did not result in the adoption of Petitioners' preferred views.

EPA also disputes Petitioners' allegation that while EPA did comply with the terms of the 1999 Appropriations Act (requiring EPA to defend the proposed Phase II Rule before Congress and then publish the final report for public comment), it demonstrated its failure to adequately consult by publishing the report for public comment *after* the Phase II Rule had been formally promulgated, rendering any subsequent public comment meaningless. EPA counters that these actions do not indicate that it failed to satisfy Congress's directive that it consult with state and local officials, because EPA had engaged in extensive consultation before Congress requested the Appropriations Act report, and Congress did not require further consultation when it conditioned promulgation of the Rule only on the submission of this final report. EPA claims that while Congress required it to publish the report after its submission, public comment on the report was not required before promulgation, and that the statutory deadline structure rendered any other interpretation impossible.

We conclude that the overall record indicates EPA met its statutory duty of consultation. A draft of the first report was circulated to States, EPA regional offices, the Association of State and Interstate Water Pollution Control Administrators ("ASIWPCA"), and other stakeholders in November, 1993, and was revised based on comments received. EPA established the Urban Wet Weather Flows Federal Advisory Committee ("FACA Committee"), balancing membership between EPA's various outside stakeholder interests, including representatives from States, municipalities, Tribes, commercial and industrial sectors, agriculture, and environmental and public interest groups. 64 Fed. Reg. 68,724. The 32 members of the Phase II FACA Subcommittee, reflecting the same balance of interests, met fourteen times over three years and state and municipal representatives provided substantial input regarding the draft reports, the ultimate Phase II Rule, and the supporting data.[44] *Id.* EPA instituted the Phase II Subcommittee meetings in addition to the standard APA notice and comment procedures, which EPA also followed.

The fact that the Rule did not conform to Petitioners' hopes and expectations does not bear on whether EPA adequately consulted state and local officials. Although required to consult with States and localities, EPA was free to chart the substantive course it saw fit. EPA was not required to consult with States on the Appropriations Act report. Even if EPA should have sought further comment at that late stage, failure to do so does not outweigh the evidence demonstrating extensive consultation and cooperation with local authorities on development of the Rule.

F. Designation of Certain Small MS4s and Construction Sites

The Industry Petitioners contend that, in designating certain small MS4s and construction sites for regulation under the Phase II Rule, EPA failed to adhere to the statutorily required regulatory basis and misinterpreted record evidence. We disagree.

1. Regulatory Basis

The Industry Petitioners and the Municipal Petitioners contend that EPA violated the statutory command to base the

[44]NRDC argues that this claim is not only meritless for the reasons stated by EPA, but also frivolous, since industry petitioner National Association of Home Builders, as a member of the FACA Phase II Subcommittee, participated in and affirmed that such consultation took place.

Phase II regulations on § 402(p)(5) studies. We review EPA's interpretation of its statutory authority under the *Chevron* standard, 467 U.S. at 842-44, and affirm.

Petitioners argue that the studies mandated by § 402(p)(5) were intended to provide the sole substantive basis for the "comprehensive program" envisioned in § 402(p)(6), but that EPA also (and thus improperly) based its designation of small MS4s and construction sites on (1) public comment received in the aftermath of judicial invalidation of the scope of construction sites regulated by the Phase I Rule,[45] and (2) additional research discussed in the Preamble to the Phase II Rule.[46]

EPA contends that the statute did not require it to base its designations exclusively on the § 402(p)(5) studies, and that it was in fact required to take account of information from other sources in promulgating the regulations. It argues that it based the Phase II Rule on conclusions reported in the § 402(p)(5) studies, but then appropriately supported these results with data described in the additional study requested by Congress in the Appropriations Act, comments submitted during the statutorily required notice-and-comment process, and other available information. To read the authorizing statute as limiting reliance to the § 402(p)(5) studies, EPA claims, would preclude it from relying on recommendations received through the separate, post-study requirement to "consult with State and local officials" under § 402(p)(6), and through the

[45]*See Natural Res. Def. Council*, 966 F.2d at 1306 (remanding EPA's decision to regulate only construction sites disturbing more than five acres, after EPA had initially proposed to regulate all sites disturbing more than one acre).

[46]The Industry Petitioners contend that EPA lacked authority to issue the Phase II regulation of construction sites based on a process EPA itself characterized as "separate and distinct" from the development of the Report to Congress. 64 Fed. Reg. at 68,732. They add that the Phase II Rule was not "based on" the 1999 Report ultimately requested by Congress in the Appropriations Act, since EPA's report in response was released on the very day that the final Phase II Rule was published.

notice and comment process mandated by the APA, 5 U.S.C. § 553(b).

Respondent-intervenor NRDC adds that the Phase II Rule is consistent with the § 402(p)(5) studies reported in 1995, and moreover, that the Industry Petitioners lack standing to raise the "regulatory basis" claim because they cannot show the requisite injury. *See Friends of the Earth*, 528 U.S. at 180-81.

a. Standing. Industry Petitioners[47] contend that they have suffered injury in fact, because their members are now either automatically regulated by the permitting requirements or subject to future regulation (under the residual authority, discussed below) that otherwise would not have been authorized, and that this is a direct result of EPA's failure to adhere to the framework of the 1995 Report, which allegedly would have precluded these aspects of the Rule. NRDC contends that the Industry Petitioners lack standing because they cannot show that being subject to NPDES permitting is the causal result of the procedural injury they urge, and because they cannot base standing on hypothetical injury that may arise in the future.

NRDC argues that the injuries Petitioners allege are not consistent with the guidelines laid out in *Friends of the Earth*. 528 U.S. at 180-81. It insists that Petitioners' only possible claims of injury from the alleged "regulatory basis" violation are purported harm to members caused by the final Phase II Rule itself or harm to members caused by EPA's alleged failure to provide adequate notice of future regulatory requirements in the 1995 Report. However, NRDC contends that Petitioners have not suffered the requisite injury, because they had actual notice that EPA might regulate small construction sites, 63 Fed. Reg. at 1583, and they can show no chain of

[47]Since we have already determined that AF&PA lacks standing to raise any of its claims, *see* Section D above, this discussion pertains to the remaining Industry Petitioner, National Association of Home Builders.

causation linking their alleged injury from the Rule itself to the actions challenged here.

NRDC's causation argument is complex. Although the Petitioners purport to challenge EPA's failure to follow all of the 1995 Report's recommendations in the final Phase II Rule, NRDC contends, they are really challenging the subsequent proceedings through which EPA developed the final Rule. Even if there were some unlawful variance between the 1995 report and final rule, NRDC continues, the cause of that variance would have been some failure to abide by rulemaking standards during administrative proceedings that produced the text of the final Rule—not EPA's attention to sources of input other than the 1995 Report. NRDC maintains that these intervening acts of rulemaking (e.g., Phase II Subcommittee activities and the notice-and-comment process) break the requisite chain of causation between EPA's alleged failure to adhere to recommendations in the 1995 report and the flaws Petitioners allege in the Phase II Rule, which NRDC claims would have been due to "purportedly unlawful EPA decisions on the merits during the subsequent administrative proceedings." *See Northside Sanitary Landfill v. Thomas*, 804 F.2d 371, 381-84 (7th Cir. 1986) (finding no standing to challenge EPA statements concerning the fate of a hazardous waste facility when subsequent state administrative acts, not EPA comments, would determine the facility's actual fate).

We note that NRDC's standing arguments apply equally to the Municipal Petitioners, who can also assert only the harms resulting to members from the Rule itself or from a lack of notice, and that we are thus not only considering the standing of the Industry Petitioners but also that of the Municipal Petitioners to raise the "regulatory basis" claim.[48] That established, we find standing for both.

[48]Although the issue of Municipal Petitioners' standing has not been raised by the parties, we are obliged to consider it to determine whether the case-or-controversy requirement of Article III is satisfied. *See, e.g., Boeing Co. v. Van Gemert*, 444 U.S. 472, 488 n.4 (1980); *Juidice v. Vail*, 430 U.S. 327, 331 (1977).

NRDC essentially argues that petitioners lack standing because (1) they cannot show that being subject to NPDES permitting is the causal result of the procedural injury they urge, (2) they cannot claim any actual notice injury from the alleged procedural wrong because notice was actually given, and (3) they cannot claim standing based on hypothetical injury that may (or may not) arise from future regulation under the residual authority. We can readily agree with the latter two contentions. As discussed above, the "actual injury" requirement of Article III standing precludes judicial consideration of exactly the kind of hypothetical harm the Industry Petitioners allege may follow from use of Phase II authority for future designations of regional sources. *Friends of the Earth*, 528 U.S. at 180-81. If future Phase II designations cause identifiable injury to Petitioners, they will then be free to pursue that ripe claim. And because EPA clearly issued notice to all regulated parties that they may be subject to regulation under the proposed rule, 63 Fed. Reg. at 1568 (MS4s) and 1582 (construction), petitioners cannot show injury from lack of actual notice.

However, NRDC's causation argument is less persuasive. NRDC correctly argues that the petitioners cannot establish a definite chain of causation between the EPA's alleged failure to limit their regulatory basis to the § 402(p)(5) studies and the fact that they now must obtain permits. But this will almost always be true of petitions challenging an agency's failure to abide by statutory procedural requirements. Because all administrative decisionmaking following an alleged procedural irregularity could always be considered an intervening factor breaking the chain of causation, NRDC's interpretation of the requisite chain of causation would dubiously shield administrative decisions from procedural review.

For this reason, we have held that the failure of an administrative agency to comply with procedural requirements in itself establishes sufficient injury to confer standing, even though the administrative result might have been the same had proper procedure been followed. *City of Davis v. Coleman*, 521 F.2d 661, 671 (9th Cir. 1975) (agency's failure to comply with National Environmental Policy Act's procedural requirements constituted injury sufficient to support standing of a geographically related plaintiff regardless of potentially similar regulatory outcome). In *City of Davis*, we noted that the standing inquiry represents "a broad test, but because the nature and scope of environmental consequences are often highly uncertain before study we think it an appropriate test." *Id.* A plaintiff who shows that a causal relation is "probable" has standing, even if the chain cannot be definitively established. *Johnson v. Stuart*, 702 F.2d 193, 195-96 (9th Cir. 1983) (school students and their parents had standing to challenge a statute that limited the texts that might be selected for teaching, even though it could not be shown whether any specific book had been rejected under this statute or for other reasons).

The Supreme Court has also acknowledged that standing may be established by harm resulting indirectly from the challenged acts, *Warth v. Seldin*, 422 U.S. 490, 504-05 (1975), and that causation may be established if the plaintiff shows a good probability that, absent the challenged action, the alleged harm would not have occurred, *Arlington Heights v. Metro. Hous. Dev. Corp.*, 429 U.S. 252, 262-64 (1977).

Thus, although the petitioners cannot show with certainty that the alleged "regulatory basis" violation caused them to be wrongfully subjected to Phase II permitting requirements, we hold that they have alleged a procedural injury sufficient to support their standing to bring the claim.

b. Merits. Although we resolve the standing issue in favor of the petitioners, we nevertheless affirm the Rule against their claim that EPA violated procedural constraints implied by the authorizing statute, § 402(p)(6).

Congress intended EPA to use all sources of information in developing a comprehensive program to protect water quality to the maximum extent practicable. The statute unambiguously required EPA to base its regulations both on the § 402(p)(5) studies and on consultation with state and local officials. Congress enacted § 402 with full knowledge that EPA would also be required to take account of public comments during the notice and comment phase of administrative rulemaking prescribed by the APA.[49]

2. *MS4s in Urbanized Areas*

The Municipal Petitioners contend that the designation of small MS4s for Phase II regulation according to Census-Bureau defined areas of population density ("urbanized areas") is arbitrary and capricious. They argue that EPA has not established that the Census Bureau's designation of urbanized areas is correlated with actual levels of pollution runoff in stormwater, and that EPA adopted the designations simply for administrative convenience. We affirm, because the record reflects a reasoned basis for EPA's decision. *See Marsh*, 490 U.S. at 378.

Conceding that the Preamble cites studies purporting to establish "a high correlation between the degree of development/urbanization and adverse impacts on receiving waters due to stormwater," 64 Fed. Reg. at 68,751, the Municipal Petitioners nevertheless contend that the record contains no "demonstrably correlated, *quantified* basis on which EPA may reasonably have concluded that any particular population, or any population density, *per se* establishes that all urban areas having that same characteristic in gross are necessarily appropriate for inclusion as Phase II sources." Pointing to *Leather Industry of America v. EPA*, 40 F.3d 392, 401 (D.C. Cir. 1994) (rejecting as arbitrary EPA's regulation

[49]Even if the statute *were* ambiguous, we would defer to EPA's reasonable interpretation. *Chevron*, 467 U.S. 843-44.

of pollutant levels in the absence of data supporting a relationship between the caps and level of risk), Petitioners argue that EPA simply assumed the relationship Congress contemplated it would establish by the § 402(p)(5) studies.

EPA responds that it extensively documented the relationship between urbanization and harmful water quality impacts from stormwater runoff, pointing to its findings that the degree of surface imperviousness in an area directly corresponds to the degree of harmful downstream pollution from stormwater runoff, 64 Fed. Reg. at 68,724-27, and that it articulated a rational connection between these record facts and its decision to designate small MS4s serving areas of high population density ("urbanized areas") to protect water quality.

We treat EPA's decision with great deference because we are reviewing the agency's technical analysis and judgments, based on an evaluation of complex scientific data within the agency's technical expertise. *See Baltimore Gas & Elec. Co. v. NRDC*, 462 U.S. 87, 103 (1983); *see also Chem. Mfrs. Ass'n v. EPA*, 919 F.2d 158, 167 (D.C. Cir. 1990) ("It is not the role of courts to 'second-guess the scientific judgments of the EPA . . . .' "). We conclude that the record supports EPA's choice.

The statute simply called upon EPA to "designate stormwater discharges," other than those designated in Phase I, "to be regulated to protect water quality." 33 U.S.C. § 1342(p)(6). EPA did so, based on record evidence showing a compelling and widespread correlation between urban stormwater runoff and deleterious impacts on water quality. Petitioners' assertion that EPA failed to establish a "quantified" basis for its designation is inapposite. The statute did not require EPA to establish with pinpoint precision a numeric population threshold within urbanized areas that would justify regulation under Phase II. In areas implicating technical expertise and judgment, courts do not require "perfect stud[ies]" or data. *Sierra*

Club, 167 F.3d at 662. EPA satisfied the *Leather Industries* standard by adopting a threshold consistent with the criterion of "protecting water quality," and did not assume, but instead sufficiently documented, the relationship between urbanization and harmful stormwater discharge.

3. *Small Construction Sites*

Industry and Municipal Petitioners also argue that EPA's decision to regulate under Phase II all construction sites disturbing between one and five acres of land ("small construction sites") is arbitrary and unsupported by the record. We do not agree. *See Marsh*, 490 U.S. at 378.

a. Record Evidence. Municipal Petitioners claim that EPA arrived at the one-acre standard based not on factual findings in the record but instead as a reaction to the earlier Ninth Circuit remand of the Phase I five-acre designation. They allege that the one-acre standard is no more based on supporting data than the rejected five-acre standard, and is thus quantitatively arbitrary.

Industry Petitioners argue that EPA's findings do not support regulation of *all* small construction sites, but indicate only that small construction sites, taken cumulatively, may cause effects similar to large sites in a given area. They contend that EPA's conclusion that adverse effects are possible under certain circumstances cannot support categorical designation of all small construction sites nationwide, and that the Rule is arbitrary because (1) it is based on an analysis that fails to take account of the frequency of negative impacts, (2) it fails to take account of acknowledged factors that determine whether small construction activities cumulatively cause harm (such as the degree of development in a watershed at any given time), and (3) EPA has acknowledged that the actual water quality impact of construction sites of all sizes varies widely from area to area depending on climatological, geological, geographical, and hydrological influences.[50]

Industry Petitioners further contend that the record does not support the designation of small sites, because almost all of the technical papers EPA relied on focused on larger sites or failed to take account of size,[51] and because the lack of an adequate factual basis for nationwide regulation of small sites makes the Phase II Rule arbitrary and capricious. *Am. Petroleum Inst. v. EPA*, 216 F.3d 50, 58 (D.C. Cir. 2000) (invalidating a solid waste rule because EPA "failed to provide a rational explanation for its decision" declining to exclude oil-bearing waste waters from the statutory definition of solid waste).

EPA maintains that construction sites regulated under the Phase II Rule degrade water quality across the United States and that the administrative record unambiguously documents that harm. EPA disputes Petitioners' assertion that it failed to establish the need to regulate small sites nationwide, but also contends that it is not required to base every administrative

[50]The Industrial Petitioners argue that although the Phase I authorizing statute required EPA to regulate all sources associated with "industrial activity," Congress expressly directed that the Phase II regulatory program be focused on sources that require regulation "to protect water quality." They assert that because EPA's rule ignores the variability of water quality impacts nationwide, the Rule is not appropriately targeted on the protection of water quality.

[51]Petitioners heavily critique two studies relied on by EPA that dealt specifically with the water quality impacts of small construction sites, noting that one concludes it is impossible to generalize about the impacts of small sites, Lee H. MacDonald, *Technical Justification for Regulating Construction Sites 1-5 Acres in Size*, July 22, 1997, and that the other merely concludes that small sites "can have" significant effects if erosion controls are not implemented, David W. Owens, et al., *Soil Erosion from Small Construction Sites*. Petitioners contend that the latter study was managed with no erosion controls, intentionally producing worst-case sediment runoff and unreasonable estimates of actual sediment yields for small sites nationwide. EPA vigorously defends the studies.

decision on a precise quantitative analysis. *See Sierra Club*, 167 F.3d at 662 ("EPA typically has wide latitude in determining the extent of data-gathering necessary to solve a problem.").

EPA also disputes petitioners' assertions that data from studies involving larger construction sites are irrelevant to the Phase II Rule. EPA explains that discharges of sediment due to erosion are the result of the interaction of several factors including soils, slope, precipitation, and vegetation:

> For construction sites that are one acre or more, none of the environmental factors contributing to sediment discharges is dependent on the size of the site disturbed. A one-acre site can have the same combination of soils, slope, degree of disturbance and precipitation as a 100-acre site, and consequently can lose soil at the same rate . . . and discharge sediments in the same concentrations . . . as a 100-acre site.

EPA contends that it is thus reasonable to extrapolate data about small sites from studies of larger ones—and that such an extrapolation may even be forgiving, since small sites are currently less likely to have effective erosion and sedimentation control plans.[52]

[52]NRDC adds that notwithstanding the clear interest of the National Association of Home Builders ("NAHB," one of the Industry Petitioners), NAHB's multi-year participation in the FACA Phase II Subcommittee Small Construction and No-Exposure Sites Work Group, and NAHB's own submission of detailed comments on the proposed Rule, NAHB failed to enter into the administrative record any study contradicting the proposition that small construction sites cause water quality problems. NRDC points to the record's showing that NAHB had itself proposed that regulation of construction sites of two acres or greater was appropriate, and contends that this is thus not a dispute over whether small construction sites should be regulated on a nationwide basis, but instead a technical disagreement over whether EPA should establish a one-acre threshold or a different threshold on a similar small scale.

Indeed, EPA argues that although adverse water quality impacts of small construction sites have been widely recognized, effective local erosion and sedimentation control programs have not been adopted in many areas.[53] Though not all watersheds are currently adversely effected by small construction sites,[54] EPA notes that the Phase II Rule acts "to protect water quality" both remedially and preventively, and argues that it need not quantify the cumulative effects of discharges from these sites or identify all watersheds that are currently harmed before acting to limit pollution from small sites.[55]

We reverse under the arbitrary and capricious standard only if the agency has relied on factors Congress did not intend it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision contrary to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise. *Motor Vehicle Mfrs. Ass'n*, 463 U.S. at 43. Petitioners' contention that EPA relied on factors Congress did not intend it to consider was rejected in our earlier discussion of the regulatory basis challenge. They submit no evidence that EPA failed to consider an important aspect of

[53]Whitney Brown and Deborah Caraco, *Controlling Stormwater Runoff Discharges from Small Construction Sites: A National Review*, Task 5 Final Report submitted by the Center for Watershed Protection to the EPA Office of Wastewater Management, March 1997, IP E.R. 633, 643.

[54]EPA adds that operators of small sites in areas unlikely to suffer adverse impacts may apply for a permit waiver if little or no rainfall is expected during the period of construction (the "rainfall erosivity waiver") or if regulation is unnecessary based on a location-specific evaluation of water quality (the "water quality waiver"). 64 Fed. Reg. at 68,776.

[55]EPA also implies permission to regulate for potential cumulative impacts of small sites from the past directive of this court. When the Phase I industrial discharge regulations were challenged, we found no record data to support that rule's exemption of construction activities on less than five acres and held that small sites did not categorically qualify for a *de minimis* exemption because "even small construction sites can have a significant impact on local water quality." *Natural Res. Def. Council*, 966 F.2d at 1306.

the problem. We cannot say that EPA's designation of small construction sites is implausible (especially given the support of twenty-some-odd studies of sedimentation from construction sites that EPA reviewed in promulgating the challenged regulations, 64 Fed. Reg. 68,728-31). We could remand this aspect of the Rule only if, as the petitioners urge, EPA's explanation for its decision to regulate small construction sites were contrary to the record evidence, and it is not.

Petitioners' primary contention is that evidence in the record suggests it is not possible to provide an explicit, quantitative link between small construction sites and an adverse effect on water quality. But even if this were so, EPA's decision to regulate preventively small construction sites "to protect water quality" is not inconsistent with the record. Petitioners contend that EPA's reliance on data from studies of large construction sites is insufficient to support EPA's designation of small sites, but EPA has adequately supported its contention that experts can reasonably extrapolate projected water quality impacts from large to small sites. We apply the substantial evidence standard when reviewing the factual findings of an agency, *Dickinson v. Zurko*, 527 U.S. 150, 156-58 (1999),[56] and find it satisfied here.

Moreover, EPA is not required to conduct the "perfect study." *Sierra Club*, 167 F.3d at 662. We defer to an agency decision not to invest the resources necessary to conduct the perfect study, and we defer to a decision to use available data unless there is no rational relationship between the means EPA uses to account for any imperfections in its data and the situation to which those means are applied. *Id.*; *Am. Iron & Steel Inst. v. EPA*, 115 F.3d 979, 1004 (D.C. Cir. 1997). The record indicates a reasoned basis for EPA's decision that reg-

[56]The "substantial evidence" standard requires a showing of such relevant evidence as a reasonable mind might accept as adequate to support a conclusion. *Edlund v. Massanari*, 253 F.3d 1152, 1156 (9th Cir. 2001).

ulating small construction sites was necessary "to protect water quality" as required by § 402(p)(6).

*b. **Waivers.*** Industry Petitioners further contend that EPA's allowance of regulatory waivers for small construction sites not likely to cause adverse water quality impacts inappropriately supplements the permitting regulations.

Petitioners argue that EPA has the burden of establishing a comprehensive program to control sources as necessary to protect water quality, and that shifting the burden to individual contractors, businesses, and homeowners to prove they do not harm water quality falls short of meeting this statutory obligation. Citing *National Mining Association v. Babbitt*, 172 F.3d 906, 910 (D.C. Cir. 1999), they argue that EPA's rebuttable regulatory presumption of water quality impact from small construction activity is unreasonable because the agency has established no scientific likelihood that any given small site will affect water quality. EPA defends the waiver approach as fair and efficient, and argues that the Industrial Petitioners are confusing arguments about the limits of presumptions in evidentiary hearings conducted under the APA.[57]

EPA is correct; the Phase II Rule creates no presumption applicable to an evidentiary hearing, and a regulation creating exemptions by waiver is reviewed under the familiar arbitrary and capricious standard. The use of waivers to allow permit exemptions for small sites unlikely to cause adverse impacts is reasonable under that standard.

*c. **Consistency.*** Industry Petitioners also argue that EPA's decision to regulate all small construction sites under the Phase II Rule is arbitrary and capricious because EPA applied

[57]EPA further argues that even if the waiver provision were properly characterized as an evidentiary presumption, it should be sustained because the record demonstrates that the presumed fact of the water quality impact of small sites is more likely true than not.

a different standard in regulating small construction projects than it applied to other potential sources of stormwater runoff subject to Phase II regulation.

Petitioners contend that EPA decided not to designate other potential sources identified in the § 402(p)(5) studies because it determined that there are not "sufficient data . . . available at this time on which to make a determination of potential adverse water quality impacts for the category of sources." 64 Fed. Reg. at 68,780. Petitioners contend this standard should have been applied to small construction sites as well, but EPA opted to regulate these sources despite an alleged lack of coherent data on small site impacts as a general category.

EPA counters, once again, that it did have adequate data to regulate small construction sites. It contends that construction sites of all sizes have greater erosion rates than almost any other land use, and thus are not similarly situated to the potential polluters that EPA chose not to regulate at this time.[58] These sources include secondary industrial activities (for example, maintenance of construction equipment or local trucking for an unregulated facility such as a grocery store) and other unregulated commercial activities (for example, car and truck rental facilities). 64 Fed. Reg. at 68,779. EPA reports that it decided not to categorically regulate these potential sources based both on available data about water quality impacts and on the extent to which potentially adverse water quality impacts are mitigated by existing regulations to which these sources are already subject. *Id.* at 68,780.

We find no error. *See Marsh,* 490 U.S. at 378. EPA acted reasonably in designating all small construction sites for Phase II regulation, and Industry Petitioners point to no record

[58]EPA notes that the Phase II Rule empowers regional permitting authorities to regulate local sources of these types known to be responsible for harmful water quality impacts via the continuing "residual designation" authority (an aspect of the Rule that Petitioners also challenge).

evidence that the nature of pollutant contributions from small construction site discharge is sufficiently similar to pollutants from the non-regulated sources to support the analogy they seek to draw. *New Orleans Channel 20 v. FCC*, 830 F.2d 361, 366 (D.C. Cir. 1987) (an agency does not act irrationally when it treats parties differently, unless the parties are similarly situated). Sufficient evidence supports EPA's conclusion that small construction sites are not similar enough to these "other sources" to support petitioner's challenge.

G. Continuing ("Residual") Designation Authority

The Industry Petitioners argue that EPA acted improperly in retaining authority to designate future sources of stormwater pollution for Phase II regulation as needed to protect federal waters. We disagree.

The Phase II Rule preserves authority for EPA and authorized States to designate currently unregulated stormwater dischargers as requiring permits under the Rule if future circumstances indicate that they warrant regulation "to protect water quality" under the terms of § 402(p)(6). 40 C.F.R. § 122.26(a)(9). In the Phase II Preamble, EPA explains this aspect of the Rule:

> Under today's rule, EPA and authorized States continue to exercise the authority to designate remaining unregulated discharges composed entirely of stormwater for regulation on a case-by-case basis. . . . Individual sources are subject to regulation if EPA or the State, as the case may be, determines that the stormwater discharge from the source contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States. This standard is based on the text of section CWA 402(p). In today's rule, EPA believes, as Congress did in drafting section CWA 402(p)(2)(E), that individual instances of stormwater discharge might

> warrant special regulatory attention, but do not fall neatly into a discrete, predetermined category. Today's rule preserves the regulatory authority to subsequently address a source (or category of sources) of stormwater discharges of concern on a localized or regional basis.

64 Fed. Reg. 68,781. The text of the Rule requires a discharger to obtain a permit if the NPDES permit authority determines that "stormwater controls are needed for the discharge based on wasteload allocations that are part of 'total maximum daily loads' (TMDLs[59]) that address the pollutant(s) of concern" or that "the discharge, or category of discharges within a geographic area, contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States." 40 C.F.R. §§ 122.26(a)(9)(i)(C)-(D).

1. Statutory Authority

The Industry Petitioners contend that this "residual" designation authority, which would allow a NPDES permitting authority to require at any future time a permit from any stormwater discharge not already regulated, is *ultra vires*. Although they concede that Congress authorized case-by-case designation in § 402(p)(2)(E),[60] they argue that this authority attached only during the permitting moratorium that ended in 1994, prior to the Phase II rulemaking. They object that EPA has impermissibly designated a category of "not yet identi-

[59]TMDLs are pollutant loading limits established by NPDES permitting authorities under the Clean Water Act for waters that do not meet a water quality standard due to the presence of a pollutant. *See* 33 U.S.C. § 1313(d).

[60]This section enables a NPDES permitting authority to designate for regulation: "[a] discharge for which the Administrator or the State, as the case may be, determines that the stormwater discharge contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States." 33 U.S.C. § 1342(p)(2)(E).

fied" sources and preserved authority to regulate them on a case-by-case basis indefinitely into the future.[61]

Petitioners contend that § 402(p)(6)[62] cannot rescue the residual authority because it does not authorize case-by-case identification of discharges to be regulated, and that Congress, had it intended otherwise, would have included language in § 402(p)(6) similar to the case-by-case authority explicitly granted in § 402(p)(2)(E).[63] They also contend that continuing

[61]Notably, Industry Petitioner NAHB itself took the position during Phase II Subcommittee proceedings that the power to designate additional sources survived the promulgation of the Phase II Rule. In a 1996 comment letter to EPA, NAHB asserted its understanding that "[t]he permitting authority still reserves the right to designate additional sources if they are shown to be a contributor of water quality impairment." NRDC Supplemental Excerpts of Record at 58.

[62]The full text of § 402(p)(6), which specifically authorizes the Phase II program, reads: "Not later than October 1, 1993, the Administrator, in consultation with State and local officials, shall issue regulations (based on the results of the studies conducted under paragraph (5)) which designate stormwater discharges, other than those discharges described in paragraph (2), to be regulated to protect water quality and shall establish a comprehensive program to regulate such designated sources. The program shall, at a minimum, (A) establish priorities, (B) establish requirements for State stormwater management programs, and (C) establish expeditious deadlines. The program may include performance standards, guidelines, guidance, and management practices and treatment requirements, as appropriate." 33 U.S.C. § 1342(p)(6).

[63]Petitioners further argue that even if EPA could preserve the case-by-case authority conferred in § 402(p)(2)(E), that section confers authority only to regulate "a discharge" determined to threaten water quality, not a category of discharges. However, we agree with respondent-intervenor NRDC's argument that § 402(p)(2)(E) does not preclude EPA from designating entire categories of sources. Petitioners' argument follows from its reliance on the fact that § 402(p)(2)(E) refers to "discharge" in the singular rather than the plural to conclude that EPA may only designate sources meeting the § 402(p)(2)(E) description on a case-by-case basis. But all five of the § 402(p)(2)(5) categories refer to "discharge" in the singular, even in reference to discharges clearly intended for categorical regulation, like "a discharge from a municipal separate storm sewer system serving

authority to designate sources based on waste load allocations that are part of TMDLs exceeds the scope of authority in § 402(p)(2), which nowhere mentions TMDLs. Finally, they argue that the categorical designation authorized by § 402(p)(6) is only permissible when based on the § 402(p)(5) studies and carried out in consultation with state and local authorities, but that the Rule allows future designations based on agency discretion unaccompanied by adequate demonstration that the source itself is a significant threat to water quality.

EPA counters that § 402(p)(6) authorized the designation, made on the basis of statutorily required sources of input and in consultation with the States, of a third class of discharges to be identified on location-specific bases by the NPDES permitting authority. EPA contends that Petitioners mistake the source of its authority for continuing designations as arising only from § 402(p)(2), discounting the full scope of its authority under § 402(p)(6). EPA argues that it permissibly interpreted § 402(p)(6) as allowing the residual designation authority because its language does not expressly preclude it, and because such authority is consistent with (and arguably required by) that section's mandate to establish a "comprehensive program" to protect water quality from adverse stormwater discharges. EPA maintains that the structure of § 402(p) reflects "Congress' intent to assure regulation of all problematic stormwater discharges as expeditiously as reasonably possible—not to limit EPA to a one-time-only opportunity to designate discharges for regulation."

We review EPA's interpretation of the statute it administers with deference, *Royal Foods Co.*, 252 F.3d at 1106, and

a population of 250,000 or more." 33 U.S.C. § 1342(p)(2)(C). The error in petitioners' interpretation is exposed by 1 U.S.C. § 1, which provides that "[i]n determining the meaning of any Act of Congress, unless the context indicates otherwise—words importing the singular include and apply to several persons, parties, or things."

affirm this aspect of the Phase II Rule as a legitimate exercise of regulatory authority conferred by § 402(p). The residual designation authority is grounded both on § 402(p)(6), which broadly authorizes a comprehensive program to protect water quality, and on § 402(p)(2)(5), which authorizes case-by-case designation of certain polluters and categories of polluters.

While not a blank check, § 402(p)(6) authorizes a comprehensive program that allows regional designation of polluting discharges that compromise water quality locally, even if they have not been established as compromising water quality nationally at the time Phase II was promulgated. In allowing continuing designation authority, EPA permissibly designated a third category of dischargers subject to Phase II regulation —those established locally as polluting U.S. waters— following all required studies and consultation with state and local officials. EPA reasonably determined that discharges other than those from small MS4s and construction sites were likely to require regulation "to protect water quality" in satisfaction of the § 402(p)(6) mandate. EPA reasonably determined that, although it lacked sufficient data to support nationwide, categorical designation of these sources, particularized data might support their designations on a more localized basis. EPA reasonably interpreted § 402(p)(6) as authorizing regional designation of sources and regional source categories, based on water quality standards including TMDLs.

Petitioners' § 402(p)(2)(5) argument (that EPA could not draw support for the residual designation authority from § 402(p)(2)(5) because such authority expired in 1994) is contradicted by the plain language of the statute. Respondent-intervenor NRDC correctly notes that § 402(p)(1) sets forth a permitting moratorium for stormwater discharges prior to 1994, and that § 402(p)(2) exempts certain categories of sources from that permitting moratorium, including those to be regulated on a case-by-case basis under § 402(p)(2)(5). Specifically, the statute provides that the 1994 date "shall not apply" to the five categories of discharges listed in § 402(p)(2). The termination of a moratorium that "shall not apply" to the continuing designation authority under § 402(p)(2)(5) cannot rescind EPA's authority to regulate sources in that category. Nothing in § 402(p) suggests that authority to designate these sources ends at any time, and EPA remains free to designate § 402(p)(2)(E) dischargers.

Finally, although Petitioners may be legitimately concerned that a permitting authority may designate a source without adequately establishing its eligibility, this issue must be addressed in the context of an actual case or controversy. Whether a NPDES authority may impose permitting requirements on a discharger without an adequate finding of polluting activity is not yet ripe for judicial review. *Thomas v. Anchorage Equal Rights Comm'n*, 220 F.3d 1134, 1141 (9th Cir. 2000) ("A concrete factual situation is necessary to delineate the boundaries of what conduct the government may or may not regulate.").

2. *Nondelegation Doctrine*

Industry Petitioners contend that EPA's interpretation of § 402(p) to allow the residual designation authority must be rejected because it would render the statute unconstitutional under the nondelegation doctrine. We deny petitioners' claim, both because it is not properly raised and because it rests on an interpretation explicitly overturned by the United States Supreme Court.

Petitioners base their contention on *American Trucking Ass'ns v. EPA*, 175 F.3d 1027, 1034 (D.C. Cir. 1999),[64] in which the D.C. Circuit remanded a regulation under the nondelegation doctrine because, although EPA had applied reasonable factors in establishing the air quality standards in

[64]This case was reversed in relevant part by the Supreme Court in *Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457, 476 (2000).

question, the agency had articulated no "intelligible principle" to channel its application of these factors. *Id.* Petitioners argue that if § 402(p) authorizes a NPDES permitting authority to require Phase II permitting of any stormwater source deemed to be a "significant contributor" of pollutants to U.S. waters, then that grant of authority likewise constitutes an unconstitutional delegation of legislative authority because—as did the *American Trucking* delegation—it "leaves [EPA] free to pick any point" at which a regulatory burden will attach. *Id.* at 1037.

However, in reversing *American Trucking*, the Supreme Court rejected the notion that an agency has the power to interpret a statute so as to either save it from being, or transform it into, an unconstitutional delegation. *Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457, 473 (2000). Whether a statute delegates legislative power "is a question for the courts, and an agency's [interpretation] has no bearing upon the answer." *Id.* Petitioner's argument to the contrary rests on the very reasoning in *American Trucking* that was overturned in *Whitman*. The relevant question is not whether EPA's interpretation is unconstitutional, but whether the statute itself is unconstitutional—a challenge Industry Petitioners do not raise.

But even if the challenge were properly raised, § 402(p) would, like the Clean Air Act standard-setting provision at issue in *Whitman*, survive constitutional review. The Supreme Court has upheld against nondelegation attacks many similar statutes establishing nonquantitative standards. *Am. Power & Light Co. v. SEC*, 329 U.S. 90, 104 (1946) (upholding statute giving SEC authority to modify corporate structures so that they are not "unduly or unnecessarily complicate[d]" and do not "unfairly or inequitably distribute voting power among security holders"); *Yakus v. United States*, 321 U.S. 414, 419-20, 423-27 (1944) (upholding statute giving agency power to set prices that "will be generally fair and equitable"). In *Yakus*, the Court held that a statutory command to "effectuate the purposes" of the overall statutory scheme withstood scrutiny. *Id.* Section 402(p)(6)'s directive "to protect water quality" summarizes the central purpose of the Clean Water Act "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters," 33 U.S.C. § 1251(a). It establishes a determinate criterion of the kind the Supreme Court upheld in *Yakus* and *American Power & Light*.

3. *Notice and Comment*

Industry Petitioners also contend that, to the extent it allows the designation of entire categories of sources, rather than individual sources, the residual designation authority violates the APA, 5 U.S.C. § 553(b)(3), because EPA did not provide public notice that it was considering such a rule. *Ober v. EPA*, 84 F.3d 304, 315 (9th Cir. 1996) (invalidating EPA rule where it deviated from proposal); *Shell Oil Co. v. EPA*, 950 F.2d 741, 746-47 (D.C. Cir. 1991). Petitioners contend that while the proposed rule would have allowed case-by-case designation where an authority "determines that the discharge contributes to a violation," 63 Fed. Reg. at 1635 (proposing 40 C.F.R. § 122.26(a)(9)(i)(D)), the final rule authorizes case-by-case designation where "the discharge, or category of discharges within a geographic area, contributes to a violation," 40 C.F.R. § 122.26(a)(9)(i)(D).

EPA notes that it had proposed to promulgate continuing designation authority in some form, and points to elements in the proposed rule that explicitly envision the categorical designation of sources at the local/watershed level.[65]

[65]"[T]oday's proposal would encourage [voluntary] control of storm-water discharges . . . unless the discharge (or category of discharges) is individually or locally designated as described in the following section. The necessary data to support designation could be available on a local, regional, or watershed basis and would allow the NPDES permitting authority to designate a category of sources or individual sources on a case-by-case basis. If sufficient nationwide data [becomes] available in the

According to the "logical outgrowth" standard, a final regulation must be "in character with the original proposal and a logical outgrowth of the notice and comments." *Hodge*, 107 F.3d at 712. EPA emphasized that it was considering continuing designations based on watershed data rather than designating these sources on a national basis, and invited comment regarding this proposal. 63 Fed. Reg. at 1536. This supports the necessary relationship between the proposed and final rule.

H. Regulatory Flexibility Act

The Industry Petitioners contend that the Phase II Rule will impose substantial compliance costs on their members and other small entities, but that EPA failed to conduct the analysis required by the Regulatory Flexibility Act ("RFA"), 5 U.S.C. §§ 601-11. They argue that EPA seeks to excuse its noncompliance by falsely certifying that the Rule does not have a significant impact on a substantial number of small entities. 64 Fed. Reg. at 68,800. We are not persuaded.

The RFA requires a federal agency to prepare a regulatory flexibility analysis and an assessment of the economic impact of a proposed rule on small business entities, 5 U.S.C. § 604, unless the agency certifies that the proposed rule will not have a "significant economic impact on a substantial number of small entities" and provides a factual basis for that certification, *id.* at § 605; *N.W. Mining Ass'n v. Babbitt*, 5 F. Supp. 2d. 9, 15-16 (D.D.C. 1998).

EPA did certify that the Phase II Rule would not yield "significant impacts," 64 Fed. Reg. at 68,800, but Petitioners con-

future, EPA could at that time designate additional categories of industrial or commercial sources on a national basis. EPA requests comment on the three-pronged analysis used to assess the need to designate additional industrial or commercial sources and invites suggestions regarding watershed-based designation." 63 Fed. Reg. at 1588.

tend this certification is erroneous because (1) EPA treats as "not significant" costs that are in fact significant, and (2) EPA failed to account for the entire universe of small entities affected (including small home construction contractors) and all significant costs to those entities. They urge that the failure to consider a significant segment of the affected small entity community requires invalidation of the Rule, citing *North Carolina Fisheries Ass'n v. Daley*, 27 F. Supp. 2d 650, 659 (E.D. Va. 1998) (certification failed to comply with RFA where agency ignored several categories of affected small entities), and *Northwest Mining*, 5 F. Supp. 2d at 15 (RFA was violated where improper definition of small entity excluded analysis of affected entities).

EPA maintains that its certification was appropriate, and, moreover, that it has already voluntarily followed the additional RFA procedures that the Industry Petitioners now request. EPA argues that Petitioners have incorrectly specified the costs that the small entities they represent will bear, referring erroneously to EPA's total annual compliance costs estimates for all entities, rather than to costs estimated for small entities as defined under the RFA. EPA maintains that it did consider economic impacts on small home construction contractors who might be denied discharge permits, and that it evaluated the annual costs of Phase II compliance associated with any land disturbance between one and five acres. 64 Fed. Reg. at 68,800-01.

Respondent-intervenor NRDC contends that Petitioners' reliance on measures of the aggregate impact of the Rule on small entities to determine compliance with the threshold test under the RFA fails as a matter of law because aggregate measures are not consistent with the statutory language setting out that test. NRDC notes that the plain language of § 605(b) sets out a three-component test indicating that EPA need not perform a regulatory flexibility analysis if it finds that the proposed rule will not have: (1) "a significant economic impact" on (2) "a substantial number" of (3) "small entities." 5 U.S.C.

§ 605(b). NRDC contends that EPA satisfied the statutory test, and that Petitioners' interpretation, which rewrites the test to omit the "substantial number" component, is erroneous.

We believe NRDC correctly interprets the statute, *Marsh*, 490 U.S. at 378, and that EPA reasonably certified that the Phase II Rule would not have a significant economic impact in compliance with the Regulatory Flexibility Act. We also conclude that, even if EPA had failed to properly comply with the procedural requirements of the RFA, its actual assessment of the Rule's economic impacts renders any defective compliance harmless error. In granting relief under RFA § 611, a court may order an agency "to take corrective action consistent with" the RFA and APA, including remand to the agency, 5 U.S.C. § 611(a)(4)(A), but EPA has already conducted the economic analyses Petitioners seek when it convened the "Small Business Advocacy Review Panel" before publishing notice of the proposed rule. 64 Fed. Reg. at 68,801. That Panel evaluated the Rule and considered the comments of small entities on a number of issues, consistent with the procedures described in RFA § 603. *Id.* Appendix 5 of EPA's preamble to the proposed rule explained provisions that had been designed to minimize impacts on small entities, based on advice and recommendations from the Panel. 63 Fed. Reg. 1615, 64 Fed. Reg. 68,811. Modifications for small entities included alternative compliance and reporting mechanisms responsive to the resources of small entities, simplified procedures, performance rather than design standards, and waivers.

Any hypothetical noncompliance would thus have been harmless, since the available remedy would simply require performance of the economic assessments that EPA actually made. Like the Notice and Comment process required in administrative rulemaking by the APA, the analyses required by RFA are essentially procedural hurdles; after considering the relevant impacts and alternatives, an administrative agency remains free to regulate as it sees fit. We affirm the Rule against this challenge.[66]

III.

CONCLUSION

We conclude that the EPA's failure to require review of NOIs, which are the functional equivalents of permits under the Phase II General Permit option, and its failure to make NOIs available to the public or subject to public hearings contravene the express requirements of the Clean Water Act. We therefore remand these aspects of the Small MS4 General Permit option so that EPA may take appropriate action to comply with the Clean Water Act. We also remand so that EPA may consider in an appropriate proceeding the Environmental Petitioners' contention that § 402(p)(6) requires EPA to regulate forest roads. We affirm all other aspects of the Phase II Rule against the statutory, administrative, and constitutional challenges raised in this action.

Petitions for Review GRANTED IN PART and DENIED IN PART.

TALLMAN, Circuit Judge, concurring in part and dissenting in part:

I concur in most of the majority's opinion, but I dissent from Section II.B, which remands the Phase II Rule because

[66]Our consideration of the issue at all may be gratuitous, since petitioners failed to submit timely comment disputing the adequacy of EPA's consideration of economic impacts on small businesses proposed at 63 Fed. Reg. at 1605-07. *United States v. L.A. Tucker Truck Lines*, 344 U.S. 33, 37 (1952) ("[C]ourts should not topple over administrative decisions unless the administrative body not only has erred but has erred against objection made at the time appropriate under its practice.").

its system of general permits is "arbitrary and capricious." I believe EPA's design of a system of general permits supported by notices of intent was a reasonable exercise of EPA's administrative discretion. We must give deference to EPA's interpretation of the laws it is charged with enforcing, so long as EPA's reading of those laws is permissible. Because EPA acted reasonably in designing a National Pollutant Discharge Elimination System ("NPDES") based on general permits and supported by NOIs, I respectfully dissent from the court's decision to remand this portion of the Phase II Rule.

I

As the majority concedes, we evaluate EPA's interpretation of the Clean Water Act with deference. Majority Op. 13796. If Congress's intent is unclear as to whether a system of general permits supplemented by NOIs is allowed, we simply ask "whether EPA's interpretation is permissible." *Ober v. Whitman*, 243 F.3d 1190, 1193 (9th Cir. 2001).

II

As an initial matter, then, we must ask if Congress was clear in its intent concerning the propriety of a system of general permits augmented by NOIs.

Five legislative commands guide this inquiry. First, 33 U.S.C. § 1342(p)(6) charges EPA with creating a system to regulate stormwater discharges. Plainly, nothing in this section speaks to whether EPA may utilize a general permit approach in regulating stormwater discharge.

Second, 33 U.S.C. § 1311(a) makes it illegal to discharge pollutants "except as in compliance" with several sections of the Clean Water Act. Again, nothing in this section addresses whether EPA may make use of general permits reinforced by NOIs.

Third, 33 U.S.C. § 1342 in general (as opposed to the limited charge in section 1342(p)(6) discussed above) authorizes EPA to issue NPDES permits, provided that the permits satisfy several conditions. But nothing in section 1342 prohibits the use of a system of general permits.

Fourth, the Clean Water Act mandates that "a copy of each permit application and each permit issued under" the NPDES permitting program be made available to the public for inspection and photocopying. 33 U.S.C. § 1342(j). The Act does not elaborate on this naked requirement. There is no explanation of the manner in which NPDES permits and applications are to be made publically available. Nor does the Act define what constitutes a "permit" that would trigger these requirements.

And fifth, the Clean Water Act authorizes the issuance of an NPDES "permit" "after opportunity for public hearing." 33 U.S.C. § 1342(a)(1). The Act does not provide a definition of "permit," nor does it further detail what triggers the requirement of a public hearing.

In short, the Clean Water Act fails to address the propriety of a general permit system, or whether NOIs ought to be considered "permits." Therefore, we should uphold EPA's creation of a system of general permits buttressed by NOIs so long as it is "permissible." *See Chevron, U.S.A., Inc. v. Natural Resources Defense Council*, 467 U.S. 837, 843-44 (1984). Our duty to defer to EPA in such a situation is based on sound policy. Given the overwhelming challenge and complexity of the programs administered by federal agencies today, it is sensible to trust agencies with the design of those programs so long as the programs are reasonable interpretations of congressional mandates.

The central issues regarding EPA's general permit system are whether the Clean Water Act allows such a system and whether NOIs should be considered "permits." The resolution of these issues requires a complicated weighing of policies (e.g., administrative streamlining vs. robust inquiry) that is precisely what agencies are designed to do and courts are without the resources or expertise to do. "[I]f the statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction." *Chevron*, 467 U.S. at 843.

III

The Phase II Rule promulgates a system of general permits. EPA contemplated that these general permits will be issued on a watershed basis, with individual stormwater dischargers then filing NOIs to operate under general permits. The federal regulations implementing this system repeatedly emphasize that "[t]he use of general permits, instead of individual permits, reduces the administrative burden of permitting authorities, while also limiting the paperwork burden on regulated parties." 64 Fed. Reg. 68,722, 68,737, 68,762 (Dec. 8, 1999).

The use of a general permit system for the administration of the NPDES system has been considered and approved before. In *NRDC v. Costle*, 568 F.2d 1369 (D.C. Cir. 1977), the District of Columbia Circuit considered a challenge to EPA's regulations under the Federal Water Pollution Control Act, which was the precursor to the Clean Water Act. In *Costle*, EPA sought approval of its design for the NPDES system. EPA had issued regulations exempting broad categories of point sources from the requirement that an NPDES permit be obtained before discharging into federal waters. Part of EPA's rationale in creating the exempted categories was that otherwise EPA would be overwhelmed by the administrative burden of issuing NPDES permits. *Id.* at 1377-79. The *Costle* court affirmed the lower court's rejection of these exemptions because the legislation in question plainly required that all point sources obtain some kind of NPDES permit. *Id.* But in rejecting EPA's regulations, the *Costle* court discussed the options available to EPA in promulgating an NPDES system that was considerate of the enormous burden such a system could impose on EPA. *Id.* at 1380-81. In particular, the court recommended "the use of area or general permits. *The Act allows such techniques*. Area-wide regulation is one well-established means of coping with administrative exigency." *Id.* at 1381 (emphasis added).

Against this backdrop, EPA's creation of a general permit system was entirely permissible. And if the creation of a general permit system is permissible, then it does not matter whether NOIs are given a public airing.

The majority contends that the general permit system prevents EPA from fulfilling its duty to make sure that municipalities do not discharge pollutants in violation of the Clean Water Act. The majority reasons that by failing to require EPA review of NOIs, the Rule fails to ensure that a regulated MS4's stormwater pollution control program will satisfy the Clean Water Act requirement that the MS4 "reduce discharges to the maximum extent practicable." Majority Op. 13800. But the majority's analysis ignores the effects of the general permit. By filing an NOI, a discharger obligates itself to comply with the limitations and controls imposed by the general permit under which it intends to operate. EPA mandates that all permits (including general permits) condition their issuance on satisfaction of pollution limitations imposed by the Clean Water Act. 40 C.F.R. § 122.44. In particular, EPA requires permits to satisfy the restrictions imposed by Clean Water Act section 307(a). *Id.* at § 122.44(b)(1). Therefore, the *general permit* imposes the obligations with which the discharger must comply (including applicable Clean Water Act standards), and EPA's decision not to review every NOI is not a failure to insure compliance with the Clean Water Act.

The majority also objects to EPA's general permit system because it fails to allow for sufficient public participation in the NOIs. Majority Op. 13802-05. The majority's position fails to give deference to EPA and imposes the majority's own wishes instead. EPA would have been justified in creating a system entirely reliant on general or area permits. Its imposition of NOIs is an indulgence to certain policy prerogatives, namely public involvement and the collection of additional information. But the power to create a general permit system necessarily implies the power to require subordinate steps for NOIs that do not quite reach the level of inquiry associated with actual permits.

IV

We function as an adjudicator of disputes, not as a policy-making body. Where an agency promulgates rules after a deliberative process, it is incumbent upon us to respect the agency's decisions or else risk trivializing the function of that agency. In this case, EPA made a permissible decision to create a general permit program supported by NOIs. Therefore, I respectfully dissent from Section II.B of the majority's opinion.

In the United States Court of Appeals For the Seventh Circuit

Nos. 03-3277, 03-3278, 03-3279, 03-3280, 03-3281 & 03-3865

TEXAS INDEPENDENT PRODUCERS AND ROYALTY OWNERS ASSOCIATION, et al.,

Petitioners,

v.

ENVIRONMENTAL PROTECTION AGENCY,

Respondent.

Petitions for Review of an Order of the Environmental Protection Agency No. 02-OW-55

ARGUED DECEMBER 7, 2004—DECIDED JUNE 13, 2005

Before BAUER, MANION, and WILLIAMS, *Circuit Judges.*

MANION, *Circuit Judge.* On July 1, 2003, the Environmental Protection Agency issued its "Final National Pollutant Discharge Elimination System General Permit for Storm Water Discharges From Construction Activities" ("General Permit"). 68 Fed. Reg. 39,087 (July 1, 2003).

Several organizations filed petitions for review of this final agency action, and those petitions were consolidated before this court. For the reasons that follow, we hold that the General Permit does not violate the Clean Water Act's requirements for public notice and public hearing. We also hold that in issuing the General Permit, the Environmental Protection Agency complied with the requirements of the Endangered Species Act. However, petitioner Natural Resources Defense Council, Inc., lacks standing to challenge other aspects of the General Permit, and accordingly we dismiss the remainder of its petition. As to the remaining petitioners who represent the interests of the oil and gas industries, we stay consideration of their challenges to the General Permit pending resolution by the Fifth Circuit as to whether those petitioners are required to obtain a permit in the first instance.

I.

Congress enacted the Clean Water Act ("CWA" or "Act")[1] "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). The CWA prohibits the "discharge of any pollutant" except in compliance with the Act's provisions. 33 U.S.C. § 1311(a). Under the Act's provisions, the discharge of pollutants into navigable waters is illegal unless authorized by a permit issued pursuant to § 402 of the Act. 33 U.S.C. § 1342. Section 402 established the National Pollutant Discharge Elimination System ("NPDES"), and requires dischargers to obtain

---

[1] An appendix to this opinion provides a comprehensive list of the numerous abbreviations used throughout the opinion.

a permit from the Environmental Protection Agency ("EPA") or an authorized state.[2] 33 U.S.C. § 1342(a)(1), (b).

The NPDES permitting system originally used individual permits, which was feasible for regulating discharges from wastewater facilities or industrial plants. However, by the 1980's it became clear that the individual permitting process was unworkable to regulate storm water discharges which can occur virtually anywhere. 56 Fed. Reg. 40948, 40949-50 (Aug. 16, 1991). Congress responded in 1987 by adding § 402(p) to the CWA. 33 U.S.C. § 1342(p). This section established a two-step phased approach to regulating storm water discharges. *See* 33 U.S.C. § 1342(p).

In Phase I, Congress required NPDES permits for storm water discharges from "industrial activities," 33 U.S.C. § 1342(p)(3)(A), defined as construction activities involving five or more acres, as well as discharges from certain large municipal storm sewer systems. 55 Fed. Reg. 47990, 48066 (Nov. 16, 1990). To implement the permit requirement for Phase I, the EPA decided to use a general permit system, as opposed to a system requiring individual permits for each construction activity. 55 Fed. Reg. 47,990, 48005-48006 (Nov. 16, 1990). With a general permit, the EPA issues a permit for specific types of activities and establishes specific rules for complying with the permit. Then, rather than apply for an individual permit, operators must file a Notice of Intent ("NOI") stating that they plan to operate under the general permit, and absent a negative ruling by the EPA, discharges that comply with the terms of the general permit are automatically authorized. The EPA uses a general permit

---

2 "The EPA administers the NPDES program in each state unless the EPA previously authorized a state program to issue NPDES permits." *Am. Paper Inst., Inc. v. EPA*, 890 F.2d 869, 871 (7th Cir. 1989) (citing 33 U.S.C. § 1342(b)).

system to assure "adequate environmental safeguards . . . without the administrative and resource burdens involved in an individual permit issuance." 56 Fed. Reg. at 40961. The EPA issued its first general permit for construction-related storm water discharges in 1992, 57 Fed. Reg. 41176 (Sept. 9, 1992), and proposed a revised general permit in 1997. 62 Fed Reg. 29786 (June 2, 1997). Neither of these general permits is at issue in this case.

In preparation for Phase II, the EPA, as directed by Congress, studied all remaining storm water discharges and established "procedures and methods to control storm water discharges to the extent necessary to mitigate impacts on water quality." 33 U.S.C. § 1342(p)(5). Then, in 1999, the EPA issued its Phase II storm water rules, designating as Phase II sources small construction sites (one to five acres), smaller municipalities, and additional sources that might be designated on a case-by-case basis. 64 Fed. Reg. 68722 (Dec. 8, 1999); 40 C.F.R. § 122.26(b)(15).

On December 20, 2002, the EPA proposed a third General Permit for storm water discharges from both large and small construction sites.[3] 67 Fed. Reg. 78116 (Dec. 20, 2002). The General Permit applies only in those jurisdictions where the EPA has not authorized the State or Indian Tribe to administer its own NPDES permitting program. These jurisdic-

[3] Although the EPA imposed the NPDES permitting requirements on small construction sites (one to five acres) it was not required to do so by statute. Rather, Congress merely directed the EPA in Phase II to issue comprehensive regulations addressing additional discharges as necessary, by "performance standards, guidelines, guidance, and management practices and treatment requirements, as appropriate." 33 U.S.C. § 1342(p)(6). Accordingly, the EPA was not required to subject the smaller construction sites to the terms of the General Permit at issue here.

tions include Massachusetts, New Hampshire, Idaho, New Mexico, Alaska, and certain tribal lands. 33 U.S.C. § 1342(c).[4] After holding a series of public meetings and considering public comments, the EPA published notice of the final General Permit on July 1, 2003. 68 Fed. Reg. 39087.

The final General Permit issued by the EPA requires operators to submit an NOI to be covered by the General Permit, and mandates that a responsible corporate official certify the basis for eligibility for such coverage. General Permit, Appendix G at 11A.1. The General Permit also requires that the operator create, maintain, and implement a site-specific Storm Water Pollution Prevention Plan ("SWPPP"), which must also be certified by a corporate official. General Permit 3.13; General Permit, Appendix G at 11A.1. The discharger must further implement best management practices ("BMP") necessary to comply with water quality standards, assure weekly site inspections, and document those inspections, including detailing weather conditions. *See* General Permit 4.5A (construction operators must "select, install, and maintain BMPs at your construction site" that minimize pollutants in the discharges as necessary to meet applicable water quality standards); General Permit 3.10.A (detailing requirements for inspections).

Shortly before it published the final regulation for the General Permit, the EPA issued 68 Fed. Reg. 11325 (March 10, 2003). That final rule provided that "[d]ischarges associated with small construction activity at such oil and gas sites will require permit authorization by March 10,

[4] The EPA also maintains that the General Permit applies to certain construction activities associated with oil and gas exploration in the States of Oklahoma and Texas.

2005." 68 Fed. Reg. at 11330.[5] On June 9, 2003, several organizations representing business interests in the oil and gas industry ("Oil and Gas Petitioners") filed a petition challenging that regulation in the Fifth Circuit. In their petition, the Oil and Gas Petitioners claimed that the EPA lacks authority to require storm water discharge permits for oil and gas construction activities based on § 402(l)(2) of the CWA. In § 402(l)(2), Congress expressly prohibited the EPA from requiring a § 402 permit for storm water discharges for oil and gas activities unless the discharges were contaminated by contact with materials located on the site of such operations. 33 U.S.C. § 1342(l)(2).[6] That petition is still pending before the Fifth Circuit. *See Indep. Petro v. EPA*, No. 03-60506 (5th Cir. oral argument Jan. 31, 2005).

In addition to challenging the EPA's proposed final rule, arguing that they are exempt from the permit requirements, the Oil and Gas Petitioners filed a petition for review of the

---

[5] The EPA has since postponed the effective date to June 12, 2006. 70 Fed. Reg. 11560 (March 9, 2005).

[6] Section 402(l)(2) provides:

> The Administrator shall not require a permit under this section, nor shall the Administrator directly or indirectly require any State to require a permit, for discharges of storm water runoff from mining operations or oil and gas exploration, production, processing, or treatment operations or transmission facilities, composed entirely of flows which are from conveyances or systems of conveyances (including but not limited to pipes, conduits, ditches, and channels) used for collecting and conveying precipitation runoff and which are not contaminated by contact with, or do not come into contact with any overburden, raw material, intermediate products, finished product, byproduct, or waste products located on the site of such operations.

.s of the General Permit in the Fifth Circuit. The Natural ources Defense Council ("NRDC"), an environmental ocacy organization, also filed a petition for review of the ieral Permit. That petition was filed before this court. e Oil and Gas Petitioners' petition was consolidated with NRDC petition pending in this court, and leave was anted the National Association of Home Builders, the isconsin Builders Association, and the Associated General ontractors of America (collectively "Builder Groups"), to itervene in support of the General Permit regulation.

II.

On appeal, petitioner NRDC raises three main arguments. First, the NRDC argues that the General Permit violates the r lates of the CWA by "authorizing the discharge of itants without ensuring that the discharge will meet the water quality and technology requirements of the CWA." Second, the NRDC challenges the "General Permit's failure to mandate public availability of the NOI and the SWPPP, as well as its failure to provide the public with the opportunity for a public hearing on the NOI and the SWPPP. . . ." Third, the NRDC claims that the General Permit violates the Endangered Species Act ("ESA"). 16 U.S.C. §§ 1531, *et seq.*

For their part, the Oil and Gas Petitioners first reiterate their position that the storm water permit requirements do not apply to construction activities in the oil and gas industry. The Oil and Gas Petitioners maintain, however, that in this appeal, they are not challenging the EPA's decision that they must obtain storm water discharge permits, as that question is currently pending before the Fifth Circuit. Rather, the Oil and Gas Petitioners assume, for purposes of this appeal, that they must obtain a permit, and instead they challenge the requirements of the General Permit established by the EPA in 68 Fed. Reg. 39,087. Specifically, the Oil and Gas Petitioners argue that the EPA's definition of "common plan" contained in the General Permit is so broad, ambiguous, and vague that it violates their rights to due process because they do not know if they need to apply for a General Permit. The Oil and Gas Petitioners also argue that the EPA's definition of "final stabilization" is too vague. Alternatively, the Oil and Gas Petitioners argue that the EPA's definitions of "common plan" and "final stabilization" are arbitrary and capricious because the definitions do not take into account the differences in construction activities related to oil and gas exploration and conventional residential and commercial activities.

The State of Louisiana's Department of Natural Resources, the Railroad Commission of the State of Texas, and the State of Oklahoma's Corporation Commission filed *amici curiae* briefs in support of the Oil and Gas Petitioners. The *amici* support the Oil and Gas Petitioners' claims that the EPA acted arbitrarily and capriciously in failing to tailor the permit criteria to construction activities in the oil and gas industries. The *amici* also highlight the importance of the oil and gas industries to their States' economies, and stress that their States currently address environmental concerns related to the oil and gas industry.

In the cross-fire is the EPA, which maintains the middle ground, asserting that it acted reasonably in adopting the General Permit and that the regulations are neither too harsh nor too lax. The Builders Group supports the EPA's position, submitting a brief as Intervening Respondents to oppose the claims asserted by the NRDC. We begin by addressing the arguments presented by the NRDC, and then consider the Oil and Gas Petitioners' claims.

A. The NRDC's Petition

1. Standing.

Before we can address the merits of the NRDC's arguments, however, we must first determine whether the parties have standing to sue, an issue raised by the Builders Group, but one this court must in any event, determine in the first instance.[7] *See Heartwood, Inc. v. United States Forest Serv.*, 230 F.3d 947, 951 (7th Cir. 2000) ("As always, before the court may consider the merits of a case, we must determine whether Plaintiffs have presented a justiciable claim.").

Section 509(b)(1)(F) of the CWA authorizes any "interested person" to obtain review of an EPA action in a Circuit Court of Appeals. 33 U.S.C. § 1369(b)(1)(F). To qualify as an "interested person" under § 509(b)(1)(F), a party, at a minimum, must have Article III standing. *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560-61 (1992) (hereinafter *Lujan II*). When a plaintiff is an association, the association has Article III standing to represent the interests of its members if the individuals have standing in their own right; the interests represented are germane to the association's purpose; and the relief sought does not require the participation of the individual members. *Hunt v. Wash. State Apple Adv. Comm'n*, 432 U.S. 333, 343 (1977). *See, e.g., Sierra Club v. Marita*, 46 F.3d 606, 611-12 (7th Cir. 1995) (holding that "Sierra Club

[7] The NRDC claims that it need not establish standing unless or until it is challenged. However, this court admonished litigants in *Rhodes v. Johnson*, 153 F.3d 785, 787 (7th Cir. 1998), to "be mindful of our obligation to satisfy ourselves of our jurisdiction and when, in cases like this, standing is an obvious issue, . . . they [should] cite to the relevant parts of the record to avoid wasting judicial time and resources."

may maintain standing on behalf of its members"). Plaintiffs, as the parties invoking federal jurisdiction, have the burden of proof and persuasion as to the existence of standing. *Lujan II*, 504 U.S. at 561.

At oral argument, we directed the NRDC to file a supplemental brief addressing whether it satisfied these requirements. In its supplemental brief, the NRDC asserts that it has standing to sue on behalf of its members as the interests involved are germane to the association's purpose, and the relief sought does not require the participation of individual members. No one takes issue with those propositions. The only real question is whether the individual members would have standing to sue in their own right. The NRDC claims that it has identified three members who have standing in their own right by virtue of living near and making use of "water bodies that receive storm water discharges authorized" by the General Permit. To determine whether this is sufficient, we turn then to the requirements for individual standing in general and, specifically, standing in an environmental case.

Generally, to establish standing a petitioner must demonstrate an injury in fact; a causal link between the injury and the challenged action; and redressability through a favorable court decision. *Id.* at 560-61; *see also Area Transp., Inc. v. Ettinger*, 219 F.3d 671, 672 (7th Cir. 2000). However, when, as here, "a plaintiff's asserted injury arises from the government's allegedly unlawful regulation (or lack of regulation) of *someone else*, much more is needed." *Lujan II*, 504 U.S. at 562 (emphasis in original). As the Supreme Court in *Lujan II* explained, that is because in such a situation, "causation and redressability ordinarily hinge on the response of the regulated (or regulable) third party to the government action or inaction—and perhaps on the response of others as well." *Id.* Thus, the plaintiff must "adduce facts showing that those choices have been, or will be, made in such manner as to produce causation and permit redressability of injury." *Id.* Accordingly, as *Lujan II* explained, "when the plaintiff is not himself the object of the government action or inaction he challenges, standing is not precluded, but it is ordinarily substantially more difficult to establish." *Id.* (internal quotations omitted).

Notwithstanding this difficult standard, the NRDC maintains that it has standing to challenge the General Permit because three of its members use various bodies of water which are polluted and that the pollution lessens their enjoyment and use of the water bodies. The NRDC asserts that that is enough to establish environmental standing, citing numerous environmental cases holding that such an interest is sufficient.

The NRDC is correct that injury to recreational or aesthetic interests constitutes a cognizable injury for purposes of standing. *See Friends of the Earth, Inc. v. Laidlaw*, 528 U.S. 167, 183 (2000) (stating that injury to aesthetic and recreational values constitutes sufficient injury for standing); *Lujan v. Nat'l Wildlife Fed'n*, 497 U.S. 871, 886 (1990) (hereinafter *Lujan I*) ("We have no doubt that 'recreational use and aesthetic enjoyment' are among the *sorts* of interests those statutes were specifically designed to protect."). However, to establish standing, the NRDC must establish not just " 'injury in fact'—an invasion of a legally protected interest which is (a) concrete and particularized,' " but also that there is "a causal connection between the injury and the conduct complained of . . . ." *Lujan II*, 504 U.S. at 560. In other words, "the injury has to be 'fairly . . . trace[able] to the challenged action of the defendant, and not . . . th[e] result [of] the independent action of some third party not before the court." *Id.*

Simply put, the NRDC must tie the asserted injury, namely its members' reduced aesthetic and recreational enjoyment, to the challenged conduct, namely the EPA's issuance of the General Permit. The NRDC asserts its members "will be directly affected by the General Permit," as it "has members in each of the states in which construction activities will be regulated by the General Permit," and that its "members swim and engage in other recreational activities in water bodies directly affected by pollution from construction activities subject to the General Permit." These contentions, however, fail to establish the requisite casual connections for standing for numerous reasons.

Initially, we note that the NRDC fails to adduce specific facts in its proffered affidavits to support its claim that the water bodies are "directly affected by pollution from construction activities subject to the General Permit." Rather, in the three affidavits presented in the NRDC's reply brief to establish standing, the members merely repeat the conclusory allegations of the NRDC's opening brief. For instance, one affiant stated: "In recent years, there has been much construction activity near the waters that I use in Idaho. . . . I believe that that [sic] these construction projects contribute to sediment, turbidity and water quality problems in the Boise River, Snake River, and Clearwater River." However, the affidavit fails to identify any specific construction project authorized under the General Permit to discharge into these bodies of water, and more significantly it fails to present evidence that discharges of sediment from the sites are actually occurring. Similarly, a second affidavit merely states: "The construction that has been occurring in and around Taos has negatively affected water quality and harmed me and my family in the process." Again, this conclusory statement does not identify any specific construction sites authorized under the General Permit and fails to present evidence of any discharges into the water bodies at issue. Finally, although the third affidavit identifies a construction project approved under the EPA's General Permit, that affidavit does not specify any discharge from that project into the water body at issue.[8] As petitioning party, the NRDC bears the burden of proof, *Lujan II*, 504 U.S. at 561, and because it has sought a ruling as a matter of law, it must present record evidence establishing standing. *Sierra Club v. EPA*, 292 F.3d 895, 899 (D.C. Cir. 2002). Repeating the conclusory allegations of a complaint is not enough. *Lujan I*, 497 U.S. at 888. Yet that is what the NRDC has done, opining that the construction activities result in pollution, without citing any supporting evidence.

The NRDC seeks to overcome the deficiencies in the affidavits by citing in its Supplemental Brief to several NOIs filed with the EPA, including some from construction companies providing a notice of an intent to discharge under the General Permit in the bodies of water used by the three affiants. There are several problems with this approach. First, the water bodies at issue span, in some cases, hundreds of miles. For instance, the Rio Grande runs the entire length of New Mexico, and pointing to an NOI seeking coverage under the General Permit for discharges into the Rio Grande does not establish an injury to the portion of the river used by the affiant. This is fatal, as "averments which state only that one of respondent's members uses unspecified portions of an immense tract of territory, on some portions of which [regulated] . . . activity has occurred or probably will occur by virtue of the governmen-

[8] Ironically, while the affiants conclusorily declare that discharges from the construction sites pollute the water bodies at issue, the NRDC's acknowledgment in its brief that it cannot "determine which point-sources might be responsible for harmful discharges" calls into question the veracity of these declarations.

tal action, are insufficient to show that the member's rights have been adversely affected or aggrieved by Government action." *Lujan I*, 497 U.S. at 889. Moreover, to satisfy the "fairly traceable" causation requirement, there must be a distinction between "the plaintiffs who lie within the discharge zone of a polluter and those who are so far downstream that their injuries cannot fairly be traced to that defendant." *Friends of the Earth, Inc. v. Gaston Copper Recy., Corp.*, 204 F.3d 149, 162 (4th Cir. 2000). *See also Lujan II*, 504 U.S. at 565-66 ("[P]laintiffs claiming injury from environmental damage must use the area affected by the challenged activity and not an area roughly 'in the vicinity' of it."). Thus, for instance, the Fifth Circuit held in *Friends of the Earth, Inc. v. Crown Cent. Petroleum Corp.*, 95 F.3d 358, 360-61 (5th Cir. 1996), that an eighteen-mile distance is "too large to infer causation." Likewise here, where the specific water bodies used by NRDC members run a great distance, pointing to NOIs that authorize discharges in those water bodies is insufficient to establish the discharges are within the zone to infer causation. *See Lujan I*, 497 U.S. at 887-89.

Second, the NOIs relied upon by the NRDC do not establish that any discharge has actually occurred into the water bodies. *See, e.g.*, 69 Fed. Reg. 76743, 76746 (Dec. 22, 2004) (In discussing the General Permit, the EPA characterizes the CWA and its implementing regulations as requiring "certain *potential* dischargers to seek permit coverage."). Nor do any of the affidavits filed present evidence of the discharge of pollutants. "[I]t will not do to 'presume' the missing facts because without them the affidavits would not establish the injury that they generally allege." *Lujan I*, 497 U.S. at 889. Additionally, even if discharges were occurring into the water bodies, the NRDC must still trace the alleged polluted conditions of the water bodies to the discharges. Although a plaintiff need not establish such a nexus with "scientific certainty," *Gaston Copper*, 204 F.3d at 161, a plaintiff must show "that a defendant discharges a pollutant [which] causes or contributes to the kinds of injuries alleged in the specific geographic area of concern." *Id.* (internal citations omitted). In *Gaston Copper*, the Fourth Circuit noted that "[w]here a plaintiff has pointed to a polluting source as the seed of his injury, and the owner of the polluting source has supplied no alternative culprit, the 'fairly traceable' requirement can be said to be fairly met." *Id.* at 162. Here, however, the NRDC failed to establish "any seed of [its] injury." The NRDC also ignores the existing polluted condition of at least three of the water bodies, the Anacostia and Potomac Rivers, and Rock Creek, in Washington D.C. This condition is in large part caused by the "estimated 3.2 billion gallons of untreated raw sewage that flows into the rivers each year from the area's sewer systems." Department of Justice Press Release, U.S. - WASA Sewage Settlement to Clean up D.C.'s Anacostia River, December 16, 2004.

Finally, and most significantly, pointing to NOIs filed with the EPA is insufficient because for the NRDC to have standing to sue, it is not enough to assert that water bodies used by its members receive storm water discharges authorized by the General Permit. Rather, the NRDC must show that the discharge caused the complained-of legally cognizable aesthetic or recreational injury. Establishing a discharge does not also establish an injury. That is because the EPA "may issue permits authorizing the discharge of pollutants in accordance with specified conditions," and such authorized discharges are not illegal. *Gwaltney of Smithfield, Ltd. v. Chesapeake Bay Found., Inc.*, 484 U.S. 49, 52 (1987) (citing 33 U.S.C. § 1342). Therefore, to establish causation and, in turn, standing, the NRDC must establish that the discharge violated the General Permit or the terms of the CWA. The NRDC has established neither.

This distinguishes our case from those relied upon by the NRDC wherein the courts found environmental standing, as those cases alleged aesthetic and recreational injuries caused by violations of a permit. For instance, in *Laidlaw* the plaintiffs sued for injunctive relief for alleged violations of an NPDES permit by a hazardous waste incinerator. The Supreme Court found standing in *Laidlaw*, reasoning: "[I]t is undisputed that Laidlaw's unlawful conduct—discharging pollutants in excess of permit limits—was occurring at the time the complaint was filed." *Laidlaw*, 528 U.S. at 184. Similarly, in *Ecological Rights Found. v. Pac. Lumber Co.*, 230 F.3d 1141, 1146 (9th Cir. 2000), the Ninth Circuit held the plaintiffs had standing because they alleged that their individual members used the water bodies at issue and that their aesthetic and recreational interests were impaired by the alleged violations of the 1992 General Permit. Likewise in *Gaston Copper*, 204 F.3d at 156, the Fourth Circuit held that the plaintiff had standing to sue because the plaintiff was "a property owner whose lake lies in the path of Gaston Copper's toxic chemical discharge. He and his family swim and fish in this lake. [Plaintiff] testified that he and his family swim less in and eat less fish from the lake because of his fears of pollution from Gaston Copper's permit *exceedances*." (emphasis added). The court in *Gaston* continued: "Plaintiff here established the required nexus for the alleged injury by presenting evidence consisting of reports show[ing] over 500 violations of the company's discharge limits, including unlawful releases of cadmium, copper, iron, lead and zinc, as well as pH violations." *Id.* at 157 (internal quotation omitted).

Conversely, in this case, the NRDC does not assert any violation of the General Permit. The NRDC responds that it need not establish a violation of the General Permit because it is attacking the General Permit scheme and not a specific discharge. However, to attack the General Permit scheme, the NRDC must still establish standing, which means the petitioner must demonstrate its members suffered an injury from the General Permit scheme. Yet the only potential injury to its members is one that could occur in the future should a contractor violate the terms of the General Permit.

Moreover, it would be illogical to hold that a petitioner has standing to challenge a General Permit *scheme* because a discharger *may* in the future violate the terms of the permit, where the Supreme Court has held that a citizen lacks standing to sue for *actual* violations of a permit where the discharger corrects the violation within the sixty-day notice period.[9] *See Atlantic States Legal Found., Inc. v. Stroh Die Casting Co.*, 116 F.3d 814, 825 (7th Cir. 1997) ("In *Gwaltney*, the Supreme Court set forth a test for standing under the Act: a plaintiff must make a 'good-faith allegation of continuous or intermittent violation.' 484 U.S. at 64, 108 S.Ct. at 385. This means that a citizen plaintiff does not have standing to maintain a suit for civil penalties for wholly past violations of the act.") (citing *Gwaltney*, 484 U.S. at 54).

Allowing an attack on the General Permit scheme where no actual violation has occurred also defeats the goal of the regulatory provisions requiring that the notice of a permit violation provide the alleged discharger with specific details so the discharger knows what it is doing wrong and what

---

[9] Section 1365(b)(1)(A) authorizes private suits for violations of the terms of an existing NPDES permit, but "[c]itizens may not bring suit, however, unless and until they have given 60 days' notice of their intent to sue to the alleged violator (as well as the Administrator and the state)". *Atlantic States*, 116 F.3d at 818 (citing 33 U.S.C. § 1365(b)(1)(A)).

corrective actions will avert a lawsuit. *Id.* Where there is no alleged violation, the dischargers have no opportunity to take corrective action, as Congress and the EPA desired. *Gwaltney*, 484 U.S. at 60 (stating that the sixty-day notice requirement provides the alleged violator "an opportunity to bring itself into compliance with the Act and thus likewise render unnecessary a citizen suit"). Moreover, allowing such suits would conflict with Congress' intent that "the great volume of enforcement actions be brought by the State," and with Congress' design that citizen suits be brought only "if the Federal, State, and local agencies fail to exercise their enforcement responsibility." *Ailor v. City of Maynardville, Tenn.*, 368 F.3d 587, 598 (6th Cir. 2004) (quoting S. Rep. No. 92-414, p.64 (1971)).

Of course, that does not mean that the NRDC would be without standing to challenge a discharge that complies with the terms of the General Permit but violates the terms of the CWA. Such a discharge would be illegal, whether or not the EPA authorized it. Some language from the NRDC's briefs could be read as presenting such an argument. For instance, in its reply brief, the NRDC frames the issue as whether the EPA has "authority to issue a General Permit that authorizes discharges that do not comply with the law." However, the NRDC has presented no evidence of a discharge authorized by the General Permit that violates the terms of the CWA. The NRDC's other briefs also demonstrate that that is not the NRDC's real contention. Rather, the NRDC's complaint is that the General Permit scheme allows for the possibility that a contractor may violate the terms of the General Permit. But to have standing to present such a claim premised on a third party's action or inaction, the NRDC must adduce facts showing that "those choices have been, or will be, made in such manner as to produce causation and permit redressability of injury." *Lujan II*, 504

U.S. at 562. This it has failed to do. Therefore, it lacks standing to challenge the substantive provisions of the General Permit.

Because the NRDC has failed to establish standing to present its substantive challenges to the General Permit, this court lacks jurisdiction to consider the NRDC's objections to the General Permit scheme. Thus, its reliance on decisions from the Ninth and Second Circuits addressing the validity of other General Permit schemes is misplaced. Specifically, the NRDC cites the Ninth Circuit's decision in *Environmental Defense Center, Inc. v. EPA*, 344 F.3d 832 (9th Cir. 2003),[10] and the Second Circuit's decision in *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486 (2d Cir. 2005),[11] in support of its challenge to the General Permit scheme. However, neither the Ninth nor the Second Circuit addressed the initial question of standing, at least as to whether environmental plaintiffs not subject to the regulation have standing to challenge the general permit.[12] Without standing, this court cannot reach

---

[10] In *Envirnomental Defense Center*, the Ninth Circuit considered a general permit authorizing municipal storm water discharges. 344 F.3d 832.

[11] In *Waterkeeper*, the Second Circuit considered the validity of a general permit authorizing discharges by Concentrated Animal Feeding Operations. 399 F.3d 486.

[12] The Second Circuit did not address the issue of standing at all. *Waterkeeper Alliance*, 399 F.3d 486. The Ninth Circuit addressed standing in considering challenges to the general permit presented by the industries subject to the permit requirements, and it concluded those petitioners lacked standing. *Environmental Defense*, 344 F.3d at 863, 867-68. The Ninth Circuit, however, did not mention the question of whether the environmental petitioners had standing. The Ninth Circuit did hold that the en-

(continued...)

the merits of the petitioner's substantive challenges to the General Permit. *In the Matter of Memorial Estates, Inc.*, 950 F.2d 1364, 1369 (7th Cir. 1991).

Whether the NRDC has standing to present procedural challenges to the General Permit, namely by attacking the General Permit's failure to mandate public availability of the NOI and SWPPP, and its failure to provide the public with the opportunity for a public hearing on the NOI and the SWPPP, however, is a separate question. Here the NRDC seeks to vindicate procedural rights established by statute to participate in the process. "The person who has been accorded a procedural right to protect his concrete interests can assert that right without meeting all the normal standards for redressability and immediacy." *Lujan II*, 504 U.S. at 572 n.7. *Lujan II* illustrated this point, noting that individuals living adjacent to a site for proposed construction have standing to challenge the licensing agency's failure to prepare an environmental impact statement, even though they "cannot establish with any certainty that the

---

12 (...continued)
vironmental petitioners' claim was ripe, noting that "we are addressing whether the EPA, in promulgating the Phase II Rule, has accomplished the substantive controls for municipal stormwater that Congress mandated in § 402(p) of the Clean Water Act, . . . [and that] question is ripe for review." *Id.* at 852 n.30. Although ripeness and standing overlap in some respects, in passing on ripeness, as the above excerpt demonstrates, the Ninth Circuit failed to consider whether the Phase II Rule at issue in that case caused an actual injury to the environmental petitioners. *Id.* at 852 n.30. That is significant because, as the above analysis demonstrates, the NRDC lacks standing to challenge the General Permit at issue in this case because it failed to present sufficient evidence that the General Permit caused a legally cognizable injury to any of its members.

statement will cause the license to be withheld or altered and even though the dam will not be completed for many years." *Id.* This court also recognized standing to vindicate a procedural right in *Sierra Club v. Marita*, 46 F.3d 606 (7th Cir. 1995), holding that the plaintiffs had standing to challenge a forest management plan because "[o]nce the plan has passed administrative review, the procedural injury has been inflicted, [and] [u]nless a plaintiff's purported interest in the matter is wholly speculative, waiting any longer to address that injury makes little sense." *Id.* at 612.

So too here: Even though the NRDC members cannot establish the immediacy of an injury from construction activities operating under the General Permit, the NRDC nonetheless has standing to challenge the EPA's failure to mandate public availability of the NOI and the SWPPP, and its failure to provide the opportunity for a public hearing related to the NOI and the SWPPP. This is because the NRDC has presented evidence that its members use water bodies that may receive discharges authorized by the General Permit and the three affiants stated that they would participate in the decision making process if allowed.

This contrasts with the *Lujan II* case in which, after reaffirming the principle of procedural standing, the Supreme Court nonetheless held that the plaintiffs lacked standing to present such a challenge because they failed to satisfactorily establish their future use of the property affected by the alleged procedural violation. *Lujan II*, 504 U.S. at 564, 572-73. Conversely, here, the NRDC members stated that they regularly use the water bodies. Accordingly, the NRDC has procedural standing. *See Rhodes*, 153 F.3d at 787 (holding that the plaintiffs have standing because they alleged they used the forest at issue and that the Forest Service's decision would diminish this use and enjoyment, and "that the defendant's failure to permit them to participate in the public review of the decision is causally connected to their harm"); *Heartwood*, 230 F.3d at 952 (holding that under *Rhodes*, plaintiffs had standing to challenge the Forest Service's exclusion of certain classes of actions from procedural safeguards designed to determine the environmental impact of those actions, and that plaintiffs had an informational injury justifying standing as well, where the alleged violation prevented them from commenting on or challenging the agency's decision).

2. Public notice and hearing.

Having concluded that the NRDC has standing to pursue its procedural injury claims, we turn to the merits of those claims. As noted above, the NRDC presents two procedural challenges: the NRDC challenges the General Permit's failure to mandate public availability of the NOIs and the SWPPP, and its failure to provide the public with the opportunity for a public hearing on the NOI and the SWPPP. In support of its position, the NRDC cites 33 U.S.C. §§ 1342(j) and 1342(1)(a).

Section 1342(j) of the CWA provides that "[a] copy of each permit application and each permit issued under this section shall be available to the public. Such permit application or permit, or portion thereof, shall further be available on request for the purpose of reproduction." Section 1342(a)(1) authorizes the EPA "after opportunity for public hearing, [to] issue a permit for the discharge of any pollutant, or combination of pollutants. . . ." The NRDC claims this statutory language requires the EPA to make the NOIs and SWPPPs publicly available and to provide for the opportunity for a public hearing. The EPA responds that Sections 1342(j) and 1342(a)(1) do not apply to the NOIs and

SWPPPs because NOIs and SWPPPs are neither permits nor permit applications.

This presents an issue of statutory interpretation, which is governed by the two-step test set forth in *Chevron U.S.A., Inc. v. National Resource Defense Council, Inc.*, 467 U.S. 837, 842-43 (1984). Under the first step, a reviewing court must determine "whether Congress has directly spoken to the precise question at issue." *Id.* at 842. If Congress' intent is clear from the statutory language, a court must "give effect to the unambiguously expressed intent of Congress." *Id.* at 842-43. However, if the statute is "silent or ambiguous with respect to the specific issue," the court must decide whether the Agency's interpretation is based on a permissible construction of the statute. *Id.* at 843. To uphold an agency's interpretation of a statute, this court need only find the interpretation permissible. *Id.*

The statutory language quoted above speaks only to "permits" and "permit applications," and not NOIs or SWPPPs. Thus, Congress has not spoken directly to the precise question at issue, or at best, it is ambiguous as to whether Congress intended to treat NOIs and SWPPPs as permits or permit applications for purposes of Sections 1342(j) and 1342(a)(1). Accordingly, under *Chevron*, we must decide whether the EPA gave a permissible construction to the term "permit applications" and "permits."

Maintaining that NOIs and SWPPPs do not constitute "permit applications" or "permits" for purposes of Sections 1342(j) and 1342(a)(1), the EPA stresses that the General Permit scheme does not make use of a permit application. Rather, general permits are proposed through a notice in the Federal Register, and the EPA solicits and receives public comments on the proposed general permits. It is at that time that the public has the opportunity to request a public hearing. Once a general permit issues, a discharger wishing to operate under the general permit must comply with the previously established permit terms. Therefore, according to the EPA, there is no need for additional public comment or a notice period. Moreover, the EPA maintains that requiring "an additional public hearing on each individual NOI and SWPPP would eviscerate the administrative efficiency inherent in the general permitting concept," in effect making the general permit scheme no different from the process for obtaining individual permits. This would be inconsistent with Congress' intent to allow for the use of general permits. *See* Pub. L. 102-240 (Dec. 18, 1991) ("The Administrator shall issue final regulations with respect to general permits for storm water discharges associated with industrial activity on or before Feb. 1, 1992."). These rationales are eminently reasonable. Therefore, we conclude that the EPA's interpretation of the terms "permit application" and "permit" as not including NOIs and SWPPPs is a permissible construction. Under the EPA's interpretation, then, NOIs and SWPPPs are not subject to the requirements of Sections 1342(j) and 1342(a)(1), and, accordingly, the EPA did not violate those sections of the CWA in issuing the General Permit at issue.[13]

---

[13] The Ninth Circuit's majority opinion in *Environmental Defense Center* found under step one of *Chevron* that Congress clearly intended NOIs to be subject to the public availability and public hearing requirements because NOIs are the functional equivalent of a permit application. 344 F.3d at 856. However, as discussed above, the statutory language at issue addresses only "permit applications" and fails to include any mention of NOIs, SWPPPs, or other so-called "functional equivalents." Thus, as the dissent in *Environmental Defense Center* concludes, the majority erred in concluding that Congress clearly spoke to the issue. *Id.* at 880-81 (Tallman, J., dissenting). Because this opinion creates a split (continued...)

3. Endangered Species Act.

Finally, the NRDC claims that the General Permit violates Section 7 of the Endangered Species Act ("ESA"). 16 U.S.C. §§ 1531, *et seq.* Section 7 requires each federal agency to ensure that any action authorized, funded, or carried out by that agency "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of designated critical habitat. 16 U.S.C. § 1536(a)(2). The relevant regulations further require any agency proposing an action to pursue either informal or formal consultation with the Fish and Wildlife Service and/or the National Marine Fisheries Service (together "Service") if the proposed federal action "may affect" a threatened or endangered species. 50 C.F.R. § 402.14(a).

The NRDC claims that the General Permit violates Section 7 because the EPA does not consult with the Service upon receipt of an NOI and the completion of a SWPPP. Again, we begin by considering the NRDC's standing. As above, the NRDC's claimed injury here is a procedural injury—the lack of statutorily required consultation. Therefore, the standing requirements are more relaxed. In this case, the NRDC alleged that some of its members use bodies of water which endangered species inhabit, and that pollution threatens the proliferation of these species. For at least one of the members, a claimed harm exists: Affiant Justin Hayes claims his use and enjoyment of the water bodies is dimin-

---

[13] (...continued)
between the circuits, we circulated it in advance of publication to the full court pursuant to Seventh Circuit Rule 40(e). No judge in active service voted to hear the case en banc. (Chief Judge Flaum and Judge Ripple did not participate in consideration of whether to hear the case en banc.)

ished because the polluted conditions prevent endangered fish species from flourishing, which means that he cannot keep the fish he catches, but must instead release them back into the water. Given that the claimed harm is a procedural injury stemming from the EPA's failure to consult with the Service, we conclude the NRDC has standing to challenge the lack of consultation. *See supra* at 20-22.

However, on the merits the NRDC loses because Section 7 only requires consultation with the Service whenever *a federal action* "may affect" a threatened or endangered species. 16 U.S.C. § 1536(a)(2). A private actor, however, files an NOI and creates a SWPPP, and neither the filing of an NOI nor the creation of a SWPPP by a private contractor requires any federal action. Without a federal action, the consultation requirements of Section 7 are not triggered. Therefore, the EPA need not engage in consultation with the Service every time an NOI is filed or a SWPPP is prepared. Consultation was required earlier, when the EPA issued the General Permit, but at that time the EPA undertook and concluded informal consultation with the Service on the issuance of the General Permit. Specifically, the EPA and the Service developed a detailed procedure designed to accommodate listed species and critical habitats and the Service agreed that the issuance of the General Permit was not likely to adversely affect those species and habitats. Accordingly, the EPA complied with the ESA in issuing the General Permit. *See* 50 C.F.R. § 402.13 (explaining that the consultation requirement is satisfied if during the informal consultation the Service concurs in writing that the action "is not likely to adversely affect" a listed species).

B. Oil and Gas Petitioners

The Oil and Gas Petitioners also challenge the terms of the General Permit, taking issue with various definitions and provisions, arguing in essence that the EPA acted arbitrarily and capriciously by failing to take into account the differences in construction activities related to oil and gas exploration and conventional residential and commercial activities. However, as noted above, the Oil and Gas Petitioners also maintain that the EPA lacks the authority to require a permit for construction activities related to oil and gas exploration. That question is currently pending before the Fifth Circuit. The Oil and Gas Petitioners acknowledge that should the Fifth Circuit rule in their favor, their claims would be moot. We agree. Accordingly, we stay consideration of the Oil and Gas Petition until the Fifth Circuit determines the initial question of whether the Oil and Gas Petitioners are subject to the permitting requirements of the CWA. *See Landis v. N. Am. Co.*, 299 U.S. 248, 254 (1936) (stating that "the power to stay proceedings is incidental to the power inherent in every court to control the disposition of the causes on its docket with economy of time and effort for itself, for counsel, and for litigants); *Aetna State Bank v. Altheimer*, 430 F.2d 750, 755 (7th Cir. 1970) ("A stay pending the outcome of litigation in another court between the same parties, involving the same or controlling issues is an acceptable means of avoiding unnecessary duplication of judicial machinery.").

III.

In sum, we conclude that the NRDC lacks standing to challenge the terms of the General Permit because it has failed to show any of its members have standing to sue in their own right; the NRDC failed to present evidence establishing the General Permit caused an actual injury to the aesthetic or recreational interests of its members. However, the NRDC has standing to present its procedural challenges to the General Permit, but those challenges fail because NOIs and SWPPPS are not permits or permit applications and therefore the CWA's public notice and hearing requirements do not apply. Likewise, while the NRDC has standing to present a procedural ESA claim, that claim fails on the merits because the filing of an NOI and the creation of a SWPPP by a private actor does not constitute "federal action," and, therefore, the consultation requirements of the ESA are not implicated. Accordingly, we DENY the NRDC's PETITION FOR REVIEW, IN PART, and DISMISS IT IN PART FOR LACK OF STANDING. We further STAY consideration of the Oil and Gas Petitioners' petition pending a decision from the Fifth Circuit as to whether the permit requirements of the CWA apply to the Oil and Gas Petitioners.

Appendix:

The Act:	The Clean Water Act
BMP:	Best Management Practices
Builder Groups:	National Association of Home Builders, the Wisconsin Builders Association, and the Associated General Contractors of America
CWA:	The Clean Water Act
EPA:	The Environmental Protection Agency
ESA:	Endangered Species Act
General Permit:	Final National Pollutant Discharge Elimination System General Permit for Storm Water Discharges From Construction Activities
NRDC:	Natural Resources Defense Council
NOI:	Notice of Intent
NPDES:	The National Pollutant Discharge Elimination System
Oil and Gas Petitioners:	Texas Independent Producers and Royalty Owners Assocation; Independent Petroleum Association of America, U.S. Oil and Gas Association, Texas Alliance of Energy Producers, Louisiana Oil and Gas Associations, Independent Gas and Gas Association of Pennsylvania, Ohio Oil and Gas Association, and Oklahoma Independent Petroleum Association
	SWPPP:

Storm Water Pollution Prevention Plan

A true Copy:

Teste:

Clerk of the United States Court of Appeals for the Seventh Circuit

UNITED STATES COURT OF APPEALS

FOR THE SECOND CIRCUIT

August Term, 2004

(Argued: December 13, 2004 Decided: February 28, 2005)

Docket Nos. 03-4470 (L), 03-4621 (C), 03-4631 (C), 03-4641 (C), 03-4849 (C), 04-40199 (C), 03-40229 (C)

WATERKEEPER ALLIANCE, INC., AMERICAN FARM BUREAU FEDERATION, NATIONAL CHICKEN COUNCIL, NATIONAL PORK PRODUCERS COUNCIL, AMERICAN LITTORAL SOCIETY, SIERRA CLUB, INC., NATURAL RESOURCES DEFENSE COUNCIL, INC.,

Petitioners/Intervenors,

—v.—

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, MICHAEL O. LEAVITT, Administrator, United States Environmental Protection Agency

Respondents.

Before:

OAKES, KATZMANN, and WESLEY, *Circuit Judges*.

The petitioners challenge an administrative rule promulgated by the United States Environmental Protection Agency in order to regulate the emission of water pollutants by concentrated animal feeding operations. *See* National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations, 68 Fed. Reg. 7176, 7179 (Feb. 12, 2003) (codified at 40 C.F.R. Parts 9, 122, 123 and 412). The petitions for review are granted in part and denied in part.

---

and control the emission of water pollutants from concentrated animal feeding operations. While we deny many of the challenges here brought, we find that several aspects of the regulation violate the express terms of the Clean Water Act or are otherwise arbitrary and capricious under the Administrative Procedure Act. Accordingly, we grant the petitions in part and deny the petitions in part.

BACKGROUND

A. Statutory Background

The Clean Water Act (the "Act") is a cornerstone of the federal effort to protect the environment. "[D]esigned to 'restore and maintain the chemical, physical, and biological integrity of the Nation's waters,'" *No Spray Coalition, Inc. v. City of New York*, 351 F.3d 602, 604 (2d Cir. 2003) (PNL, RDS, Korman, D.J.) (quoting 33 U.S.C. § 1251(a)), the Act is the principal legislative source of the EPA's authority – and responsibility – to abate and control water pollution. *See* 33 U.S.C. §§ 1311(a), 1342, 1362.

By way of very brief overview, the Act formally prohibits the "discharge of a pollutant"[1] by "any person"[2] from any "point source"[3] to navigable waters except when authorized by a

[1] The term "discharge of a pollutant" is defined to mean, *inter alia*, "any addition of any pollutant to navigable waters from any point source." 33 U.S.C. § 1362(12)(A).

[2] The term "person" is defined to mean "an individual, corporation, partnership, association, State, municipality, commission, or political subdivision of a State, or any interstate body." 33 U.S.C. §1362 (5).

[3] The term "point source" is defined to mean "any discernible, confined and discrete conveyance . . . from which pollutants are or may be discharged." 33 U.S.C. § 1362 (14). Notably, the Act includes "concentrated animal feeding operation" as an example of a point source. *Id.*

are technology-based restrictions on water pollution. They are technology-based, because they are established in accordance with various technological standards that the Act statutorily provides and that, pursuant to the Act, vary depending upon the type of pollutant involved, the type of discharge involved, and whether the point source in question is new or already existing. We will discuss these with greater detail below. For now, we note simply that the technology standards for already existing point sources include (1) the best available technology economically achievable, *see* 33 U.S.C. § 1311(b)(2)(A); (2) the best conventional pollutant control technology, *see* 33 U.S.C. § 1314(b)(2)(A); and (3) the best practicable control technology currently available, *see* 33 U.S.C. § 1314(b)(1)(A). The technology standard for new point sources, which is commonly referred to as a new source performance standard, is based on the best available demonstrated control technology, *see* 33 U.S.C. § 1316.

We also note that where effluent limitations prove insufficient to attain or maintain certain water quality standards, the Act requires NPDES permits to include additional water quality based effluent limitations. *See* 33 U.S.C. §§ 1311(b)(1), 1312(a). Overall, we hope to make clear that the NPDES permit is critical to the successful implementation of the Act because – by setting forth technology-based effluent limitations and, in certain cases, additional water quality based effluent limitations – the NPDES permit "defines, and facilitates compliance with, and enforcement of, a preponderance of a discharger's obligations under the [Act]." *California, ex rel. State Water Res. Control Bd.*, 426 U.S. at 205.

B. <u>Regulatory Background</u>

livestock.[5] For example, a "Medium CAFO"[6] raises as many as 9,999 sheep, 54,999 turkeys, or

---

[5] The CAFO Rule defines a concentrated animal feeding operation as "an AFO [animal feeding operation] that is defined as a Large CAFO or as a Medium CAFO by the terms of this paragraph, or that is designated as a CAFO in accordance with paragraph (c) of this section." 40 C.F.R. § 122.23(b)(2). Paragraph (c) provides that an appropriate authority (either a state director, the EPA administrator or both) may designate an AFO as a CAFO upon a determination that the AFO is "a significant contributor of pollutants to waters of the United States." 40 C.F.R. § 122.23(c).

[6] According to 40 C.F.R. § 122.23(b)(6), the term Medium CAFO includes:

> ... any AFO with the type and number of animals that fall within any of the ranges listed in paragraph (b)(6)(i) of this section and which has been defined or designated as a CAFO. An AFO is defined as a Medium CAFO if:
>
> (i) The type and number of animals that it stables or confines falls within any of the following ranges:
> (A) 200 to 699 mature dairy cows, whether milked or dry;
> (B) 300 to 999 veal calves;
> (C) 300 to 999 cattle other than mature dairy cows or veal calves. Cattle includes but is not limited to heifers, steers, bulls and cow/calf pairs;
> (D) 750 to 2,499 swine each weighing 55 pounds or more;
> (E) 3,000 to 9,999 swine each weighing less than 55 pounds;
> (F) 150 to 499 horses;
> (G) 3,000 to 9,999 sheep or lambs;
> (H) 16,500 to 54,999 turkeys;
> (I) 9,000 to 29,999 laying hens or broilers, if the AFO uses a liquid manure handling system;
> (J) 37,500 to 124,999 chickens (other than laying hens), if the AFO uses other than a liquid manure handling system;
> (K) 25,000 to 81,999 laying hens, if the AFO uses other than a liquid manure handling system;
> (L) 10,000 to 29,999 ducks (if the AFO uses other than a liquid manure handling system); or
> (M) 1,500 to 4,999 ducks (if the AFO uses a liquid manure handling system); and
>
> (ii) Either one of the following conditions are met:
> (A) Pollutants are discharged into waters of the United States through a man-made ditch, flushing system, or other similar man-made device; or
> (B) Pollutants are discharged directly into waters of the United States which

has focused on the industry because CAFOs also generate millions of tons of manure every year,[10] and "when improperly managed, [this manure] can pose substantial risks to the environment and public health." Preamble to the Final Rule at 7179.

Animal waste includes a number of potentially harmful pollutants. According to the EPA, the pollutants associated with CAFO waste principally include: (1) nutrients such as nitrogen and phosphorus; (2) organic matter; (3) solids, including the manure itself and other elements mixed with it such as spilled feed, bedding and litter materials, hair, feathers and animal corpses; (4) pathogens (disease-causing organisms such as bacteria and viruses); (5) salts; (6) trace elements such as arsenic; (7) odorous/volatile compounds such as carbon dioxide, methane, hydrogen sulfide, and ammonia; (8) antibiotics; and (9) pesticides and hormones. *See* National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitations Guidelines and Standards for Concentrated Animal Feeding Operations, 66 Fed. Reg. 2960, 2976-79 (proposed Jan. 12, 2001) [hereinafter "Proposed Rule"]; *see also* Preamble to the Final Rule at 7181.

These pollutants can infiltrate the surface waters in a variety of ways including spills and other dry-weather discharges, overflows from storage "lagoons," and discharge to the air coupled with subsequent redeposition on the landscape. *See* Preamble to the Final Rule at 7181. Perhaps the most common way by which pollutants reach the surface waters is through improper "land

[10] The USDA estimates that operations that confine livestock and poultry generate about 500 million tons of animal manure each year – over three times more raw waste than humans generate in the United States, according to the EPA. Preamble to the Final Rule at 7180.

January 12, 2001, proposed to "revise and update" the first set of CAFO regulations. *See* Proposed Rule at 2960. The EPA explained, in proposing its revisions, that the new rule aimed to address not only inadequate compliance with existing policy, but also the "changes that have occurred in the animal production industries." Proposed Rule at 2972. Specifically, the EPA pointed to the "continued trend toward fewer but larger operations, coupled with greater emphasis on more intensive production methods and specialization," a trend that – along with "increased reports of large-scale discharges from these facilities" and "continued runoff" – had contributed to "the significant increase in nutrients and resulting impairment of many U.S. waterways." *Id.*

The EPA received approximately 11,000 public comments on the proposed rule, *see* Preamble to the Final Rule at 7187, as well as an additional 450 or so comments following the publication, in November 2001 and July 2002, of Notices of Data Availability (documents that summarized new data and information presented to the EPA). *See id.* at 7187-88. Ultimately, on February 12, 2003, the EPA promulgated its Final CAFO Rule ("CAFO Rule" or "Rule"). *See* 40 C.F.R. §§ 9, 122, 123, 412; *see also* Preamble to the Final Rule at 7176.

The aspects of the Rule most relevant to the petitions before us are as follows:

(1) <u>The Duty to Apply for an NPDES Permit</u>

The Rule requires that all CAFO owners or operators must apply for an individual NPDES permit or submit a notice of intent for coverage under an NPDES general permit. *See* 40 C.F.R. § 122.23(d)(1). There is, however, an exception: Section 122.23(d)(2) provides, in effect, that an owner or operator of a Large CAFO need not seek coverage under an NPDES permit if the owner we will describe in a moment) further require that each Large CAFO develop and implement a nutrient management plan that, *inter alia,* includes a waste "application rate" that "minimize[s] phosphorus and nitrogen transport from the field to surface waters." 40 C.F.R. § 412.4(c)(2).

(3) The Discharges Subject to NPDES Requirements

The Rule provides, in § 122.23(e), that all land application discharges from a CAFO are subject to NPDES requirements, i.e., any discharge of manure, litter, or process wastewater that results from the land application of these materials by a CAFO is a discharge that is regulable and subject to NPDES permit requirements. 40 C.F.R. § 122.23(e). Where, however, CAFOs land-apply waste in accordance with site-specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients in that waste, any subsequent "precipitation-related" discharge is considered to be an "agricultural stormwater discharge" that is, under the Act, exempt from regulation. *See id.*; 33 U.S.C. § 1362(14).

(4) Effluent Limitation Guidelines

The Rule establishes effluent limitation guidelines ("ELGs") that apply to land application discharges by Large CAFOs and to the "production areas"[13] of Large CAFOs.[14] Two general

---

[13] 40 C.F.R. § 122.23(b)(8) defines production area as:

> that part of an AFO that includes the animal confinement area, the manure storage area, the raw materials storage area, and the waste containment areas. The animal confinement area includes but is not limited to open lots, housed lots, feedlots, confinement houses, stall barns, free stall barns, milkrooms, milking centers, cowyards, barnyards, medication pens, walkers, animal walkways, and stables. The manure storage area includes but is not limited to lagoons, runoff ponds, storage sheds, stockpiles, under house or pit storages, liquid impoundments, static piles, and composting piles. The raw materials storage area includes but is not limited to feed

installation of depth markers in surface and liquid impoundments (e.g., lagoons, ponds, and tanks). *See* 40 C.F.R. § 412.37; Preamble to the Final Rule at 7214-21.

DISCUSSION

Two sets of petitioners bring challenges to the CAFO Rule: the "Environmental Petitioners" (Waterkeeper Alliance, Inc., Sierra Club, Natural Resources Defense Council, Inc., and the American Littoral Society) and the "Farm Petitioners" (American Farm Bureau Federation, National Chicken Council, and the National Pork Producers Council).[15] *Amici curiae*, who represent various environmental and public health interests, join the Environmental Petitioners in some of their challenges.

All the challenges we here consider – most of which are brought by the Environmental Petitioners – can be divided into three general categories: (1) challenges to the permitting scheme established by the CAFO Rule; (2) challenges to the types of discharges subject to regulation under the CAFO Rule; and (3) challenges to the effluent limitation guidelines established by the CAFO Rule.[16] We will address each category in turn.

---

[15] We refer to both sets of petitioners as they refer to themselves.

[16] The Farm Petitioners also challenge the CAFO Rule for impermissibly assuming jurisdiction over all "surface waters," when the Clean Water Act confers upon the EPA the authority to regulate only "navigable waters," a term defined by the Act to mean "waters of the United States, including the territorial seas." 33 U.S.C. § 1362(7). The EPA has clarified, however, that the CAFO Rule employs the term "surface waters" only in an effort to distinguish surface water from groundwater and that the Agency fully recognizes that its regulatory authority encompasses only the "waters of the United States, including the territorial seas." Given these clarifications, we deny the Farm Petitioners' challenge as moot.

consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *Id.* at 43 (internal quotations and citations omitted).

With this background in mind, we turn now to the various challenges.

A. Challenges to the CAFO Rule Permitting Scheme

1. Failure to Regulate

The Environmental Petitioners broadly indict the CAFO Rule as countenancing the creation of an "impermissible self-regulatory permitting regime." More precisely, the Environmental Petitioners argue that the CAFO Rule is unlawful because: (1) it empowers NPDES authorities to issue permits to Large CAFOs in the absence of any meaningful review of the nutrient management plans those CAFOs have developed; and (2) it fails to require that the terms of the nutrient management plans be included in the NPDES permits. We agree with the Environmental Petitioners on both counts.

a. Failure to Require Permitting Authority Review

The Clean Water Act demands regulation in fact, not only in principle. Under the Act, permits authorizing the discharge of pollutants may issue only where such permits *ensure* that every discharge of pollutants will comply with all applicable effluent limitations and standards. Section 1342(a)(1) of Title 33 provides, for example, that when the EPA is, itself, issuing NPDES permits, the EPA may issue a permit for the discharge of any pollutant or combination of litter, and process wastewater, Large CAFOs must, *inter alia*, develop and implement nutrient management plans that, pursuant to paragraph(c)(2), include "application rates" that "minimize phosphorus and nitrogen transport from the field to surface waters in compliance with the technical standards for nutrient management established by the Director." *See* 40 C.F.R. § 412.4(c)(2).

As presently constituted, the CAFO Rule does nothing to *ensure* that each Large CAFO has, in fact, developed a nutrient management plan that satisfies the above requirements. The CAFO Rule does nothing to ensure, in other words, that each Large CAFO will comply with all applicable effluent limitations and standards. This is because, most glaringly, the CAFO Rule fails to require that permitting authorities review the nutrient management plans developed by Large CAFOs before issuing a permit that authorizes land application discharges.

A recent decision of the Ninth Circuit supports the conclusion we here reach. In *Environmental Defense Center, Inc. v. EPA* ("EDC"), the Ninth Circuit considered a challenge to a "Phase II" EPA rule for municipal storm sewer systems. *See* 344 F.3d 832 (9th Cir. 2003), *cert. denied*, *Texas Cities Coalition on Stormwater v. EPA*, 124 S.Ct. 2811 (2004). Among other things, the Phase II Rule allowed small municipal storm sewer systems to seek permission to discharge pollutants by submitting an individualized set of best management practices designed by each municipal storm sewer system ("stormwater management plans"), either in the form of an individual permit application or in the form of a notice of intent to comply with a general permit. *See EDC*, 344 F.3d at 842. So long as a notice of intent included a stormwater management plan, the EPA deemed a municipal storm sewer system to be in compliance with the safeguard against a municipal storm sewer system's "misunderstanding or misrepresenting its own stormwater situation and proposing a set of minimum measures for itself that would reduce discharges by far less than the maximum extent practicable." *Id.*

Like the Phase II Rule, the CAFO Rule does not require that NPDES permitting authorities review the nutrient management plans to ensure that the nutrient management plans designed by the Large CAFOs will *in fact* reduce land application discharges in a way that "achieve[s] realistic production goals, while minimizing nitrogen and phosphorus movement to surface waters." 40 C.F.R. § 412.4(c)(1). Like the Phase II Rule, the CAFO Rule does not adequately prevent Large CAFOs "from misunderstanding or misrepresenting" their specific situation and adopting improper or inappropriate nutrient management plans, with improper or inappropriate waste application rates.[19]

The EPA offers two principal arguments in defense of the permitting scheme, neither of which we find to be persuasive. First, the EPA argues that the nutrient management plan does not, itself, constitute an effluent limitation guideline but is, instead, "simply a planning tool" to

---

[19] There may well be reason to fear that Large CAFOs may misunderstand their specific situation and prepare inadequate nutrient management plans as a result. Even the EPA has acknowledged that crafting proper waste application rates is a complicated task – that is why the EPA expressly recommended, but notably did not require, that waste application rates be prepared by those who are "competent in or have an understanding of a number of technical areas, including soil science and soil fertility, nutrient application and management, crop production, soil and manure testing and results interpretation, fertilizer materials and their characteristics, BMPs [best management practices] for the management of nutrients and water, and applicable laws and regulations." Preamble to the Final Rule at 7213. Tellingly, the EPA also specifically recognized, in the Preamble to the CAFO Rule, that "USDA, and other organizations such as the American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, and a number of land grant universities, recommend that nutrient management plans be prepared by trained and certified specialists." *Id.*

standards are based on *field*-specific assessments. But Large CAFOs ultimately set application rates based on *site*-specific assessments of the relevant field conditions, as the EPA concedes in the Preamble to the Rule. *See* Preamble to the Final Rule at 7209 ("Today's rule requires Large CAFOs to determine and implement *site-specific* nutrient application rates that are consistent with the technical standards for nutrient management established by the permitting authority.") (emphasis added); *see also id.* at 7213 ("The nutrient management plan is the tool CAFOs must use to assess soil and other field conditions at their operation . . . to determine the *site-specific* nitrogen or phosphorus-based rate at which manure, litter, and other process wastewaters are to be applied.") (emphasis added).[20] By not providing for permitting authority review of these application rates, the CAFO Rule fails to adequately prevent Large CAFOs from "misunderstanding or misrepresenting" the application rates they must adopt in order to comply with state technical standards. The CAFO Rule does not ensure that the Large CAFOs will, in fact, develop nutrient management plans – and waste application rates – that comply with all applicable effluent limitations and standards.

b. Failure to Require that the Terms of the Nutrient Management Plans be

[20] On its face, the Rule requires CAFOs – like state permitting authorities – to develop nutrient management plans based on "field-specific assessments." 40 C.F.R. § 412.4(c)(1). However, it is clear that each CAFO must make such "field-specific assessments" on a site-by-site basis; that is, each CAFO must determine what the relevant field conditions are at its site in order to determine its site-specific waste application rate. *See* Preamble to the Final Rule at 7209 ("Today's rule requires Large CAFOs to determine and implement *site-specific* nutrient application rates that are consistent with the technical standards for nutrient management established by the permitting authority.") (emphasis added); *see also id.* at 7213 ("The nutrient management plan is the tool CAFOs must use to assess soil and other field conditions at their operation . . . to determine the *site-specific* nitrogen or phosphorus-based rate at which manure, litter, and other process wastewaters are to be applied.") (emphasis added).

biological, and other constituents which are discharged from point sources . . ." 33 U.S.C. § 1362(11) (emphasis added). There is no doubt that under the CAFO Rule, the only restrictions actually imposed on land application discharges are those restrictions imposed by the various terms of the nutrient management plan, including the waste application *rates* developed by the Large CAFOs pursuant to their nutrient management plans. Indeed, the requirement to develop a nutrient management plan constitutes a restriction on land application discharges only to the extent that the nutrient management plan actually imposes restrictions on land application discharges. To accept the EPA's contrary argument – that *requiring* a nutrient management plan is itself a restriction on land application discharges – is to allow semantics to torture logic.

Because we believe that the terms of the nutrient management plans constitute effluent limitations, we hold that the CAFO Rule – by failing to require that the terms of the nutrient management plans be included in NPDES permits – violates the Clean Water Act and is otherwise arbitrary and capricious in violation of the Administrative Procedure Act.

2. <u>Lack of Public Participation</u>

______The Environmental Petitioners also argue, and we here find, that the permitting scheme established by the CAFO Rule violates the Clean Water Act's public participation requirements and is otherwise arbitrary and capricious under the Administrative Procedure Act.

Congress clearly intended to guarantee the public a meaningful role in the implementation of the Clean Water Act. The Act unequivocally and broadly declares, for example, that "[p]ublic participation in the development, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program established by the Administrator or any State under this Act shall be deprives the public of its right to assist in the "development, revision, and enforcement of ... [an] *effluent limitation*." 33 U.S.C. § 1251(e) (emphasis added). More specifically, the CAFO Rule prevents the public from calling for a hearing about – and then meaningfully commenting on – NPDES permits before they issue. *See* 33 U.S.C. §§ 1342(a), 1342 (b)(3). The CAFO Rule also impermissibly compromises the public's ability to bring citizen-suits, a "proven enforcement tool" that "Congress intended [to be used...] to both spur and supplement government enforcement actions." Clean Water Act Amendments of 1985, Senate Environment and Public Works Comm., S. Rep. No. 50, 99th Cong., 1st Sess. 28 (1985). Under the CAFO Rule, as written, citizens would be limited to enforcing the mere requirement to develop a nutrient management plan, but would be without means to enforce the terms of the nutrient management plans because they lack access to those terms. This is unacceptable.

And even assuming, *arguendo*, that the nutrient management plans did not themselves constitute effluent limitations, we would still hold that the CAFO Rule violates the Act's public participation requirements. Nutrient management plans are, even under the EPA's own theory of the CAFO Rule, a critical indispensable feature of the "plan, or program established by the Administrator or any State" in order to regulate Large CAFO land application discharges. 33 U.S.C. § 1251(e). The EPA itself has stated in the Preamble to the Rule that "the only way to ensure that non-permitted point source discharges of manure, litter, or process wastewaters from CAFOs do not occur is to require . . . [land application] in accordance with site specific nutrient management practices." Preamble to the Final Rule at 7198. Since nutrient management plans embody all the relevant "site specific nutrient management practices," it is clear that, even *combination of pollutants*. *See* 33 U.S.C. § 1342 (a)(1) ("the Administrator may, after opportunity for public hearing, issue a permit for *the discharge of any pollutant, or combination of pollutants*") (emphasis added); *see also* 33 U.S.C. § 1342(b) (authorizing states to administer permit programs for "discharges into navigable waters"). In other words, unless there is a "discharge of any pollutant," there is no violation of the Act, and point sources are, accordingly, neither statutorily obligated to comply with EPA regulations for point source discharges, nor are they statutorily obligated to seek or obtain an NPDES permit.

Congress left little room for doubt about the meaning of the term "discharge of any pollutant." The Act expressly defines the term to mean "(A) any addition of any pollutant to navigable waters from any point source, [or] (B) any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft." 33 U.S.C. § 1362(12). Thus, in the absence of an actual addition of any pollutant to navigable waters from any point, there is no point source discharge, no statutory violation, no statutory obligation of point sources to comply with EPA regulations for point source discharges, and no statutory obligation of point sources to seek or obtain an NPDES permit in the first instance.

The CAFO Rule violates this statutory scheme. It imposes obligations on all CAFOs regardless of whether or not they have, in fact, added any pollutants to the navigable waters, i.e. discharged any pollutants. After all, the Rule demands that every CAFO owner or operator either apply for a permit – and comply with the effluent limitations contained in the permit – or affirmatively demonstrate that no permit is needed because there is "no potential to discharge." *See* 40 C.F.R. §§ 122.23(d) and (f). In the EPA's view, such demands are appropriate because all sources *of discharge of pollutants* in accordance with the provisions of this chapter." 33 U.S.C. § 1311(e) (emphasis added). Thus, while point sources are statutorily defined to include potential dischargers, effluent limitations can, pursuant to 33 U.S.C. § 1311(e), be applied only to "point sources of *discharge of pollutants*," i.e. those point sources that are *actually* discharging.[21] *Id.*

The EPA also argues that the "duty to apply" provision is consistent with the Act's goal of not just reducing, but eliminating water pollution. It is true that the duty to apply provision is consistent with the broad goal of eliminating water pollution. However, the duty to apply flatly contravenes the statute's text, which more specifically defines – and circumscribes – the powers that Congress conferred upon the EPA in order to effectuate the Clean Water Act's goals. Principles of statutory construction forbid us from sanctioning EPA conduct that is plainly inconsistent with a statute's specific text. *See Caminetti v. United States*, 242 U.S. 470, 485 (1917) ("It is elementary that the meaning of a statute must, in the first instance, be sought in the language in which the act is framed, and if that is plain . . . the sole function of the courts is to enforce it according to its terms.").

For all these reasons, we believe that the Clean Water Act, on its face, prevents the EPA from imposing, upon CAFOs, the obligation to seek an NPDES permit or otherwise demonstrate that they have no potential to discharge. *See Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc.,* 467 U.S. 837, 842-43 (1984) (where Congress has "directly spoken to the precise

---

[21] We also point out that our reading of 33 U.S.C. § 1311(e) does not render superfluous the "may be" language included in the statutory definition of point source. In our view, the "may be" language can be read to clarify the reach of the EPA's power to seek injunctive relief. *See* 33 U.S.C. § 1319(b); *see generally Weinberger v. Romero-Barcelo,* 456 U.S. 305 (1982).

carves out an exception where the discharge in question is "an agricultural storm water discharge," *id.* – a category of discharges that the Act exempts from regulation via the statutory definition of "point source." *See* 33 U.S.C. § 1362(14). More specifically, the Rule classifies, as agricultural stormwater, any "precipitation-related discharge of manure, litter, or process wastewater from land areas under the control of a CAFO" where the "manure, litter or process wastewater has [otherwise] been applied in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization." 40 C.F.R. § 122.23(e).

The Environmental Petitioners contend that this approach violates the Clean Water Act and is otherwise arbitrary and capricious in violation of the Administrative Procedure Act because the Clean Water Act's definition of "point source" requires regulation of *all* CAFO discharges, notwithstanding the fact that agricultural stormwater discharges are otherwise deemed exempt from regulation. We disagree.

The Act defines the term "point source" as follows:

> "[P]oint source" means any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, *concentrated animal feeding operation*, or vessel or other floating craft, from which pollutants are or may be discharged. *This term does not include agricultural stormwater discharges* and return flows from irrigated agriculture.

33 U.S.C. § 1362(14) (emphasis added). Contrary to the views of the Environmental Petitioners, we find that this provision is self-evidently ambiguous as to whether CAFO discharges can ever constitute agricultural stormwater. Here, the Act expressly defines the term point source to *include* "concentrated animal feeding operations;" the Act expressly defines "point source" to

intent of a subsequent Congress, in the same way that "*subsequent* legislative history is a hazardous basis for inferring the intent of an *earlier* Congress." *Pension Benefit Guaranty Corp. v. LTV Corp.*, 496 U.S. 633, 650 (1990) (emphasis added) (citation omitted). And, in any event, none of the legislative history from 1972 comes close to casting doubt on the construction we permit here.[23]

Precedent from this circuit also supports the construction that the EPA advances and we here permit. In *Concerned Area Residents for the Environment v. Southview Farm*, this Court considered the agricultural stormwater exemption and its statutory relationship to point source discharges, specifically CAFO discharges. 34 F.3d 114 (2d Cir. 1994). The essence of the Court's holding was not, as Environmental Petitioners contend, that discharges from an area under the control of a CAFO can *never* qualify for the agricultural stormwater exemption. Rather, the Court held that a discharge from an area under the control of a CAFO can be considered *either* a CAFO discharge that is subject to regulation *or* an agricultural stormwater discharge that is not subject to regulation. Whether or not a discharge is regulable turned, in the

[23] For example, the Environmental Petitioners substantially rely on a statement from Senator Robert Dole acknowledging the environmental threat posed by "[p]recipitation runoff" from areas storing animal and poultry waste. 2 A LEGISLATIVE HISTORY OF THE WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972, Committee Print Compiled for the Senate Committee on Public Works by the Library of Congress, Ser. No. 93-1, p. 1295 (1973). Senator Dole did not at all suggest that the Act aimed, in fact, to regulate precipitation runoff. His statement about precipitation runoff was merely part of a larger discussion about the general environmental threat posed by animal and poultry waste. To wit, he stated that: "In these modern facilities, the use of bedding and litter has been greatly reduced; consequently, the manure which is produced remains essentially in the liquid state and is much more difficult to handle without odor and pollution problems. Precipitation runoff from these areas picks up high concentrates of pollutants, which reduce oxygen levels in receiving streams and lakes and accelerate the eutrophication process." *Id.*

Environmental Petitioners contend that CAFOs must be viewed as industrial, not agricultural. We disagree. Dictionaries from the period in which the agricultural stormwater exemption was adopted define "agriculture" or "agricultural" in a way that can permissibly be construed to encompass CAFOs. For example, Webster's New World Dictionary defined the term "agriculture" to include, *inter alia*, "work of cultivating the soil, producing crops, and raising livestock." WEBSTER'S NEW WORLD DICTIONARY OF AMERICAN ENGLISH 26 (3rd College Ed. 1988). The Oxford English Dictionary similarly defined agriculture to include, *inter alia*, "cultivating the soil," "including the allied pursuits of gathering in the crops and rearing live stock." I THE OXFORD ENGLISH DICTIONARY 267 (2d Ed. 1989). Here, there is no question that CAFOs "rais[e]" or "rear" livestock and, because land-applied manure is used as fertilizer, "cultivat[e] the soil" as well. *Cf.* Preamble to the Final Rule at 7197 ("When manure or process wastewater is applied in accordance with practices designed to ensure appropriate agricultural utilization of nutrients, it . . . fulfills an important agricultural purpose, namely the fertilization of crops . . ."). As a result, we cannot say that the EPA has impermissibly treated CAFOs as agricultural in character.

Additionally, we note again that the CAFO Rule classifies precipitation-related discharges as agricultural stormwater only where CAFOs have otherwise applied "manure, litter or process wastewater . . . in accordance with site specific nutrient management practices that ensure appropriate *agricultural* utilization." 40 C.F.R. § 122.23(e) (emphasis added). Thus, even the CAFO Rule's application of the agricultural stormwater exemption is expressly tethered conduit, well, discrete fissure, container, rolling stock, *concentrated animal feeding operation*, or vessel or other floating craft, *from which pollutants are or may be discharged*. 33 U.S.C. § 1362(14) (emphasis added). Given that the Act expressly defines "point source" to include concentrated animal feeding operations, the Farm Petitioners can prevail on their challenge only if we find that the Act prohibits classifying a land application discharge as a discharge "*from*" a CAFO. We believe, however, that the Act not only permits, but demands, that land application discharges be construed as discharges "from" a CAFO to the extent that they are not otherwise agricultural stormwater.

As this Court previously held in *Catskill Mountains Chapter of Trout Unlimited, Inc. v. City of New York*, the term point source refers to "the proximate source from which the pollutant is directly introduced to [a] destination water body." *See* 273 F.3d 481, 493 (2d Cir. 2001).[25] Here, CAFOs are unquestionably "the proximate source" of any discharge of pollutants from land application areas under their control to the surface waters (again, except where those discharges are agricultural stormwater). But for the application of manure by the CAFO to the land, there could never be a discharge of pollutants from the land to the surface waters. Thus, any land application discharge that is not agricultural stormwater is, definitionally, a discharge

[25] We note that, in this respect, *Catskill Mountains* is in complete accord with *Southview Farm*. Implicit in *Southview Farm* is the idea that when a discharge from a land application area under the control of a CAFO is primarily caused by rain, such a discharge is not subject to regulation because the rain – not the CAFO – is the proximate source of the discharge; but when "run-off [is] primarily caused by the over-saturation of the fields rather than the rain and [there are] sufficient quantities of manure . . . present," *Southview Farm*, 34 F.3d at 121, such a discharge *is* subject to regulation because the CAFO – not the rain – is the proximate source of the discharge.

90% of CAFO-generated waste is land applied." EPA, STATE COMPENDIUM: PROGRAMS AND REGULATORY ACTIVITIES RELATED TO ANIMAL FEEDING OPERATIONS 13 (May 2002). Given this fact and given that, under the Rule, only discharges from land application areas "under [the] control" of a CAFO are subject to regulation, *see* 40 C.F.R. § 122.23(e), the EPA could quite reasonably conclude that runoff from a land application area is runoff from a CAFO.

Thus, we reject the challenge to the CAFO Rule's regulation of land application discharges, including "uncollected" discharges.

C. <u>Challenges to the CAFO Rule Effluent Limitations</u>

The Environmental Petitioners bring a host of challenges to: (1) the CAFO Rule's technology-based effluent limitation guidelines; and (2) the CAFO Rule's failure to promulgate additional water quality based effluent limitations.

Again, we note that the specific effluent limitations contained in each individual NPDES permit are dictated by the terms of more general "effluent limitation guidelines" ("ELGs"), which are separately promulgated by the EPA. *Cf. EPA v. California, ex rel. State Water Res. Control Bd.*, 426 U.S. 200, 205 (1976) ("An NPDES permit serves to transform generally applicable effluent limitations and other standards including those based on water quality into the obligations . . . of the individual discharger."). ELGs, and the effluent limitations established in accordance with them, are technology-based restrictions on water pollution; they are technology-based because they are established in accordance with various technological standards that the Act statutorily provides and that, pursuant to the Act, vary depending upon the type of pollutant involved, the type of discharge involved, and whether the point source in question is new or practices for land application areas; and (4) provide an opportunity for alternative performance standards based upon "site-specific alternative technologies that achieve a quantity of pollutants discharged from the production area equal to or less than the quantity of pollutants that would be discharged under the baseline." *See* 40 CFR § 412.31(a)(2).

The Environmental Petitioners present several challenges to the technology-based ELGs promulgated by the EPA. Specifically, they challenge the BAT-based ELGs, the BCT-based ELGs for pathogens, and the new source performance standard adopted for Subpart D CAFOs. The Environmental Petitioners also challenge the EPA's decision not to impose additional water quality based effluent limitations. We address each set of challenges in turn.

1. <u>Challenges to the BAT Standards</u>

The Environmental Petitioners contend that the CAFO Rule's BAT-based ELGs – i.e. the ELGs reflecting the best available technology economically achievable ("BAT"), *see* 33 U.S.C. § 1311(b)(2)(A) – violate the Clean Water Act, or are otherwise arbitrary and capricious, in three respects. To wit, the Environmental Petitioners claim that: (a) in establishing the BAT standards, EPA failed to consider the best-performing technologies in the CAFO industry; (b) EPA improperly abandoned a more suitable option as BAT for beef and cattle CAFOs (Subpart C CAFOs); and (c) the EPA improperly rejected a more suitable option for swine, poultry and veal CAFOs (Subpart D CAFOs). We deny all these challenges.

a. <u>Failure to Consider the Best Performing Technologies</u>

The Environmental Petitioners sweepingly contend that, in developing its BAT standards, better than any other available, economically achievable technologies. And it generally justified this decision within the bounds of its discretion. *See, e.g., id.* at 7215 ("One recent study from Iowa State University suggested 76 percent of earthen manure structures lacked appropriate accompanying management and maintenance activities. Another study in North Carolina stated more than 90 percent of violations were attributed to operation and management deficiencies.").

To be sure, the CAFO Rule does not *explicitly* identify the single, existing best-performing CAFO in each category or subcategory of the Rule. However, it is obvious that the CAFO Rule *substantively* establishes standards that make "reference to the best performer in any industrial category" – and nothing in the Act or the legislative history indicates that any more was required of the EPA. *See* 1 A LEGISLATIVE HISTORY OF THE WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972, Committee Print Compiled for the Senate Committee on Public Works by the Library of Congress, Ser. No. 93-1, p. 170 (1973). We believe that in all BAT subcategories, the EPA has either adopted the technology employed by the best performers or declined to do so for permissible reasons. Indeed, the Environmental Petitioners cannot identify any specific performance standard that the EPA failed to consider or rejected for impermissible reasons in adopting its BAT standards. Thus, the EPA has complied with its statutory duties in setting the BAT standards, and we consequently reject the Environmental Petitioners' challenge to them.

b. <u>BAT for Beef and Cattle CAFOs ("Subpart C CAFOs")</u>

The Environmental Petitioners also challenge the BAT standards on the narrower ground that the EPA improperly abandoned a more suitable option as BAT for beef and cattle (Subpart

Option 7 would require the same controls as Option 2, but would also prohibit manure application to frozen, snow-covered, or saturated ground.

See EPA, PROPOSED RULE DEVELOPMENT DOCUMENT 10-14 to 10-21 (Jan. 2001).

The EPA initially proposed adopting Option 3 as BAT for Subpart C CAFOs, *see* Proposed Rule at 3061-62, but ultimately adopted Option 2. *See* Preamble to the Final Rule at 7215-16. That is to say, the EPA initially proposed that various groundwater-related requirements be uniformly imposed on CAFOs, but ultimately decided that groundwater-related requirements be implemented, as necessary, on a case-by-case basis. *See id.*; Proposed Rule at 3062.[26] The Environmental Petitioners claim that the rejection of Option 3's groundwater requirements is unsupported in the record. The EPA argues, in opposition, that it reasonably determined that Option 2 is better technology than Option 3, and that Option 3 would impose prohibitive economic costs on

---

[26] As the EPA explained in the Preamble to the Proposed Rule and reaffirmed in its brief in this consolidated petition,

> even under Option 2, permit writers [are] required to consider whether a facility is located in an area where its hydrogeology makes it likely that the ground water underlying the facility is hydrologically connected to surface water and whether a discharge to surface water from the facility through such hydrologically connected ground water may cause or contribute to a violation of State water quality standards. In cases where such a determination was made by the permit writer, he or she would impose appropriate conditions to prevent discharge via a hydrologic connection [and that these conditions] would be included in the permit.

Proposed Rule at 3062. It is thus clear that when the EPA stated, in the Preamble to the Final Rule, that "requirements limiting the discharge of pollutants to surface water via groundwater ... are beyond the scope of today's ELGs," Preamble to the Final Rule at 7216, the EPA meant only that uniform national requirements are beyond the scope of today's ELGs. The EPA did not, in other words, mean to suggest that NPDES authorities lacked the power to impose groundwater-related requirements on a case-by-case basis, where necessary.

Inst. v. EPA, 787 F.2d 965, 972 (5th Cir. 1986) ("EPA would disserve its mandate were it to tilt at windmills by imposing BAT limitations which removed de minimis amounts of polluting agents from our nation's waters, while imposing possibly disabling costs upon the regulated industry."). EPA's final economic analysis showed a nearly six-fold increase in the number of beef, dairy, and heifer CAFOs projected to close under Option 3, were that Option, rather than Option 2, adopted. This amounted to a potential facility closure rate under Option 3 of 29% for heifer CAFOs, 19% for beef, and 12% for the subcategory as a whole. *See* EPA, FINAL RULE ECONOMIC ANALYSIS 3-22 (Dec. 2002). At the same time, the EPA found that while it was difficult to quantify on an industry-wide basis the pollutant reduction that would be associated with nationally-applicable ELGs for groundwater controls, its pollution reduction models showed a difference of less than 1% difference between the nitrogen load reduction achieved under Option 3 as opposed to Option 2. *See* EPA, PROPOSED RULE DEVELOPMENT DOCUMENT 12-15 (Jan. 2001).

In light of all the above, we deny the Environmental Petitioners' challenge to the selection of Option 2 as BAT for Subpart C CAFOs.

c. <u>BAT for Swine, Poultry and Veal CAFOs ("Subpart D CAFOs")</u>

Although the EPA initially proposed Option 5 as BAT for Subpart D CAFOs, *see* Proposed Rule at 3063-64; the EPA ultimately determined that the costs of Option 5 would not be economically achievable and, accordingly, adopted Option 2. *See* Preamble to the Final Rule at 7218-19. The Environmental Petitioners here challenge the EPA's rejection of Option 5 on the grounds that: (1) the EPA gave undue consideration to cost; (2) the EPA's economic modeling is flawed; and (3) even assuming the reasonableness of the EPA's economic models, the Agency has, whole, vulnerable to closure. *See* EPA, FINAL RULE ECONOMIC ANALYSIS at 3-19 to 3-22 (Dec. 2002).[27]

Environmental Petitioners challenge the probity of the EPA's economic modeling, because, in their view, the EPA should have assumed that CAFOs could offset their compliance costs by obtaining state and federal funding ("cost-share assistance") and by passing the costs on to consumers ("cost passthrough"). In evaluating this challenge, we wish to make clear, at the outset, that the EPA's determinations about costs, as well as the methodology that the EPA employs in making such determinations, are entitled to deference.[28] "While EPA must take seriously its statutory duty to consider cost, courts of review should be mindful of the many problems inherent in an undertaking of this nature and uphold a reasonable effort made by the Agency." *Nat'l Wildlife Fed'n v. EPA*, 286 F.3d 554, 563 (D.C. Cir. 2002) (quoting *FMC Corp. v. Train*, 539 F.2d 973, 979 (4th Cir. 1976)). A reviewing court can neither "second-guess EPA's analysis nor 'undertake [its] own economic study'; rather, the court must 'uphold the regulations if EPA has established in the record a reasonable basis for its decision.'" *Id.* at 565 (citation omitted); *see also Chem. Mfrs. Ass'n v. EPA*, 870 F.2d 177, 250 (5th Cir. 1989) ("a 'court's inquiry will be limited to whether the Agency considered the cost of technology, along with the other statutory factors, and whether its conclusion

[27] Because the Clean Water Act "imposes no obligation on EPA to subdivide industries so that each point-source category contains identical producers," *BASF Wyandotte Corp. v. Costle*, 598 F.2d 637, 655 (1st Cir. 1979), we reject the Environmental Petitioners' claim that EPA should segregate poultry CAFOs out of Subpart D and separately consider the costs of imposing Option 5 on them.

[28] We agree with the Environmental Petitioners that the EPA's economic determinations are not – as the EPA puts it – entitled to "heightened deference." Deference, not "heightened" deference, is due.

Second, with respect to cost passthrough, we believe that EPA determined, within the bounds of its discretion, that the possibility of passing costs on to consumers was also too uncertain to rely upon. The EPA explained in its proposed rule economic analysis that farmers are at the bottom of a long food marketing chain, subject to imperfect market conditions characterized by "local oligopsony conditions, or 'few buyers'." *See* EPA, PROPOSED RULE ECONOMIC ANALYSIS 4-60 (Jan. 2001), citing Rogers and Sexton, *Assessing the Importance of Oligopsony Power in Agricultural Markets*, 76 AMER. J. AGR. ECON. 1143-50, Dec. 1994. Given the limited bargaining power of those who raise and confine animals, *see id.* at 2-25 to 2-26, the EPA thus concluded that "[i]ndividual farmers generally have a limited ability to pass on increased costs associated with regulations" and that, as a result, it would be a mistake to rely on cost passthrough. *See id.* at 4-60. We cannot say that the EPA acted unreasonably in making these determinations.[29]

Having rejected the challenges to the soundness of the EPA's economic models, we move finally to Environmental Petitioners' claim that, even assuming the reasonableness of the EPA's economic modeling, the results do not support a finding that Option 5 was economically unachievable because the Agency has, in other contexts, deemed "economically achievable" technologies that produced the same or worse economic costs. We reject this claim as well. The EPA here estimated that Option 5 would expose up to 11% of Subpart D CAFOs to financial stress sufficient to create a risk of closure. *See* EPA, FINAL RULE ECONOMIC ANALYSIS at 3-22 (Dec.

---

[29] We also uphold, as reasonable, EPA's decision not to rely on "long-run market adjustments," given that these, too, are inherently uncertain and difficult to predict and that, in any event, adjustments for the long-run might "mask severe financial effects at regulated CAFOs in the short-run." *See* EPA, FINAL RULE ECONOMIC ANALYSIS 2-64 (Dec. 2002).

Environmental Petitioners in part.

The EPA does not dispute that it is required, under the Clean Water Act, to promulgate BCT-based effluent guidelines for at least one pathogen, namely fecal coliform. *See* 33 U.S.C. § 1314(a)(4) (listing fecal coliform as a conventional pollutant subject to regulation); 33 U.S.C. § 1311(b)(2)(E) (requiring the promulgation of BCT standards for pollutants). That is to say, the EPA does not dispute that it is required to promulgate a technology standard for achieving pathogen reductions that reflects the *best* conventional pollutant control technology. The EPA also does not here dispute that there is a more than *de minimis* presence of pathogens in the animal waste regulated by the CAFO Rule. In the Preamble to the CAFO Rule, for example, the EPA expressly acknowledges "the presence of pathogens in animal wastes and the potential risk they pose to human health and the environment." Preamble to the Final Rule at 7217. *See also* EPA, RESPONSE TO COMMENTS ON THE NPDES PERMITTING REQUIREMENTS AND EFFLUENT LIMITATIONS GUIDELINES FOR CONCENTRATED ANIMAL FEEDING OPERATIONS A-8 (Dec. 2002) ("EPA recognizes the presence of pathogens in animal wastes and the potential risk they pose to human health and the environment"); Proposed Rule at 2977 (noting that livestock manure "contains countless microorganisms, including bacteria, viruses, protozoa, and parasites," that "[m]ultiple species of pathogens may be transmitted directly from a host animal's manure to surface water" and that "[o]ver 150 pathogens found in livestock manure are associated with risks to humans").

The EPA argues that, notwithstanding the above, its failure to impose any BCT-based ELGs specifically designed to achieve pathogen reductions is justified. Principally, the EPA argues that: (1) the pathogen controls it did evaluate, most of which appear to relate to the use or potential use

Accordingly, we grant the petition to the extent that Environmental Petitioners challenge the EPA's failure to impose ELGs specifically designed to reduce pathogens in CAFO discharges as a violation of the Clean Water Act.

3. <u>Challenge to the New Source Performance Standard for Swine, Poultry, and Veal</u>

The Environmental Petitioners claim that the EPA's "new source performance standard" for the production areas of swine, poultry, and veal CAFOs is arbitrary and capricious and that – because the EPA introduced a change to the standard that was not subject to public comment – the new source performance standard for the production areas of swine, poultry, and veal CAFOs violates the Clean Water Act's public participation requirements. We agree with them in part.

The Clean Water Act requires the EPA to promulgate "New Source Performance Standards" ("NSPS") for new, as opposed to already existing, sources of pollution. *See* 33 U.S.C. § 1316. The Act provides that these standards must "reflect the greatest degree of effluent reduction which the Administrator determines to be achievable through application of the best available demonstrated control technology, processes, operating methods, or other alternatives, including, where practicable, a standard permitting no discharge of pollutants." 33 U.S.C. §1316(a)(1). The Act further requires that the EPA "take into consideration the cost of achieving such effluent reduction, and any non-water quality, environmental impact and energy requirements." 33 U.S.C. § 1316(b)(1)(B). And we note that the EPA is given "considerable discretion to weigh and balance the various factors required by statute to set [NSPS]." *Riverkeeper, Inc. v. EPA*, 358 F.3d 174, 195 (2d Cir. 2004) (citation omitted).

The EPA initially proposed that the NSPS for the production areas of swine, poultry and veal the record for either: (1) the EPA's decision to allow CAFOs to comply with the "total prohibition" requirement by designing, operating, and maintaining a facility to contain the runoff from a 100-year, 24-hour rainfall event; or (2) the EPA's decision to allow CAFOs to comply with the "total prohibition" requirement through alternative performance standards.

With respect to the former, the EPA claims that the "100-year, 24-hour rainfall event" design standard is functionally equivalent to or a logical outgrowth of a total prohibition standard. The EPA has not, however, adequately substantiated this claim. For example, the EPA never modeled the potential overflows and pollutant loads from a system with a 100-year, 24-hour storm event design capacity; so far as we can tell, the EPA modeled only the potential overflows and pollutant loads from a system with a 25-year, 24-hour storm event. And while certain studies may have shown that the production area BMPs adopted by the CAFO Rule would have substantially prevented the production area discharges documented in the record, we think it obvious that *substantially preventing* discharges is not the same as prohibiting them outright.

With respect to the latter, the EPA has not justified in any way – let alone with adequate support in the record – its decision to allow a CAFO to comply with the total prohibition standard through an alternative standard permitting production area discharges so long as the CAFO's aggregate pollution is equivalent to or lower than what it would have been without the production area discharges.

Additionally, because the EPA did not indicate, until the adoption of the final rule, that it was considering either the 100-year, 24-hour rainfall event option or the possibility of alternative performance standards, we find that the EPA's decision to adopt such provisions as part of the NSPS best available technology." 2 A LEGISLATIVE HISTORY OF THE WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972, Committee Print Compiled for the Senate Committee on Public Works by the Library of Congress, Ser. No. 93-1, p. 1464 (1973).

The CAFO Rule does not, here, promulgate any WQBELs. This much is clear. And this does not present a problem to the extent that the Rule fails to promulgate – and bars the states from promulgating – WQBELs for any "agricultural stormwater discharge," as that term is defined in 40 C.F.R. § 122.23(e).[32] Agricultural stormwater discharges are, after all, statutorily exempt from any effluent limitations, including WQBELs, because they are not point source discharges. *See* 33 U.S.C. § 1362(14).

What is fully unclear is: (1) why the CAFO Rule exempts discharges other than agricultural

[32] The Environmental Petitioners argue that the Preamble to the Final Rule can be construed to give the term "agricultural stormwater discharge" a broader definition than the one provided in 40 C.F.R. § 122.23(e). Because the Preamble at one point states that where a CAFO has developed site specific practices to ensure appropriate agricultural utilization of nutrients, "*[a]ny remaining discharge* ... would be covered by the agricultural storm water exemption," the Environmental Petitioners claim that the agricultural stormwater exemption might be read to include even "dry weather discharges," i.e., discharges not caused by rain. Preamble to the Final Rule at 7198. We disagree. First and most importantly, the CAFO Rule itself provides that only a "precipitation-related discharge" can be classified as agricultural stormwater. 40 C.F.R. § 122.23(e). Dry-weather discharges are, by definition, not precipitation-related. Second, the Preamble expressly states – in the paragraph preceding the statement that the Environmental Petitioners construe as suggesting a broader definition of agricultural stormwater – that "any dry weather discharge of manure or process wastewater resulting from its application to land area [sic] under the control of a CAFO would not be considered an agricultural storm water discharge and would thus be subject to Clean Water Act requirements." Preamble to the Final Rule at 7198. Thus, the agricultural stormwater exemption encompasses only those discharges that the CAFO Rule defines as agricultural stormwater, that is, a "precipitation-related discharge of manure, litter, or process wastewater from land areas under the control of a CAFO" where the "manure, litter or process wastewater has [otherwise] been applied in accordance with site specific nutrient management practices that ensure appropriate agricultural utilization." 40 C.F.R. § 122.23(e).

WQBELs are needed to assure that CAFO discharges will not "interfere with the attainment or maintenance of that water quality in a specific portion of the navigable waters which shall assure protection of public health, public water supplies, agricultural and industrial uses, and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water." 33 U.S.C. § 1312(a).

Additionally, we find that the Preamble to the Rule is ambiguous about whether states may promulgate WQBELs for discharges other than agricultural stormwater discharges as that term is defined in 40 C.F.R. § 122.23(e). On the one hand, the Preamble does, at one time, seem to suggest that states may promulgate WQBELs; it provides that "[a]lthough, as noted above, manure and process wastewater discharges from the land application area are not directly subject to water quality-based effluent limits, EPA encourages States to address water quality protection issues in their technical standards for determining appropriate land application practice." Preamble to the Final Rule at 7198. On the other hand, the Preamble elsewhere says that where a CAFO has implemented site-specific practices designed to ensure appropriate agricultural utilization of nutrients, it is free from *any* further regulation. To wit, the Preamble states:

> In explaining how the scope of CAFO point source discharges is limited by the agricultural storm water exemption, EPA intends that this limitation will provide a "floor" for CAFOs that will ensure that, where a CAFO is land applying manure, litter or process wastewater in accordance with site specific practices designed to ensure appropriate agricultural utilization of nutrients, *no further effluent limitations will be authorized, for example, to ensure compliance with water quality standards*.

---

other, about the propriety of imposing WQBELs, that determination must be reasonable and supported in the record, i.e., not arbitrary and capricious.

issue permits that do not include the terms of the nutrient management plans and that do not provide for adequate public participation; and (3) require CAFOs to apply for NPDES permits or otherwise demonstrate that they have no potential to discharge. We also remand other aspects of the CAFO Rule to the EPA for further clarification and analysis. Specifically, we direct the EPA to: (1) definitively select a BCT standard for pathogen reduction; and (2) clarify – via a process that adequately involves the public – the statutory and evidentiary basis for allowing Subpart D CAFO's to comply with the new source performance standard by either: (a) designing, constructing, operating and maintaining production areas that could contain all manure, litter and process wastewater including the runoff and the direct precipitation from a 100-year, 24-hour rainfall event; or (b) complying with alternative performance standards that allow production area discharges, so long as such discharges are accompanied by an equivalent or greater reduction in the quantity of pollutants released to other media. Additionally, we direct the EPA to clarify the statutory and evidentiary basis for failing to promulgate water quality based effluent limitations for discharges other than agricultural stormwater discharges, as that term is defined in 40 C.F.R. § 122.23(e), and also direct the EPA to clarify whether states may develop water quality based effluent limitations on their own. We uphold the CAFO Rule in all other respects.

United States Court of Appeals
Fifth Circuit
FILED
June 16, 2005
Charles R. Fulbruge III
Clerk

IN THE UNITED STATES COURT OF APPEALS
FOR THE FIFTH CIRCUIT

No. 03-60506

TEXAS INDEPENDENT PRODUCERS AND ROYALTY OWNERS ASSOCIATION, et al.,

Petitioners,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY,

Respondent.

ON PETITION FOR REVIEW FROM THE ENVIRONMENTAL PROTECTION AGENCY

Before JOLLY, DAVIS and CLEMENT, Circuit Judges.

W. EUGENE DAVIS, Circuit Judge:

Petitioners filed their petition to review a final rule promulgated by the Environmental Protection Agency (EPA) issued under the Clean Water Act (CWA). The appeal was taken from Final Rule 70 FR 2832, which deferred the National Pollution Discharge Elimination System (NPDES) permit requirement for certain oil and gas construction sites until March 10, 2005. Since then, EPA has promulgated Final Rule 40 CFR Part 122 on March 9, 2005, which further delays the date by which small oil and gas construction sites must obtain permits until June 12, 2006. For the reasons included a limitation on permit requirements for certain oil, gas and mining operations. Section 402(l)(2) expressly prohibited EPA from requiring a permit for stormwater discharges from oil and gas activities, unless the discharges were contaminated by contact with materials located on the site of such operations. The exemption reads as follows:

> The Administrator shall not require a permit under this section, nor shall the Administrator directly or indirectly require any State to require a permit, for discharges of stormwater runoff from mining operations or oil and gas exploration, production, processing, or treatment operations or transmission facilities, composed entirely of flows which are from conveyances or systems of conveyances (including but not limited to pipes, conduits, ditches, and channels) which are not contaminated by contact with, or do not come into contact with, any overburden, raw material, intermediate products, finished product, byproduct, or waste products located on the site of such operations.

The reasoning behind this exception, as found in the legislative history, was to allow "important oil, gas, and mining operations [to] continue without unnecessary paperwork restrictions, while protection of the environment remains at a premium". See 132 Cong. Rec. 31, 964 (1986); 133 Cong. Rec. H171 (daily ed. Jan. 8, 1987).

On December 8, 1999, after identifying additional sources of storm water discharges that needed to be regulated to protect water quality, EPA issued the Phase II storm water rule (Phase II Rule). The Phase II Rule extends the NPDES permit program to additional dischargers, including operators of construction sites industry association, intervened in the cases. The three petitions were consolidated by the Court.

On March 9, 2005, EPA published a final rule amending the Deferral Rule by postponing the requirement for obtaining permit coverage for discharges associated with oil and gas construction activity that disturbs one to five acres of land from March 10, 2005 to June 12, 2006. Along with this rule, EPA published a statement that "[w]ithin six months of [this] action, EPA intends to publish a notice of proposed rulemaking in the Federal Register for addressing these discharges and to invite public comments".

II.

EPA urges this Court to dismiss the petition for review as unripe because it has never issued a final rule with respect to the oil and gas exemption and, further, the Deferral Rule contemplates an additional evaluation and assessment of Section 402(l)(2) during the Deferral Period. According to EPA, this Court's consideration of Petitioner's attack on EPA's interpretation of § 402(l)(2) amounts to an improper interference with the agency's administrative actions.

In analyzing whether or not this case is ripe for review we start with the awareness that, in some cases, pre-enforcement review is acceptable. If there is certainty that the law will be

Ohio Forestry Ass'n v. Sierra Club, 523 U.S. 726, 733 (1998). A court, in determining whether a case is ripe for review, must evaluate the following factors:

> (1) whether delayed review would cause hardship to the plaintiffs;
> (2) whether judicial intervention would inappropriately interfere with further administrative action; and
> (3) whether the courts would benefit from further factual development of the issues presented.

Ohio Forestry Ass'n, 523 U.S. at 733. Stated differently, a case or controversy is ripe for judicial review when "an administrative decision has been formalized and its effects felt in a concrete way by the challenging parties." Arch Mineral Corp. v. Babbitt, 104 F.3d 660, 665 (4th Cir. 1997).

Our application of the Ohio Forestry Ass'n test leads us to conclude that this case is not ripe for review. Starting with the second factor, it is clear to us that our ruling on this case would inappropriately interfere with administrative action. Given that EPA has specifically stated its intent to examine, during the Deferral Period, the issue of "how best to resolve questions posed by outside parties regarding section 402(l)(2) of the Clean Water Act", any interpretation we would provide would necessarily prematurely cut off EPA's interpretive process.

We are also unpersuaded that Petitioner has satisfied the first element of the ripeness test. Most particularly, we are unconvinced that the hardship faced by Petitioners at this time attempt to require a permit for the construction of a road leading to a drilling site, a ruling of this Court would be little more than a direction to EPA to give effect to the oil and gas exemption. On the other hand, when EPA determines the specific types of construction related to oil and gas development upon which it will impose a permit requirement, Petitioners will be in a better position to demonstrate how the regulation violates the provisions of the statute. With this background, it is easy to see how this case is distinguishable from Abbott Laboratories. In that case the regulation unambiguously required drug companies to label all prescription drugs in a particular way. This regulation left no doubt of the immediate and severe consequences the drug companies would face in re-labeling all prescription drugs. By contrast, in our case it is uncertain whether EPA will require permits from Petitioners and there is no immediacy to the requirements as they do not go into effect for a year. EPA may promulgate a regulation which defines oil and gas operations to cover, for example, the building of roads at a drilling site or only drilling and oil and gas pipelines. Given the lack of specificity in the present rule, we would only be able to address the issue by attempting to hypothesize possible situations in which the rule might apply and determine what is or is not an oil and gas "operation". We conclude, therefore, that

RUNOFF ANALYSIS FOR THE MALIBU CREEK WATERSHED

- Introduction
- Background
- Model Inputs and Methods
- Assumptions, Limitations
- Results
- Conclusions
- References

INTRODUCTION

This analysis was undertaken in the spring, 1998, as part of a water quality monitoring program of Heal the Bay, funded by the California Coastal Conservancy, and created by the 606 Studio as a degree fulfillment masters project for the Graduate Program in Landscape Architecture at California Polytechnic State University, Pomona.

This document was originally prepared as an appendix to the Cal Poly Masters Project called "The Malibu Creek Watershed: A Framework for Monitoring, Enhancement and Action" completed in 1998.

Timothy Kovacs, Lance Nielsen, and Christopher Smemoe of EMRL have been instrumental in the development of this analysis, as well as Mark Abramson of Heal the Bay. Their willingness to help, and attention to detail is greatly appreciated.

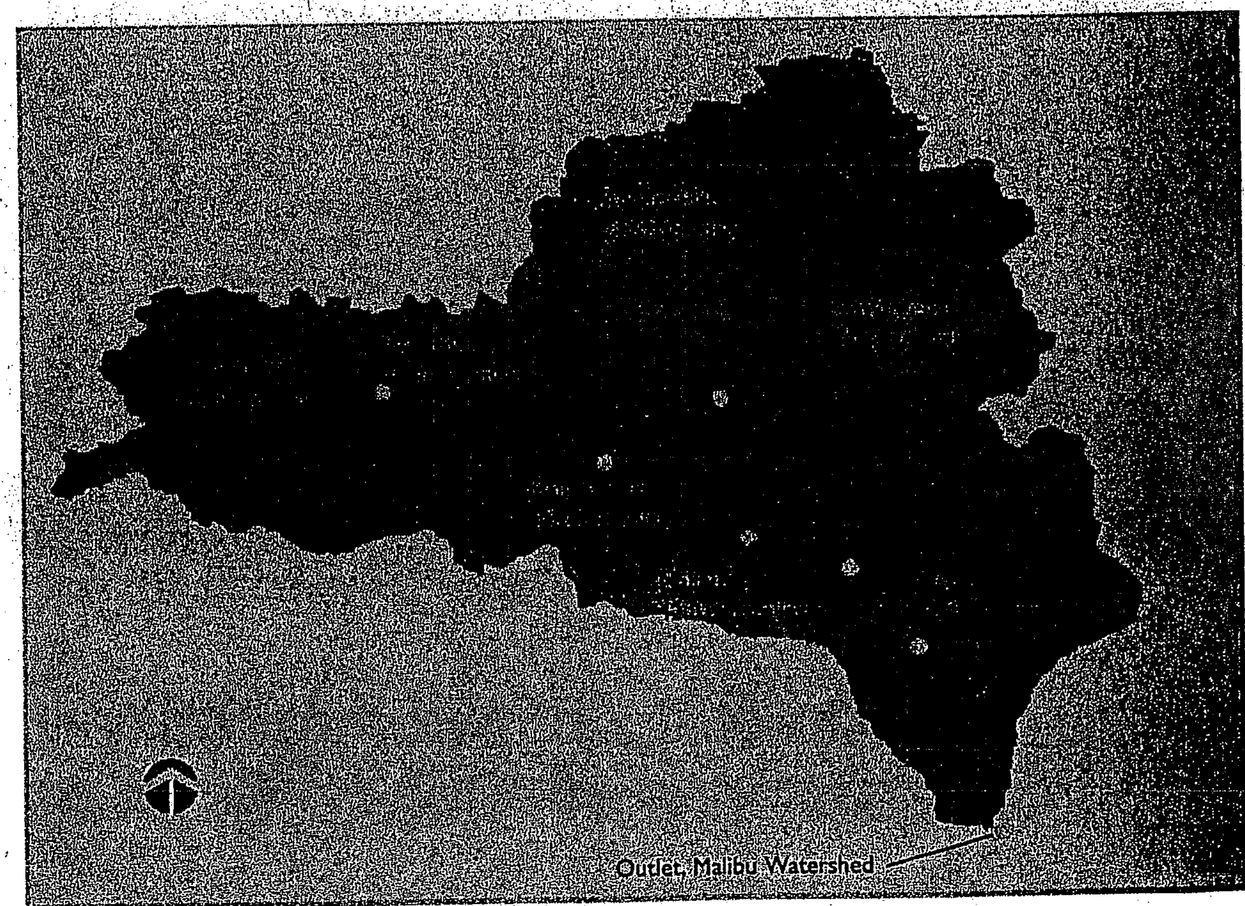


Figure 1. Malibu Creek Watershed Boundaries and Subsheds.

Storm Interval	Malibu Creek Outlet	Malibu Cyn	Cold Creek	Malibou Lake	Las Virgenes	Agoura Hills	Westlake	[illegible]
2yr/24hr	1,601	229	97	260	248	278	159	[illegible]
5yr/24hr	5,247	635	483	522	1,702	856	901	[illegible]
10yr/24hr	8,663	964	681	841	2,762	1,856	1,001	[illegible]
25yr/24hr	13,130	1,829	1,177	1,285	4,064	2,109	1,308	[illegible]
50yr/24hr	15,427	2,393	1,289	1,533	4,581	2,652	1,761	[illegible]
100yr/24hr	23,056	3,398	1,908	2,545	6,463	4,175	2,498	[illegible]

Table 2. Runoff Data of Malibu Creek Wastershed Outlet and Subsheds, Pre-Development Conditions [cfs].

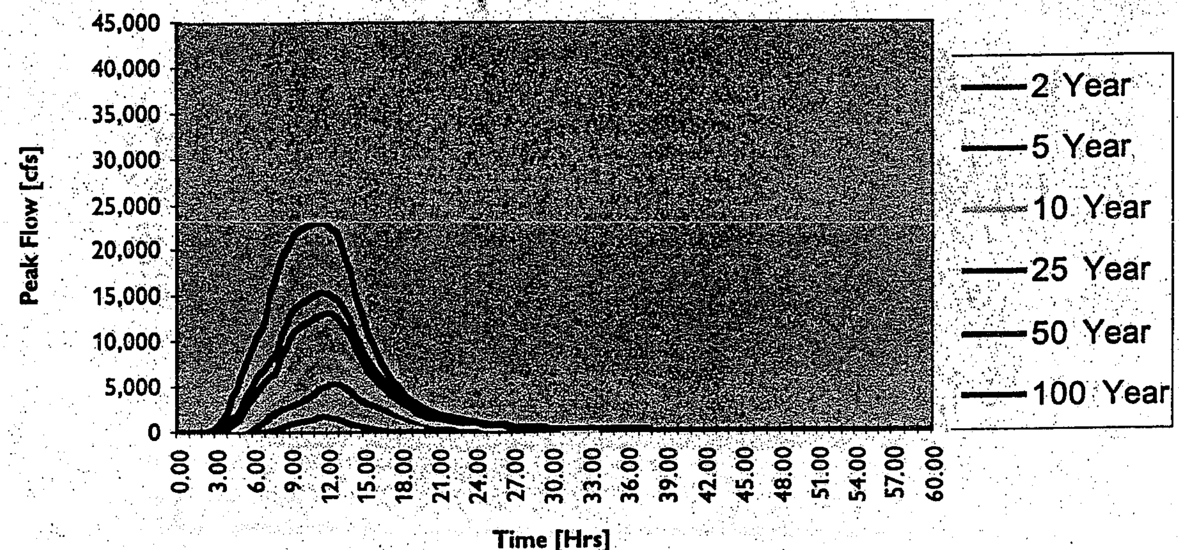


Figure 2. Hydrograph of Malibu Creek Watershed Outflow, Pre-Development Conditions [cfs].

MODEL INPUTS AND METHODS

The WMS software requires that certain data sets are available depending on the model type and accuracy desired. A typical model would be developed based on Digital Elevation Models (DEM's) that are readily available on the World Wide Web. A DEM is spatial data that provides gridded elevation for a given land area and usually corresponds to a USGS quad map.

For this model, data was provided by LA County Dept. of Public Works; this included land use, soil types, vegetation, and watershed and subshed boundaries. This data was modified by the Cal Poly team to reflect the latest conditions using digital aerial photography and 3D modeling and input into the model in GIS shapefile format (except for the vegetation data, which is not used directly by the model; this will be discussed later in this document). In addition to the shapefiles,

Category	Malibu Canyon	Cold Creek	Malibou Lake	Las Virgenes	Agoura Hills	Westlake	[illegible]
Total Area (mi2)	12.41	8.16	13.15	24.31	21.32	12.99	[illegible]
Mapped Impervious (Current) (mi2)	0.48	0.16	0.44	1.73	3.98	2.97	[illegible]
Percent Impervious (Pre-Dev)	0.00	0.00	0.00	0.00	0.00	0.00	[illegible]
Percent Increased Impervious (Current)	3.71	2.01	3.38	7.11	18.39	22.8[illegible]	[illegible]
Pre-Dev Runoff (2yr/24hr) (cfs)	229	97	248	260	278	159	[illegible]
Current Dev Runoff (2yr/24hr) (cfs)	573	270	693	702	921	1307	[illegible]
Percent Increased Runoff	150	178	179	170	231	722	[illegible]

Table 4. Impervious Area Comparison, Pre-development vs. Current Development (1998).

Category	Malibu Canyon	Cold Creek	Malibou Lake	Las Virgenes	Agoura Hills	Westlake	[illegible]
Percent Increased Impervious (Current)	3.71	2.01	3.38	7.11	18.69	22.8[illegible]	[illegible]
Percent Increased Runoff	150.22	178.35	179.44	170.00	231.29	722.01	[illegible]

Table 5. Percent Increase, Impervious Area and Increased Runoff.

same reason. The curve number method was developed by the SCS (now NRCS) as a way to index various surface runoff conditions based on land use conditions and soil characteristics.

A hydrograph is a representation of a volume surface flow in a given time period (cubic feet per second). For this model, a 24 hour storm was used as the time period. After the initial infiltration of rain into the topsoil, overland flow, or runoff, will occur and a peak will also occur at some point when the flows are greatest due to factors such as subshed geometry (area, slope), soil types, cover (land use, vegetation), and storm pattern. The hydrograph is a graphical representation of the collection of runoff at a common point (such as at a stream gage).

The model was run for intervals of 2-5-20-25-50-100 year storms based on rain data available from the National Oceanic Atmospheric Agency (NOAA) and applied to two conditions- current developed conditions, and pre-development conditions based on a vegetation survey from 1930-1934 by AE Wieslander of the United States Forestry Service. For pre-development land use conditions, the Wieslander survey was area averaged visually in order to input subshed curve numbers into the model

Table 1 lists the primary data sets used for the model and the source for the information. Additional source information is available in the reference section at the end of this document.

Assumptions, Limitations

This model is dependent on the available primary data; it is assumed that this was the best available at the time. It is known that the soil survey on which the GIS shapefile was based is an interim survey by the NRCS and is currently being updated for official release due in year 2001 (personal communication, Al Wasner, NRCS). In increased the runoff into Malibu Creek (with the assumption being that the predeveloped condition had zero impervious surface). The clearest example is in the Westlake subshed where a 22.89% increase in impervious surface has led to a 722.01% increase in runoff.

The graphs (See Figure 4)demonstrate that a small increase in impervious area within a watershed will result in large increases in runoff; two scales, logarithmic and linear, are shown in order to bring out the relationship visually. For instance, the linear graph (second graph) shows that the increase has a logarithmic relationship; small incremental increases of impervious surface leads to greater and greater amounts of runoff.

Although typical (and costly) structural devices such as dams and weirs can be used to control runoff, it is clear that this watershed will yield extreme amounts of runoff as impervious surfaces increase and, due to the erosive nature of the soils, will render these devices largely ineffective in relatively short periods of time as seen with Rindge Dam which has completely filled with sediment. It would seem that a more comprehensive management of the watershed resources will result in a cost effective and habitat conserving condition.

References

Bedient, Philip B. *Hydrology and Floodplain Analysis*. Addison-Wesley Publishing Company. 1992.

Dams Within Jurisdiction of the State of California, Bulletin 17. California State Department of Water Resources. June 1993. *http://dlp.CS.Berkeley.EDU/kopec/b17/*.

Environmental Modeling Research Laboratory. Brigham Young University, Provo, Utah. (801) 378-2812. *http://www.emrl.byu.edu/wms.htm*.

Heal the Bay. Santa Monica, CA. (800) HEALBAY. *http://www.healthebay.org*.

HEC-1 Users Manual version 4.0, United States Army Corps of Engineers, Hydrologic Engineering Center. 1990.

Maidement, David R., ed. *Handbook of Hydrology*. McGraw-Hill, Inc. 1992.

Owens, Bradley B. *http://sites.netscape.com/riverrestore/homepage*.

Precipitation Frequency Maps for the Western United States (Return Periods NOAA Atlas 2). *http://www.wrcc.dri.edu/pcpnfreq.html*.

WMS Reference Manual, version 5.0, Environmental Computer Graphics Laboratory. Brigham Young University, Provo, Utah. 1997.

WMS Tutorial, version 5.1, Environmental Computer Graphics Laboratory. Brigham Young University, Provo, Utah. 1998.

U.S. Environmental Protection Agency

Environmental Appeals Board

Affirmed EPA Decision

EAB Case Name: General Motors Corp., CPC-Pontiac Fiero Plant

FEDERAL COURT REVIEW

Court: D.C. Cir 1999.

Decision Title: General Motors Corp. v. EPA

Federal Court Citation: 168 F.3d 1377

Decision Date: 03/23/1999

Statute(s): Clean Water Act

EAB Appeal Number(s): CWA 96-5

The documents provided by the Board are Adobe Acrobat PDF (Portable Document Format). They can be viewed, and printed, with the use of an Adobe Acrobat Reader. The Adobe Acrobat Reader is available, free, for Unix, Macintosh, IBM DOS, and IBM Windows operating systems. Download the latest version of Adobe Acrobat Reader EXIT disclaimer from Adobe's Web site. Adobe also offers accessibility tools EXIT disclaimer to enable the conversion of PDF to html.

Significant case history

- 12/24/1997 **EAB DECISION**, 7 E.A.D. 465 (Final Decision)
- 03/23/1999 **FEDERAL COURT REVIEW** General Motors Corp. v. EPA, 168 F.3d 1377 (D.C. Cir 1999.) (Affirmed EPA Decision)

IN RE GENERAL MOTORS CORPORATION, CPC-PONTIAC FIERO PLANT

CWA Appeal No. 96-5

FINAL DECISION

Decided December 24, 1997

Syllabus

General Motors Corporation ("GM") appeals from an Initial Decision assessing a civil penalty of $62,500 for numerous violations of the Clean Water Act ("CWA") at GM's Pontiac Fiero plant in Pontiac, Michigan. By complaint dated March 1, 1993, and amended November 10, 1993, U.S. EPA Region V charged GM with violating the CWA on 92 occasions between May 1992 and August 1993, by discharging more pollutants (copper, lead, and zinc) than allowed by GM's 1988 National Pollutant Discharge Elimination System ("NPDES") permit issued by the Michigan Department of Natural Resources ("MDNR"). By accelerated decision dated June 28, 1996, the Presiding Officer found GM liable for the violations alleged in the complaint. By separate ruling dated October 31, 1996, the Presiding Officer assessed the above-mentioned penalty.

The permit at issue here was first applied for by GM on July 6, 1984, to cover stormwater discharges from an outfall at its facility now known as outfall 002. GM's application identified copper, lead, and zinc as among the pollutants discharged from the outfall. On June 16, 1988, MDNR issued a permit containing, among other things, numerical discharge limits for copper, lead, and zinc. The permit provided for an appeal to the Michigan Water Resource Commission within 60 days of permit issuance. GM did not, however, file an administrative challenge to the permit within the 60-day period or at any other time. The permit also stated that in order to discharge beyond the permit's October 1, 1990 expiration date, GM must submit a renewal request no later than 180 days prior to the date of expiration (*i.e.,* April 1, 1990). GM did not submit its renewal application until May 18, 1990.

The discharges from outfall 002 consisted of stormwater collected at GM's facility. According to the Presiding Officer, the stormwater contained metals that were apparently partly present in the rainwater and partly leached from roofs and exterior components of buildings at the facility. It is undisputed that discharges from outfall 002, as reported by GM in its discharge monitoring reports, exceeded the permit's limitations for copper, lead, and zinc.

In May and December of 1991, prior to filing the complaint, the Region issued two notices of violation and orders for compliance requiring that GM take certain actions necessary to come into compliance with the permit. On May 7, 1993, two months after the Region filed its complaint in this matter, GM requested that MDNR terminate the permit. MDNR denied the request due to GM's continued noncompliance with the permit's effluent limitations. GM filed a second request for termination, which MDNR also denied. GM's third request for termination was granted by MDNR on December 20, 1994, after MDNR had confirmed that GM had completed the cleaning and coating of roofs at the facility and had come into compliance.

GM has raised the following three issues in the present appeal: (1) whether the permit was void *ab initio* because the State of Michigan lacked the authority to issue the permit. In support of this assertion, GM cites to CWA § 402(p), 33 U.S.C. § 1342(p), added to the Act by the Water Quality Act of 1987. Subject to certain exceptions, CWA § 402(p) prohibits EPA or States from requiring permits for discharges consisting solely of stormwater prior to October 1, 1994; (2) whether, under the circumstances of this case, copper, lead, and zinc may be considered "pollutants" under the CWA; and (3) whether (assuming the permit was valid when issued) the permit expired by operation of law in 1990 because GM did not file a timely request for renewal.

Held: (1) Because GM failed to exhaust its administrative remedies under State law, GM may not now raise objections to the permit five years later in this federal enforcement proceeding. GM's allegation that the permit is void *ab initio* because of legislation passed prior to issuance of the permit is insufficient to excuse GM's failure to exhaust its remedies under State law. Whatever the merits of GM's arguments as to Michigan's alleged lack of authority to issue the permit in light of the 1987 CWA amendments, those arguments could and should have been raised before the State entity that issued the permit or to the Michigan Water Resource Commission in an administrative appeal following issuance of the permit in 1988. Similarly, GM's assertion that regulation of outfall 002 was the result of the MDNR's erroneous assumption that the metals in the discharge resulted from some cross connection from process or other operations at the plant may not be raised in this enforcement proceeding; (2) Having failed to raise a timely challenge under State law to the inclusion of the permit limitations for copper, lead, and zinc, GM may not now collaterally attack their inclusion in the context of this enforcement proceeding; (3) The permit did not expire by operation of law in 1990. Although GM's renewal application was not submitted 180 days prior to expiration of the permit, it is clear that MDNR decided to consider the renewal application timely filed. Both GM and MDNR continued to behave as if the permit were in full force and effect until it was formally terminated. By requesting renewal of the 1988 permit prior to its expiration, behaving as if the permit remained in effect, and failing to file a timely objection to continuation of the permit, GM cannot now be heard to deny that the permit continued in effect beyond October 1, 1990.

Finally, because GM has not pointed to any error in the Presiding Officer's penalty calculation, and because the Board finds nothing erroneous in that calculation, the Board upholds the Presiding Officer's October 31, 1996 penalty ruling assessing a penalty of $62,500.

Before Environmental Appeals Judges Ronald L. McCallum, Edward E. Reich and Kathie A. Stein.

Opinion of the Board by Judge Stein:

By complaint dated March 1, 1993, and amended on November 10, 1993, U.S. EPA Region V ("Region") charged the General Motors Corporation ("GM") with numerous violations of the Clean Water Act ("CWA" or "Act"), 33 U.S.C. §§ 1251-1387, at GM's Pontiac Fiero plant in Pontiac, Michigan. In particular, the Region charged GM with violating the CWA on 92 occasions between May 1992 and August 1993 by discharging more pollutants (copper, lead, and zinc) than allowed by GM's 1988 National Pollutant Discharge Elimination System ("NPDES") permit[1]

[1] Under the Clean Water Act, discharges into waters of the United States by point sources must be authorized by a permit in order to be lawful. CWA § 301, 33 U.S.C. § 1311. The National Pollutant Discharge Elimination System is the principal permitting program under the Clean Water Act. CWA § 402, 33 U.S.C. § 1342.

issued by the Michigan Department of Natural Resources ("MDNR").[2] The permit is enforceable by both the State and EPA. *See* CWA § 309(g)(1)(A), 33 U.S.C. § 1319(g)(1)(A) (authorizing EPA to assess a civil penalty for violation of a State-issued NPDES permit).

By accelerated decision issued on June 28, 1996, Administrative Law Judge Thomas W. Hoya ("Presiding Officer") determined that GM was liable for the violations alleged in the complaint. *See* Ruling on Motions for Accelerated Decision ("Accelerated Decision"). For these violations the Presiding Officer assessed a penalty of $62,500. *See* Initial Decision (Oct. 31, 1996) (hereinafter referred to as "Penalty Ruling").[3] GM has appealed. Notice of Appeal of Appellant General Motors Corporation and attached Brief in Support of Notice of Appeal to Environmental Appeals Board ("Appeal") (filed on November 29, 1996). On December 17, 1996, the Region, joined by the U.S. EPA Office of General Counsel, filed a reply asking that the Board affirm the Presiding Officer's decision. Complainant-Appellee's Reply Brief ("Region's Reply"). For the reasons stated below, we affirm.

I. *BACKGROUND*

By letter dated July 6, 1984, GM applied to MDNR for a permit at its Pontiac Fiero plant for stormwater discharges from an outfall now referred to as "outfall 002."[4] *See* Exhibit ("Exh.") 1 to Region's Reply. The application filed by GM identified copper, lead, and zinc as being among the pollutants discharged from that outfall. In its initial response to the application, dated July 30, 1984, MDNR advised GM that the application would not be processed at that time but would be processed when GM submitted its renewal application for GM's previously existing NPDES permit governing process-related discharges from another outfall. *See* Exh. 3 to Region's Reply.[5]

On November 19, 1984, GM submitted a renewal application for its existing permit as well as a request for a permit governing stormwater discharges from outfall 002. *See* Exh. 4 to Region's Reply. MDNR issued the renewed permit on June 16, 1988, containing numerical discharge limits for copper, lead, and zinc from outfall 002.

---

[2] The MDNR is now known as the Michigan Department of Environmental Quality.

[3] Together, the liability and penalty rulings constitute an initial decision pursuant to 40 C.F.R. § 22.20(b).

[4] At the time of the application, outfall 002 was referred to as outfall C-5.

[5] The plant was subsequently shut down and has been idle since August of 1988.

See Exh. 5 to Region's Reply. The permit stated that in order to discharge beyond the permit's October 1, 1990 expiration date, GM must submit a renewal request "no later than 180 days prior to the date of expiration" (or April 1, 1990). *Id.* at 1. The permit also stated that "[a]ny person who feels aggrieved by this permit may file a sworn petition with the [Michigan Water Resource] Commission setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Commission may reject any petition filed more than 60 days after issuance as being untimely." *Id.* GM did not file an administrative challenge to the permit with the Michigan Water Resource Commission within the 60-day period or at any subsequent time.

The discharge from outfall 002 consisted of stormwater collected at GM's facility. According to the Presiding Officer, the stormwater contained metals that were apparently partly present in the rainwater and partly leached from roofs and exterior components of buildings at the facility.[6] Accelerated Decision at 3. Pursuant to the 1988 permit, GM submitted discharge monitoring reports ("DMRs") on the content of the effluent at outfall 002, and these reports served as the basis of the Region's complaint.[7] It is undisputed that GM's discharges from this outfall, as reported in the DMRs, exceeded the permit limitations for copper, lead, and zinc. In May and December of 1991, prior to filing the complaint, the Region issued two notices of violation and orders for compliance requiring that GM take certain actions necessary to come into compliance with the permit. *See* Exhs. 7-8 to Region's Reply.

On May 7, 1993, two months after the Region filed its complaint in this matter, GM requested that MDNR terminate the permit. Letter from David E. Rugg, GM Senior Environmental Engineer, to Roy E. Schrameck, District Supervisor, MDNR (Exh. 10 to Region's Reply). MDNR denied the request on September 27, 1993, due to GM's continued noncompliance with the permit's effluent limitations. Letter

[6] According to GM, at the time the permit was issued, neither it nor MDNR were able to determine the source of these metals in the discharge and the parties assumed the discharges were in some way related to industrial activity at the facility. *See* Appeal at 5-6. The parties now appear to agree that the effluent discharged from outfall 002 consisted solely of stormwater collected at the facility and that the metals were either already present in the rainwater or leached from outside structures at the facility.

[7] DMRs filed by a permittee indicating violations of a permit's effluent limitations constitute admissions that the violations reflected in the reports actually occurred. *See Sierra Club v. Simpkins Indus., Inc.*, 847 F.2d 1109, 1115 n.8 (4th Cir. 1987); *NRDC v. Texaco Refining & Marketing, Inc.*, 800 F. Supp. 1 (D. Del. 1992).

from Roy E. Schrameck, to David E. Rugg (Exh. 11 to Region's Reply). GM filed a second request for termination on October 1, 1993. Letter from David E. Rugg, to Peter Ostlund, MDNR Surface Water Quality Division (Exh. 12 to Region's Reply). MDNR also denied that request pending further monitoring of the effluent. Letter from Peter Ostlund to David E. Rugg (March 18, 1994) (Exh. 13 to Region's Reply). GM's third request for termination, filed on September 7, 1994,[8] was granted by MDNR on December 20, 1994,[9] after MDNR had confirmed that GM had completed the cleaning and coating of roofs at the facility and had come into compliance.[10]

GM has raised the following three issues in the present appeal:[11] (1) whether the permit was void *ab initio* because the State of Michigan lacked the authority to issue the permit; (2) whether, under the circumstances of this case, copper, lead, and zinc may be considered "pollutants" under the CWA; and (3) whether (assuming the permit was valid when issued) the permit expired by operation of law in 1990 because GM did not file a timely request for renewal.

A. *Validity of the 1988 Permit*

GM argues that the permit was void from the date of issuance because MDNR had no authority to issue a permit regulating discharges consisting solely of stormwater. In support of this assertion, GM cites to CWA § 402(p), 33 U.S.C. § 1342(p), added to the Act by the Water Quality Act of 1987. That section, which established a phased approach to bringing stormwater discharges under regulatory coverage,[12] states, in pertinent part, as follows:

---

[8] Letter from David E. Rugg, to Hae-Jin Yoon, MDNR Environmental Quality Analyst and Peter Ostlund (Exh. 14 to Region's Reply).

[9] Exh. 15 to Region's Reply ("Permit Termination").

[10] *Id.*

[11] GM has attached two exhibits to its appeal, a letter from Franz Morsches, President, Jones & Henry Engineers, Inc., to David Rugg, GM Site Operations (April 24, 1994), and a draft permit dated November 5, 1995. The Region has objected to the submission of these documents to the Board because they "were not provided to the ALJ for his consideration * * *." Region's Reply at 2. GM does not dispute that the documents were not presented to the Presiding Officer for his consideration. In any case, as neither of these exhibits is relevant to our determination we need not rule on their admissibility in this proceeding.

[12] Previously, throughout the 1970's and early 1980's, the Agency's attempts to regulate point source discharges of stormwater were challenged in court. Regulations promulgated in 1973 were invalidated in *NRDC v. Train*, 396 F. Supp. 1393 (D.D.C. 1975), *aff'd NRDC v. Costle*,
Continued

Municipal and industrial storm water discharges

(1) General rule

Prior to October 1, 1994, the Administrator or the State (in the case of a permit program approved under section 1342 of this title) shall not require a permit under this section for discharges composed entirely of storm water.

(2) Exceptions

Paragraph (1) shall not apply with respect to the following storm water discharges:

(A) A discharge with respect to which a permit has been issued under this section before February 4, 1987.

(B) A discharge associated with industrial activity.

(C) A discharge from a municipal separate storm sewer system serving a population of 250,000 or more.

(D) A discharge from a municipal separate storm sewer system serving a population of 100,000 or more but less than 250,000.

(E) A discharge for which the Administrator or the State, as the case may be, determines that the storm water discharge contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States.

According to GM, because the permit regulated stormwater but did not fall within any of the above-listed exceptions, MDNR had no authority to issue the permit and the permit must therefore be considered void *ab initio.*

The Presiding Officer did not reach the merits of GM's argument regarding the validity of the permit. Because GM never timely challenged the 1988 permit, the Presiding Officer declined to consider the permit's validity several years later in the context of an enforcement

---

568 F.2d 1369 (D.C. Cir. 1977). Regulations promulgated in 1976 and revised in 1979 and 1980 were challenged in *NRDC v. EPA*, 673 F.2d 392 (D.C. Cir. 1980). As part of the settlement in that case, the Agency proposed new stormwater regulations in 1982 that were finally adopted in 1984. The 1984 regulations were challenged and vacated at the Agency's request, in *NRDC v. EPA*, No. 80-1607 (D.C. Cir. 1987). For a detailed history of the EPA's stormwater regulations, *see* 53 Fed. Reg. 49,416 (Dec. 7, 1988).

proceeding. According to the Presiding Officer: "[t]he crucial point that rebuts Respondent's challenges to its Michigan NPDES permit is * * * the unavailability of this federal enforcement action as a forum for reviewing the permit." Accelerated Decision at 27. On appeal, GM argues that it is not challenging any individual permit provisions, but asserting that under CWA § 402(p)(1) the permit never existed. GM contends that the Presiding Officer erred in concluding that GM was precluded from making this assertion.

In its reply, the Region states that GM failed to challenge the permit in the appropriate forum and now seeks to have the Board void the action of an authorized permitting authority. According to the Region "[n]ot only is such a remedy inconsistent with EPA's role in the oversight of State programs, it is also inconsistent with the general administrative law principle of finality embodied in the structure of the CWA." Region's Reply at 9. The Region also addresses the merits of GM's argument. In particular, the Region argues that CWA § 402(p)(1) does not prohibit States from *issuing* permits to applicants who request them. Rather, that section only prohibits States from *requiring* certain stormwater permits. The Region argues that Michigan did not require the permit but merely responded to GM's request.[13]

The Region also contends that an exception to the prohibition on requiring stormwater-only permits, specifically, the exception provided by CWA § 402(p)(2)(E), applies in this case. The exception on which the Region relies states that the prohibition does not apply where the State determines that the discharge is a "significant contributor of pollutants to waters of the United States." Similarly, at the time the permit was issued, Michigan law required permits for stormwater discharges making a significant contribution to pollution.[14] Although the record does not contain any formal finding or determination by MDNR that GM's stormwater discharges are a significant source of pollution, the Region takes the position that the "issuance of the permit containing water quality based effluent limitations constituted an implicit finding under § 402(p)(2)(E) that GM was a significant contributor of pollutants * * * [and that] [b]y applying for the NPDES permit, GM requested

[13] GM asserts that its application for a permit is irrelevant in this case because it was merely responding to a then-existing requirement that it seek a permit. Appeal at 12 n.7.

[14] In particular, Michigan water permitting regulations at the time the permit was issued stated that a permit is not required for discharges from storm sewers "unless a particular storm water discharge has been identified by the [Michigan Water Resource] Commission or the regional administrator as a significant contributor to pollution." Mich. Admin. Code r. 323.2109 (1988).

that Michigan make such a determination." Region's Reply at 13. GM disputes that any such finding was made. Appeal at 15.

B. *Whether Copper, Lead, and Zinc are "Pollutants"*

GM also asserts that the Region erred by classifying the copper, lead, and zinc discharged from outfall 002 as "pollutants" within the meaning of Act. Specifically, GM argues that although the term "pollutants" is defined broadly under the Act,[15] the Agency has the discretion to treat certain chemicals as pollutants in some circumstances but not in others. According to GM, under the circumstances of this case, the Region should have used this discretion and determined that copper, lead, and zinc are not "pollutants" within the meaning of the Act. GM asserts that EPA has not required permits for other similarly situated dischargers and states that EPA's inaction with regard to these other dischargers "demonstrates that [EPA] viewed the discharge of these 'metals' without a permit as permissible." Appeal at 24. GM's argument in this regard constitutes a challenge to the inclusion of effluent limitations for copper, lead, and zinc in GM's permit when, according to GM, the Region has not placed similar restrictions on other dischargers.[16]

C. *Permit Expiration*

Finally, GM argues that if the permit was valid when issued, it expired by operation of law on October 1, 1990, because GM failed to file a timely application for renewal. If this were the case, it would bar 53 of the 92 violations alleged in the complaint since these 53 violations occurred after the claimed expiration date. As noted above, the 1988 permit indicated that it would expire on October 1, 1990, and that renewal was to be requested no later than 180 days prior its expiration (or by April 1, 1990). GM submitted its renewal request by

---

[15] The Act defines "pollutant" as follows:

> The term "pollutant" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.

CWA § 502(6), 33 U.S.C. § 1362(6).

[16] The Presiding Officer concluded that both the CWA and its implementing regulations make clear that copper, lead, and zinc are indeed "pollutants" within the meaning of the Act. *See* Accelerated Decision at 11-15.

letter dated May 18, 1990. Thus, GM argues that the permit expired by operation of law on October 1, 1990.

In response, the Region points out that GM's renewal letter stated that it was being submitted in lieu of a formal application pursuant to a conversation between the MDNR and GM. The Region asserts that as a result of this conversation and the letter, the renewal was timely and the permit therefore administratively continued pursuant to Michigan law.[17] Region's Reply at 13-14. The Region also points out that the renewal was submitted well before expiration of the permit, MDNR accepted the late renewal request, both parties continued to operate as if the permit were still effective, and GM itself requested termination of the permit in 1993.

The Presiding Officer, although finding this issue "less clear cut" than the issue of whether GM could challenge the validity of the entire permit in an enforcement proceeding, agreed with the Region. In particular, the Presiding Officer stated:

> The actions of Respondent and the State of Michigan, such as Respondent's continuing submission of monthly reports and the 1992-94 correspondence that led to the State's 1994 termination of the permit, reflect an apparent assumption by both, as noted by Complainant, that the permit remained in force until the 1994 termination.

Accelerated Decision at 27-28 (footnote omitted).[18]

---

[17] Under the Michigan Administrative Procedures Act, "[w]hen a licensee makes timely and sufficient application for renewal of a license * * *, the existing license does not expire until a decision on the application is finally made by the agency * * *." Mich. Comp. Laws § 24.291(2). The term "license" is defined as "includ[ing] the whole or part of an agency permit." *Id.* at § 24.205(1); *see also Bois Blanc Island v. The Natural Resource Commission*, 158 Mich. Ct. App. 239, 242, 404 N.W.2d 719, 721 (1987) (the broad definition of "license" in the Administrative Procedures Act includes practically any form of permission required by law). MDNR did not make a final determination on the renewal application prior to termination of the permit.

[18] In his penalty determination, the Presiding Officer concluded that even if the permit had expired in 1990, thus reducing the number of violations from 92 to 39, the violations would still be significant enough to warrant the same penalty amount ($62,500). Penalty Ruling at 12.

II. *ANALYSIS*

A. *Validity of the 1988 Permit*

As previously stated, GM's 1988 permit provided for an appeal to the Michigan Water Resource Commission within 60 days of issuance. GM did not file such an appeal within this time period or at any other time. Nevertheless, GM argues that it may challenge the "existence" of the permit in the present enforcement proceeding. We disagree.

It is well established that where, as here, a permittee fails to take advantage of the opportunity to challenge a State-issued permit under applicable State administrative procedures, objections to the permit may not be raised years later in the context of an enforcement proceeding. *Public Interest Research Group of New Jersey, Inc. v. Powell Duffryn Terminals, Inc.*, 913 F.2d 64, 77-78 (3rd Cir. 1990) (by failing to challenge State-issued NPDES permit under applicable State law, permittee lost "'forever the right to do so, even though [an enforcement action] might eventually result in the imposition of substantial penalties.'") (quoting *Texas Mun. Power Agency v. EPA*, 836 F.2d 1482, 1484-85 (5th Cir. 1988)); *Sierra Club v. Union Oil Company of California*, 813 F.2d 1480, 1486-87 (9th Cir. 1987) (permittee's failure to follow administrative steps that would have allowed issuing State agency to address NPDES permit objections precludes raising permit objections in an enforcement proceeding), *vacated and remanded on other grounds,* 485 U.S. 931 (1988); *Public Interest Research Group of New Jersey v. Yates Indus., Inc.*, 757 F. Supp. 438, 445-446 (D.N.J. 1991) (permittee is responsible for the terms of its permit; by failing to challenge NPDES permit provisions through proper State agency procedures, permittee lost the right to challenge these provisions), *modified on other grounds* 790 F. Supp. 511; *United States v. CPS Chemical Co., Inc.*, 779 F. Supp. 437, 453-54 (E.D. Ark. 1991) ("Having failed to appeal its 1984 [federal permit] limits, [permittee] cannot now challenge in this enforcement action the merits of the limitations and the conditions imposed in the 1984 permit on the grounds that it was impossible to comply with those limits."); *Connecticut Fund for the Environment v. The Job Plating Company, Inc.*, 623 F. Supp. 207, 216 (D. Conn. 1985) ("By failing to challenge its NPDES permit under state law at the time when its purported legal deficiency should have been as apparent to [permittee] as it is now, the [permittee] is precluded from doing so * * *.").

In the present case, it is abundantly clear that GM has failed to exhaust its State administrative remedies. If GM had objections to any condition of its 1988 permit (or to the permit itself), it had the opportunity as well as the obligation to raise such objections at the time the permit was issued under existing State procedures. The permit on its face stated that challenges could be filed with the Michigan Water Resources Commission within 60 days of issuance. Such a challenge would have allowed the Commission "to perform functions within its special competence — to make a factual record, to apply its expertise, and to correct its own errors * * *." *Parisi v. Davidson*, 405 U.S. 34, 37 (1972) (discussing rationale for requiring exhaustion of administrative remedies). GM did not, however, raise a timely challenge to the permit in that forum. Indeed, GM *never* raised an administrative challenge to the validity of the permit, and it did not even request termination of the permit until after the Region had issued two compliance orders and filed the complaint in this matter. Having failed to exhaust its State administrative remedies, GM may not now raise objections to its permit five years later in this federal enforcement proceeding. *See Sierra Club*, 813 F.2d at 1486-87 (declining to consider challenge to permit terms in an enforcement proceeding and stating that by failing to exhaust its administrative remedies under state law, a permittee is bound by the terms of its permit);[19] *Friends of the Earth, Inc. v. Laidlaw Environmental Services (TOC), Inc.*, 956 F. Supp. 588, 598 (D.S.C. 1997) (declining to consider challenge to State-issued NPDES permit in an enforcement proceeding; if permittee believed the permit to be invalid for any reason its remedy "was to seek an administrative adjudication pursuant to [state] law * * * [which] provided the [permittee] with the opportunity to challenge its permit in an administrative proceeding * * * and to have the administrative determination reviewed by a state court * * *."). Thus, we agree with the Presiding Officer that GM may not challenge the validity of the permit in the present enforcement proceeding.[20]

[19] *See also McKart v. United States*, 395 U.S. 185, 193 (1969) (a party must exhaust its administrative remedies before it can obtain judicial review of an agency decision); *Myers v. Bethlehem Shipbuilding Corp.*, 303 U.S. 41, 50-51 (1938) (stating the general rule that "no one is entitled to judicial relief for a supposed or threatened injury until the prescribed administrative remedy has been exhausted").

[20] This conclusion is consistent with Congress' desire to limit the scope of enforcement proceedings under the CWA. *See* S. Rep. No. 92-414, at 64 (1972) (discussing the Act's enforcement provision at CWA § 309, 33 U.S.C. § 1319) ("[The Act] establishes and makes precise new requirements imposed on persons and [sic] subject to enforcement. One purpose of these new requirements is to avoid the necessity of lengthy fact finding, investigations, and negotiations at the time of enforcement. Enforcement of violations of requirements under this Act should be based on relatively narrow fact situations requiring a minimum of discretionary decision making or delay."); CWA § 509(b)(2), 33 U.S.C. § 1369(b)(2) (stating that "[a]ction of the Administrator with respect to which review could have been obtained under paragraph (1) of this subsection [including the issuing of an NPDES permit] shall not be subject to judicial review in any civil or

Continued

GM makes much of the fact that it is challenging the validity of the permit itself rather than any particular permit provisions. GM provides no reasonable explanation, however, as to why this challenge was not raised in the appropriate State forum. GM's allegation that the permit is void *ab initio* because of legislation passed prior to issuance of the permit is simply insufficient to excuse GM's failure to exhaust its remedies under State law. *See United States v. City of Geneva*, 1986 U.S. Dist. LEXIS 23515 (N.D. Ill. 1986) (permittee's failure to challenge State-issued permit under applicable State procedures bars challenge to permit during civil enforcement proceeding even where permittee alleges that the permit was void *ab initio*).

Whatever the merits of GM's arguments as to Michigan's alleged lack of authority to issue the permit in light of the 1987 CWA amendments (specifically, CWA § 402(p)),[21] those arguments could and should have been raised before the State entity that issued the permit or to the Michigan Water Resource Commission in an administrative appeal following issuance of the permit in 1988. In this way, the State could have evaluated whether, for example, it agreed with the argument GM now makes that the State lacked legal authority to issue the permit or whether the permit came within one of the statutory exceptions to CWA § 402(p). If GM disagreed with the State agency's final decision, GM could then have appealed that decision in State court. *See* Mich. Comp. Laws § 24.301 ("Exhaustion of remedies; reviewable decisions"). Thus, not only is GM years too late with its challenge, but it is also plainly in the wrong forum. GM was well aware of the proper forum for raising such challenges. When GM sought termination of the permit following the filing of the complaint, it sought relief from the State. The State twice denied such relief, and granted it on the third occasion only after its concerns were addressed. *See* Exh. 15 to Region's Reply. Under these circumstances and in light of GM's failure to exhaust its administrative remedies, as outlined above, we

criminal proceeding for enforcement."); Conf. Rep. No. 92-1236, at 147-48 (1972) ("The conferees intend that [section 509(b)(2)] limit the availability of judicial review of a standard or requirement where judicial review was available at the time the standard or requirement was established."); *see also* S. Rep. No. 92-414, at 79 (discussing the Act's citizen suit provision at CWA § 505, 33 U.S.C. § 1365) ("An alleged violation of an effluent control limitation or standard, would not require reanalysis of technological [or] other considerations at the enforcement stage. These matters will have been settled in the administrative procedure leading to the establishment of such effluent control provision.").

[21] As stated above, subject to certain exceptions CWA § 402(p) prohibits EPA or States from requiring permits for discharges consisting solely of stormwater prior to October 1, 1994. This provision was passed into law prior to issuance of the permit in 1988.

decline to review the merits of GM's argument that the permit was void *ab initio*.[22]

GM has also asserted that regulation of outfall 002 was the result of the MDNR's erroneous assumption that the metals in the discharge resulted from some cross connection from process or other operations at the plant. Appeal at 13-14. According to GM, GM disputed the need to regulate discharges from outfall 002 prior to issuance of the permit but "could not conclusively rule out possible contributions by process or other operations, such as drinking water fountain cross connections." *Id.* at 13. GM states that it "ultimately has demonstrated, however, [that] stormwater only discharges are involved and the metals in question result from atmospheric deposition and the leaching effect of acidic precipitation on metal building structures at the site." *Id.* at 14. Thus, according GM, the issuance of the permit resulted from a mutual mistake and the State-issued permit should therefore be subject to challenge in this federal enforcement proceeding. We disagree.

Having failed to raise a timely objection in the proper State forum,[23] GM may not now challenge the underlying permit in the context of this enforcement proceeding. *See Connecticut Fund for the Environment v. The Job Plating Company, Inc.*, 623 F. Supp. 207, 216 (D. Conn. 1985); *cf. National Mining Association v. U.S. Department of the Interior*, 70 F.3d 1345, 1350 (D.C. Cir. 1995) (concluding that to the extent that appellants' challenge to a regulation as *ultra vires* was based on grounds that were available to appellant at the time the regulation was adopted, the court did not have jurisdiction over the challenge).

Moreover, even if, at the time the permit was issued, MDNR and GM erroneously believed that the metals discharged from outfall 002 resulted from contributions from process or other operations, GM subsequently ruled out any such contributions by at least November of 1991. *See* Letter from David E. Rugg, GM Senior Environmental Engineer, to Roy Schrameck, District Supervisor, MDNR (Nov. 11, 1991) (stating that GM has identified the source of the exceedances in outfall 002). Thus, all the information necessary for GM to seek mod-

[22] In so doing, we do not reach and we express no view as to the merits of the legal arguments concerning the authority of Michigan to issue a "stormwater-only" permit.

[23] GM itself has stated that at the time the permit was issued Michigan law provided for an administrative appeal "[w]henever any person shall feel aggrieved by * * * any * * * order or permit * * *." Respondent's Rebuttal to Complainant's Reply to Respondent's Cross Motion for Partial Accelerated Decision (submitted to the Presiding Officer on Sept. 27, 1994) (quoting Mich. Comp. Laws § 323.8 (1988)). As the Presiding Officer stated, however, GM never utilized any State appeals procedure at any time.

ification or revocation of the permit was available to it in 1991. Nevertheless, despite the existence of provisions in the Michigan regulations for seeking modification or revocation, GM did not pursue these options with the State at that time. *See, e.g.,* Mich. Admin. Code r. 323.2159 ("State and national permits; modification or revocation by the commission"). Rather, GM waited until after the Region filed a complaint in 1993 to request that the State terminate the permit. We agree with the Region that there are sound reasons why the federal government, in the exercise of its enforcement functions, should not seek to revisit the basic terms or validity of a duly issued State permit. Questions concerning whether a permit was issued by mistake are precisely the kinds of questions best evaluated by the entity that issued the permit.

B. *Whether Copper, Lead, and Zinc are "Pollutants"*

For the same reasons explained in Section II.A. above, we also decline to address the merits of GM's assertion that, under the circumstances of this case, copper, lead, and zinc are not "pollutants" within the meaning of the Act. Essentially, GM is asserting that because these metals are not "pollutants," the effluent limitations were erroneously included in the permit. Having failed to raise a timely challenge under State law to the inclusion of these permit limitations, however, GM may not now collaterally attack their inclusion in the context of this enforcement proceeding.

C. *Permit Expiration*

GM argues that even if the permit is considered valid when issued, it expired by operation of law when GM failed to file an application for renewal by April 1, 1990. We disagree.

GM is correct that its letter requesting renewal of the permit was not submitted until May 18, 1990 (47 days after the April 1 deadline). It is important to note, however, that the renewal was submitted more than four months before expiration of the permit. In addition, the letter stated that it was being submitted in lieu of a formal application *per a conversation between GM and MDNR.* Letter from Ernest N. Hawley, Plant Manager, C-P-C Pontiac Operations, to Chang Bek, Chief, Permits Section, MDNR (May 18, 1990). Although the record does not indicate the precise date or nature of this conversation, it is clear that MDNR (presumably at GM's request) decided to consider the renewal application timely filed. Apparently, MDNR determined that the circumstances warranted a relaxation of the filing deadline in this case. *See West Bloomfield Hosp. v. Certificate of Need Board*, 452 Mich. 515, 524, 550 N.W. 2d 223, 227 (1996) (Michigan State agencies may relax or modify procedural rules where the ends of justice so require) (citing *American Farm Lines v. Black Ball Freight Service*, 397 U.S. 532 (1970)). Although Michigan regulations require that renewal applications be submitted 180 days prior to a permit's expiration date,[24] this is not a statutory requirement and we see no reason why this requirement could not be relaxed or modified in appropriate circumstances.[25]

Further, following submission of the renewal request, GM and MDNR continued to behave as if the permit were in full force and effect. In particular, GM continued to submit its DMRs as required by the permit, and, as previously stated, GM later made several requests that MDNR terminate the permit. The fact that GM filed its 1993 termination requests with MDNR indicates that not only did GM believe that the permit was in full force and effect at that time, but also that GM knew the appropriate forum within which to raise permit objections.

By requesting renewal of the 1988 permit prior to its expiration, behaving as if the permit remained in effect, and failing to file a timely objection to continuation of the permit, GM cannot now be heard to deny that the permit continued in effect beyond October 1, 1990. *See The Job Plating Co., Inc.*, 623 F. Supp. at 218 n.11 (rejecting permittee's challenge to its NPDES permit where the permittee relied on and tacitly accepted the permit for years until it faced an enforcement action); *cf. Bois Blanc Island v. The Natural Resource Commission*, 158 Mich. Ct. App. 239, 242-44, 404 N.W.2d 719, 721-722 (1987)[26] (holding that an otherwise expired permit remained in full force and effect based on the permittees' continued operation under the permit and State's failure to challenge this continued operation).

---

[24] Mich. Admin. Code r. 323.2151.

[25] We note that under federal law:

> [P]ermittees with currently effective permits shall submit a new application 180 days before the existing permit expires, except that:
>
> (i) The Regional Administrator may grant permission to submit an application later than the deadline for submission otherwise applicable, but no later than the permit expiration date * * *.

40 C.F.R. § 122.21(d)(2).

[26] In *Bois Blanc*, the Court of Appeals of Michigan found that by allowing certain permittees to continue operating sanitary landfills for nine years without reapplying for new permits, the

continued

A003693

D. *Penalty*

GM has not filed any specific objections to the Presiding Officer's penalty calculation. Rather, it argues that if the Board agrees with Presiding Officer that copper, lead, and zinc can be considered "pollutants" under the circumstances of this case, "imposition of a penalty is inappropriate because GM was not given fair notice of EPA's interpretation * * *." Appeal at 23 n.14. This assertion has no merit. The inclusion of effluent limitations for copper, lead, and zinc in the 1988 permit put GM on notice that these metals were considered to be pollutants regulated under the Act. Indeed, the permit states that failure to comply with the permit's effluent limitations could subject the permittee "to the criminal and civil enforcement provisions of both state and federal law." Exh. 5 to Region's Reply at 1. Moreover, GM itself identified these metals as pollutants in its 1984 permit application. *See* Exh. 4 to Region's Reply. We therefore reject the assertion that GM lacked fair notice of the Region's position.

As previously stated, the Presiding Officer assessed a total penalty of $62,500. Because GM has not pointed to any error in the Presiding Officer's calculation, and because we find nothing erroneous in that calculation, we uphold the Presiding Officer's October 31, 1996 Penalty Ruling.[27]

MDNR "created an implied agreement that the [existing] permits were to be automatically renewed upon their expiration * * *." *Bois Blanc, supra,* at 722. The court therefore concluded that the permits were still in effect and could not be summarily terminated without a hearing. *Id.* GM argues that the court in *Bois Blanc* created an "equitable permit" and that by relying on that case, the Presiding Officer improperly "impos[ed] civil penalties on the basis of equity." Appeal at 19. We find no merit to this assertion. *Bois Blanc* does not hold that permittees were entitled to "equitable permits" but that their existing permits continued in full force and effect. Similarly, the Presiding Officer in the present case concluded that, based on GM's actions, its existing permit remained effective. Moreover, contrary to GM's assertion, the Presiding Officer did not "rel[y] solely" on *Bois Blanc.* Appeal at 17. Rather, the Presiding Officer simply noted that "[t]he one case cited by the parties, *Bois Blanc,* supports complainant, albeit, as noted by [GM], that it goes against the state and not a private party." Accelerated Decision at 27 (footnote omitted). We therefore reject GM's assertion that the Presiding Officer improperly relied on *Bois Blanc* in assessing a penalty in this case.

[27] We note that the Presiding Officer did not ignore GM's assertion that, but for the fact that GM applied for a stormwater permit, GM might have been left unregulated. *See* Penalty Ruling at 11 ("Finally, there is [GM's] argument that it alone among thousands of stormwater dischargers is being sanctioned, only because it in good faith obtained an NPDES permit."). Although the Presiding Officer found this argument irrelevant on the issue of liability, he found that under the circumstances of this case imposition of the maximum penalty of $125,000 was inappropriate and thus reduced the penalty by 50%. *Id.* The Region has not appealed the Presiding Officer's Penalty Ruling.

III. *CONCLUSION*

For the reasons set forth above, a civil penalty of $62,500 is assessed against respondent GM.[28] GM shall pay the full amount of the civil penalty within sixty (60) days after receipt of this final order, unless otherwise agreed to by the parties. Payment shall be made by forwarding a cashier's check or certified check in the full amount payable to the Treasurer, United States of America at the following address:

EPA - Region V
Regional Hearing Clerk
P.O. Box 70753
Chicago, IL 60673

So ordered.

[28] Because the Board does not believe that oral argument would be of material assistance in resolving this matter, GM's request for oral argument is denied. We also reject GM's suggestion in its Notice of Appeal that further hearings are necessary in order to determine the validity of the permit. As stated above, GM's failure to exhaust its State administrative remedies precludes it from challenging the validity of the permit in this enforcement proceeding.

In this example case, the Agency prefers to have all the discharges covered by one individual permit, rather than have authorization for the discharges split between an individual permit and a general permit.

Comment 9:

DynMcDermott stated the toxicity testing requirement seems more related to "process waste water" that to storm water. For a site with numerous but similar storm water outfalls, provisions should be made to allow selection and testing or "representative" discharges, in an effort to relieve a site from excessive expenditures of time and money. They say this concept is already employed in the existing NPDES storm water general permit

Response 9:

As discussed in the fact sheet for the proposed permit and in Response 4, above, the toxicity limit is required by the State Water Quality Standards at 31 TAC 307.6(e)(2)(B). The only discharges excluded from that requirement are those where mortality is a result of an excess, deficiency, or imbalance of dissolved inorganic salts which are in the effluent and are not listed in 31 TAC 307.6 or which are in source waters.

EPA agrees to add the provision contained in Part XI.P.2(d) of the NPDES Multi-Sector Storm Water General Permit which allows a facility with multiple storm water outfalls discharging substantially identical storm water effluents to collect and analyze an effluent sample from one of those outfalls and report that the data also apply to the other substantially identical outfalls. The permittee's pollution prevention plan will have to explain why the outfalls are expected to discharge substantially identical effluents. Note that this provision will apply to storm water only outfalls, not to outfalls containing "facility waste water".

Comment 10:

DynMcDermott said the permit does not address the testing of collected rainfall before touching the ground in order to accommodate an "upstream" source water that may cause a less than 50% survival rate in 100% effluent in 24 hours.

Response 10:

The commentor raises the issue that the toxicity limit requirement should have an allowance for pollutants in the "intake" rainfall, similar to that provided in 40 CFR 122.45(g) for pollutants in intake water. In determining effluent limits, it is the Agency's position that credit will not be given for pollutants in the rain water falling on a facility. See, In the matter of General Motors Corp., CRC - Pontiac Fiero Plant , 1996 EPA ALJ LEXIS 2 (June 28, 1996). That Administrative Law Judge decision said that credit cannot be given for pollutants in the rain water because the water was not initially from the same navigable waters into which its discharges went; therefore, the permittee was responsible for any pollutants in its discharges. The Administrative Law Judge stated "The Act does not impose liability only where a point source discharge creates a net increase in the level of pollution. Rather, the Act categorically prohibits any discharge of a pollutant from a point source without a permit."

Final NPDES General Permit for Discharges from Petroleum Bulk Stations and Terminals in Texas (TXG340000)

(Top of Page)

Filed 10/5/06

CERTIFIED FOR PARTIAL PUBLICATION*

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA

SECOND APPELLATE DISTRICT

DIVISION FIVE

COUNTY OF LOS ANGELES et al., Plaintiffs and Appellants, v. CALIFORNIA STATE WATER RESOURCES CONTROL BOARD et al., Defendants and Respondents.	B184034 (Los Angeles County Super. Ct. No. BS080792)

APPEAL from an order of the Superior Court of Los Angeles County, Victoria G. Chaney, Judge. Affirmed in part; reversed in part with directions.

Raymond G. Fortner, Jr., Los Angeles County Counsel, Judith A. Fries, Principal Deputy County Counsel, and Burhenn & Gest, Howard Gest, and David W. Burhenn for Plaintiffs and Appellants County of Los Angeles and Los Angeles County Flood Control District.

Rutan & Tucker, Richard Montevideo, and Peter Howell, for Plaintiffs and Appellants The Cities of Arcadia et al.

Burke, Williams & Sorensen, Leland C. Dolley, Rufus C. Young, and Amy E. Morgan for Plaintiffs and Appellants City of Industry, City of Santa Clarita, and City of Torrance.

---

* Pursuant to California Rules of Court, rules 976(b) and 976.1, this opinion is certified for publication with the exception of part IV (G)-(L).

Richards, Watson & Gershon, Lisa Bond, Matthew F. Cohen, and John J. Harris for Plaintiffs and Appellants The Cities of Monrovia, Norwalk, Rancho Palos Verdes, Artesia, Beverly Hills, Carson, La Mirada, and Westlake Village.

Bill Lockyer, Attorney General, Tom Greene, Chief Assistant Attorney General, Mary E. Hackenbracht, Assistant Attorney General, Richard Magasin, Helen G. Arons, and Jennifer Faye Novak, Deputy Attorneys General, for Defendants and Respondents California Regional Water Quality Control Board, Los Angeles Region and State Water Resources Control Board.

David Saul Beckman, Anjali I. Jaiswal, and Michelle S. Mehta, for Defendants and Respondents Natural Resources Defense Council, Santa Monica Baykeeper, and Heal the Bay.

I. INTRODUCTION

Plaintiffs, 32 cities,[1] the County of Los Angeles (the county), the Los Angeles County Flood Control District (the flood control district), the Building Industry Legal Defense Fund, and the Construction Industry Coalition on Water Quality, appeal from a March 24, 2005 judgment in favor of defendants, California Regional Water Quality Control Board, Los Angeles Region (the regional board) and the State Water Resources Control Board (the state board) and intervenors, Natural Resources Defense Council, Inc., Santa Monica Baykeeper, and Heal the Bay. Plaintiffs challenge the legality of the regional board's issuance of Order No. 01-182 adopting the National Pollutant Discharge Elimination System Permit No. CAS004001 (the permit) which is entitled, "Municipal

---

1 The following cities have appealed Arcadia, Artesia, Bellflower, Beverly Hills, Carson, Cerritos, Claremont, Commerce, Covina, Diamond Bar, Downey, Gardena, Hawaiian Gardens, Industry, Irwindale, La Mirada, Lawndale, Monrovia, Norwalk, Paramount, Pico Rivera, Rancho Palos Verdes, Rosemead, Santa Clarita, Santa Fe Springs, Signal Hill, South Pasadena, Torrance, Vernon, Walnut, West Covina, Westlake Village, and Whittier.

Storm Water And Urban Runoff Discharges Within The County Of Los Angeles, And The Incorporated Cities Therein, Except The City Of Long Beach." The December 13, 2001 permit was issued to the county, the flood control district, and 84 incorporated cities in Los Angeles County.

We agree with plaintiffs the regional board was required to conduct environmental review pursuant to Public Resources Code section 21080.5. We disagree with every other contention raised by plaintiffs. Upon issuance of the remittitur, the trial court is to set aside its orders denying the administrative mandate petitions. The trial court is to order the regional board to conduct environmental review pursuant to Public Resources Code section 21080.5.

II. THE PERMIT

A. Overview

The permit was issued pursuant to the obligations imposed by the Clean Water Act which will be discussed in greater detail later in this opinion. The Clean Water Act was originally entitled the Federal Water Pollution Control Act. (62 Stat. 1115; 1948 U.S. Code Cong. & Admin. News at pp. 2215-2220.) For purposes of clarity and consistency, the federal applicable water pollution statutes will collectively be referred to as the Clean Water Act. The 72-page permit is divided into 6 parts. There is an overview and findings followed by: a statement of discharge prohibitions; a listing of receiving water limitations; the Storm Water Quality Management Program; an explanation of special provisions; a set of definitions; and a list of what are characterized as standard provisions. The county, the flood control district, and the 84 cities are designated in the permit as the permittees. The findings and permit are as follows.

B. Findings

The permit found that the county, the flood control district, and the 84 cities discharge and contribute to the release of pollutants from "municipal separate storm sewer systems" (storm drain systems). These discharges were the subject of permits issued by the regional board in 1990 and 1996. The 1996 order served as the National Pollutant Discharge Elimination System permit for the discharge of municipal storm water.

The regional board found that storm drain systems in the county discharged cyanide, indicator bacteria, total dissolved solids, total suspended solids, turbidity, nutrients, total aluminum, dissolved cadmium, copper, lead, total mercury, nickel, zinc, bis(2-ethylhexyl)phthalate, polycyclic aromatic hydrocarbons, diazinon, and chlorpyrifos. According to the regional board, there were certain pollutants present in urban runoff which resulted from sources over which the permittees had no control. Among the runoff sources over which the permittees have no control are polycyclic aromatic hydrocarbons which are the products of internal combustion engines or copper from brake pad wear. Various reports prepared by the regional board, the Los Angeles County Grand Jury, and academic institutions indicated pollutants are threatening to or actually impairing the beneficial uses of water bodies in the Los Angeles region.

The regional board concluded that urbanization: increased the velocity, volume, and duration of water runoff; increased erosion; and adversely affected natural drainages. The regional board found: "The [county] has identified as the seven highest priority industrial and commercial critical source types, (i) wholesale trade (scrap recycling, auto dismantling); (ii) automotive repair/parking; (iii) fabricated metal products; (iv) motor freight; (v) chemical and allied products; (vi) automotive dealers/gas stations; [and] (vii) primary metal products." Also, the regional board concluded "auto repair facilities" contribute "significant concentrations of heavy metals" to storm waters. Moreover, paved surfaces such as those outside fast food establishments or parking lots "are potential sources of pollutants" in storm water runoff. Further, storm water runoff from retail gas establishments "have concentrations" of heavy metals and hydrocarbons.

The regional board further made findings concerning the background of the permit and its coverage area. The essential components of a Storm Water Management Program are: adequate legal authority; fiscal resources; the actual Storm Water Quality Management Program itself; and a monitoring program. A Storm Water Quality Management Program consists of: a Public Information and Participation Program; an Industrial/Commercial Facilities Program: a Development Planning Program; a Development Construction Program; a Public Agency Activities Program; and an Illicit Connection and Illicit Discharges Elimination Program. The permittees filed a Report of Waste Discharge dated January 31, 2001, which contained a proposed Storm Water Quality Management Program.

C. Prohibited And Allowable Discharges

In the prohibited discharges portion of the permit, the county and the cities were required to "effectively prohibit non-storm water discharges" into their storm sewer systems. This prohibition contains the following exceptions: where the discharge is covered by a National Pollutant Discharge Elimination permit for non-storm water emission; natural springs and rising ground water; flows from riparian habitats or wetlands; stream diversions pursuant to a permit issued by the regional board; "uncontaminated ground water infiltrations" as defined by 40 Code of Federal Regulations, part 35.2005(b)(20) (1990); and waters from emergency fire fighting flows. Another category of permissible discharges were flows incidental to urban activities consisting of: reclaimed and potable landscape irrigation runoff; potable drinking water discharges which comply with the American Water Works Association guidelines for dechlorination and "suspended solids reduction practices"; drains for foundations, footings, and crawl spaces; air conditioning condensate; "dechlorinated/debrominated" swimming pool discharges; dewatering of lakes and decorative fountains; non-commercial car washing by residents or non-profit organizations; and sidewalk rinsing.

The regional board's executive officer was granted authority to add or remove categories of non-storm water discharges. If one of the foregoing categories was determined to be "a source of pollutants" by the regional board's executive officer, the discharge was to be no longer exempt. The executive officer retained the authority to impose conditions on the city or county to ensure that the discharge was "not a source of pollutants." Also, the executive director was given the authority to impose additional "prohibitions on non-storm water discharges" after considering either of two factors. The first factor the regional board's executive officer could consider is anti-degradation policies. The second factor the regional board's executive officer could consider is the total maximum load an impaired water body can receive and still meet applicable water quality standards and protect beneficial uses. (33 U.S.C. § 1313(d)(1).)

D. Receiving Water Limitations

Receiving waters are defined thusly, '"Receiving waters' means all surface water bodies . . . ." Discharges from storm sewer systems that "cause or contribute" to violations of "Water Quality Standards" objectives in receiving waters as specified in state and federal water quality plans were prohibited. Storm or non-storm water discharges from storm sewer systems which constitute a nuisance were also prohibited. The term nuisance is defined, '"Nuisance' means anything that meets all of the following requirements: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property; (2) affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal; (3) occurs during, or as a result of, the treatment or disposal of wastes." In order to comply with the receiving water limitations, the permittees were required to implement control measures in accordance with the permit. If the Storm Water Quality Management Program did not assure compliance with the receiving water requirements, the permittee was required to: immediately notify the regional board; submit a Receiving Water Limitations Compliance Report that described the best management practices that were currently being used and proposed changes to them; submit an implementation schedule as part of the Receiving Water Limitations Compliance Report; and, after approval by the regional board, promptly implement the new best management practices. If the permittee makes the foregoing changes, even if there were further receiving water discharges beyond those addressed in the Water Limitations Compliance Report, additional changes to the best management practices need not be made unless directed to do so by the regional board.

E. Storm Water Quality Management Program

The permittees were to implement the Storm Water Quality Management Program which meet the standards of 40 Code of Federal Regulations, part 122.26(d)(2) (2000) and reduce the pollutants in storm waters to the maximum extent possible with the use of best management practices. Further, the permittees were required to revise the Storm Water Quality Management Program to comply with specified total daily maximum load allocations. If a permittee modified the countywide Storm Water Quality Management Program, it was required to implement a local management program. Each permittee was required by November 1, 2002, to adopt a storm water and urban runoff ordinance. By December 2, 2002, each permittee was required to certify that it had the requisite legal authority to comply with the permit through adoption of ordinances or municipal code modifications.

The county was designated as the "Principal Permittee" and was given coordination responsibilities of the Storm Water Quality Management Program. Among other things, the county was to convene Watershed Management Committees which were to meet at least four times per year. Each permittee was entitled to have a voting representative on the committees. The committees were to coordinate and monitor implementation of the Storm Water Quality Management Program. Each permittee was required to designate a technically knowledgeable representative to the appropriate Watershed Management Committees. Each permittee was required to prepare a budget summary of moneys spent on the Storm Water Quality Management Program.

The permit granted each permittee the "necessary legal authority" to prohibit non-storm water discharges into the storm drain system. That authority extended to prohibiting discharges from: illicit connections of all kinds; wash waters from gas stations and automotive service facilities; runoff from mobile cleaning businesses; areas where oil, fluid, or antifreeze was dripping from machinery; storage areas containing hazardous substances; swimming pool waters; washing of toxic materials; and washing impervious surfaces in industrial and commercial areas. The authority also extended to the discharge of concrete and cement laden wash waters and prohibition of dumping of materials into storm drain systems. The legal authority extended to: requiring persons to comply with permittees' ordinances; holding dischargers to storm drain systems accountable; controlling pollutants and their potential contributors; inspecting, watching, and monitoring procedures to insure compliance with the permit including prohibition of illicit discharges into storm drain systems; and requiring the use of best management practices to reduce pollutant discharge into the storm drain systems to the maximum extent possible.

F. Special Provisions

The regional board's executive officer had the power to alter a best management practice under specified circumstances. The county, as the principal permittee, was required to implement a public information and participation program. The program included: marking all storm drains with '"no dumping"' signs; instituting a county-wide hotline to report illicit discharges and other environmental hazards; public education;

every year, requiring 50 percent of all school children to be educated on storm water pollution; assessments of education; and other outreach programs.

Each permittee was required to maintain a database of entities that are "critical sources" of storm water pollution. Each permittee was required to inspect under specified circumstances critical facilities including: restaurants; automotive service businesses; retail gasoline outlets; and automotive dealerships. Further, each permittee was to evaluate best management practices and increase their severity if appropriate. Violations of the Storm Water Quality Management Program were to be investigated within specified time periods. By August 1, 2002, the permittees were to amend their ordinances or municipal codes to implement the standard urban storm water mitigation plans contained in the permit. Special requirements were imposed when discharges occur in environmentally sensitive areas.

Each permittee was required to consider storm water quality impacts as part of their California Environmental Quality Act assessments. Each permittee was required to update its general plan to include "considerations and policies" of watershed and storm water quality and quantity management. The permittees were required to educate employees involved in development planning regarding the permit's requirements.

G. Development Construction Program

The permittees were required to implement programs to "control" runoff from construction sites. Runoff from construction sites was prohibited. Non-storm water runoff from equipment washing on construction sites was to be contained on-site. Special requirements were imposed on construction sites of one acre or greater in area. Additional requirements were imposed on developments which were five acres or larger including securing a General Construction Activity Storm Water Permit. The permit imposed "Numerical Design Criteria" which required that post construction best management practices incorporate "either a volumetric or flow based treatment control design standard, or both" under specified circumstances. If there is a violation of a General Construction Activity Storm Water Permit, the permittee may refer the violator to the state board.

H. Public Agency Activities Program

The permittees were required to minimize storm water pollution impacts. The requirements extended to: sewer systems; public construction; vehicle related facilities; landscape and recreational facilities; storm drain management; and street maintenance. The permittees were also required to participate in a study concerning possible dry weather discharges and the use of alternative treatment control best management practices.

I. Illicit Discharges And Connections

The permit states, "Permittees shall eliminate all illicit connections and . . . discharges to the storm drain system, and shall document, track, report all such cases . . . ." The elimination and reporting of such discharges required: development of an implementation program; by February 3, 2003, the municipalities provide the county with a list of all approved connections in the storm drain system; the county to conduct an annual evaluation of illicit discharges; and training of personnel in the identification and investigation of such discharges. The permittees were to complete the screening of illicit connections as follows: open channels, no later than February 3, 2003; underground pipes by February 1, 2005; and underground pipes with a diameter of 36 inches or greater by December 12, 2006. By December 12, 2006, the permittees were to complete a review of all "permitted connections" to the storm drain system to insure eliminating illicit discharges. Upon receipt of a report an illicit connection, an investigation was to be initiated within 21 days to determine the source and the responsible party. Within 180 days, the permittees were required to "ensure termination of the connection" using appropriate enforcement authority. As to illicit discharges, a permittee was required within one business day to respond to a report and clean up a discharge. Illicit discharges were to be investigated as soon as possible and appropriate enforcement action was to be pursued.

III. NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS, PROCEDURAL HISTORY, AND STANDARDS OF REVIEW

The present appeal arises from the issuance of the permit. The legal genesis of the National Pollutant Discharge Elimination System permits for the discharge of municipal storm water has previously been described in some detail in other decisions. (*City of Burbank v. State Water Resources Control Bd.* (2005) 35 Cal.4th 613, 619-621; *City of Rancho Cucamonga v. Regional Water Quality Control Board* (2006) 135 Cal.App.4th 1377, 1380-1381.) In *City of Rancho Cucamonga*, our colleagues in the Division Two of the Fourth Appellate District summarized the complex federal and state relationship: '"Part of the Federal Clean Water Act [33 U.S.C. § 1251 et seq.] is the National Pollutant Discharge Elimination System (NPDES), "[t]he primary means" for enforcing effluent limitations and standards under the Clean Water Act. (*Arkansas v. Oklahoma* (1992) 503 U.S. 91, 101.) The NPDES sets out the conditions under which the federal [Environmental Protection Agency] or a state with an approved water quality control program can issue permits for the discharge of pollutants in wastewater. (33 U.S.C. § 1342(a) & (b).) In California, wastewater discharge requirements established by the regional boards are the equivalent of the NPDES permits required by federal law. (§ 13374.)' (*Burbank, supra,* 35 Cal.4th at p. 621.) [¶] California's Porter-Cologne Act (Wat. Code, § 13000 et seq.) establishes a statewide program for water quality control. Nine regional boards, overseen by the State Board, administer the program in their respective regions. (Wat. Code, §§ 13140, 13200 et seq., 13240, and 13301.) Water

Code sections 13374 and 13377 authorize the Regional Board to issue federal NPDES permits for five-year periods. (33 U.S.C. § 1342, subd. (b)(1)(B).)" (*City of Rancho Cucamonga v. Regional Water Quality Control Board*, *supra*, 135 Cal.App.4th at pp. 1380-1381.)

After the board issued the aforementioned December 13, 2001 permit, on January 17, 2003, a series of legal challenges, consisting of the filing administrative mandate and mandate petitions and complaints, were instituted by plaintiffs. Judgments in favor of the regional and state boards were entered on March 24, 2005. After the judgments were entered, notices of appeal were filed on June 21 and 22, 2005. The parties stipulated to the maximum extensions of time to brief the matter as allowed by California Rules of Court, rule 15(b)(1). This court had no authority to deny the stipulated to extensions of time to file briefs. (Cal. Rules of Court, rule 15(b) ["The reviewing court may not shorten a stipulated extension"].) No extension of time request was ever granted by any member of this court. The final reply brief was filed on August 1, 2006. Oral argument was held on September 6, 2006.

There are varying standards of review. Many of the challenges to the content of the permit involve review of the denial of Code of Civil Procedure section 1094.5 administrative mandate petitions filed pursuant to Water Code section 13330, subdivision (b). We review the trial court's factual findings for substantial evidence. (*Fukuda v. City of Angels* (1999) 20 Cal.4th 805, 824; *Drummey v. State Bd. of Funeral Directors* (1939) 13 Cal.2d 75, 86.) Further, it is presumed the regional board considered the documents before it. (*City of Santa Cruz v. Local Agency Formation Com.* (1978) 76 Cal.App.3d 381, 393-394.) All reasonable doubts are resolved in favor of upholding the regional board's decision. (*Laurel Heights Improvement Assn. v. Regents of the University of California* (1988) 47 Cal.3d 376, 393; *San Franciscans Upholding the Downtown Plan v. City and County of San Francisco* (2002) 102 Cal.App.4th 656, 674.) We (and trial courts) examine the regional board's interpretation of legal matters utilizing a de novo standard of review. But we defer to the regional board's expertise in construing language which is not clearly defined in statutes involving pollutant discharge into storm drain sewer systems. (*Yamaha Corp. of America v. State Board of Equalization* (1998) 19 Cal.4th 1, 7-8; *City of Rancho Cucamonga v. Regional Water Quality Control Board*, *supra*, 135 Cal.App.4th at p. 1384.) Finally, the trial court's denials of plaintiffs' new trial and to enter a new judgment motions and declaratory relief requests are reviewed for an abuse of discretion. (*Ashcraft v. King* (1991) 228 Cal.App.3d 604, 616 [new trial motion]; *Bess v. Park* (1955) 132 Cal.App.2d 49, 52 [declaratory relief].)

IV. DISCUSSION

A. The Jurisdiction of the Regional Board To Issue The Permit

Plaintiffs contend the regional board did not have jurisdiction to issue the permit. Plaintiffs rely on language appearing in the Code of Federal Regulations. For example, the permittees cite to 40 Code of Federal Regulations part 123.1(g)(1) (1998) which states, "NPDES authority may be shared by two or more State agencies but each agency must have Statewide jurisdiction over a class of activities or discharges."[2] Further the permittees refer to the following language in 40 Code of Federal Regulations part 123.22(b) (1998), "If more than one agency is responsible for administration of a

---

2 40 Code of Federal Regulations part 123.1(g)(1) (1998) states in its entirety: "(g)(1) Except as may be authorized pursuant to paragraph (g)(2) of this section or excluded by § 122.3, the State program must prohibit all point source discharges of pollutants, all discharges into aquaculture projects, and all disposal of sewage sludge which results in any pollutant from such sludge entering into any waters of the United States within the State's jurisdiction except as authorized by a permit in effect under the State program or under section 402 of [Clean Water Act]. [National Pollutant Discharge Elimination System] authority may be shared by two or more State agencies but each agency must have Statewide jurisdiction over a class of activities or discharges. When more than one agency is responsible for issuing permits, each agency must make a submission meeting the requirements of § 123.21 before [the Environmental Protection

program, each agency must have statewide jurisdiction over a class of activities."[3] Moreover, 40 Code of Federal Regulations part 123.1(f) (1998) states, "Any State program approved by the Administrator shall at all times be conducted in accordance with the requirements of this part."

Plaintiffs reason that under state law, the regional board does not have statewide jurisdiction. Water Code section 13100 states that the state and regional boards are part of the California Environmental Protection Agency. Water Code section 13200 identifies the scope of jurisdiction of the nine regional boards. The regional board's limited jurisdiction is defined in Water Code section 13200, subdivision (d).[4] The powers of the

---

Agency] will begin formal review. [¶] (2) A State may seek approval of a partial or phased program in accordance with section 402(n) of the [Clean Water Act]."

3 40 Code of Federal Regulations part 123.22(b) (1998) states in its entirety: "A description (including organization charts) of the organization and structure of the State agency or agencies which will have responsibility for administering the program, including the information listed below. If more than one agency is responsible for administration of a program, each agency must have statewide jurisdiction over a class of activities. The responsibilities of each agency must be delineated, their procedures for coordination set forth, and an agency may be designated as a 'lead agency' to facilitate communications between [the Environmental Protection Agency] and the State agencies having program responsibility. If the State proposes to administer a program of greater scope of coverage than is required by Federal law, the information provided under this paragraph shall indicate the resources dedicated to administering the Federally required portion of the program. [¶] (1) A description of the State agency staff who will carry out the State program, including the number, occupations, and general duties of the employees. The State need not submit complete job descriptions for every employee carrying out the State program. [¶] (2) An itemization of the estimated costs of establishing and administering the program for the first two years after approval, including cost of the personnel listed in paragraph (b)(1) of this section, cost of administrative support, and cost of technical support. [¶] (3) An itemization of the sources and amounts of funding, including an estimate of Federal grant money, available to the State Director for the first two years after approval to meet the costs listed in paragraph (b)(2) of this section, identifying any restrictions or limitations upon this funding."

4 Water Code section 13200, subdivision (d) states: "The state is divided, for the purpose of this division, into nine regions: [¶] Los Angeles region, which comprises all

regional boards are set forth in Water Code section 13225 with the caveat that the powers exist "with respect to its region."[5] Because the regional board is not a statewide agency, plaintiffs argue the permit is void.

This argument has no merit. Effective September 22, 1989, the authority to issue National Pollutant Discharge Elimination System permits was vested by the federal Environmental Protection Agency in the state board. (54 Fed. Reg. 40664, 40665 (Oct. 3, 1989); see *Building Industry Assn. of San Diego County v. State Water Resources Control Bd.* (2004) 124 Cal.App.4th 866, 875.) The state board is organized into nine regional boards which are part of the California Environmental Protection Agency. (Wat.

---

basins draining into the Pacific Ocean between the southeasterly boundary, located in the westerly part of Ventura County, of the watershed of Rincon Creek and a line which coincides with the southeasterly boundary of Los Angeles County from the ocean to San Antonio Peak and follows thence the divide between San Gabriel River and Lytle Creek drainages to the divide between Sheep Creek and San Gabriel River drainages."

5 Water Code section 13225 states in its entirety: "Each regional board, with respect to its region, shall: [¶] (a) Obtain coordinated action in water quality control, including the prevention and abatement of water pollution and nuisance. [¶] (b) Encourage and assist in self-policing waste disposal programs, and upon application of any person, advise the applicant of the condition to be maintained in any disposal area or receiving waters into which the waste is being discharged. [¶] (c) Require as necessary any state or local agency to investigate and report on any technical factors involved in water quality control or to obtain and submit analyses of water; provided that the burden, including costs, of such reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained therefrom. [¶] (d) Request enforcement by appropriate federal, state and local agencies of their respective water quality control laws. [¶] (e) Recommend to the state board projects which the regional board considers eligible for any financial assistance which may be available through the state board. [¶] (f) Report to the state board and appropriate local health officer any case of suspected contamination in its region. [¶] (g) File with the state board, at its request, copies of the record of any official action. [¶] (h) Take into consideration the effect of its actions pursuant to this chapter on the California Water Plan adopted or revised pursuant to Division 6 (commencing with Section 10000) of this code and on any other general or coordinated governmental plan looking toward the development, utilization or conservation of the water resources of the state. [¶] (i) Encourage regional planning and action for water quality control."

Code, §§ 174 et seq. 13100; see *City of Arcadia v. State Water Resources Control Bd.* (2006) 135 Cal.App.4th 1392, 1405.) The nine regional boards are authorized under this state's laws to issue National Pollutant Discharge Elimination System permits. (*Building Industry Assn. of San Diego County v. State Water Resources Control Bd., supra*, 124 Cal.4th at p. 875; Wat. Code, § 13374.) The federal Environmental Protection Agency memorandum of agreement with the state board complies with the statewide jurisdiction requirements imposed by the federal regulations. The fact the state board is organized into nine regional boards is legally irrelevant. The state board has statewide jurisdiction.

Further, we agree with the Attorney General that plaintiffs may not challenge the regional board's authority to issue a National Pollutant Elimination System permit in this proceeding. Such an indirect challenge to the board's authority is barred by the de facto officer doctrine. The Supreme Court has described the de facto officer doctrine, which bars a challenge to an agency's action based on a purported lack of legal authority to act, thusly: "[W]e conclude that under the 'de facto officer' doctrine prior actions of the Commission cannot be set aside on the ground that the appointment of the commissioners who participated in the decision may be vulnerable to constitutional challenge. As this court explained in *In re Redevelopment Plan for Bunker Hill* (1964) 61 Cal.2d 21, 41-42: 'The de facto doctrine in sustaining official acts is well established. [Given the existence of] a de jure office, "[p]ersons claiming to be public officers while in possession of an office, ostensibly exercising their function lawfully and with the acquiescence of the public, are *de facto* officers. . . . The lawful acts of an officer *de facto*, so far as the rights of third persons are concerned, are, if done within the scope and by the apparent authority of office, as valid and binding as if he were the officer legally elected and qualified for the office and in full possession of it." [Citations.]' (See also *Pickens v. Johnson* (1954) 42 Cal.2d 399, 410 ['There is no question but that . . . the status of a judge de facto attached to his action. The office to which he was assigned was a de jure office. By acting under regular assignment under a statute authorizing it he was acting under color of authority as provided by law. His conduct in trying the cases and rendering judgment therein cannot here be questioned.']).'' (*Marine Forests Soc. v. California Coastal Com.* (2005) 36 Cal.4th 1, 54; original italics.) Here, plaintiffs are challenging the permit by attacking the regional board's authority. Under these circumstances, this they may not do in what amounts to a licensing proceeding. (*Ibid.*; *In re Redevelopment Plan for Bunker Hill*, *supra*, 61 Cal.2d at pp. 41-42.)

Finally there is no merit to the contention that because the regional board is not an elected body, it cannot make the financial decisions of the scope entailed by the permit. The board's powers exist because of: the Clean Water Act which was adopted and amended by elected members of Congress and signed into law by elected presidents; provisions of the Water Code which were enacted by elected legislators and approved by elected governors; and the members, who must have special competence, are appointed by an elected governor and confirmed by the elected State Senate. (Wat. Code, § 13201, subds. (a)-(b).) The democratic processes of government control every aspect of the creation of the board, its legal authority, and the selection of its members. Further, the decisions of regulatory institutions such as the regional board, are entitled by law to a presumption of competence and propriety. (*City of Rancho Cucamonga v. Regional Water Quality Control Bd.*, *supra*, 135 Cal.App.4th at p. 1384; *Communities for a Better Environment v. State Water Resources Control Bd.* (2003) 109 Cal.App.4th 1089, 1104.)

B. The Motions To Strike

Plaintiffs argue that the trial court erroneously granted the regional board's motions to strike portions of the petition. Plaintiffs contend: the motions to strike were in fact disguised summary adjudication motions; the orders granting the motions to strike did not resolve entire causes of action; and hence, the orders violated Code of Civil Procedure section 437c, subdivision (f)(1). This contention has no merit. Code of Civil Procedure section 436 allows a court to strike portions of a cause of action. (*City of*

Rancho Cucamonga v. Regional Water Quality Control Bd., *supra*, 135 Cal.App.4th at p. 1386; *PH II, Inc. v. Superior Court* (1995) 33 Cal.App.4th 1680, 1682-1683.)

C. The State Board's Demurrer

Plaintiffs argue that the trial court erroneously sustained the state board's demurrer to the petitions. The state board contended it was not properly joined as a party to the litigation. A group of plaintiffs alleged the state board required the regional boards to adopt terms and conditions on National Pollutant Discharge Elimination System permits without complying with Government Code sections 11340.5, subdivision (a)[6] and 11352, subdivision (b) which are part of the Administrative Procedure Act. Plaintiffs had a duty to specifically allege every fact that would give rise to liability by the state board. (*Covenant Care, Inc. v. Superior Court* (2004) 32 Cal.4th 771, 790; *Lopez v. Southern Cal. Rapid Transit Dist.* (1985) 40 Cal.3d 780, 795.) The state board refused to assume jurisdiction over this case. There were thus no specific allegations as to the state board to hold it liable as it engaged in no independent activity. Hence, this contention has no merit and the demurrer was properly sustained. (*City of Rancho Cucamonga v. Regional Water Quality Control Bd.*, *supra*, 135 Cal.App.4th at p. 1383; *People ex rel Cal. Regional Wat. Quality Control Bd. v. Barry* (1987) 194 Cal.App.3d 158, 177.)

---

6 Government Code sections 11340.5, subdivision (a) states, "No state agency shall issue, utilize, enforce, or attempt to enforce any guideline, criterion, bulletin, manual, instruction, order, standard of general application, or other rule, which is a regulation as defined in Section 11342.600, unless the guideline, criterion, bulletin, manual, instruction, order, standard of general application, or other rule has been adopted as a regulation and filed with the Secretary of State pursuant to this chapter."

D. The Declaratory Relief Claims

The trial court sustained the regional board's demurrers to the declaratory relief claims. Plaintiffs argue they were entitled to declaratory relief as to whether: the permittees were required to "go beyond the [maximum extent practicable]" standard to comply with part 2 of the permit which relates to receiving water limitations; part 2 contained a "safe harbor" if the permittees were acting in good faith in implementing best management practices to control excessive discharge of pollutants and nuisance conditions; the requirement in part 4 of the permit that each permittee's general plan and California Environmental Quality Act review take into account storm water runoff is lawful; the regional board was required to consider the economic impact of the proposed permit and its effect on housing; and the regional board was required to perform a "cost/benefit analysis" of the monitoring and reporting program.

When a remedy has been designated by the Legislature to review an administrative action, declaratory relief is unavailable. (*State of California v. Superior Court* (1974) 12 Cal.3d 237, 249; *Scott v. City of Indian Wells* (1972) 6 Cal.3d 541, 546.) Water Code section 13330, subdivision (b) provides that a regional board order may be reviewed by a Code of Civil Procedure section 1094.5 administrative mandate petition filed within 30 days after the state board denies review. Therefore, the demurrer was correctly sustained to the declaratory relief claims. (*Hill v. City of Manhattan Beach* (1971) 6 Cal.3d 279, 287; *Hostetter v. Alderson* (1952) 38 Cal.2d 499, 500.)

E. The Regional Board Has Not Unlawfully Interfered In Local General Plans And California Environmental Quality Act Review.

The permit requires the permittees to update their general plans to include watershed and storm water runoff as considerations in the land use, housing, conservation, and open space planning. Further, the permittees were required to amend their California Environmental Quality Act process to insure review of the effect of commercial and residential development on storm water runoff. Plaintiffs argue these aspects of the permit violate the separation of powers doctrine. This contention has no merit. As noted, the regional boards are part of a joint state and federal process to enforce the Clean Water Act. (*City of Burbank v. State Water Resources Control Bd.*, *supra*, 35 Cal.4th at pp. 619-620; *City of Rancho Cucamonga v. Regional Water Quality Control Bd.*, *supra*, 135 Cal.App.4th at pp. 1380-1381.) The general plan powers and duties of cities and counties are limited by statewide law. (Cal. Const., art. XI, § 7; Gov. Code, § 65030.1; *Jackson v. City of Los Angeles* (2003) 111 Cal.App.4th 899, 907-908; *Suter v. City of Lafayette* (1997) 57 Cal.App.4th 1109, 1118.) Further, the Clean Water Act supersedes all conflicting state and local pollution laws. (*Arkansas v. Oklahoma* (1992) 503 U.S. 91, 101; *City of Burbank v. State Water Resources Control Bd.*, *supra*, 35 Cal.4th at p. 621.) The state and regional boards are vested with the primary responsibility of controlling water quality. (Wat. Code, § 13001; see *Arkansas v. Oklahoma, supra,* 503 U.S. at p. 101; *Hampson v. Superior Court* (1977) 67 Cal.App.3d 472, 484.) Regional boards are explicitly granted the authority to issue orders for purposes of enforcing the federal Clean Water Act. (Wat. Code, § 13377.) Federal law requires that permits include controls to reduce pollutant discharge in areas of new development and significant redevelopment—the very area where regional board review occurs. (40 C.F.R. § 122.26(d)(2)(iv)(A)(2) (2006).) So long as the regional boards' decisions carry out federal and state water quality mandates resulting from express legislative action as the challenged orders in this case in fact do, no separation of powers issue is present. (*Kugler v. Yocum* (1968) 69 Cal.2d 371, 375-377; *Salmon Trollers Marketing Assn. v. Fullerton* (1981) 124 Cal.App.3d 291, 300.) Given the foregoing, we need not address the waiver, laches, and estoppel contentions of the regional and state boards and the intervenors.

F. Failure To Comply With the California Environmental Quality Act

Plaintiffs argue that the permit issuance process violates provisions of the California Environmental Quality Act. Plaintiffs rely on Water Code section 13389 which provides that chapter 3 of the California Environmental Quality Act does not apply to National Pollutant Discharge Elimination Systems permit proceedings: "Neither the state board nor the regional boards shall be required to comply with the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code prior to the adoption of any waste discharge requirement, except requirements for new sources as defined in the Federal Water Pollution Control Act or acts amendatory thereof or supplementary thereto." California Code of Regulations, title 23, section 3733 also states, "Environmental documents are not required for adoption of waste discharge requirements under Chapter 5.5, Division 7 of the Water Code, except requirements for new sources as defined in the Federal Water Pollution Control Act. This exemption is in accordance with Water Code Section 13389 which does not apply to the policy provisions of Chapter 1 of CEQA." Plaintiffs argue that the California Environmental Quality Act applies to: the receiving water limitations; the revision of the Storm Water Quality Management Program; and the Development Planning Program. (See *City of Arcadia v. State Water Resources Control Bd., supra,* 135 Cal.App.4th at pp. 1420-1426; *Committee for Progressive Gilroy v. State Water Resources Control Bd.* (1987) 192 Cal.App.3d 847, 862.)

We agree that Water Code section 13389 explicitly excludes chapter 3 of the California Environmental Quality Act. But as plaintiffs argue, chapters 1 and 2.6 of the California Environmental Quality Act required the regional board to engage in specified environmental assessments. We agree with the analysis of our Fourth Appellate District, Division One colleagues set forth in *City of Arcadia v. State Water Resources Control Bd., supra,* 135 Cal.App.4th at pages 1420-1430 that regional board permits for basin plans which may have a significant impact on the environment are subject to limited

California Environmental Quality Act review. The Storm Water Quality Management Program portion of the permit imposes considerable requirements on development in residential and business settings including: development and redevelopment planning; conserving natural areas; protecting slopes and channels; altering surface flows of storm waters; and developing flow based treatment control designs to mitigate by infiltrating, filtering, or treating of storm water runoff. Such matters, which can involve significant construction, project development, and urban planning are commonly subject to California Environmental Quality Act review. (Pub. Resources Code, § 21065; Cal. Code Regs., tit. 14, §§ 15378, subd. (a), 15382; *Association for a Cleaner Environment v. Yosemite Community College Dist.* (2004) 116 Cal.App.4th 629, 639 [removal of firing range]; *Quail Botanical Gardens Foundation, Inc. v. City of Encinitas* (1994) 29 Cal.App.4th 1597, 1600-1607 [city approval of a subdivision]; *Terminal Plaza Corp. v. City and County of San Francisco* (1986) 177 Cal.App.3d 892, 899-907 [ordinance which could lead to future construction]; *Erven v. Board of Supervisors* (1975) 53 Cal.App.3d 1004, 1012-1014 [road]; *County of Inyo v. Yorty* (1973) 32 Cal.App.3d 795, 802-806 [groundwater extraction project].)

But as in *City of Arcadia*, there is no requirement that a full environmental impact report be prepared as would be required for a project subject to chapter 3 of the California Environmental Quality Act. Rather, the regional board must prepare a certification pursuant to Public Resources Code section 21080.5. (*Mountain Lion Foundation v. Fish & Game Com.* (1997) 16 Cal.4th 105, 127-128; *City of Arcadia v. State Water Resources Control Bd., supra*, 135 Cal.App.4th at pp. 1421-1426.) Upon issuance of the remittitur, subject to our discussion below concerning potential mootness, the trial court is to direct the regional board to prepare a certification pursuant to Public Resources Code section 21080.5.

There is no merit to the regional board's argument that the permit is not subject to California Environmental Quality Act review. The exemptions to California Environmental Quality Act review authorized by Public Resources Code section 21084, subdivision (a) and title 14 California Code of Regulations sections 15307 and 15308 are inapplicable.[7] The Legislature has clearly indicated in Water Code section 13389 that only chapter 3 of the California Environmental Quality Act does not apply to National Pollutant Discharge Elimination System permits. Insofar as title 14 California Code of Regulations sections 15307 and 15308 are in conflict with Water Code section 13389, they are unenforceable. (Gov. Code, § 11342.2 ["Whenever by the express or implied terms of any statute a state agency has authority to adopt regulations to implement, interpret, make specific or otherwise carry out the provisions of the statute, no regulation adopted is valid or effective unless consistent and not in conflict with the statute and reasonably necessary to effectuate the purpose of the statute"]; *Wildlife Alive v. Chickering* (1976) 18 Cal.3d 190, 205-206.) In *Wildlife Alive*, the Supreme Court explained the limited scope of the categorical exemption regulations: "Even if section 15107 was intended to cover the commission's hunting program, it is doubtful that such a categorical exemption is authorized under the statute. We have held that no regulation is valid if its issuance exceeds the scope of the enabling statute. (See Gov. Code, § 11374; *Whitcomb Hotel, Inc.* v. *Cal. Emp. Com.* (1944) 24 Cal.2d 753, 757.) The secretary is

---

7 Public Resources Code section 21084 states: "The guidelines prepared and adopted pursuant to Section 21083 shall include a list of classes of projects which have been determined not to have a significant effect on the environment and which shall be exempt from this division. In adopting the guidelines, the Secretary of the Resources Agency shall make a finding that the listed classes of projects referred to in this section do not have a significant effect on the environment." Title 14 California Code of Regulations section 15307 states: "Class 7 consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment. Examples include but are not limited to wildlife preservation activities of the State Department of Fish and Game. Construction activities are not included in this exemption." Title 14 California Code of Regulations section 15308 provides: "Class 8 consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Construction activities and relaxation of standards allowing environmental degradation are not included in this exemption."

empowered to exempt only those activities which do not have a significant effect on the environment. (Pub. Resources Code, § 21084.) It follows that where there is any reasonable possibility that a project or activity may have a significant effect on the environment, an exemption would be improper." (*Wildlife Alive v. Chickering, supra,* 18 Cal.3d at pp. 205-206.) Here, the statutory and regulatory inconsistency is even more pronounced—Water Code section 13389 makes it clear only chapter 3 of the California Environmental Quality Act does not apply to the "adoption of any waste discharge requirement" which by its very terms would include the permit. To construe title 14 of the California Code of Regulations sections 15307 and 15308 to bar limited environmental review prior to issuance of a National Pollutant Discharge Elimination System permit would conflict with Water Code section 13389.

Further, there is nothing in federal law that excludes this case from California Environmental Quality Act coverage. None of the applicable forms of federal preemption principles apply to Water Code section 13389. There are three different ways a state statute can be preempted by a federal law: where Congress has made its intent known through explicit statutory language; where state law regulates conduct in a field that Congress intended the federal government to occupy exclusively; and where it is impossible for a party to comply with both state and federal requirements or where state law stands as an obstacle to the accomplishment and execution of the full congressional purposes and objectives. (*English v. General Electric Co.* (1990) 496 U.S. 72, 78-79; *Dowhal v. SmithKline Beecham Consumer Healthcare* (2004) 32 Cal.4th 910, 923.) None of these factors are present. Congress has never explicitly addressed California's limited environmental review process in the context of National Pollutant Elimination System permit issuance procedures. The manner in which National Pollutant Elimination System permits are issued by state agencies such as the regional board is not a field occupied exclusively by the federal government—it is a partnership between federal and state governments. (*Arkansas v. Oklahoma, supra,* 503 U.S. at p. 101 *City of Burbank v. State Water Resources Control Bd., supra,* 35 Cal.4th at p. 620.) There is no evidence in this case limited environmental review conducted pursuant to chapter 2.6 of the California Environmental Quality Act will stand as an obstacle to the accomplishment of congressional objectives. If there is a case where the facts are that limited environmental review pursuant to chapter 2.6 of the California Environmental Quality Act will frustrate Congress's purposes and objectives, then certainly, federal preemption can potentially occur. But in the context of this case, we respectfully conclude that the arguments of the regional and state boards and the intervenors that requiring compliance with chapter 2.6 of the California Environmental Quality Act stands as an obstacle to the full accomplishment and execution of congressional purposes and objectives or that it is impossible to comply with both state and federal law are based on speculation. (*Solorzano v. Superior Court* (1992) 10 Cal.App.4th 1135, 1148 ["mere speculation about a hypothetical conflict is not the stuff of which preemption is made"]; *Consumer Justice Center v. Olympian Labs, Inc.* (2002) 99 Cal.App.4th 1056, 1062 ["preemption cannot be based on a belief in phantoms, i.e., speculation"].)

Finally, contrary to the regional board's contention, there is nothing in the National Environmental Policy Act that requires the permit be excluded from California Environmental Quality Act review. Neither title 33 United States Code section 1342(b) nor the federal regulations speak to California Environmental Quality Act review.

At oral argument we raised the question of whether by the time our remittitur issues, the present permit will have expired. If the present permit is no longer in effect, it would seem that it would be a moot point to require limited environmental review. It is unclear what will happen in the future. The best course of action is to leave this matter in the good hands of the trial court. It is entirely possible the present permit will have to be replaced by another permit by the time our remittitur issues. If so, the trial court is free to conclude it would be moot to require limited environmental review in connection with the present permit and may then deny the mandate petition. (*Youngblood v. Board of Supervisors* (1978) 22 Cal.3d 644, 657; *MHC Operating Limited Partnership v. City of San Jose* (2003) 106 Cal.App.4th 204, 214.)

[The portions of the opinion that follow, parts IV (G)-(L) are deleted from publication. See *post* at page 46, where publication is to resume.]

G. Sufficiency Of The Evidence Contentions

1. Overview

Many of plaintiffs' contentions are overtly stated or deftly disguised sufficiency of the evidence arguments. We agree with the intervenors that plaintiffs in making these assertions have failed in every respect to set forth all of the relevant evidence. As such, all evidence sufficiency contentions have been waived. (*State Water Resources Control Bd. Cases* (2006) 136 Cal.App.4th 674, 749; see *Foreman & Clark Corp. v. Fallon* (1971) 3 Cal.3d 875, 881.)

2. The reasonableness of the permit requirements

Plaintiffs argue that the permit violates the statutory requirement it be reasonable. Plaintiffs contend that four parts of the permit exceed federal requirements which only require that a permit restrict pollutant discharges to the maximum extent possible. Plaintiffs identify three parts of the permit which exceed the federal maximum extent possible limit and reason as follows. Part 2.1 of the permit, which involves receiving water restrictions, prohibits all water discharges which violate water quality standards or objectives regardless of whether the best management practices are reasonable. Part 2.4, also part of the receiving water restrictions, permits the regional board to adopt best management practices without any reasonableness restriction. Part 3.C requires the permittees to revise their storm water quality management programs in order to implement the total maximum daily loads for impaired water bodies. As a result, according to plaintiffs, parts 3.G and 4 authorize the regional board to require strict requirements with numeric limits on pollutants which are incorporated into the total maximum daily load restrictions. Because these four parts of the permit exceed federal requirements, plaintiffs argue the permit violates a state law requirement derived from Water Code sections 13000, 13241, and 13263, subdivision (a)[8] that restrictions on storm water system discharges be reasonable.

---

[8] Water Code section 13000 states: "The Legislature finds and declares that the people of the state have a primary interest in the conservation, control, and utilization of the water resources of the state, and that the quality of all the waters of the state shall be protected for use and enjoyment by the people of the state. [¶] The Legislature further finds and declares that activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible. [¶] The Legislature further finds and declares that the health, safety and welfare of the people of the state requires that there be a statewide program for the control of the quality of all the waters of the state; that the state must be prepared to exercise its full power and jurisdiction to protect the quality of waters in the state from degradation originating inside or outside the boundaries of the state; that the waters of the state are increasingly influenced by interbasin water development projects and other statewide considerations; that factors of precipitation, topography, population, recreation, agriculture, industry and economic development vary from region to region within the state; and that the statewide program for water quality control can be most effectively administered regionally, within a framework of statewide coordination and policy." The portions of Water Code section 13241 upon which plaintiff rely state: "Each regional board shall establish such water quality objectives in water quality control plans as in its judgment will ensure the reasonable protection of beneficial uses and the prevention of nuisance; however, it is recognized that it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses. Factors to be considered by a regional board in establishing water quality objectives shall include, but not necessarily be limited to, all of the following: [¶] . . . (c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area. [¶] (d) Economic considerations. [¶] (e) The need for developing housing within the region. [¶] (f) The need to develop and use recycled water." Water Code section 13263, subdivision (a) states: "The regional board, after any necessary hearing, shall prescribe requirements as to the nature of any proposed discharge, existing discharge, or

These contentions have no merit. To begin with, insofar as these contentions involve sufficiency of the evidence contentions, they are waived because of a failure to set forth all of the applicable evidence. (*Foreman & Clark Corp. v. Fallon*, *supra*, 3 Cal.3d at p. 881; *State Water Resources Control Bd. Cases*, *supra*, 136 Cal.App.4th at p. 749.) In any event, regardless of whether the permit imposed requirements beyond what plaintiffs contend is the maximum extent feasible, the regional board has the authority to impose additional restrictions. As the intervenors explain, title 33 United States Code section 1342(p)(3)(B) states in part: "Permits for discharges from municipal storm sewers— [¶] . . . (ii) shall include a requirement to effectively prohibit non-stormwater discharges into the storm sewers; and [¶] (iii) shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the . . . State determines appropriate for the control of such pollutants."

In fact, the regional board had the duty to place limits on the release of pollutants into certain waters. Our colleagues in Division One of the Fourth Appellate District have explained: the Clean Water Act requires that states identify a level of permissible pollution, the "total maximum daily load"; the total maximum daily load must be established at a level to achieve certain water standards; and the National Pollutant Elimination System permits must be consistent with the amount of pollutants described in the state specified total maximum daily load. (*City of Arcadia v. State Water Resources Control Bd.*, *supra*, 135 Cal.App.4th at p. 1404; 33 U.S.C. § 1313(d).) The federal Clean Water Act requires the following, "Except as in compliance with this section and

---

material change in an existing discharge, except discharges into a community sewer system, with relation to the conditions existing in the disposal area or receiving waters upon, or into which, the discharge is made or proposed. The requirements shall implement any relevant water quality control plans that have been adopted, and shall take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the provisions of Section 13241."

sections . . . [1312, 1316, 1317, 1328, 1342, and 1344] of this Act, the discharge of any pollutant by any person shall be unlawful." (33 U.S.C. § 1311(a).) In terms of the regional board's statutory duty in setting a total maximum daily load, the Clean Water Act requires: "Each State shall establish for the waters identified in paragraph (1)(A) of this subsection, and in accordance with the priority ranking, the total maximum daily load, for those pollutants which the Administrator identifies under section [1314(a)(2)] as suitable for such calculation. Such load shall be established at a level necessary to implement the applicable water quality standards . . . ." (33 U.S.C. § 1313(d)(1)(C).) As can be noted, the regional board is permitted to take into account the maximum extent practicable limitation in setting the total maximum daily load. (*City of Arcadia v. State Water Resources Control Bd.*, *supra*, 136 Cal.App.4th at p. 1428.) The regional board's total maximum daily load specification in this case was entirely consistent with federal water quality law. Nothing in the Water Code can circumvent the foregoing federally imposed requirements as to the calculation of the total maximum daily load. (See *City of Burbank v. State Water Resources Control Bd.*, *supra*, 35 Cal.4th at pp. 618, 626-627.) And the regional board's authority in setting the total maximum daily load extended to imposing requirements beyond the maximum extent practicable. (*City of Arcadia v. State Water Resources Control Bd.*, *supra*, 135 Cal.App.4th at p. 1428; *Building Industry Assn. of San Diego County v. State Water Resources Control Bd.*, *supra*, 124 Cal.App.4th at pp. 885-886.)

There is substantial evidence the permit imposes reasonable pollutant discharge requirements. The regional board had before it the study entitled "Fundamentals of Urban Runoff Management" which detailed the feasibility of the restrictions at issue. In footnote 6 of the trial court's March 24, 2005 statement of decision are 16 separate studies or analyses that evaluate the reasonableness of the restrictions at issue. Further, as described below, there was a vast array of reports and official papers that addressed the reasonableness issue in varying contexts ranging from economics to housing. Substantial evidence supports the trial court's finding that the permit's restrictions on pollutant discharge are reasonable. It is presumed the regional board examined these reports. (*City of Santa Cruz v. Local Agency Formation Com.*, *supra*, 76 Cal.App.3d at pp. 393-394; see *Laurel Heights Improvement Assn. v. Regents of the University of California*, *supra*, 47 Cal.3d at p. 393.)

There is likewise no merit to the factually unsupported theory of the county and the flood control district that they cannot comply with the permit. The county and the flood control district assert, without citation to any evidence in the record, they cannot comply with the permit thereby rendering it, as matter of law, unreasonable. We agree with the intervenors that there is insufficient facts to permit an evidentiary challenge of the type asserted by the county and the flood control district. (*Building Industry Assn. of San Diego County v. State Water Resources Control Bd.*, *supra*, 124 Cal.App.4th at p. 888; Cal. Rules of Court, rule 14(a)(1)(C).)

3. Failure to consider the economic effects of the permit and engage in a proper cost benefit analysis

Plaintiffs argue that the regional board failed to consider the economic impact of issuance of the permits. A regional board is authorized to issue a permit which imposes more protective restrictions on waste water discharge than required by the Clean Water Act. (Wat. Code, § 13377.[9]) As noted, Water Code section 13241, subdivision (d) requires that the regional board consider the economic effect including the cost of compliance of the issuance of the permit. (See fn. 6, *supra*.) Plaintiffs argue the permit

---

9 Water Code section 13377 states, "Notwithstanding any other provision of this division, the state board or the regional boards shall, as required or authorized by the Federal Water Pollution Control Act, as amended, issue waste discharge requirements and dredged or fill material permits which apply and ensure compliance with all applicable provisions of the act and acts amendatory thereof or supplementary, thereto, together with any more stringent effluent standards or limitations necessary to implement water quality control plans, or for the protection of beneficial uses, or to prevent nuisance."

imposes conditions more stringent than required by the federal Clean Water Act. Therefore, they reason that the regional board was required to consider the economic effect of the permit. (*City of Burbank v. State Water Resources Control Bd., supra*, 35 Cal.4th at p. 618 ["When, however, a regional board is considering whether to make the pollutant restrictions in a wastewater discharge permit *more stringent* than federal law requires, California law allows the board to take into account economic factors, including the wastewater discharger's cost of compliance" (orig. italics)]; *City of Arcadia v. State Water Resources Control Bd., supra*, 135 Cal.App.4th at pp. 1415-1418 [finding sufficient consideration of economic effect of total daily maximum loads for trash restriction imposed in 2001 permit].) Further, plaintiffs argue that the regional board failed to conduct a cost benefit analysis as required by Water Code sections 13165[10], 13225, subdivision (c)[11], 13267, subdivision (b)[12] before imposing monitoring and reporting obligations as part of the permit.

---

10 Water Code section 13165 states, "The state board may require any state or local agency to investigate and report on any technical factors involved in water quality control; provided that the burden, including costs, of such reports shall bear a reasonable relationship to the need for the reports and the benefits to be obtained therefrom."

11 Water Code section 13225, subdivision (c) states: "Each regional board, with respect to its region, shall: [¶] (c) Require as necessary any state or local agency to investigate and report on any technical factors involved in water quality control or to obtain and submit analyses of water; provided that the burden, including costs, of such reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained therefrom."

12 Water Code section 13267, subdivision (b)(1) states: "In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard

These contentions have no merit. To begin with, insofar as plaintiffs argue that the there was no substantial evidence these issues were considered, they have waived their opportunity to do so because they failed to set forth all of the documents considered by the regional board. Plaintiffs have failed to detail an extensive array of reports and analysis appearing in the administrative record. (*Foreman & Clark Corp. v. Fallon*, *supra*, 3 Cal.3d at p. 881; *State Water Resources Control Bd. Cases*, *supra*, 136 Cal.App.4th at p. 749.)

Nonetheless this contention is without merit. The permit explicitly states it is intended to provide a cost-effective storm water pollution program to the maximum extent possible. The permit applies the same cost-effective analysis to efforts to reduce the flow of pollutants into receiving waters. Moreover, the regional board in its findings referred to a report specifying how the "maximum extent practicable" requirement includes considerations of costs and benefit. The regional board had before it: a study of costs prepared by the Maryland Department of Environment; a 58-page study prepared for Parsons Engineering Service on the costs and benefits of storm water best management practices; the extensive federal Environmental Protection Agency data summary of best management practices and their costs which include programs incorporated into the permit; a federal Environmental Protection Agency fact sheet showing the cost effectiveness of reductions in storm water run-off; a federal Environmental Protection Agency document detailing the economic benefits of run off controls; a 44-page federal Environmental Protection Agency document detailing cost analyses of various best management practices; a 99-page report entitled "Cost Analysis" on storm water programs in the state of Washington; a similar analysis prepared for the Commonwealth of Virginia; a federal Environmental Protection Agency analysis of the economic effects of clean water; a lengthy analysis prepared by the federal

---

to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports."

Environmental Protection Agency on the effects of restrictions of runoff on housing values; and an 11-page study entitled, "The Economics of Watershed Protection." It is presumed the regional board examined these reports. (*City of Santa Cruz v. Local Agency Formation Com., supra*, 76 Cal.App.3d at pp. 393-394; see *Laurel Heights Improvement Assn. v. Regents of the University of California, supra*, 47 Cal.3d at p. 393.) This constitutes substantial evidence the regional board considered the costs and benefits of implementation of the permit. Finally, for the foregoing reasons, the trial court did to abuse its discretion when it denied the posttrial motions which asserted the regional board did not consider the economic consequences of the permit.

4. Failure to consider the effect of the permit on housing

Plaintiffs argue that the regional board neglected to consider the effect of the permit on the need to develop housing as required by Water Code section 13241, subdivision (e). (See fn. 6, *supra*.) Plaintiffs argue that the Legislature has determined that all state agencies such as the regional board must "facilitate the improvement and development" of affordable housing. (Gov. Code, § 65580, subds. (c)-(d).) Plaintiffs argue: the permit is designed to impose new storm runoff limitations on future residential projects; the Standard Urban Water Mitigation Plan portion of the permit applies to both development and redevelopment projects; the permit requires that runoff mitigation occur on single family residences occupying one acre or more and 10-unit or more housing developments; among the mitigation requirements are retention of runoff and erosion from construction sites; transfers of property were subject to maintenance agreements; and the permit will require a significant amount of land to comply with treatment control best management practices.

Plaintiffs have failed to detail an extensive array of reports and analyses appearing in the administrative record. Thus, the issue of whether there is substantial evidence the regional board considered the effect of the permit on housing has been waived.

(*Foreman & Clark Corp. v. Fallon*, *supra*, 3 Cal.3d at p. 881; *State Water Resources Control Bd. Cases*, *supra*, 136 Cal.App.4th at p. 749.) Nonetheless, there is substantial evidence the regional board considered housing issues prior to issuing the permit. The regional board had before it: the May 16, 2001 expression of concerns by the Building Industry Association; demographic analyses; a scholarly discussion of the effects of environmental regulation and housing availability; the federal Environmental Protection Agency analysis of the potential effects of restrictions of runoff on housing values; a technical analysis of runoff controls on housing design and planning; a National Association of Homebuilders guide for residential storm water runoff; an analysis of site design and watershed management in the context of residential subdivisions; the document entitled, "Storm Water Management in Washington" which discusses the technical requirements for small and large parcel developments; the regional board staff analysis; an analysis of the experiences in Virginia; and an article on additional housing costs resulting from storm water regulation. It is presumed the regional board examined these reports. (*City of Santa Cruz v. Local Agency Formation Com.*, *supra*, 76 Cal.App.3d at pp. 393-394; see *Laurel Heights Improvement Assn. v. Regents of the University of California*, *supra*, 47 Cal.3d at p. 393.) Thus, there is substantial evidence the regional board considered housing related issues before it issued the permit.

H. Improper Specifications Of Design Characteristics.

Plaintiffs argue that the regional board improperly specified the '"design or the particular manner"' as to how there was to be compliance with waste discharge requirements. Plaintiffs rely on Water Code section 13360, subdivision (a) which states: "No waste discharge requirement or other order of a regional board . . . issued under this division shall specify the design, location, type of construction, or particular manner in which compliance may be had with that requirement, order, or decree, and the person so ordered shall be permitted to comply with the order in any lawful manner." Plaintiffs contend two provisions of the permit violate Water Code section 13360, subdivision (a). First, plaintiffs argue that the permit improperly imposes a series of specific design criteria for '"Volumetric Treatment Control"' and '"Flow based Treatment Control"' best management practices. Second, plaintiffs challenge the requirement that some of them place and maintain trash receptacles at transit stops.

Theses contentions have no merit. As held in *City of Rancho Cucamonga v. Regional Water Quality Control Bd., supra*, 135 Cal.App.4th at page 1389, the federal Clean Water Act authorizes National Pollutant Discharge Elimination Systems permits to set forth specific practices which will restrict polluted storm water runoff. (33 U.S.C. § 1342(a)(1), (p)(3)(B)(iii).) In *City of Rancho Cucamonga*, Associate Justice Barton C. Gaut explained: "Rancho Cucamonga's reliance on Water Code section 13360 is misplaced because that code section involves enforcement and implementation of state water quality law, (Wat. Code, § 13300 et seq.) not compliance with the Clean Water Act (Wat. Code, § 13370 et seq.) The federal law preempts the state law. (*Burbank, supra*, 35 Cal.4th at p. 618.) The Regional Board must comply with federal law requiring detailed conditions for NPDES permits." (*City of Rancho Cucamonga v. Regional Water Quality Control Bd., supra*, 135 Cal.App.4th at p. 1389.) Thus, nothing in state law in general or Water Code section 13360 in particular is violated by the specific pollution control requirements imposed on the permittees. We need no address the parties' remaining contentions concerning trash receptacles.

I. Hearing Related And Due Process Arguments

1. Overview of arguments

Plaintiffs contend that the December 13, 2001 hearing failed to comply with due process requirements in the following particulars: the notice did not comply with the requirements for an adjudicative hearing specified in Government Code section 11425.10, subdivision (a)(2); no sworn testimony was presented nor any documentary evidence admitted into evidence; the permittees were not given the opportunity to present evidence, cross-examine witnesses, or present a rebuttal in accordance with Government Code section 11425.10, subdivision (a) and California Code of Regulations, title 23, sections 648.4 and 648.5; the permit was not based on evidence offered at the hearing in violation of Government Code section 11425.50, subdivision (c) and California Code of Regulations, title 23, sections 648.2 and 648.3; technical and scientific matter was relied upon without complying with California Code of Regulations, title 23, section 648.2; and substantive changes were made to the permit after the hearing was concluded without giving the permittees an opportunity to comment on the amendments; most of the administrative record was never set forth at the hearing and was not identified until four months after the December 13, 2001 hearing.

2. Adequacy of the hearing notice

Plaintiffs contend that they did not receive an adequate notice that an adjudicative hearing would be conducted. As to state law requirements, plaintiffs argue the notice never states an adjudicative hearing was going to be held. Plaintiffs argue: Government Code section 11440.20, subdivision (a)[13] requires that written notice be given of an

---

13 Government Code section 11440.20, subdivision (a) states: "Service of a writing on, or giving of a notice to, a person in a procedure provided in this chapter is subject to

adjudicatory hearing; the "Notice Of Public Hearing" did not comply with Government Code section 11425.10, subdivision (a)(2);[14] the written notice does not state that what evidence would be relied upon; the notice does not state that there would a waiver of the formal regulatory hearing and evidentiary requirements as permitted by California Code of Regulations, title 23, section 648, subdivision (d)[15]; and the written notice did not indicate an informal hearing would be held as permitted by Government Code section 11445.20 et seq. and California Code of Regulations, title 23, section 648.7.[16]

---

the following provisions: [¶] (a) The writing or notice shall be delivered personally or sent by mail or other means to the person at the person's last known address or, if the person is a party with an attorney or other authorized representative of record in the proceeding, to the party's attorney or other authorized representative. If a party is required by statute or regulation to maintain an address with an agency, the party's last known address is the address maintained with the agency."

14 Government Code section 11425.10, subdivision (a)(2) states: "(a) The governing procedure by which an agency conducts an adjudicative proceeding is subject to all of the following requirements: [¶] . . . (2) The agency shall make available to the person to which the agency action is directed a copy of the governing procedure, including a statement whether Chapter 5 (commencing with Section 11500) is applicable to the proceeding."

15 California Code of Regulations title 23, section 648, subdivision (d) states: "(d) Waiver of Nonstatutory Requirements. The presiding officer may waive any requirements in these regulations pertaining to the conduct of adjudicative proceedings including but not limited to the introduction of evidence, the order of proceeding, the examination or cross-examination of witnesses, and the presentation of argument, so long as those requirements are not mandated by state or federal statute or by the state or federal constitutions."

16 California Code of Regulations, title 23, section 648.7 states: "Unless the hearing notice specifies otherwise, the presiding officer shall have the discretion to determine whether a matter will be heard pursuant to the informal hearing procedures set forth in article 10, commencing with section 11445.20, of chapter 4.5 of the Administrative Procedure Act. [¶] Among the factors that should be considered in making this determination are: [¶] The number of parties, [¶] The number and nature of the written comments received, [¶] The number of interested persons wishing to present oral comments at the hearing, [¶] The complexity and significance of the issues involved, and [¶] The need to create a record in the matter. [¶] An objection by a party, either in writing or at the time of the hearing, to the decision to hold an informal hearing shall be

We agree with the regional board that the December 13, 2001 hearing was an adjudicative, quasi-judicial, proceeding. (*City of Rancho Cucamonga v. Regional Water Quality Control Bd.*, *supra*, 135 Cal.App.4th at p. 1385; see *Sommerfield v. Helmick* (1997) 57 Cal.App.4th 315, 320.) As an adjudicative proceeding, a National Pollutant Discharge Elimination Systems permit hearing is exempt from the rulemaking procedures of the Administrative Procedures Act. (Gov. Code, § 11352, subd. (b)[17]; *City of Rancho Cucamonga v. Regional Water Quality Control Bd.*, *supra*, 135 Cal.App.4th at p. 1385.) Thus, Government Code sections 11400 through 11475.70 and 11513 apply to regional board permit issuance proceedings. (Cal. Code Regs., tit. 23, § 648, subd. (b)[18]; *City of Rancho Cucamonga v. Regional Water Quality Bd.*, *supra*, 135 Cal.App.4th at p. 1385.)

The permittees received a document entitled "Notice of Public Hearing" sent by the regional board on September 27, 2001. The notice stated: "The hearing will start at 9:00 a.m. Regional Board's staff will present an overview of the proposed permit. Interested persons are invited to attend and to testify in front of the Regional Board. For the accuracy of the record, comments should also be submitted in writing. The Regional Board may ask questions of staff and persons who testify prior to making a decision on

---

resolved by the presiding officer before going ahead under the informal procedure. Failure to make a timely objection to the use of informal hearing procedures before those procedures are used will constitute consent to an informal hearing. A matter shall not be heard pursuant to an informal hearing procedure over timely objection by the person to whom agency action is directed unless an informal hearing is authorized under subdivision (a), (b), or (d) of section 11445.20 of the Government Code."

17 Government Code section 11352, subdivision (b) states: "The following actions are not subject to this chapter: [¶] (b) The issuance . . . of waste discharge requirements and permits pursuant to Sections 13263 and 13377 of the Water Code. . . ."

18 California Code of Regulations, title 23, section 648, subdivision (b) states: "(b) Incorporation of Applicable Statutes. Except as otherwise provided, all adjudicative proceedings before the State Board, the Regional Boards, or hearing officers or panels appointed by any of those Boards shall be governed by these regulations, chapter 4.5 of the Administrative Procedure Act (commencing with section 11400 of the Government Code), sections 801-805 of the Evidence Code, and section 11513 of the Government Code."

the adoption of the proposed." On October 11, 2001, the regional board sent a "Announcement of a Public Hearing and Transmittal of the Tentative Draft—County of Los Angeles Municipal Storm Water NPDES Permit" scheduling the hearing on the permit for November 29, 2001. The October 11, 2001 announcement stated: "Following the consideration of written comments and oral testimony, the Board may take action to adopt tentative Order No. 01-XXX during a public meeting on November 29, 2001. At its discretion, however, the Board may direct further investigation." The October 11, 2001 announcement: indicated a agenda would be posted on the regional board's website by November 19, 2001; stated the permittees were operating under a permit which expired on July 30, 2001; contained a summary of the principal changes to be made to the permit that expired on July 30, 2001; referred to an attached staff report; and requested comments to the tentative draft of the proposed permit. Attached to the announcement was the notice of hearing which: identified when and where the hearing would be held; explained where documents pertinent to the hearing could be located; and indicated interested persons could testify and submit comments in writing.

The November 29, 2001 regional board meeting was continued to December 13, 2001 after an unsuccessful effort at achieving settlement through mediation. On November 30, 2001, the regional board gave notice on its website of the December 13, 2001 hearing. The regional board's meeting agenda posted on its website on December 13, 2001, listed as item No. 10 under the heading "STORM WATER – NPDES PERMIT RENEWAL" (original bold and underscore): "Consideration of a proposed renewal of the municipal storm water permit for the County of Los Angeles and incorporated cities therein, except the City of Long Beach. (After a public hearing, the Board will consider renewal of the existing municipal permit for the County and 83 cities.) [¶] [Xavier Swamikannu, 576-6654] . . . Board [¶] Action" (Original italics.) Above the listing of the agenda items, the following appears, "All Board files pertaining to the items on this agenda are hereby made a part of the record submitted to the [regional board] by staff for its consideration prior to action on the related items." The regional board adopted the permit at the December 13, 2001 hearing. Plaintiffs through their counsel appeared at the December 13, 2001 hearing.

There is no merit to the state law inadequate notice contention. There was no requirement that the notice state an adjudicative hearing would be held. As a matter of law, an adjudicative hearing would be held in connection with any renewal or issuance of a National Pollutant Discharge Elimination Systems permit. (*City of Rancho Cucamonga v. Regional Water Quality Control Bd.*, *supra*, 135 Cal.App.4th at p. 1385.) Further, the notices complied with the requirements imposed by California Code of Regulations, title 23, section 647.2, subdivisions (a) through (c) and (e).[19]

Plaintiffs contend that the foregoing notice was deficient because it violates federal and state laws. Plaintiffs argue that the notice fails to comply with federal law. Plaintiffs rely on the following provisions of 40 Code of Federal Regulations part 124.8 (2001) which states: "(a) A fact sheet shall be prepared for every draft permit . . . . The fact sheet shall briefly set forth the principal facts and the significant factual, legal, methodological and policy questions considered in preparing the draft permit. The Director shall send this fact sheet to the applicant and, on request, to any other person.

---

[19] California Code of Regulations, title 23, section 647.2, subdivisions (a) through (c) and (e) states: "(a) Purpose. Government Code Section 11125 requires state agencies to provide notice at least one week in advance of any meeting to any person who requests such notice in writing except that emergency meetings may be held with less than one week's notice when such meetings are necessary to discuss unforeseen emergency conditions as defined by published rule of the agency. The purpose of this section is to establish procedures for compliance with Government Code Section 11125 by the State Board and the Regional Boards. [¶] (b) Contents of Meeting Notice. The notice for all meetings of the State Board and Regional Boards shall specify the date, time and location of the meeting and include an agenda listing all items to be considered. The agenda shall include a description of each item, including any proposed action to be taken. [¶] (c) Time of Notice. Notice shall be given at least one week in advance of the meeting. When the notice is mailed, it shall be placed in the mail at least eight days in advance of the meeting. [¶] (e) Distribution. Notice shall be given to all persons directly affected by proceedings on the agenda and to all persons who request in writing such notice. Notice shall be given to any person known to be interested in proceedings on the agenda."

[¶] (b) The fact sheet shall include, when applicable: [¶] . . . (6) A description of the procedures for reaching a final decision on the draft permit including: [¶] . . . (ii) Procedures for requesting a hearing and the nature of that hearing . . . ." We agree with the Attorney General that these provisions doe not apply to a regional board National Pollutant Discharge Elimination Systems permit renewal and issuance proceedings.

Finally, in terms of the notice issues, plaintiffs argue the permittees' due process rights were violated. The state and federal due process provisions require that "some form of notice" be given. (*Sommerfield v. Helmick*, *supra*, 57 Cal.App.4th at p. 320; *B. C. Cotton, Inc. v. Voss* (1995) 33 Cal.App.4th 929, 954.) The notices that were provided complied with all due process requirements applicable to an adjudicative hearing.

3. Adequacy of the hearing

Plaintiffs contend the proceedings before the regional board were not conducted as a proper adjudicative hearing. Plaintiffs argue they were denied the opportunity to present or rebut evidence. Government Code section 11425.10, subdivision (a)(1) states in part: "(a) The governing procedure by which an agency conducts an adjudicative proceeding is subject to all of the following requirements: [¶] (1) The agency shall give the person to which the agency action is directed notice and an opportunity to be heard, including the opportunity to present and rebut evidence." The mode of presentation of evidence at adjudicatory hearing is spelled out in California Code of Regulations, title 23, sections 648.4, subdivision (a) and 648.5.[20] Because there was no evidence produced at

---

[20] California Code of Regulations, title 23, section 648.4, subdivision (a) provides: (a) It is the policy of the State and Regional Boards to discourage the introduction of surprise testimony and exhibits. [¶] (b) The hearing notice may require that all parties intending to present evidence at a hearing shall submit the following information to the Board prior to the hearing: the name of each witness whom the party intends to call at the hearing, the subject of each witness' proposed testimony, the estimated time required by the witness to present direct testimony, and the qualifications of each expert witness. The required information shall be submitted in accordance with the procedure specified in the

hearing notice. [¶] (c) The hearing notice may require that direct testimony be submitted in writing prior to the hearing. Copies of written testimony and exhibits shall be submitted to the Board and to other parties designated by the Board in accordance with provisions of the hearing notice or other written instructions provided by the Board. The hearing notice may require multiple copies of written testimony and other exhibits for use by the Board and Board staff. Copies of general vicinity maps or large, nontechnical photographs generally will not be required to be submitted prior to the hearing. [¶] (d) Any witness providing written testimony shall appear at the hearing and affirm that the written testimony is true and correct. Written testimony shall not be read into the record unless allowed by the presiding officer. [¶] (e) Where any of the provisions of this section have not been complied with, the presiding officer may refuse to admit the proposed testimony or the proposed exhibit into evidence, and shall refuse to do so where there is a showing of prejudice to any party or the Board. This rule may be modified where a party demonstrates that compliance would create severe hardship. [¶] (f) Rebuttal testimony generally will not be required to be submitted in writing, nor will rebuttal testimony and exhibits be required to be submitted prior to the start of the hearing." California Code of Regulations, title 23, section 648.5 provides: "a) Adjudicative proceedings shall be conducted in a manner as the Board deems most suitable to the particular case with a view toward securing relevant information expeditiously without unnecessary delay and expense to the parties and to the Board. Adjudicative proceedings generally will be conducted in the following order except that the chairperson or presiding officer may modify the order for good cause: [¶] (1) An opening statement by the chairperson, presiding member, or hearing officer, summarizing the subject matter and purpose of the hearing; [¶] (2) Identification of all persons wishing to participate in the hearing; [¶] (3) Administration of oath to persons who intend to testify; [¶] (4) Presentation of any exhibits by staff of the State or Regional Board who are assisting the Board or presiding officer; [¶] (5) Presentation of evidence by the parties; [¶] (6) Cross-examination of parties' witnesses by other parties and by Board staff assisting the Board or presiding officer with the hearing; [¶] (7) Any permitted redirect and recross-examination; [¶] (b) Questions from Board members or Board counsel to any party or witness, and procedural motions by any party shall be in order at any time. Redirect and recross-examination may be permitted. [¶] (c) If the Board or the presiding officer has determined that policy statements may be presented during a particular adjudicative proceeding, the presiding officer shall determine an appropriate time for presentation of policy statements. [¶] (d) After conclusion of the presentation of evidence, all parties appearing at the hearing may be allowed to present a closing statement."

the hearing, the permittees argue the findings were inadequate. (*English v. City of Long Beach* (1950) 35 Cal.2d 155, 158; *Southern Cal. Edison Co. v. State Water Resources Control Bd.* (1981) 116 Cal.App.3d 751, 760.)

We have read the transcript of the hearing. Those who wished to address the regional board were placed under oath. Presentations were made by the county, the City of Los Angeles, the Coalition for Practical Regulation, and a council representing the interests of various cities. Other individuals were permitted to present their views. The permittees' counsel made no request to call witnesses or objected to the manner in which the hearing proceeded as is argued on appeal. The permittees' counsel were given an opportunity to be heard. Further, extensive written comments were made by the permittees and their counsel. In light of the extensive notice given to them, if the permittees' counsel had any objections akin to those raised on appeal, they should have asserted them. No due process, statutory, or regulatory violation occurred. (*Mohilef v. Janovici* (1996) 51 Cal.App.4th 267, 285-287; Cal. Code Regs., tit. 23, § 648, subd. (d).)

4. Belated findings

Plaintiffs contend that untimely findings were made by the regional board. The changes made without an opportunity and comment were: an amendment to the total daily maximum loads for trash; the insertion of a requirement that complaints referred by the regional board be investigated within one business day; and significant changes to the inspection program. We agree with the Attorney General that the modifications in the permit were not of such gravity that a due process or other violation occurred. The final permit was a logical outgrowth of the draft permit. Hence, there was no violation of any right to notice or a hearing. (See *Natural Resources Defense Council v. U.S. E.P.A.* (9th Cir. 2002) 279 F.3d 1180, 1186 [applying federal notice and hearing provisions inn the administrative context]; *Center for Biological Diversity v. Bureau of Land Management* (N.D. Cal. 2006) 422 F.Supp.2d 1115, 1155-1156 [same].)

J. Inspection Requirements

Plaintiffs argue the inspection requirements imposed in the permit are unlawful. The permit requires the permittees to inspect to insure there are no illicit discharges into the storm sewer system and critical sources of pollutants in runoff. We agree with the intervenors—no statute or regulation prohibited the regional board from imposing the inspection requirements. Further, there is federal regulatory authority that required the regional board consider imposing the inspection requirements. (40 C.F.R. 122.26(d), (g) (2000).) This contention has no merit.

K. Propriety Of The Regional Board Considering The Administrative Record In The Long Beach Case

Plaintiffs contend that the regional board should not have considered the administrative record in proceedings involving the 1996 issuance of a National Pollutant Discharge Elimination System permit to the City of Long Beach. According to plaintiffs, the administrative record was prepared in connection with the challenge by the City of Long Beach to the National Pollutant Discharge Elimination System Permit issued in 1996. Plaintiffs assert most of the administrative record in the Long Beach case is unrelated to the present case. Plaintiffs argue that consideration of the Long Beach records: are surprise evidence received in violation of title 23, California Code of Regulations, section 648.4, subdivision (a); violated the requirement that the regional board's presentation of exhibits be followed by the parties' presentation of evidence as required by title 23, California Code of Regulations, section 648.5, subdivisions (a)(4) and (5); and the process for admitting public records by reference pursuant to California Code of Regulations, section 648.3 was violated.

We disagree. The regional board certified the administrative record as including documents relevant to a National Pollutant Discharge Elimination System permit issued for the City of Long Beach. It is presumed the regional board considered the documents pertinent to the Long Beach National Pollutant Discharge Elimination System permit. (*Mason v. Office of Admin. Hearings* (2001) 89 Cal.App.4th 1119, 1131; see *Bar MK Ranches v. Yuetter* (10th Cir. 1993) 994 F.2d 735, 740.) Admissibility of evidence is controlled by Government Code sections 11400 and 11513, subdivision (c). Government Code section 11513, subdivision (c) states: "The hearing need not be conducted according to technical rules relating to evidence and witnesses, except as hereinafter provided. Any relevant evidence shall be admitted if it is the sort of evidence on which responsible persons are accustomed to rely in the conduct of serious affairs, regardless of the existence of any common law or statutory rule which might make improper the admission of the evidence over objection in civil actions." What is unclear is the standard of judicial review of the regional board's decision to consider the Long Beach National Pollutant Discharge Elimination System permit. It would appear the standard of judicial review is that set forth in Code of Civil Procedure section 1094.5, subdivision (b) whether: the regional board's evidentiary ruling was in excess of jurisdiction; there was a fair trial; or there was any prejudicial abuse of discretion. Insofar as we are examining the trial court's ruling allowing the Long Beach evidence to be part of the record, as with any relevancy issue, we apply an abuse of discretion standard of review. (*People v. Panah* (2005) 35 Cal.4th 395, 474; *People v. Kipp* (2001) 26 Cal.4th 1100, 1123.) Under any standard of review, the Long Beach evidence is relevant. The actions taken in imposing runoff conditions on the second largest city in the county are pertinent to what conditions to impose on the remainder of the county. Finally, there is insufficient evidence to support plaintiffs' surprise contention. There is no evidence that any of the permittees' attorneys were prohibited from examining the entire administrative record prior to the December 13, 2001 hearing.

L. The Trial Court Did Not Abuse Its Discretion In Refusing To Augment The Record

Plaintiffs contend the trial court improperly refused to augment the record to include petitions they had filed with state board. This issue is in essence an issue of relevance which is reviewed for an abuse of discretion. (*Western States Petroleum Assn. v. Superior Court* (1995) 9 Cal.4th 559, 573, fn. 3; *People v. Panah*, *supra*, 35 Cal.4th at p. 474; *People v. Kipp*, *supra*, 26 Cal.4th at p. 1123.) The documents at issue were all prepared after the regional board issued the permit. Without abusing its discretion, the trial court could conclude that the post permit issuance papers were irrelevant. (*Cynthia D. v. Superior Court* (1993) 5 Cal.4th 242, 250, fn. 7; *People v. Rowland* (1992) 4 Cal.4th 238, 268.)

[The balance of the opinion is to be published.]

V. DISPOSITION

The judgment is reversed. Upon issuance of the remittitur, the trial court is to issue its writ of administrative mandate which solely directs defendant, California Regional Water Quality Control Board, Los Angeles Region, to set aside its permit and conduct limited California Environmental Quality Act review as discussed in the body of this opinion. In exercising its equitable discretion, if plaintiffs' environmental review contentions become moot either when the writ of mandate is issued or on a later date because another permit is issued, the trial court retains the authority to decline to order limited environmental review. All other aspects of the orders denying the administrative mandate petitions, dismissing the complaints, and denying the post trial motions are affirmed. Defendants, California Regional Water Quality Control Board, Los Angeles Region and the State Water Resources Board, are to recover their costs incurred on appeal jointly and severally from plaintiffs, the Cities of Arcadia, Artesia, Bellflower, Beverly Hills, Carson, Cerritos, Claremont, Commerce, Covina, Diamond Bar, Downey, Gardena, Hawaiian Gardens, Industry, Irwindale, La Mirada, Lawndale, Monrovia, Norwalk, Paramount, Pico Rivera, Rancho Palos Verdes, Rosemead, Santa Clarita, Santa Fe Springs, Signal Hill, South Pasadena, Torrance, Vernon, Walnut, West Covina, Westlake Village, and Whittier, and the County of Los Angeles, Los Angeles County Flood Control District, Building Industry Legal Defense Fund, and the Construction Industry Coalition on Water Quality.

CERTIFIED FOR PARTIAL PUBLICATION

TURNER, P. J.

We concur:

ARMSTRONG, J.

KRIEGLER, J.

U.S. Census Bureau
American FactFinder

P001. PERSONS - Universe: Persons
Data Set: 1990 Summary Tape File 3 (STF 3) - Sample data

NOTE: For information on confidentiality, sampling error, nonsampling error, and definitions, see http://factfinder.census.gov/home/en/datanotes/expstf390.htm.

	Ventura County, California
Total	669016

U.S. Bureau of the Census
1990 Census of Population and Housing

Standard Error/Variance documentation for this dataset:
Variance Document for STF 3 (PDF 84KB)

U.S. Census Bureau
American FactFinder

GCT-T1. Population Estimates
Data Set: 2004 Population Estimates
Geographic Area: **California -- County**

Geographic area	Population Estimates July 1, 2004	July 1, 2003	July 1, 2002	July 1, 2001	July 1, 2000	Estimates Base April 1, 2000	Census 2000 April 1, 2000
California	35,893,799	35,462,712	34,988,261	34,532,163	34,002,467	33,871,653	33,871,648
COUNTY							
Alameda County	1,455,235	1,458,749	1,463,948	1,470,528	1,450,398	1,443,741	1,443,741
Alpine County	1,190	1,188	1,216	1,204	1,207	1,208	1,208
Amador County	37,837	37,331	36,816	35,847	35,194	35,100	35,100
Butte County	212,968	211,151	208,713	205,923	203,791	203,171	203,171
Calaveras County	45,939	44,727	43,143	41,774	40,730	40,554	40,554
Colusa County	20,339	19,755	19,370	19,138	18,838	18,804	18,804
Contra Costa County	1,009,144	999,930	988,602	976,888	953,659	948,816	948,816
Del Norte County	28,351	27,902	27,545	27,405	27,479	27,507	27,507
El Dorado County	172,889	169,199	165,767	161,397	157,198	156,299	156,299
Fresno County	866,772	850,650	832,057	814,688	802,161	799,407	799,407
Glenn County	27,488	27,227	26,807	26,423	26,455	26,453	26,453
Humboldt County	128,529	127,908	127,424	126,695	126,338	126,518	126,518
Imperial County	152,448	148,924	145,702	143,715	142,533	142,361	142,361
Inyo County	18,244	18,364	18,299	17,997	17,924	17,945	17,945
Kern County	734,846	713,445	693,060	675,859	663,780	661,653	661,645
Kings County	142,561	138,708	134,543	131,935	129,819	129,461	129,461
Lake County	64,446	63,397	62,274	60,611	58,600	58,309	58,309
Lassen County	34,661	34,153	33,642	33,659	33,767	33,828	33,828
Los Angeles County	9,937,739	9,860,382	9,763,844	9,656,433	9,545,829	9,519,330	9,519,338
Madera County	138,951	133,696	128,815	125,880	123,660	123,109	123,109
Marin County	246,045	246,635	247,191	248,399	247,672	247,289	247,289
Mariposa County	18,003	17,797	17,318	17,164	17,150	17,130	17,130
Mendocino County	88,551	88,476	87,599	86,946	86,425	86,265	86,265
Merced County	237,005	231,397	224,934	218,189	211,665	210,554	210,554
Modoc County	9,599	9,465	9,358	9,332	9,420	9,449	9,449
Mono County	12,766	12,831	12,997	12,897	12,866	12,853	12,853
Monterey County	414,629	414,423	411,578	408,258	403,165	401,762	401,762
Napa County	132,339	131,751	129,991	127,733	124,606	124,279	124,279
Nevada County	97,660	96,252	95,102	93,886	92,537	92,033	92,033
Orange County	2,987,591	2,960,149	2,927,943	2,895,782	2,856,988	2,846,289	2,846,289
Placer County	307,004	293,630	279,011	264,874	251,327	248,399	248,399
Plumas County	21,359	21,198	21,012	20,901	20,779	20,824	20,824
Riverside County	1,871,950	1,782,822	1,694,623	1,620,834	1,559,962	1,545,387	1,545,387
Sacramento County	1,352,445	1,330,730	1,301,716	1,266,480	1,230,259	1,223,499	1,223,499
San Benito County	56,243	56,187	55,686	54,994	53,860	53,234	53,234
San Bernardino County	1,921,131	1,862,195	1,808,893	1,765,578	1,719,107	1,709,434	1,709,434
San Diego County	2,931,714	2,918,829	2,896,098	2,858,891	2,824,591	2,813,833	2,813,833
San Francisco County	744,230	751,908	761,983	774,479	776,665	776,733	776,733
San Joaquin County	649,868	631,876	612,564	593,079	568,252	563,598	563,598
San Luis Obispo County	254,566	253,072	252,055	250,867	247,713	246,681	246,681
San Mateo County	699,216	699,094	701,271	707,417	708,436	707,163	707,161

Geographic area	Population Estimates July 1, 2004	July 1, 2003	July 1, 2002	July 1, 2001	July 1, 2000	Estimates Base April 1, 2000	Census 2000 April 1, 2000
Santa Barbara County	401,851	402,795	401,481	400,816	399,695	399,347	399,347
Santa Clara County	1,685,188	1,675,915	1,674,598	1,690,090	1,686,237	1,682,585	1,682,585
Santa Cruz County	250,633	251,725	253,352	255,339	255,804	255,602	255,602
Shasta County	177,816	175,654	171,923	167,269	163,842	163,256	163,256
Sierra County	3,490	3,546	3,499	3,528	3,576	3,555	3,555
Siskiyou County	44,891	44,630	44,231	44,109	44,263	44,301	44,301
Solano County	412,970	411,636	409,503	404,555	397,201	394,542	394,542
Sonoma County	468,450	467,304	465,902	465,724	460,446	458,614	458,614
Stanislaus County	498,355	491,014	480,233	465,287	449,863	446,997	446,997
Sutter County	86,760	84,670	82,247	80,138	79,192	78,930	78,930
Tehama County	60,075	58,892	57,652	56,816	56,158	56,039	56,039
Trinity County	13,671	13,502	13,256	13,020	13,015	13,022	13,022
Tulare County	401,502	391,084	381,280	374,023	368,927	368,021	368,021
Tuolumne County	56,962	56,790	56,044	55,285	54,679	54,504	54,501
Ventura County	797,699	790,560	780,863	769,070	756,672	753,197	753,197
Yolo County	184,364	181,898	179,327	174,742	169,762	168,660	168,660
Yuba County	64,631	63,594	62,360	61,373	60,330	60,219	60,219

Source: U.S. Census Bureau, Population Estimates Program
More Tables and Information: Population Estimates Program

NOTE: The April 1, 2000 Estimates Base reflects modifications to the Census 2000 population as documented in the Count Question Resolution program, updates from the Boundary and Annexation Survey, and geographic program revisions. An "(X)" for the Census 2000 value indicates a locality that was formed or incorporated after Census 2000 or was erroneously omitted from Census 2000. See Geographic Change Notes for additional information on these localities.

Results for "horse"

Index entry	NAICS Code 2002	NAICS Code 1997	2002 U.S. NAICS Title
Horse (including thoroughbreds) production	112920		Horses and Other Equine Production
Horse bits manufacturing	332999		All Other Miscellaneous Fabricated Metal Product Manufacturing
Horse boots and muzzles manufacturing	316999		All Other Leather Good Manufacturing
Horse racetracks	711212		Racetracks
Horse racing stables	711219		Other Spectator Sports
Horse rental services, recreational saddle	713990		All Other Amusement and Recreation Industries
Horse show managers with facilities	711310		Promoters of Performing Arts, Sports, and Similar Events with Facilities
Horse show managers without facilities	711320		Promoters of Performing Arts, Sports, and Similar Events without Facilities
Horse show organizers with facilities	711310		Promoters of Performing Arts, Sports, and Similar Events with Facilities
Horse show organizers without facilities	711320		Promoters of Performing Arts, Sports, and Similar Events without Facilities
Horse show promoters with facilities	711310		Promoters of Performing Arts, Sports, and Similar Events with Facilities
Horse show promoters without facilities	711320		Promoters of Performing Arts, Sports, and Similar Events without Facilities
Horse trailers (except fifth-wheel-type) manufacturing	336214		Travel Trailer and Camper Manufacturing
Horse trailers, fifth-wheel-type, manufacturing	336212		Truck Trailer Manufacturing
Horse-drawn carriage operation	487110		Scenic and Sightseeing Transportation, Land
Horseback riding, recreational	713990		All Other Amusement and Recreation Industries
Horsemeat produced in slaughtering plants	311611		Animal (except Poultry) Slaughtering
Horsemeat, processing, for dog and cat food	311111		Dog and Cat Food Manufacturing
Horseradish (except sauce) canning	311421		Fruit and Vegetable Canning
Horseradish, prepared sauce, manufacturing	311941		Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing
Horses (except racehorses), boarding	115210		Support Activities for Animal Production
Horses and Other Equine Production	112920		Horses and Other Equine Production

Horses merchant wholesalers	424590	422590	Other Farm Product Raw Material Merchant Wholesalers
Horses, training (except racehorses)	115210		Support Activities for Animal Production
Horseshoe nails, iron or steel, made in wire drawing plants	331222		Steel Wire Drawing
Horseshoeing	115210		Support Activities for Animal Production
Horseshoes, ferrous forged, made from purchased iron or steel	332111		Iron and Steel Forging

Try another keyword search: NAICS SEARCH

U.S. Census Bureau

2002 NAICS Definitions
111 Crop Production

111 Crop Production

Industries in the Crop Production subsector grow crops mainly for food and fiber. The subsector comprises establishments, such as farms, orchards, groves, greenhouses, and nurseries, primarily engaged in growing crops, plants, vines, or trees and their seeds.

The industries in this subsector are grouped by similarity of production activity, including biological and physiological characteristics and economic requirements, the length of growing season, degree of crop rotation, extent of input specialization, labor requirements, and capital demands. The production process is typically completed when the raw product or commodity grown reaches the "farm gate" for market, that is, at the point of first sale or price determination.

Establishments are classified to the crop production subsector when crop production (i.e., value of crops for market) accounts for one-half or more of the establishment's total agricultural production. Within the subsector, establishments are classified to a specific industry when a product or industry family of products (i.e., oilseed and grain farming, vegetable and melon farming, fruit and tree nut farming) account for one-half or more of the establishment's agricultural production. Establishments with one-half or more crop production with no one product or family of products of an industry accounting for one-half of the establishment's agricultural production are treated as general combination crop farming and are classified in Industry 11199, All Other Crop Farming.

Industries in the Crop Production subsector include establishments that own, operate, and manage and those that operate and manage. Those that manage only are classified in Subsector 115, Support Activities for Agriculture and Forestry.

11142 Nursery and Floriculture Production

This industry comprises establishments primarily engaged in (1) growing nursery and floriculture products (e.g., nursery stock, shrubbery, cut flowers, flower seeds, foliage plants) under cover or in open fields and/or (2) growing short rotation woody trees with a growing and harvesting cycle of 10 years or less for pulp or tree stock (e.g., cut Christmas trees, cottonwoods).

Cross-References. Establishments primarily engaged in--

- Growing vegetable and melon bedding plants--are classified in Industry 11121, Vegetable and Melon Farming;
- Operating timber tracts (i.e., growing cycle greater than 10 years)--are classified in Industry 113110, Timber Tract Operations; and
- Retailing nursery, tree stock, and floriculture products primarily purchased from others--are classified in Industry 444220, Nursery, Garden Center, and Farm Supply Stores.

U.S. Census Bureau

2002 NAICS Definitions

111421 Nursery and Tree Production

This U.S. industry comprises establishments primarily engaged in (1) growing nursery products, nursery stock, shrubbery, bulbs, fruit stock, sod, and so forth, under cover or in open fields and/or (2) growing short rotation woody trees with a growth and harvest cycle of 10 years or less for pulp or tree stock.

Cross-References. Establishments primarily engaged in--

- Growing vegetable and melon bedding plants--are classified in Industry 11121, Vegetable and Melon Farming;
- Operating timber tracts (i.e., growing cycle greater than 10 years)--are classified in Industry 113110, Timber Tract Operations; and
- Retailing nursery, tree stock, and floriculture products primarily purchased from others--are classified in Industry 444220, Nursery, Garden Center, and Farm Supply Stores.

Go to: No change 1997 to 2002 2002 NAICS to 1987 SIC

2002 NAICS	1997 NAICS	1987 SIC	Corresponding Index Entries
111421	111421	0181	Azalea farming
111421	111421	0811	Christmas tree growing
111421	111421	0181	Corms farming
111421	111421	0181	Field nurseries (i.e., growing of flowers and shrubbery)
111421	111421	0181	Flower bulb growing
111421	111421	0181	Fruit stock (e.g., plants, seedlings, trees) growing
111421	111421	0181	Herbaceous perennial growing
111421	111421	0181	Nursery stock growing
111421	111421	0181	Nursery with tree production (except for reforestation)
111421	111421	0181	Preseeded mat farming
111421	111421	0181	Propagation material farming
111421	111421	0181	Rose bush growing
111421	111421	0181	Short rotation woody tree growing (i.e., growing and harvesting cycle ten years o
111421	111421	0181	Shrubbery farming
111421	111421	0181	Sod farming

A003751

U.S. Census Bureau

2002 NAICS Definitions

111422 Floriculture Production

This U.S. industry comprises establishments primarily engaged in growing and/or producing floriculture products (e.g., cut flowers and roses, cut cultivated greens, potted flowering and foliage plants, and flower seeds) under cover and in open fields.

Cross-References. Establishments primarily engaged in retailing floriculture products primarily purchased from others are classified in Industry 444220, Nursery, Garden Center, and Farm Supply Stores.

Go to: No change 1997 to 2002 2002 NAICS to 1987 SIC

2002 NAICS	1997 NAICS	1987 SIC	Corresponding Index Entries
111422	111422	0181	Bedding plant growing (except vegetable and melon bedding plants)
111422	111422	0181	Cultivated florist greens growing
111422	111422	0181	Cut flower growing
111422	111422	0181	Cut rose growing
111422	111422	0181	Cuttings farming
111422	111422	0181	Flower growing
111422	111422	0181	Flower seed production
111422	111422	0181	Foliage growing
111422	111422	0181	Hanging basket plant growing
111422	111422	0181	House plant growing
111422	111422	0181	Ornamental plant growing
111422	111422	0181	Plant, ornamental, growing
111422	111422	0181	Plant, potted flower and foliage, growing
111422	111422	0181	Plug (i.e., floriculture products) growing

U.S. Census Bureau

2002 NAICS Definitions
424 Merchant Wholesalers, Nondurable Goods

424 Merchant Wholesalers, Nondurable Goods

Industries in the Merchant Wholesalers, Nondurable Goods subsector sell nondurable goods to other businesses. Nondurable goods are items generally with a normal life expectancy of less than three years. Nondurable goods merchant wholesale trade establishments are engaged in wholesaling products, such as paper and paper products, chemicals and chemical products, drugs, textiles and textile products, apparel, footwear, groceries, farm products, petroleum and petroleum products, alcoholic beverages, books, magazines, newspapers, flowers and nursery stock, and tobacco products.

The detailed industries within the subsector are organized in the classification structure based on the products sold.

Business to business electronic markets, agents, and brokers primarily engaged in wholesaling nondurable goods, generally on a commission or fee basis, are classified in Subsector 425, Wholesale Electronic Markets and Agents and Brokers.

4241 Paper and Paper Product Merchant Wholesalers

42411 Printing and Writing Paper Merchant Wholesalers

See industry description for 424110 below.

424110 Printing and Writing Paper Merchant Wholesalers

This industry comprises establishments primarily engaged in the merchant wholesale distribution of bulk printing and/or writing paper generally on rolls for further processing.

Cross-References. Establishments primarily engaged in the merchant wholesale distribution of stationery are classified in Industry 424120, Stationery and Office Supplies Merchant Wholesalers.

Go 2002 NAICS to 1997 2002 NAICS to 1987 1997 Economic Bridge Between 1997 NAICS

424910	422910	5191	Saddlery merchant wholesalers
424910	422910	5191	Seeds (e.g., field, flower, garden) merchant wholesalers
424910	422910	5191	Straw merchant wholesalers
424910	422910	5191	Vegetable dusts and sprays merchant wholesalers

42492 Book, Periodical, and Newspaper Merchant Wholesalers

See industry description for 424920 below.

424920 Book, Periodical, and Newspaper Merchant Wholesalers

This industry comprises establishments primarily engaged in the merchant wholesale distribution of books, periodicals, and newspapers.

Go to: 2002 NAICS to 1997 NAICS | 2002 NAICS to 1987 SIC | 1997 Economic Census | Bridge Between 1997 NAICS and SIC

2002 NAICS	1997 NAICS	1987 SIC	Corresponding Index Entries
424920	422920	5192	Antique book merchant wholesalers
424920	422920	5192	Books merchant wholesalers
424920	422920	5192	Magazines merchant wholesalers
424920	422920	5192	Maps (except globe, school, wall) merchant wholesalers
424920	422920	5192	Newspaper agencies merchant wholesalers
424920	422920	5192	Newspapers merchant wholesalers
424920	422920	5192	Pamphlets merchant wholesalers
424920	422920	5192	Periodicals merchant wholesalers

42493 Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers

See industry description for 424930 below.

424930 Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers

This industry comprises establishments primarily engaged in the merchant wholesale distribution of flowers, florists' supplies, and/or nursery stock (except plant seeds and plant bulbs).

Cross-References. Establishments primarily engaged in--

- Merchant wholesale distribution of cut Christmas trees--are classified in Industry 424990, Other Miscellaneous Nondurable Goods Merchant Wholesalers; and
- Merchant wholesale distribution of plant seeds and plant bulbs--are classified in Industry 424910, Farm Supplies Merchant Wholesalers.

Go to: 2002 NAICS to 1997 NAICS 2002 NAICS to 1987 SIC 1997 Economic Census Bridge Between 1997 NAICS and SIC

2002 NAICS	1997 NAICS	1987 SIC	Corresponding Index Entries
424930	422930	5193	Artificial flowers merchant wholesalers
424930	422930	5193	Florist's supplies merchant wholesalers
424930	422930	5193	Flowers merchant wholesalers
424930	422930	5193	Nursery stock (except plant bulbs, seeds) merchant wholesalers
424930	422930	5193	Trees merchant wholesalers

42494 Tobacco and Tobacco Product Merchant Wholesalers

See industry description for 424940 below.

424940 Tobacco and Tobacco Product Merchant Wholesalers

This industry comprises establishments primarily engaged in the merchant wholesale distribution of tobacco products, such as cigarettes, snuff, cigars, and pipe tobacco.

Cross-References. Establishments primarily engaged in the merchant wholesale distribution of leaf tobacco are classified in Industry 424590, Other Farm Product Raw Material Merchant Wholesalers.

Go to: 2002 NAICS to 1997 NAICS 2002 NAICS to 1987 SIC 1997 Economic Census Bridge Between 1997 NAICS and SIC

2002 NAICS	1997 NAICS	1987 SIC	Corresponding Index Entries

U.S. Census Bureau

2002 NAICS Definitions
44-45 Retail Trade

44-45 Retail Trade

The Sector as a Whole

The Retail Trade sector comprises establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise.

The retailing process is the final step in the distribution of merchandise; retailers are, therefore, organized to sell merchandise in small quantities to the general public. This sector comprises two main types of retailers: store and nonstore retailers.

1. Store retailers operate fixed point-of-sale locations, located and designed to attract a high volume of walk-in customers. In general, retail stores have extensive displays of merchandise and use mass-media advertising to attract customers. They typically sell merchandise to the general public for personal or household consumption, but some also serve business and institutional clients. These include establishments, such as office supply stores, computer and software stores, building materials dealers, plumbing supply stores, and electrical supply store Catalog showrooms, gasoline services stations, automotive dealers, and mobile home dealers are treated as store retailers.

In addition to retailing merchandise, some types of store retailers are also engaged in the provision of after-sales services, such as repair and installation. For example, new automobile dealers, electronic and appliance stores, and musical instrument and supply stores often provide repair services. As a general rule, establishments engaged in retailing merchandise and providing after-sales services are classified in this sector.

The first eleven subsectors of retail trade are store retailers. The establishments are grouped into industries and industry groups typically based on one or more of the following criteria:

(a) The merchandise line or lines carried by the store; for example, specialty stores are distinguished from general-line stores.

(b) The usual trade designation of the establishments. This criterion applies in cases where a store type is well recognized by the industry and the public, but difficult to define strictly in terms of commodity lines carried; for example, pharmacies, hardware stores, and department stores.

(c) Capital requirements in terms of display equipment; for example, food stores have equipment requirements not found in other retail industries.

(d) Human resource requirements in terms of expertise; for example, the staff of an automobile dealer requires

U.S. Census Bureau

2002 NAICS Definitions
444 Building Material and Garden Equipment and Supplies Dealers

444 Building Material and Garden Equipment and Supplies Dealers

Industries in the Building Material and Garden Equipment and Supplies Dealers subsector retail new building material and garden equipment and supplies from fixed point-of-sale locations. Establishments in this subsector have display equipment designed to handle lumber and related products and garden equipment and supplies that may be kept either indoors or outdoors under covered areas. The staff is usually knowledgeable in the use of the specific products being retailed in the construction, repair, and maintenance of the home and associated grounds.

U.S. Census Bureau

2002 NAICS Definitions

444220 Nursery, Garden Center, and Farm Supply Stores

This industry comprises establishments primarily engaged in retailing nursery and garden products, such as trees, shrubs, plants, seeds, bulbs, and sod, that are predominantly grown elsewhere. These establishments may sell a limited amount of a product they grow themselves.

Cross-References. Establishments primarily engaged in--

- Retailing nursery and garden products via electronic home shopping, mail-order, or direct sale--are classified in Subsector 454, Nonstore Retailers;
- Providing landscaping services--are classified in Industry 561730, Landscaping Services; and
- Growing and retailing nursery stock--are classified in U.S. Industry 111421, Nursery and Tree Production.

Go to: No change 1997 to 2002 · 2002 NAICS to 1987 SIC · 1997 Economic Census · Bridge Between 1997 NAICS and SIC

2002 NAICS	1997 NAICS	1987 SIC	Corresponding Index Entries
444220	444220	5191	Farm supply stores
444220	444220	5191	Feed stores (except pet)
444220	444220	5261	Garden centers
444220	444220	5261	Lawn supply stores
444220	444220	5261	Nursery and garden centers without tree production

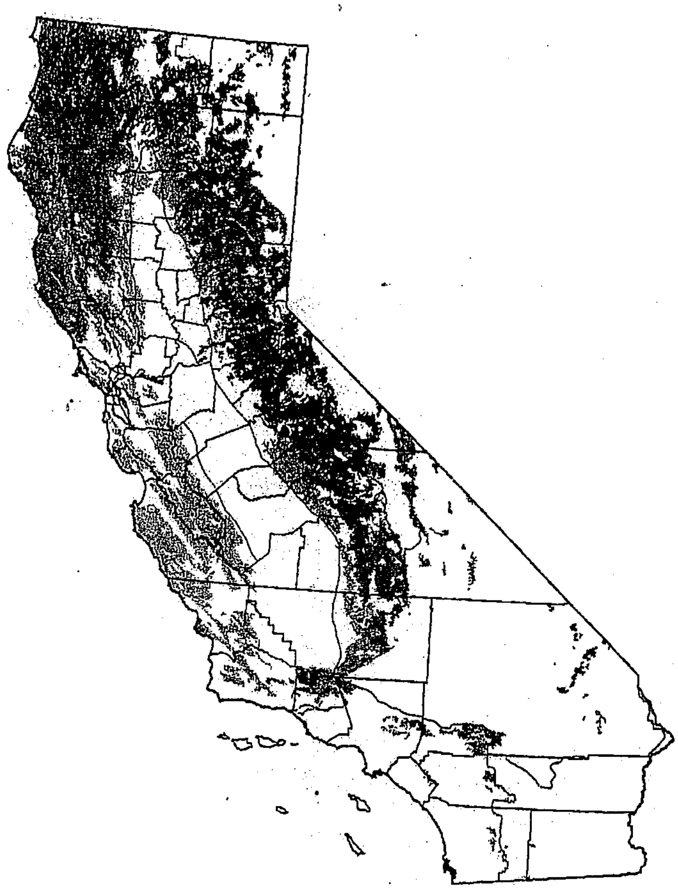
Definition

The United States Geological Survey (http://ga.water.usgs.gov/edu/dictionary.html#S) defines a stream as:

A general term for a body of flowing water; natural water course containing water at least part of the year. In hydrology, it is generally applied to the water flowing in a natural channel as distinct from a canal.

FRAP
Fire and Resource Assessment Program
California Department of Forestry and Fire Protection

The Land Base of California's Forests



Tian-Ting Shih

Fire and Resource Assessment Program
California Department of Forestry and Fire Protection
1920 20th Street
Sacramento, California 95814, U.S.A.

December, 1998

{PRIVATE}TERM	DEFINITION
Forest Land	Land at least 10 percent stocked with live trees, or land that had this minimum tree stocking in the past and is not currently developed for nonforest use. The minimum area recognized is 1 acre.
Timber Productive Forest Land	Forest land which is not Other Forest Land as defined below.
Other Forest Land	Forest land incapable of growing 20 cubic feet per acre per year (mean increment at culmination in fully stocked, natural stands) of industrial wood because of adverse conditions such as sterile soils, dry climate, poor drainage, subalpine sites, steepness, or rockiness.
Timberland	Forest land capable of growing 20 cubic feet or more per acre per year (mean increment at culmination in fully stocked, natural stands) of industrial wood and not in a reserved status through removal of the area from timber utilization by statute, ordinance, or administrative order; and not in a withdrawn status where it is pending consideration for reserved status.
Reserved Timberland	Forest land capable of growing 20 cubic feet or more per acre per year (mean annual increment at culmination in fully stocked, natural stands) of industrial wood that has been dedicated to noncommodity use through statute, ordinance, or administrative order.
Deferred Timberland	National Forest timberland that was under study for wildness designation at the time of survey.
Withdrawn Timberland	Timberland in National Forests that is being considered for permanent reserved status. Although this land has not been removed from timber utilization by statue, ordinance, or administrative order, it is not being actively managed as timberland.
National Forest Lands	Federal lands that have been designated by Executive order or statute as National Forest or purchase units and other lands under the administration of the Forest Service, U.S. Department of Agriculture, including experimental areas and Bankhead-Jones Title III lands.
Other Public Lands	Lands administrated by public agencies other than the U.S. Department of Agriculture, Forest Service. Native American lands were included in this category in the FIA OCC2 (1984) data but not included in this category in the FIA OCC3 (1994) data.
Forest Industry Lands	Lands owned by companies that grow timber for industrial use. Includes companies both with and without wood processing plants.
Other Private Lands	Private lands not owned by forest industry. Native American lands, farmer-owned lands, and miscellaneous private lands were included in this category in the 1994 FIA survey data but only farmer-owned lands and miscellaneous private lands were included in this category in the 1984 survey.

Readers must review the definition of terms and the confidence intervals of FIA data published in all FIA publications to fully understand the findings and to avoid erroneous conclusions. FIA is designed for national resource assessment and seeks to reduce sampling error to acceptable levels at the scale of the Resource Area. When users such as FRAP summarize the data for smaller units such as ownership or county, the coefficients of variation of FIA data grow.

Continuous FIA data are generally not fully comparable over time because of changes in procedures and definitions used on each occasion of FIA surveys both inside and outside National Forest boundaries. Changes in forest survey protocols confound real and methodological changes and make it difficult to

Agriculture

About this sector

The Agriculture sector includes crop production, livestock production and agricultural chemicals. The Department of Commerce formerly classified this industry under the 1987 Standard Industrial Classification codes **01, 02** and **287**; the sector is now classified under the 1997 North American Industry Classification System EXIT disclaimer as **111, 112** and **3253**.

Additional Compliance Assistance information is provided based by statute (e.g. Clean Air Act, Clean Water Act) or through compliance incentives and auditing. Note that multiple statutes may apply to your entity. Information on EPA's compliance monitoring program also is organized by statutory programs. All regulated entities may be subject to EPA's statutory and civil enforcement program.

Return to Top

Tools and information on how to comply

The following list of resources focuses on federal regulations and is not exhaustive. Additional resources may be available from other parts of EPA or from other federal, state or local agencies.

The National Agriculture Compliance Assistance Center provides comprehensive, easy to understand compliance information targeted for the agriculture community. It offers information that helps you understand your environmental requirements. Available materials include plain-English guides, consolidated checklists, fact sheets, and information on ways to reduce the costs of compliance, such as best management practices.

The Profile of the Agriculture Crop Industry, the Profile of the Agriculture Livestock Production Industry, and the Profile of the Agriculture Chemical, Pesticide and Fertilizer Industry Sector Notebooks are plain language booklets that describe environmental problems associated with major U.S. industries. Information includes, but is not limited to, regulatory requirements, pollution prevention techniques, pollutant release data and innovative programs.

National Compliance Assistance Clearinghouse links to public and private compliance assistance materials. Users may post

Agriculture Sector Highlights

Sector Notebooks
Profile of the Agriculture Chemical, Pesticide, and Fertilizer Industry
Profile of the Agriculture Crop Industry
Profile of the Agriculture Livestock Industry

Compliance Assistance Center
Agriculture Center

Environmental Management System
Agribusiness

Compliance Assistance Clearinghouse
Agriculture

Agriculture Information Resources

when the driver overcorrected, he lost control, said Tom McCreary, commander of the California Highway Patrol's Barstow station.

were sisters, said CHP Officer Chuck Wagner.

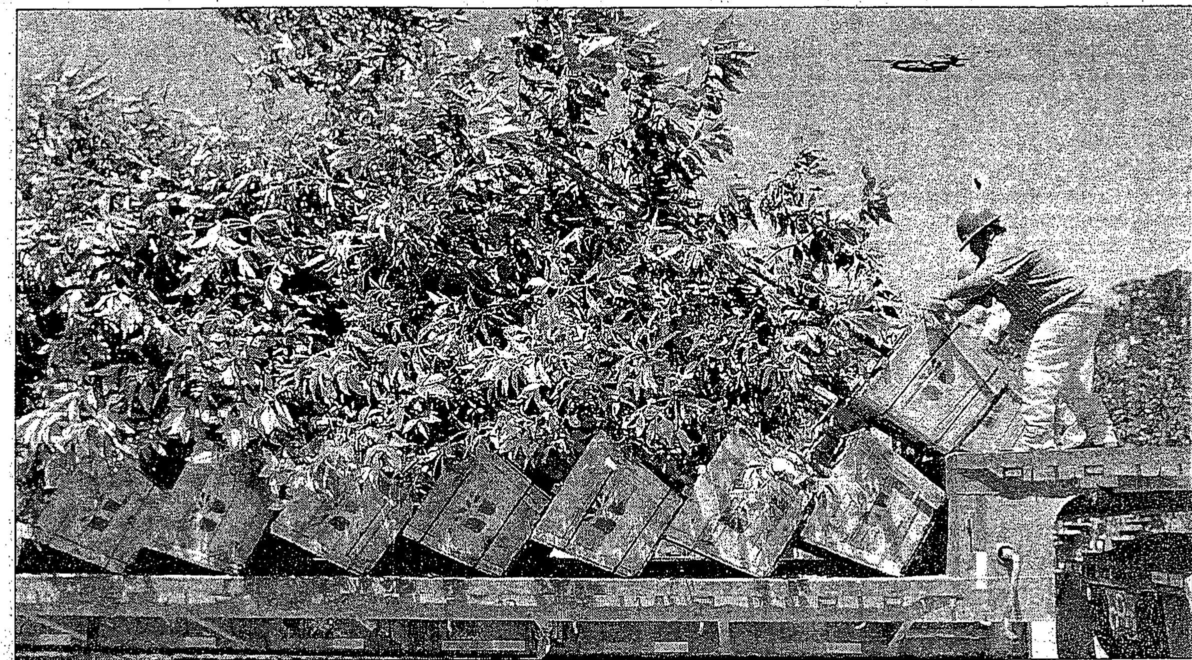
Five passengers suffered major injuries and 10 had minor injuries. They were all taken to

Mexico, and an identification card issued by a Mexican consulate.

CHP Lt. Oscar Medellin said officers believe the van began its

SUV carrying 21 people suspected of being illegal immigrants, killing one.

Times staff writer Lance Pugmire contributed to this report.



CARLOS CHAVEZ *Los Angeles Times*

GROWTH: *In Santa Paula, Valley Crest Tree Co. workers move trees to be transplanted. Over the last decade, the value of nursery stock in Ventura County has nearly tripled to $222 million, second only to strawberries.*

Nurseries Strengthen Roots in Ventura County

Construction booms trigger the demand for landscape material, now the area's No. 2 crop.

By FRED ALVAREZ
Times Staff Writer

No one has had a better view than Brad Bowers of the rapid rise of Ventura County's nursery industry, which now produces the county's second biggest cash crop.

As production manager for Valley Crest Tree Co., Bowers helped guide the transition over the last decade of the company's inventory from narrow wedges of leased land under power lines in Los Angeles County to wide swaths of Ventura County farmland, offered by orange growers unable to turn a profit.

Valley Crest has bought hundreds of acres in the bucolic Santa Clara River Valley, bulldozing 20,000 citrus trees to establish a state-of-the-art nursery to fuel a building boom taking place in California and other parts of the West.

Others have followed suit, triggering a revenue surge that in 10 years has seen the value of the trees, plants and turf used for landscaping, nearly triple to $222 million, second only to strawberries.

"It was all oranges when we first got here, but the whole area has changed," said Bowers, who oversees production on about 350 acres in Ventura County.

"It's all tied to construction," he said. "If you get a few more big players here, I can see the nursery industry becoming No. 1."

Nursery stock is among dozens of high-value crops that helped push Ventura County farm income to a record $1.3 billion in 2004, according to the county's annual crop report. Strawberries were the top crop, generating $363.6 million.

Nearly 30 crops generated at least $1 million in gross sales last year. Overall, farm revenue increased $272 million from 2003 to 2004.

Few industries have risen as rapidly as the nursery business. Nursery stock generated $82.5 million in 1994 and was ranked fifth on the county's crop report that year. In 2003, the value was pegged at $173 million, and nursery stock for the first time moved into second place on the crop report. That year, the county was the third-largest producer in the state of nursery products, flowers and foliage, behind San Diego and Monterey counties.

The 2004 total includes the gross value of trees, potted plants and turf, much of which were shipped throughout the western United States to landscape new housing projects and commercial developments.

"Ironically, it's all fueled by the housing boom, which seems to be happening everywhere but here" in Ventura County, said Rex Laird, executive director of the county farm bureau. Local voters have enacted tough growth-control laws that put much of the farmland off-limits to development, he said.

The industry's rise is evident along California 126 in the Santa Clara River Valley. The rural highway cuts through Ventura County's agricultural heartland. From Santa Paula to Piru, tens of thousands of citrus trees have been removed in recent years to make way for potted plants, bushes and trees laid out in orderly rows on the coffee-colored soil.

San Gabriel-based Norman's Nursery started expanding into the area about five years ago and now has 200 acres of nursery land along that stretch of highway. It's one of about a dozen sites the company maintains statewide.

"It's an ideal climate and we really enjoy being out there," said Charles Norman, president of the family-run operation. "For those of us located in that area, I'd say 80% of what we do leans heavily toward commercial landscaping and construction."

Family-owned Boething Treeland Farms was well ahead of the curve, expanding some 40 years ago from its first nursery in the San Fernando Valley to acreage in eastern Ventura County. Today, about a third of the company's 700 growing acres are in Ventura County. The Woodland Hills-based nursery is in the process of adding 27 acres near Moorpark.

Boething's expansion into the county is also fueled largely by building booms in cities such as Phoenix and Las Vegas.

"A lot of nurseries are shipping to those locales [Arizona and Nevada] because the demand is there," said Bruce Pherson, a Boething official.

A003763

Linda S. Adams
Secretary for Environmental Protection

State Water Resources Control Board

Office of Chief Counsel
1001 I Street, 22nd Floor, Sacramento, California 95814
P.O. Box 100, Sacramento, California 95812-0100
(916) 341-5161 ♦ FAX (916) 341-5199 ♦ http://www.waterboards.ca.gov

Arnold Schwarzenegger
Governor

April 18, 2008

Ms. Paula Higashi, Executive Director
Commission on State Mandates
980 Ninth Street, Suite 300
Sacramento, CA 95814

Dear Ms. Higashi:

STORM WATER POLLUTION CONTROL REQUIREMENTS, FILES 03-TC-04, 03-TC-19, 03-TC-20, 03-TC-21: RESPONSE TO TEST CLAIMS 03-TC-04, 03-TC-19, 03-TC-20, 03-TC-21

The State Water Resources Control Board ("State Water Board") and the Los Angeles Regional Water Quality Control Board ("Los Angeles Water Board") jointly file this opposition to Test Claims 03-TC-04, 03-TC-19, 03-TC-20, and 03-TC-21. All of these test claims arise from a single permit that was issued by the Los Angeles Water Board as Order No. 01-182, Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges within the County of Los Angeles, and the Incorporated Cities therein, Except the City of Long Beach ("the Permit").[1] The requests for reimbursement in the test claims arise almost entirely from two requirements in the Permit and consolidation is therefore proper.

The Permit was issued by the Los Angeles Water Board pursuant to requirements in the federal Clean Water Act ("CWA").[2] The State Water Board and Los Angeles Water Board have been authorized by the United States Environmental Protection Agency ("U.S. EPA") to issue NPDES permits—which are mandated by the CWA—in lieu of issuance of these permits by U.S. EPA. The Permit regulates the discharge of storm water runoff from the municipal separate storm sewer system (MS4) of 84 cities and County of Los Angeles to rivers and the Santa Monica Bay.

The federal Clean Water Act mandates that municipalities must apply for and receive permits regulating discharges of pollutants from their MS4s to waters of the United States. Pursuant to federal regulations, the Permit contains numerous requirements for the cities and County to take actions to reduce the flow of pollutants into the rivers and the Bay, known as Best Management Practices (BMPs). These test claims, filed by 20 cities and the County, seek reimbursement by the State of California for expenses they incur in implementing two of the requirements of the Permit: (1) Inspections of commercial and industrial facilities; and (2) Placement of trash receptacles at transit sites.

[1] The Permit serves as National Pollutant Discharge Elimination System permit (NPDES) No. CAS004001. It was issued by the Los Angeles Water Board on December 13, 2001.

[2] Federal Water Pollution Control Act [FWPCA; 33 U.S.C.A. §§ 1251 et seq.] The federal Act is referred to herein by its popular name, the Clean Water Act ("CWA") and the code sections used are those for the CWA.

In order to obtain reimbursement, the claimants must show that the requirements constitute a new program or higher level of service. They must prove either: (1) the program must carry out a governmental function of providing services to the public, or (2) the requirements, to implement a state policy, impose unique requirements on local governments and do not apply generally to all residents and entities in the state. The claimants must also prove that the costs are mandated on them by the state, rather than by federal law. Finally, they must prove that any additional costs beyond the federal mandate are substantial and not *de minimis*. The claimants do not meet any of these tests.

The Permit as a whole, and including the inspection and trash receptacle provisions, is mandated on the local governments by federal law. The federal mandate applies to many dischargers of storm water, both public and private, and is not unique to local governments. The federal mandate requires that the Permit be issued to the local governments; it is not a question of "shifting" the costs from the state to the local governments. The specific requirements challenged are consistent with the minimum requirements of federal law. Even if the Permit were to be interpreted as going beyond federal law, any additional state requirements are *de minimis*. Moreover, the costs are not subject to reimbursement because the programs were proposed by the cities and County themselves, and because they have the ability to comply with these requirements through charges and fees, and are not required to raise taxes. The U.S. EPA has submitted a letter to the State Water Board dated April 10, 2008, in agreement with this position.[3]

<u>Description of the Test Claims</u>

The test claims focus on two discrete requirements in the Permit: the requirement to inspect certain industrial and commercial facilities that discharge into the MS4 and the requirement for some of the permittees to place and maintain trash receptacles at transit stops.

<u>Industrial and Commercial Facilities Control Program</u> (Part 4.C.)

Test claims 03-TC-19, 03-TC-20, and 03-TC-21 claim subvention for costs of complying with permit requirements to reduce pollutants from industrial and commercial facilities. Test claims 03-TC-19 and 03-TC-20 are limited to Part 4.C.2.a. and b., the requirements to inspect industrial and commercial facilities. Test Claim 03-TC-21 refers broadly to Part 4.C., the entire industrial and commercial facilities control program, but the costs discussed in the test claim are those associated with inspections. (See, Declaration of Richard Montevideo, No. 4.) Therefore, the Boards' analysis of the subvention claims for Part 4.C. is generally limited to the inspection requirements.

Part 4.C. of the Permit requires permittees to implement pollutant reduction and control measures at industrial and commercial facilities within their jurisdictions. Permittees may choose from various pollutant reduction and control measures, alone or in combination and

[3] Letter dated April 10, 2008, from Alexis Strauss, Director, Water Division, U.S. EPA to Tam M. Doduc, Chair, and Dorothy R. Rice, Executive Director, State Water Board, Attachment 3.

before, during, or after the activities that generate pollutants. The permittees are required to track, inspect, and ensure compliance at those facilities that are critical sources of pollutants in storm water.

Critical sources are specified commercial facilities (restaurants and automobile-related businesses), and industrial facilities that are required by federal regulations to obtain their own NPDES storm water permits.

Part 4.C.2.a. and b. contain inspection requirements, which are generally to conduct two inspections of facilities over a 5-year period. The Permit describes what the inspector must look at. (For example, inspectors at restaurants must see if operators pour grease into the street, and gas station inspectors must observe whether fuel-dispensing areas are swept.) The Permit states that for industrial sites, inspection requirements do not apply if the Los Angeles Water Board conducted an inspection of the site within two years.

Trash Receptacle Requirements (Part 4.F.5.c.3)

Test claims 03-TC-04, and 03-TC-20, and 03-TC-21 claim subvention for costs of complying with permit requirements for some of the permittees to place trash receptacles at public transit stops. Claim 03-TC-21 states that it challenges the entirety of the storm drain operation and maintenance and streets and road maintenance requirements, but the only costs in these sections for which it seeks reimbursement are for the placement and maintenance of trash receptacles. The claims are limited to the trash receptacle requirements for those municipalities that are not subject to a separate federal requirement, the "trash TMDL."[4] The requirements are to place trash receptacles at all transit stops and to maintain these receptacles.

Discharge Prohibitions and Receiving Water Limitations (Parts 1 and 2).

Test claim 03-TC-21 appears to claim subvention for costs associated with Parts 1 and 2 of the Permit, which include general prohibitions and requirements to protect water quality. The claim itself fails to specify any particular costs associated with this claim, other than a general study that considers a hypothetical treatment plant. As discussed below, storm water permits are written with the assumption that there will be no treatment plant and the permit certainly does not require one. In any event, there are no signed declarations to support this claim and no estimate of costs to the specific claimants.

Background of Federal Law Requirements for Storm Water Permits

In order to understand the federal mandate that required this permit, some background of the federal law and of MS4s is necessary. In 1972, the federal Clean Water Act was extensively amended to implement a permitting system for all discharges of pollutants from "point sources"

[4] As will be explained below, the Los Angeles Water Board has also adopted a federally-mandated total maximum daily load ("TMDL") for the deposition of trash into rivers and the Bay. The claimants do not claim subvention for the trash receptacle requirements for those cities and portions of the County subject to the TMDL, presumably conceding that those requirements are not reimbursable.

to waters of the United States.[5] The permits are issued pursuant to the national pollutant discharge elimination system, and are known as "NPDES permits." The 1972 amendments allowed U.S. EPA to authorize states to issue these permits.[6] California was the first state in the nation to obtain such authorization. In order to obtain this authorization, the California Legislature amended the Water Code, finding that the state should implement the federal law in order to avoid direct regulation by the federal government.[7] The California legislature mandated that California's permit program must ensure consistency with federal law.[8] The Water Boards are the state agencies charged with implementing the federal program.[9] The State Water Board incorporates the U.S. EPA regulations for implementing the federal permit program.[10] Therefore, both the CWA and U.S. EPA regulations are applicable to the permit program in California.[11] In California, permits to allow discharges into state waters are termed "waste discharge requirements."[12] The term "waste discharge requirements" is equivalent to the term "permit" in the CWA, when the waste discharge requirements are issued to comply with the CWA.[13] Thus, waste discharge requirements that the Water Boards issue to comply with the CWA are NPDES permits under federal law. When the Los Angeles Water Board, a state agency, adopts an NPDES permit in lieu of U.S. EPA, it must adopt as stringent a permit as the federal agency would have.[14]

The discharge of pollutants from point sources to waters of the United States is illegal, except in compliance with an NPDES permit.[15] In 1973, U.S. EPA issued regulations that exempted certain types of discharges it determined were administratively infeasible to regulate, including storm water runoff. The reason that such regulation is difficult, as will be more fully explained below, is that storm water runoff generally is not subjected to any treatment. Instead, it simply runs off urban streets, into gutters and drainage ways, and flows directly into streams, lakes, and the ocean.[16] This exemption was overruled in *Natural Resources Defense Council v. Costle* (1977) 568 F.2d 1369, which held that the exemption was illegal, and ordered U.S. EPA

[5] CWA §§ 301 and 402.

[6] CWA § 402(b).

[7] Wat. Code, § 13370 *et seq.*, adding Chapter 5.5 to the Porter-Cologne Water Quality Control Act.

[8] Wat. Code, § 13372.

[9] Wat. Code, § 13370.

[10] Cal. Code of Regs., tit. 23, (C.C.R.) § 2235.2.

[11] The permits *may* also include additional state requirements. (C.C.R., tit. 23, § 2235.3; *City of Burbank v. State Water Resources Control Bd.* (2005) 35 Cal.4th 613.)

[12] Wat. Code, § 13263.

[13] Wat. Code, § 13374.

[14] CWA § 402(b).

[15] CWA § 301(a). In general, "navigable waters" or "waters of the United States," includes all surface waters, such as rivers, lakes, bays and the ocean. (CWA § 502.)

[16] The chief traditional categories of discharges subject to NPDES permits are industrial process wastewater and sanitary sewer effluent. Both of these discharges are typically processed in a treatment plant before they are discharged to surface waters.

to require NPDES permits for storm water runoff. In *Costle*, the court suggested innovative methods for permitting, including using general permits for numerous sources and issuing permits that "proscribe industry practices that aggravate the problem of point source Pollution."[17] Where permits proscribe actions that dischargers must implement, these requirements are commonly called "best management practices" ("BMPs").

Despite the *Costle* decision, U.S. EPA had not adopted regulations implementing a permitting program for storm water runoff by 1987. That year, Congress amended the CWA, specifically requiring storm water permits for industrial and municipal storm water runoff.[18] The amendments require NPDES permits for "[a] discharge from a municipal separate storm sewer system ["MS4"] serving a population of 250,000 or more."[19] The CWA contains three provisions specific to permits for MS4s: (1) Permits may be issued on a system- or jurisdiction-wide basis; (2) Permits must include a requirement to effectively prohibit non-storm water discharges into storm sewers; and (3) Permits must require controls to reduce the discharge of pollutants to the maximum extent practicable ("MEP").[20] In describing the controls that permits must include, the statute states that the controls shall include: "management practices, control techniques and system, design and engineering methods, and such other provisions as the [permit writer] determines appropriate for the control of such pollutants."[21] Thus, the federal law mandates that permits issued to MS4s must require management practices[22] that will result in reducing pollutants to the MEP. The state is required, by federal law, to select the BMPs.[23]

In 1990, U.S. EPA adopted regulations to implement section 402(p).[24] The regulations define which entities need to apply for permits and also the information they must include in permit applications. The regulations define "industrial activity" to include numerous categories of manufacturing, construction, and other typically private enterprises.[25] The regulations define MS4s as storm sewer systems operated by numerous public agencies, including cities, counties, states, and the federal government.[26] While both industrial activities and MS4s must

---

[17] *Costle, supra*, at 1380.

[18] CWA § 402(p).

[19] CWA § 402(p)(2)(C). U.S. EPA defines municipal separate storm sewer systems (MS4s) that serve a population over 250,000 as "large" MS4s. The population of the County of Los Angeles is approximately 9.5 million. (Permit, D.1.)

[20] CWA § 402(p)(B).

[21] *Ibid.*

[22] These are commonly referred to as "best management practices," or "BMPs."

[23] *NRDC v. USEPA* (9th Cir. 1992) 966 F.2d 1292.

[24] Vol. 55, Federal Register (Fed.Reg.) 47990 and following.

[25] 40 C.F.R. § 122.26(b)(14).

[26] 40 C.F.R. § 122.26(b)(8).

obtain permits, the requirements in the industrial permits must be more stringent than in MS4 permits.[27]

In order to obtain coverage under an NPDES permit, as required by the CWA, entities seeking coverage file an application with the permitting authority and the permitting authority holds a public hearing on contested permits.[28] U.S. EPA regulations specify the information that applicants for MS4 permits must include in their applications.[29] For large and medium MS4s, the application requirements are extensive.[30] Some of the application requirements relevant to these Test Claims are: management programs including procedures to control pollution resulting from construction activities (at § 122.26(d)(1)(v)), legal authority to control the contribution of pollutants associated with industrial activity (at § 122.26(d)(2)(i)(A)), programs to control illicit discharges to the MS4 (at § 122.26(d)(1)(v)), and conducting inspections to determine compliance with permit conditions (at § 122.26(d)(2)(i)(F)). The permit applicants must propose management programs that the permitting authority will consider in adopting the permit.[31] The management programs must address oversight of discharges into the system from the general population and from industrial and construction activities within its jurisdiction, and also maintenance and control activities by the permittees.[32]

Most NPDES permits are largely comprised of numeric limitations for pollutants. Compliance is measured by sampling the treated effluent, which is discharged from a treatment plant into surface waters. These permits are written assuming that an engineered treatment plant can be built and operated to obtain a specified effluent. Storm water permits, on the other hand, usually require dischargers to implement BMPs that will result in lessening the pollutants in the runoff, since without a treatment plant the pollutants can flow directly into surface waters. Storm water permits apply to several types of entities—industries, construction, and municipalities—and all usually mandate BMPs. For municipalities that operate MS4s, the BMPs require the municipalities take actions that will lessen the incidence of pollutants *entering* storm drains by regulating the *behavior and practices* of the municipalities, their residents, and their businesses.[33]

U.S. EPA has issued regulations and guidance documents that discuss the types of BMPs that must be included in storm water permits in order to reduce the discharge of pollutants in storm

---

27 *Defenders of Wildlife v. Browner* (9th Cir. 1999) 191 F.3rd 1159. The differences between municipal and industrial permits are complicated, but are relevant to the question whether this permit addresses a uniquely governmental program, and are therefore discussed in more detail below.

28 CWA § 402(b)(3).

29 40 C.F.R. § 122.26(a)(4). The U.S. EPA regulations have varied requirements depending on the size of the population served by the MS4. A "large" MS4 serves a population of 250,000 or more. (40 C.F.R. § 122.26(b)(4).) Los Angeles County and the 84 cities regulated by this permit far exceed the minimum population for a large MS4.

30 40 C.F.R. § 122.26(d).

31 40 C.F.R. § 122.26(d)(2)(iv).

32 *Ibid.*

33 There may also be engineered solutions, and there are some in Los Angeles, but it is important to keep in mind that there is no single engineered storm sewer treatment plant as there is for sanitary sewage.

water to the "maximum extent practicable." Numerous guidance documents point to inspections of businesses and proper trash collection as important parts of an effective BMP program.[34] U.S. EPA has issued an MS4 Program Evaluation Guide, which includes a lengthy process for conducting inspections of businesses. This Guide makes clear that inspections of businesses are mandatory:

> Inspections
> Most effective industrial/commercial inspection programs maintain a complete facility inventory and group them according to priorities established by the permittee. An inspection frequency is determined based on priority, and a database is used to manage such information as inspection findings, enforcement actions, and required follow-up activities. Many permittees use and cross-train existing staff to perform industrial/commercial inspections, but some permittees may need to maintain an exclusive stormwater inspector due to a potentially large number of high-priority facilities. There should be an inspection standard operating procedure that has been formalized and documented. It should include a checklist to be used during the inspection and possibly a report format. Inspectors should be aware of federal, state, and local stormwater regulations that may apply to industrial/commercial facilities. Inspectors should be familiar with various types of BMPs commonly used at the types of facilities typically found in the permit area and should be able to educate facility operators about such BMPs. In addition, inspectors should understand and use the permittee's established enforcement escalation response plan to gain compliance as necessary. The inspection staff should be proficient in the enforcement escalation procedure and should properly document all enforcement actions accordingly. Inspections should be used not only to identify non-compliance issues, but as an opportunity to educate facility operators about proper stormwater BMPs.[35]

The Guide also states that MS4 programs must address trash and litter.[36]

Adoption of the Los Angeles MS4 Permit

Starting in 1990, pursuant to the CWA amendments of 1987, the Los Angeles Water Board issued storm water permits to the County of Los Angeles and to the cities therein.[37] Without such a permit, the cities would be discharging pollutants in violation of federal law.[38] The permit

---

[34] See, e.g., Guidance documents at http://cfpub.epa.gov/npdes/docs.cfm?document_type_id=1&view=Policy%20and%20Guidance%20Documents&program_id=6&sort=name, including http://www.epa.gov/npdes/pubs/owm0233.pdf (citing examples from MS4 permits throughout the country).

[35] MS4 Program Evaluation Guidance, at pp. 77-78.

[36] *Id.* at 79.

[37] For reasons not relevant to this matter, one city—Long Beach—has a separate permit. The current permit covers 84 cities.

[38] CWA §§ 301(a), 402(p)(3)(B).

that is the subject of these test claims is the third such permit, and was adopted December 13, 2001.[39] It is largely comprised of requirements to implement BMPs, most of which were proposed by the permittees.[40] The County and thirty-two of the cities challenged numerous aspects of the permit and the process by which it was issued, culminating in a court of appeal decision upholding the permit in its entirety.[41]

On February 1, 2001, the County, on behalf of all permittees,[42] submitted a Report of Waste Discharge (permit application), including a Stormwater Quality Management Plan (SQMP). The SQMP constituted the permittees' proposal for the BMPs that would be required in the permit.[43] (Permit C.) The permit that was ultimately adopted was based on the SQMP, with some revisions and additions necessary to meet minimum federal requirements. (*Id.*) The SQMP prepared by the County included several proposed BMPs that relate to inspections of commercial and industrial facilities and placement and maintenance of trash receptacles:

(1) Municipalities must conduct site visits to industrial and commercial facilities, including automotive service businesses and restaurants, which must include, "a site walk-through to verify for, at a minimum, evidence of BMP implementation," and shall revisit facilities and take enforcement where illicit discharges are found;[44]

(2) Municipalities will maintain a database of automotive and food service facilities, including whether they have "NPDES stormwater permit coverage;"[45] and

(3) Municipalities must minimize trash from entering recreational water bodies,[46] remove trash from open channels;[47] and control litter and debris in streets.[48]

The SQMP included detailed requirements for municipalities to implement at construction sites, including inspections by the municipality.[49] The SQMP proposed that all municipalities be

---

[39] NPDES permits generally expire after 5 years, and must be reissued thereafter.

[40] A single permit applies to the County and 84 cities. Thus, while some entities may disagree with some provisions, other entities will agree and the entire group may propose permit terms that some cities oppose. The entire group submits a single proposed storm water management plan.

[41] *County of Los Angeles v. State Water Resources Control Board* (2006) 143 Cal.App.4th 985; referred to hereafter as *County of Los Angeles*.

[42] All permittees include the County and 84 cities. The County and the 21 cities that filed these Test Claims participated jointly with the application and permitting procedures with the remaining 63 cities who did not file Test Claims.

[43] The SQMP is several hundred pages. Relevant sections are attached; the entire SQMP is available should the Commission request it.

[44] SQMP, pp. 22-23 and 28.

[45] *Ibid.*

[46] SQMP, ES-6

[47] SQMP, ES-7

[48] *Ibid.*

[49] SQMP, pp. 24-26.

required to collect trash along open channels and encourage voluntary trash collection in natural stream channels.[50] The SQMP contains an Illicit Connection and Illicit Discharge Elimination Program, which includes education of inspectors employed by the permittees who will investigate businesses.[51]

Following adoption of the permit and a petition to the State Water Resources Control Board ("State Water Board"), the County, 32 cities,[52] the Los Angeles County Flood Control District and industry groups representing builders filed suit challenging numerous provisions in the Permit. The Superior Court upheld the Permit, and the Court of Appeal affirmed the judgment in its entirety.[53] First, the court held that the permit as a whole "imposes reasonable pollutant discharge requirements." Because the minimum federal requirement is that the permit require the municipalities to reduce pollutants to the maximum extent practicable, the court clearly determined that the permit's requirement are MEP. In its discussion of the consideration of costs to the municipalities, the court found that the permit did not exceed any federal requirements:

> "The permit explicitly states it is intended to provide a cost-effective storm water pollution program to the maximum extent possible. The permit applies the same cost-effective analysis to efforts to reduce the flow of pollutants into receiving waters. Moreover, the [Los Angeles Water Board] in its finding referred to a report specifying how the 'maximum extent practicable' requirement includes considerations of costs and benefits."[54]

The court also discussed various cost analysis reports and U.S. EPA Guidance. It rejected the claim that the permit's requirements exceeded the federal mandatory standard. The court specifically upheld the inspection requirements, stating: "there is federal regulatory authority that required [the Los Angeles Water Board] to consider imposing the inspection requirements."

Several of the permittees filed these test claims with the Commission on State Mandates. The Commission rejected the claims, basing its determination on Government Code section 17516, subdivision (c), which exempted Water Board permits from the requirements to reimburse state-mandated local funds. That action also resulted in a Court of Appeal decision finding that subdivision to be unconstitutional and remanding to the Commission to determine the test claims.[55] In its decision, the court stated that the Commission must address factual issues

---

[50] SQMP, p. 28

[51] SQMP, App. D

[52] These include 18 of the cities that filed the Test Claims, and Bellflower, Claremont, Diamond Bar, Gardena, Hawaiian Gardens, Industry, Irwindale, La Mirada, Lawndale, Monrovia, Paramount, Rosemead, Santa Clarita, Santa Fe Springs, Torrance, Walnut, and Whittier.

[53] *County of Los Angeles, supra.* Some of the determinations of the appellate court discussed here were not published and thus cannot be cited as precedent in other cases. They are binding on the claimants. A copy of the entire decision is attached.

[54] Unpublished decision, at p. 20.

[55] *County of Los Angeles v. Commission on State Mandates* (2007) 150 Cal.App.4th 898.

regarding the requirements to conduct inspections and to place and maintain trash receptacles constitute state or federal mandates.

Following *Commission on State Mandates*, each of the four test claims was re-filed without any revisions.[56] All of the test claims are based upon requirements in the permit. Test Claim 03-TC-04 was filed by the County of Los Angeles, and challenges the requirement to place trash receptacles at transit stops.[57] Test Claim 03-TC-19 was filed by the County of Los Angeles, and challenges the requirements to inspect industrial and commercial businesses.[58] Test Claim 03-TC-20 was filed by nine cities[59] and challenges the requirements for trash receptacles and inspections, and the general requirements for a construction program.[60] Test Claim 03-TC-21 was re-filed by ten cities[61] and challenges the following permit requirements: discharge prohibitions, receiving water limitations, industrial program, construction program, storm drain program, and street and road maintenance[62]. While Test Claims 03-TC-20 and 03-TC-21 appear to assert broader requests for reimbursement, they address in detail only the requirements for inspections and trash receptacles, and these are the only requirements that the court in *Commission on State Mandates* stated were subject to the test claims.[63] In light of the absence of the necessary information for such claims and the court's remand, we assume that any claims additional to the inspections and trash receptacles are not valid claims.

In addition to the litigation over this permit, cities made similar arguments against an MS4 permit adopted by the Santa Ana Regional Water Quality Control Board. In a published decision, an appellate court in that case made additional findings applicable to the arguments in this matter[64]. It found that there was no evidence to support an argument that the permit "exceeded federal requirements." This finding is important because the cities in *Rancho Cucamonga* had argued that a ground for overturning that permit was that it used the same provisions as had

[56] The State Water Board and Los Angeles Water Board received several Notices of Complete Test Filing: a letter dated October 16, 2007, stated 03-TC-21 was complete; a letter dated October 29, 2007, stated that 03-TC-04 was complete; a letter dated October 29, 2007, stated that 03-TC-19 was complete; and a letter dated December 12, 2007, stated 03-TC-20 was complete. On December 21, 2007, the Commission extended time to respond to all four test claims until April 21, 2008.

[57] 03-TC-04 challenges Permit Part 4.F.5.c.3.

[58] 03-TC-19 challenges Permit Part 4.C.2.a. and b.

[59] The cities that filed the test claim are Artesia, Azusa, Beverly Hills, Carson, Commerce, Norwalk, Rancho Palos Verdes, Westlake Village, and Vernon.

[60] 03-TC-20 challenges Permit Part 4.C.2.a. and b., 4.E, and 4.F.5.C.3.

[61] The cities that filed the test claim are Arcadia, Baldwin Park, Bellflower, Cerritos, Covina, Downey, Monterey Park, Pico Rivera, Signal Hill, South Pasadena, and West Covina.

[62] 03-TC-21 challenges Permit Parts 1, 2, 4.C, 4.E, 4.F.5 and 6. In a letter dated January 18, 2008, sent to the Commission from Howard Gest, he states that the cities he represents, which include five of the cities that filed the claim, "do not currently intend to pursue a claim" as to Parts 1 and 2, but that the limitation is "without prejudice." In light of the fact that Mr. Gest apparently does not represent all of the cities that filed the claim and the limited nature of this limitation, we will address Parts 1 and 2 and ask the Commission to determine that these parts do not create a reimbursable mandate.

[63] 150 Cal.App.4th 898, 903.

[64] *City of Rancho Cucamonga v. Regional Water Quality Control Board*, 135 Cal.App.4th 1377.

been crafted for other permittees, including the Los Angeles MS4 permit. The *Rancho Cucamonga* court specifically addressed inspection requirements, holding that federal law, either expressly or by implication, required NPDES permittees to perform inspections for illicit discharge prevention and detection, including inspection of industrial facilities and construction sites. Because the Los Angeles MS4 permit is based on BMPs and courts have determined that it is consistent with MEP, it is necessarily no more stringent than required by federal law.

State Mandate Law

Article XIIIB, Section 6 of the California Constitution requires subvention of funds to reimburse local governments for state-mandated programs in specified situations. There are several exceptions and limitations to the subvention requirements that provide bases for the Commission to determine that the Test Claims are not subject to subvention. Article XIIIB, Section 6 provides: "Whenever the Legislature or any state agency mandates a new program or higher level of service on any local government, the State shall provide a subvention of funds to reimburse that local government for the costs of the program or increased level of service."

Implementing statutes clarify that no subvention of funds is required if: (1) the mandate imposes a requirement that is mandated by a federal law or regulation and results in costs mandated by the federal government, unless the statute or executive order mandates costs that exceed the mandate in that federal law or regulation (Govt. Code, § 17556(c)); or (2) the local agency has the authority to levy service charges, fees, or assessments sufficient to pay (Govt. Code, § 17556(d)); or (3) the local agency proposed the mandate (Govt. Code, § 17556(a)). Each of these exceptions to subvention applies to these Test Claims. All of the mandates for which the Test Claims seek reimbursement are mandated by federal law or regulation. The County and cities can assess fees for all of the costs incurred. The claimants themselves, as part of the group of the County and 84 cities who applied for the permit, proposed most of the specific requirements challenged.

Numerous judicial decisions have further defined limitations on the requirements for subvention of funds. Specifically, subvention is only required if expenditure of tax monies is required, and not if the costs can be reallocated or paid for with fees.[65] In addition, reimbursement to local agencies is required only for the costs involved in carrying out functions peculiar to government, not for expenses incurred by local agencies as an incidental impact of laws that apply generally to all state residents and entities. Laws of general application are not entitled to subvention.[66] The fact that a requirement may single out local governments is not dispositive; where local agencies are required to perform the same functions as private industry, no subvention is required.[67]

[65] *County of Los Angeles v. Commission on State Mandates* (2003) 110 Cal.App.4th 1176; *Redevelopment Agency v. Commission on State Mandates* (1997) 55 Cal.App.4th 976.

[66] *County of Los Angeles v. State of California* (1987) 43 Cal.3d 46.

[67] *City of Richmond v. Commission on State Mandates* (1998) 64 Cal.App.4th 1190.

The Permit is not subject to subvention; it meets each of these exceptions. The requirements that are the subject of the claims are part of permits that meet, but do not exceed, the minimum federal requirements. The federal mandate is specifically directed at the municipalities and not at the state in general. The costs for the programs can be paid for by levying service charges, including charges to companies for conducting their businesses, fees for collection of refuse, fees for transit services, and fees especially enacted for storm water programs.[68] Compliance with NPDES permits, and specifically with storm water permits, is required by private industry also. In fact, the requirements for industrial and construction entities are more stringent than for government dischargers. In addition, the government requirements apply to all governmental entities that operate MS4s, including state and federal facilities; local government is not singled out. The local agencies can assess fees to perform the required tasks; tax monies are not required. Finally, to the extent that any portion of the claims would otherwise qualify for subvention, they are *de minimis* and therefore do not qualify.

In its remand, the court stated that the most significant issue is "whether the two obligations in question constitute federal or state mandates" and that these present factual issues for the Commission to decide.[69] The court pointed to four cases that the Commission stated would apply in making this determination.[70] Each case is discussed below:

City of Sacramento v. State of California (1990) 50 Cal.3d 51: The court held that application of unemployment insurance law to state and local agencies was not subject to subvention. In discussing whether the requirement was a federal mandate, the court held that the issue is whether compliance with the federal law was "mandatory" or "optional," which is based on the following factors: "A determination in each case must depend on such factors as the nature and purpose of the federal program; whether its design suggests an intent to coerce; when state and/or local participation began; the penalties, if any, assessed for withdrawal or refusal to participate or comply; and any other legal and practical consequences of nonparticipation, noncompliance, or withdrawal."[71]

Hayes v. Commission on State Mandates (1992) 11 Cal.App.4th 1564: The court considered claims for subvention for a special education mandate. It concluded that, although the program was a federal mandate, the state had freely chosen to shift the costs to local governments and that subvention was proper. The court held that the test for whether there is a federal mandate is whether compliance with federal requirements is "a matter of true choice," in other words whether participation in the federal program is "truly voluntary."[72] The court listed the significant factual determinations: "In our view the determination whether certain costs were imposed upon a local agency by a federal mandate must focus upon the local agency which is ultimately

[68] The claimants refer to limitations on assessing services fees under California law. The referenced law concerns only the percent of voters who must approve the assessment. In fact, the largest entity subject to the permit, the City of Los Angeles, has successfully adopted such an assessment.

[69] *Commission on State Mandates*, 150 Cal.App.4th 898, 918.

[70] *Id.*, at 919.

[71] 50 Cal.3d 51, 76.

[72] 11 Cal.App.4th 1564, 1582.

forced to bear the costs and how those costs came to be imposed upon that agency. If the state freely chose to impose the costs upon the local agency as a means of implementing a federal program then the costs are the result of a reimbursable state mandate regardless whether the costs were imposed upon the state by the federal government."[73]

Long Beach Unified School District v. State of California (1990) 225 Cal.App.3rd 155: The court held that subvention does apply where actions are mandated by the state, which go beyond the federal constitution or case law. Because federal law clearly would not have required steps for de-segregation where there was no finding of segregation, subvention applied.

San Diego Unified School District v. Commission on State Mandates (2004) 33 Cal.4th 859: A school district sought subvention of funds to conduct expulsion hearings. The federal law made expulsions discretionary, but where expulsions occurred, the federal law mandated certain hearing procedures. The state law mandated expulsions whenever firearms were involved, and made all other expulsions discretionary. It also mandated some hearing procedures in addition to the federal requirements. The Supreme Court held that for firearms expulsions, the state mandated a higher level of service, and that all hearing costs for these expulsions were reimbursable, even those attributable to procedures mandated by federal law. It also held that no hearing costs are reimbursable for expulsions that are discretionary under state law. Even if the hearing procedures are mandated by state law, the court found they are incidental to federal due process requirements and are *de minimis* and therefore not reimbursable. In determining that any additional state-mandated hearing costs were *de minimis*, the court found that the state reasonably set forth requirements that were intended to implement the federal hearing requirements: "challenged state rules or procedures that are intended to implement an applicable federal law-and whose costs are, in context, *de minimis*-should be treated as part and parcel of the underlying federal mandate."[74]

The Claims do not Qualify for Subvention

The Programs are Federal Mandates that Apply Directly to Local Governments; the State has not Shifted the Burden; and the Mandates do not Exceed Federal Law

The challenged provisions are mandated by federal law. Two appellate courts have determined that the provisions in this permit constitute MEP—the minimum requirements mandated by federal law. The court in *Los Angeles* has determined that the Permit is cost-effective and based on the MEP standard. The court in *Rancho Cucamonga* found that a very similar permit met the MEP standard and did not exceed the minimum federal standard. That case specifically stated that the requirement to conduct inspections reflected MEP. The federal law specifically requires that permits be issued to the local governments that operate MS4s and that permits must require programs and actions that will result in reducing the pollutants that discharge from the MS4 to waters of the United States to the maximum extent practicable. The permit is a federal mandate on the local governments. It is the local governments that must apply for and obtain a permit. Without the permit, the cities are discharging pollutants in violation of federal

---

[73] *Id.* at 1593-4.

[74] 33 Cal.4th 859, 889.

law.[75] If the Water Boards had not been authorized to issue the permit in lieu of U.S. EPA, that federal agency would have issued a similar permit directly to the local governments.

The claimants contend that the Los Angeles Water Board exercised discretion to impose requirements beyond those required by federal law because the Los Angeles Water Board had a choice in establishing the mandated programs and "[t]he [Water Boards] cannot point to any provisions of the Clean Water Act or related regulations that require the programs at issue in this claim."[76] The fact that some discretion is exercised in implementing a federal program does not mean that subvention is required. The court in *Hayes* explained that, where the state has some discretion in mandating the program but ultimately the factual situation requires some type of mandate, there is a federal mandate:

> "The remaining question is whether the state's participation in the federal program was a matter of "true choice" or was "truly voluntary." The alternatives were to participate in the federal program and obtain federal financial assistance and the procedural protections accorded by the act, or to decline to participate and face a barrage of litigation with no real defense and ultimately be compelled to accommodate the educational needs of handicapped children in any event. We conclude that so far as the state is concerned the Education of the Handicapped Act constitutes a federal mandate."[77]

The central issue before the Commission is whether the requirements to conduct inspections and to place trash receptacles at bus and train stops exceed the federal mandate for MS4 permits. As to the inspections, the claimants appear to concede that federal law specifically requires MS4s to conduct inspections of industrial facilities and construction sites, but claim that the Los Angeles Water Board could have conducted all of the inspections and instead exercised its discretion to "shift" the responsibility to the claimants. They base this contention on a permit issued by the State Water Board to industrial facilities[78] and contend that permit obligates the Regional Water Boards, including Los Angeles, to conduct inspections. Therefore, they claim, the Los Angeles Water Board has shifted that responsibility to the municipalities. They also contend that the federal law does not specify that restaurants and automobile-related businesses must be inspected. As to the trash receptacles, they claim that the federal law does not specify this particular BMP.

In order to evaluate these contentions, some more detailed discussion of the storm water permitting scheme established by U.S. EPA is necessary. Of particular importance are: the process of selecting BMPs that are included in MS4 permits; the obligation of MS4s to regulate discharges from businesses into their systems, including discharges that are simultaneously regulated by separate NPDES permits; the process for selecting which businesses to regulate; and the requirement for MS4s to conduct inspections.

---

75 CWA §§ 301(a), 402(p)(3)(B).

76 Test Claim 03-TC-21, at page 10.

77 11 Cal.App.4th 1564, 1593.

78 Order No. 97-03-DWQ; http://www.waterboards.ca.gov/stormwtr/docs/induspmt.pdf

The Process for Selecting BMPs

The chief argument regarding trash receptacles is that the federal law does not specify this particular BMP and that, therefore, it exceeds federal law. The claimants appear to rely on *Hayes* to argue that the exercise of any discretion in selecting requirements automatically results in a reimbursable state mandate. As discussed above, however, the federal law specifically requires that the Water Boards prescribe the BMPs that the MS4 must implement. This issue was addressed succinctly in *Rancho Cucamonga*:

> In creating a permit system for dischargers from municipal storm sewers, Congress intended to implement actual programs. [Cite to *NRDC, supra.*] The Clean Water Act authorizes the imposition of permit conditions, including: "management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." [Cite to CWA § 402(p)(3)(B)(iii).] The Act authorizes states to issue permits with conditions necessary to carry out its provisions. [Cite to § 402(a)(1).] The permitting agency has discretion to decide what practices, techniques, methods and other provisions are appropriate and necessary to control the discharge of pollutants. [Cite to *NRDC.*] That is what the Regional Board has created in the 2002 permit."[79]

Because the federal mandate requires the Water Boards to choose specific BMPs that are included in MS4 permits as requirements, the "discretion" exercised in selecting those BMPs is necessarily a part of the federal mandate. It is not comparable to the discretion that the courts in *Hayes* or *San Diego* spoke of, where the state truly had a "free choice." The Los Angeles Water Board was mandated by federal law to select BMPs that would result in compliance with the federal MEP standard. "The [Water Board] must comply with federal law requiring detailed conditions for NPDES permits."[80] This is completely different from the state discretion exercised in *San Diego*, where the state law compelled expulsions for bringing firearms to school, while the federal law clearly did not mandate such expulsions. Therefore, it is clear that the mere exercise of discretion in selecting BMPs, does not create a reimbursable mandate.

It is conceivable that an MS4 permit issued in California could require practices that exceed the federal requirement of MEP. It is clear, however, that inspection requirements do not exceed MEP. That issue has been specifically ruled on by *Rancho Cucamonga* and there are federal regulations, discussed below, that require these inspections. The claimants allege, however, that there is no similar requirement for the placement of trash receptacles at transit stops. The trash receptacle requirements in the Permit are different for those cities subject to a "trash TMDL" than for other cities. The Los Angeles Water Board has adopted TMDLs for some of the water bodies that receive discharges from MS4s subject to the permit. As required by the TMDL and federal law, the permit contains specific provisions for permittees that are subject to the trash TMDLs. The claimants do not seek subvention for those requirements. For

[79] *Rancho Cucamonga, supra,* at 1389.

[80] *Ibid.*

permittees not subject to a trash TMDL, the permit requires they implement BMPs to reduce trash entering the MS4s, including placing trash receptacles at all transit stops that have shelters by August 1, 2002, and at all other transit stops by February 3, 2003, and that they maintain trash receptacles as necessary. (Permit, Part 4.F.5.c.3.)

The requirements regarding trash receptacles are found in the section of the Permit concerning public agency activities. (Part 4.F.) This section imposes BMPs concerning sewage treatment overflows, construction by public agencies, storm drain maintenance and operation, and municipal construction projects. In other words, these are BMPs concerning the municipalities' own activities, as opposed to its regulation of discharges into its system by others. U.S. EPA storm water regulations address BMP requirements for the MS4s' maintenance and operation of the storm sewer system. Specifically, the MS4s' plan must include maintenance activities and schedules, including a "description of practices for operating and maintaining public streets, roads and highways and procedures for reducing the impact on receiving waters of discharges from municipal storm sewer systems. . ."[81] As early as 1993, the Executive Officer of the Los Angeles Water Board directed all of the cities regulated by the permit to "increase cleaning frequency of and number of roadside trash receptacles in areas where needed."[82]

The requirements to control the release of trash into MS4s and surface waters are at the heart of the storm water program. "Storm sewer waters carry suspended metals, sediments, algae-promoting nutrients (nitrogen and phosphorus), *floatable trash*, used motor oil, raw sewage, pesticides, and other toxic contaminants into streams, rivers, lakes, and estuaries across the United States."[83] In carrying out the federal mandate to select BMPs, the decision to require trash receptacles at transit stops is a reasonable, practicable, and cost-effective method to reduce trash in storm water runoff. The claimants have not, and cannot, explain how such a requirement exceeds the federal standard of actions that reflect the "maximum extent practicable." The Permit also allows individual permittees to substitute BMPs for specific requirements in the Permit.[84]

At bottom, the trash receptacle requirements reflect the federal requirement to reduce pollutants from the MS4 to the maximum extent practicable. It is federal law that animates the requirement and federal law that mandates specificity in describing the BMPs.

<u>The Role of MS4s in Regulating Discharges from Industrial and Commercial Activities</u>

The claimants allege that because the Water Boards have a role in directly regulating businesses within the jurisdiction of MS4s, and therefore conduct inspections at such sites, that the requirements in the Permit for the MS4s to conduct inspections reflect a decision to shift the costs of a federal mandate from the state to local government. The court in *Hayes* discussed

[81] 40 C.F.R. § 122.26(d)(2)(iv)(A)(3).

[82] Letter dated June 17, 1993, from Robert P. Ghirelli to Thomas A. Tidemanson. Attachment 34.

[83] *Environmental Defense Center v. U.S. EPA* (9th Cir. 2003) 344 F.3d 832, 841; emphasis added.

[84] Permit, Part 4.A.1..

this issue. There, the mandate was to the state generally, and the state government decided to shift the cost for implementing special education to local school districts. Here, there is no general mandate addressed to the entire state. Instead, the federal law clearly required that municipalities that operate MS4s must obtain and comply with a permit. The state does not operate the MS4; the mandate is directed to the municipalities.

In addition to the requirements for permits issued to municipalities, the Water Boards are also mandated to issue permits to entities that discharge storm water "associated with industrial activity."[85] As part of its responsibilities for its in lieu program, the State Boards must administer and enforce all of its permits.[86] The State Water Board has issued permits for industrial and construction discharges of storm water, and the Los Angeles Water Board administers those permits within its jurisdiction. Therefore, the Los Angeles Water Board does conduct inspections at businesses in Los Angeles County to ensure compliance with the state permits. In addition, the MS4 Permit requires the permittees also to conduct inspections. This approach, which may result in two different entities inspecting the same businesses to review storm water practices, was specifically envisioned and required by U.S. EPA in adopting its storm water regulations.[87]

In promulgating its regulations for MS4s and industrial dischargers, U.S. EPA made clear its intent to require industrial facilities that discharge into municipal storm sewers to obtain their own NPDES permits and *also* to require MS4s to regulate and be liable for these same discharges. In 1990, U.S. EPA adopted the regulations that spell out the federal mandates for MS4s to develop and implement plans for regulation of industrial facilities. In its Preamble to the regulations, it explained that MS4 permits "are expected to require that controls be placed on storm water discharges associated with industrial activity which discharge through the municipal system." It presented the rationale for this dual regulatory approach:

> "[U.S. EPA] believes that municipal operators of large and medium municipal systems have an important role in source identification and the development of pollutant controls for industries that discharge storm water through municipal separate storm sewer systems is appropriate. Under the CWA, large and medium municipalities are responsible for reducing pollutants in discharges from municipal separate storm sewers to the [MEP]. Because storm water from industrial facilities may be a major contributor of pollutants to municipal separate storm sewer systems, municipalities are obligated to develop controls for storm water discharges associated with industrial activity through their system in their storm water management program."[88]

[85] CWA § 402(p)(2)(B).

[86] CWA § 402(b).

[87] In fact, the Los Angeles Water Board acted to lessen any duplication of effort and costs to the municipal permittees by exempting them from inspection requirements if the same facility has been inspected by the Board.

[88] Vol. 55, Federal Register (Fed.Reg.), at 48009.

Thus, U.S. EPA specifically mandated that industrial facilities were to be subject to permits issued directly to them by the Water Boards and also through MS4 permits, where municipalities must regulate the facilities: "Dischargers of storm water associated with industrial activity through municipal separate storm sewer systems will be subject to municipal management programs that address such discharges as well as to an individual or general NPDES permit for those discharges."[89]

Requirements for MS4s to Conduct Inspections

The federal regulations also specifically require local storm water agencies, as part of their responsibilities under NPDES permits, to conduct inspections.[90] Throughout the federal law, there are numerous requirements for entities that discharge pollutants to waters of the United States to monitor and inspect their facilities and their effluent.[91] The claimants are the dischargers of pollutants into surface waters; as part of their permit allowing these dischargers, they must conduct inspections. The Los Angeles Water Board is charged with administering and enforcing the permit. Its policing responsibilities may also include inspecting the facilities and waters it regulates, but that does not mean it is shifting its responsibilities when it properly mandates inspections by MS4s.

The Process of Selecting Which Businesses MS4s Must Regulate

The claimants contend that federally mandated inspections do not include restaurants, automotive service facilities, retail gasoline outlets, or automotive dealerships. Instead, they claim that the federal mandate is limited to municipal landfills, hazardous waste sites, industrial facilities listed under the federal Superfund law, and industrial facilities that the permittees themselves determined are contributing substantial pollutants to their systems.

They base this contention on the U.S. EPA's regulations for MS4 applications. The federal regulation states that the storm water management plan that MS4s must submit must address the municipalities' enforcement against pollutants from "municipal landfills, hazardous waste treatment, disposal and recovery facilities, industrial facilities that are subject to section 313 of title III of [the federal Superfund law], and *industrial facilities that the municipal permit applicant determines are contributing a substantial pollutant loading to the municipal storm sewer system.*"[92] The claim is essentially that, after MS4s submitted their first application for a permit, which was required by the U.S. EPA regulations in 1990,[93] and listed any industrial facilities they deemed to be contributors of substantial pollutant loading, the federal law did not mandate any further actions, regardless of whether new information or monitoring might reveal such

---

[89] *Id.* at 48058.

[90] 40 C.F.R. § 122.26(d)(2)(iv)(C). While the U.S. EPA regulations are phrased as "application requirements," wherein the MS4 must propose the various BMPs that will achieve MEP, these requirements must be included in the mandatory storm water management program. (*Los Angeles, supra,* 143 Cal.App.4th 985, 993.)

[91] See, e.g. CWA § 402(b)(2)(B); 40 C.F.R. § 122.44(i).

[92] 40 C.F.R. § 122.26(d)(2)(iv)(C); emphasis added.

[93] Vol. 55, Fed.Reg. 47990.

contributors. This is not a reasonable reading of the federal regulation. In adopting this regulation, U.S. EPA acknowledged that this initial selection by MS4s was only a starting point and that the mandate was to follow where information and monitoring led:

> "The object of [the requirements in 122.26(d)(2)(iv)(C)] is initially to set priorities for monitoring requirements. Then, if the situation requires controls can be developed and instituted. . . . .the selection of facilities is only a means of setting priorities for facilities for the development of municipal plans. ¶ EPA agrees. . . that there will be other facilities that are significant sources of pollutants and should be addressed by municipalities as soon as possible under management programs."

As early as 1993, the Executive Officer of the Los Angeles Water Board directed all of the cities regulated by the permit to implement facility inspections of "auto repair shops, auto body shops, auto parts and accessory shops, gasoline stations, and restaurants."[94] The letter noted that the BMPs listed therein constitute the minimum required for area-wide implementation, and that the list "is not an additional requirement, but incorporates BMPs already proposed by some permittees." Thus, it appears that the inspection requirements were, in fact, proposed by permittees.[95] In any event, MEP is not limited to the sources and controls proposed by the permittees. U.S. EPA Guidance documents make clear that MEP requires an iterative process, where municipalities assess sources, conduct investigations, and improve their programs.[96]

<u>The Local Governments have the Authority to Levy Service Charges, Fees, or Assessments to Pay for the Programs</u>

The County and cities need not spend tax monies to comply with the Permit. They can and do adopt fees from their residents and businesses that fund their storm water programs. The City of Los Angeles (the largest entity covered by the permit, and which has not filed any test claims) adopted a fee ordinance, based on property assessments, for implementation of the program. All of the municipalities have the ability to charge fees to businesses to cover inspection costs. The cities' trash collection responsibilities, which include placement of trash receptacles, are also paid for through existing fees. Moreover, the trash receptacle requirements that are the subject of the Test Claims are limited to public transit stops. Any additional costs associated with trash removal at these transit stops, a service cities already provide, could be borne by transit users through higher transit fees.

The cities and the County have failed to show that they must use tax monies to pay for these requirements. It is also clear that any "additional" costs that could conceivably be considered additional to the federal mandate would be *de minimis* and would not require payment from tax monies. For example, it is assumed that most cities routinely place trash receptacles at bus stops. In fact, the claimants make no allegation of any increased costs from this requirement;

[94] Letter dated June 17, 1993, from Robert P. Ghirelli to Thomas A. Tidemanson. Attachment 34.

[95] The issue of proposals by the permittees is discussed below.

[96] See, e.g. U.S. EPA document on Evaluating the Effectiveness of Municipal Storm Water Programs.

instead, they conflate any costs by listing "estimated trash receptacles, catch basin, and/or other treatment devices – capital and installation costs."[97]

The Local Governments Applied for the Permit and Proposed the Programs

The County and cities bound by the permit requested the mandate and the Permit allows alternatives in the manner of compliance. The County and cities jointly applied for the permit and proposed a management plan that is consistent with many of the requirements in the permit. Relevant portions of the Report of Waste Discharge that the County submitted are attached. The entire Report of Waste Discharge is available upon request. It is clear from these attachments, which include not only proposed programs but a draft permit, that many of the programs subject to the claims—including regulation of industrial and commercial sites, and specifically restaurants and automobile-service businesses—were proposed in the permittees' original plan submitted in February 2001. For example, the permittees proposed that the permit prohibit discharge of wash waters from gas stations, auto repair garages, and other automotive service facilities.[98] In addition, the permittees proposed a requirement that they "visit" automotive service and food service facilities every two years, and that they "revisit" facilities and take enforcement action if there is evidence of continuing illicit discharges.[99] The permittees submitted a lengthy list of proposed BMPs that site inspectors should look for during site visits.[100] Whether the term is "site visit" or "inspection," it is clear that the permittees proposed the mandate. The permittees also proposed that the permit mandate trash collection alongside, or in improved open channels.[101]

The permit was issued upon the joint request of all of the petitioners, with the County acting as the lead. Where the County and 84 cities apply for a single area-wide permit, the permit writer obviously is not required to write separate requirements for each entity and the County may be presumed to speak for the whole.

The Programs are not Mandates Peculiar to Government

Finally, the NPDES permit program, and the storm water requirements specifically, are not peculiar to local government. Industrial and construction facilities must also obtain NPDES storm water permits. These permits, however, are more stringent than municipal permits because the federal law requires that they meet more stringent technology-based standards and that they attain strict compliance with water quality standards in receiving waters.[102] As such, the only difference between the municipal storm water program and other storm water requirements is that federal law provides separate, more lax requirements for the municipalities.

---

97 Claim 03-TC-21, at p.2.

98 Report of Waste Discharge at R0000026.

99 *Id.* at R0000031.

100 *Id.* at R0000273 – R0000360.

101 *Id.* at R0000036.

102 *Defenders of Wildlife v. Browner, supra.*

The Water Boards' implementation of federal law reflects this dichotomy and the fact that the municipalities receive their own permit, as required by CWA section 402(p)(3)(B) does not change the fact that storm water permit requirements are not peculiar to local government.

It is the municipalities who operate MS4s and who discharge pollutants to surface waters. It is the municipalities who must obtain permits and comply with those permits. Similarly, industrial dischargers who discharge storm water runoff to waters of the United States must also obtain and comply with permits. The state is not the discharger (except in those situations where state agencies operate MS4s, such as the Department of Transportation, where they are themselves subject to permits), and the state is not uniquely shifting a new program or higher level of service onto municipalities.[103]

Discussion of Test Claims that were not Substantiated

Development Construction Program (Part 4.E)

Test claim 03-TC-21 claims subvention of costs for the development construction program. It did not, however, include any substantiation of this claim.

Public Agency Activities Program (Part 4.F.5 and 6)

Test claims 03-TC-04, 03-TC-20, and 03-TC-21 claim subvention for portions of the public agency activities program. Test claim 03-TC-21 claims subvention for the all requirements concerning storm drain operation and streets and roads maintenance, while test claims 03-TC-04 and 03-TC-20 are limited to the requirements to place trash receptacles at transit stops and to maintain these receptacles. Test claim 03-TC-21, however, did not include any substantiation of this claim, apart from the discussion of trash receptacles, above.

Discharge Prohibitions and Receiving Water Limitations (Parts 1 and 2)

Test claim 03-TC-21 challenges the discharges prohibitions and receiving water limitations in the Permit. Parts 1 and 2 contain the basic prohibitions and requirements for attaining compliance with water quality standards through an iterative process. The whole of the claim is that, "if enforced and read to literarily [*sic*] to require the City to prevent any and all exceedances from urban runoff of all water quality standards or water quality objectives" the costs would be excessive. The court in *County of Los Angeles, supra,* rejected this exaggeration of the permit's terms and found the requirements to be entirely reasonable. In addition, the *Rancho Cucamonga* and *Building Industry Association* both upheld identical provisions and found them to be reasonable and to be consistent with the minimum federal standard of MEP.

[103] The State Water Board issues a separate permit to the Department of Transportation, for both its municipal activities (roads and freeways) and its industrial facilities (construction and maintenance yards). The permit is available at http://www.waterboards.ca.gov/stormwtr/docs/caltrans/caltranspmt.pdf.

Conclusion

For all the reasons set forth above, the Test Claims must be dismissed. The Permit requirements have already been upheld by the courts as reflecting the federal Clean Water Act's requirements for municipal storm water permitting. The permit in its entirety, including the Test Claim provisions, reflects the federally mandated, federal minimum standard of reducing pollutants to the "maximum extent practicable." Further, the cities can pay for any costs associated with the requirements by levying service charges or fees. Finally, to the extent that any portion of the claims would otherwise qualify for subvention, they are *de minimis* and therefore do not warrant subvention.

I certify and declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this document was executed on April 18, 2008, at Sacramento, California.

Sincerely,

Elizabeth Miller Jennings
Staff Counsel IV
Office of Chief Counsel
State Water Resources Control Board
1001 I Street, 22nd Floor [95814]
P.O. Box 100
Sacramento, CA 95812-0100
Telephone: (916) 341-5175
Facsimile: (916) 341-5199

Attachments

cc: Howard Gest, Esq.
Burhenn & Gest, LLP
624 South Grand Avenue, Suite 2200
Los Angeles, CA 90017

Richard Montevideo, Esq.
Rutan & Tucker, LLP
611 Anton Boulevard, Suite 1400
P.O. Box 1950
Costa Mesa, CA 92628-1950

Ms. Tracy Egoscue **[via email only]**
Executive Officer
Los Angeles Regional Water Quality Control Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Continued on next page

cc: (Continued)

Ms. Carla Castaneda
Department of Finance (A-15)
915 L Street, 11th Floor
Sacramento, CA 95814

Michael J. Levy, Esq. **[via email only]**
Office of Chief Counsel
State Water Resources Control Board
1001 I Street, 22nd Floor [95814]
P.O. Box 100
Sacramento, CA 95812-0100

Ms. Dorothy Rice **[via email only]**
Executive Director
State Water Resources Control Board
1001 I Street, 25th Floor [95814]
P.O. Box 2815
Sacramento, CA 95812-2815

Elizabeth Miller Jennings, Esq. **[via email only]**
Office of Chief Counsel
State Water Resources Control Board
1001 I Street, 22nd Floor [95814]
P.O. Box 100
Sacramento, CA 95812-0100

Interested Persons List

PROOF OF SERVICE

I, JEANNETTE L. BASHAW, declare that I am over 18 years of age and not a party to the within action. I am employed in Sacramento County at 1001 I Street, 22nd Floor, Sacramento, California 95814. My mailing address is P.O. Box 100, Sacramento, CA 95812-0100. On this date, I served the within documents:

LETTER TO COMMISSION ON STATE MANDATES DATED APRIL 18, 2008, REGARDING STORM WATER POLLUTION CONTROL REQUIREMENTS, FILES 03-TC-04, 03-TC-19, 03-TC-20, 03-TC-21: RESPONSE TO TEST CLAIMS 03-TC-04, 03-TC-19, 03-TC-20, 03-TC-21

	BY FACSIMILE: I caused a true and correct copy of the document to be transmitted by a facsimile machine compliant with rule 2003 of the California Rules of Court to the offices of the addresses at the telephone numbers shown on the service list.
X	**BY HAND DELIVERY:** I caused a true and correct copy of the document(s) to be hand-delivered to the person(s) as shown.
	BY OVERNIGHT MAIL TO ALL PARTIES LISTED: I am readily familiar with my employer's practice for the collection and processing of overnight mail packages. Under that practice, packages would be deposited with an overnight mail carrier that same day, with overnight delivery charges thereon fully prepaid, in the ordinary course of business.
X	**BY FIRST CLASS MAIL TO ALL PARTIES LISTED:** I am readily familiar with my employer's practice for the collection and processing of mail. Under that practice, envelopes would be deposited with the U.S. Postal Service that same day, with first class postage thereon fully prepaid, in the ordinary course of business. I am aware that on motion of the party served, service is presumed invalid if the postal cancellation date or postage meter date is more than one day after the date of deposit for mailing shown in this proof of service.

By placing a true copy thereof in separate, sealed envelopes addressed to:

See Exhibit A attached hereto and made a part hereof.

I certify and declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this document was executed on April 18, 2008, at Sacramento, California.

Jeannette L. Bashaw

JEANNETTE L. BASHAW

EXHIBIT A

(VIA HAND DELIVERY)
Paula Higashi, Executive Director
Commission on State Mandates
980 Ninth Street, Suite 300
Sacramento, CA 95814

Ms. Tracy Egoscue **[via email only]**
Executive Officer
Los Angeles Regional Water Quality
Control Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Michael J. Levy, Esq. **[via email only]**
Office of Chief Counsel
State Water Resources Control Board
1001 I Street, 22nd Floor [95814]
P.O. Box 100
Sacramento, CA 95812-0100

(VIA U.S. MAIL)
Jim Spano
State Controller's Office (B-08)
Division of Audits
300 Capitol Mall, Suite 518
Sacramento, CA 95814

(VIA U.S. MAIL)
David Wellhouse
David Wellhouse & Associates, Inc.
9175 Kiefer Boulevard, Suite 121
Sacramento, CA 95826

(VIA U.S. MAIL)
Glen Everroad
City of Newport Beach
3300 Newport Boulevard
P.O. Box 1768
Newport Beach, CA 92659-1768

(VIA U.S. MAIL)
Annette Chinn
Cost Recovery Systems, Inc.
705-2 East Bidwell Street, #294
Folsom, CA 95630

(VIA U.S. MAIL)
Sergio Ramirez
City of Foster City/Estero
Municipal Improvement District
100 Lincoln Centre Drive
Foster City, CA 94404

(VIA U.S. MAIL)
Howard Gest, Esq.
Burhenn & Gest, LLP
624 South Grand Avenue, Suite 2200
Los Angeles, CA 90017

(VIA U.S. MAIL)
Carla Castaneda
Department of Finance (A-15)
915 L Street, 12th Floor
Sacramento, CA 95814

Betsy Jennings, Esq. **[via email only]**
Office of Chief Counsel
State Water Resources Control Board
1001 I Street, 22nd Floor [95814]
P.O. Box 100
Sacramento, CA 95812-0100

(VIA U.S. MAIL)
Clark Moseley
City of El Monte
11333 Valley Boulevard
El Monte, CA 91731-3293

(VIA U.S. MAIL)
Allan Burdick
MAXIMUS
4320 Auburn Boulevard, Suite 2000
Sacramento, CA 95841

(VIA U.S. MAIL)
Steve Smith
Steve Smith Enterprises, Inc.
3323 Watt Avenue, #291
Sacramento, CA 95821

(VIA U.S. MAIL)
Ginny Brummels
State Controller's Office (B-08)
Division of Accounting & Reporting
3301 C Street, Suite 500
Sacramento, CA 95816

(VIA U.S. MAIL)
Richard Montevideo, Esq.
Rutan & Tucker, LLP
611 Anton Boulevard, Suite 1400
P.O. Box 1950
Costa Mesa, CA 92628-1950

Ms. Dorothy Rice **[via email only]**
Executive Director
State Water Resources Control Board
1001 I Street, 25th Floor [95814]
P.O. Box 2815
Sacramento, CA 95812-2815

(VIA U.S. MAIL)
Leonard Kaye, Esq.
County of Los Angeles
Auditor-Controller's Office
500 W. Temple Street, Room 603
Los Angeles, CA 90012

(VIA U.S. MAIL)
Susan Geanacou
Department of Finance (A-15)
915 L Street, Suite 1190
Sacramento, CA 95814

(VIA U.S. MAIL)
Scott Nichols
Albarez-Glasman & Clovin
13181 Crossroads Parkway North
Suite 400
City of Industry, CA 91746

(VIA U.S. MAIL)
Juliana F. Gmur
MAXIMUS
2380 Houston Avenue
Clovis, CA 93611

(VIA U.S. MAIL)
Harmeet Barkschat
Mandate Resource Services
5325 Elkhorn Boulevard, #307
Sacramento, CA 95842

(VIA U.S. MAIL)
J. Bradley Burgess
Public Resource Management Group
1380 Lead Hill Boulevard, Suite 106
Roseville, CA 95661

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

APR 10 2008

Ms. Tam M. Doduc, Chair
Ms. Dorothy R. Rice, Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Dear Ms. Doduc and Ms. Rice:

I understand that certain specific provisions of the 2001 Municipal Separate Storm Sewer System ("MS4") permit for the County of Los Angeles have been called into question as going beyond what is required under section 402(p) of the CWA. (Commission on State Mandates, File Nos. 03-TC-04, 03-TC-19, 03-TC-20, and 03-TC-21.) The permit conditions at issue are: 1) the requirements for conducting inspections at industrial and commercial facilities including, restaurants and automobile servicing, [Parts 4.C.2.a. and b.] and, 2) the requirement for permittees not subject to the Trash TMDL to locate and maintain trash receptacles at transit stops [Part 4.F.5.c.3.]. California RWQCB, Los Angeles Region, Order No. 01-182, NPDES No. CAS004001 (Dec. 13, 2001). This letter discusses these permit conditions in the context of EPA's expectations for MS4 permits.

Section 402(p) of the Clean Water Act, 33 U.S.C. 1342(p), requires EPA (or authorized states) to issue National Pollutant Discharge Elimination System ("NPDES") permits to regulate the discharge of stormwater from MS4s. Typically, these MS4s are owned and operated by cities and counties. Pursuant to the Clean Water Act, these permits must require the MS4 to: 1) "effectively prohibit" non-stormwater discharges, and 2) "reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." 33 U.S.C. 1342(p)(3)(B)(ii) and (iii).

The NPDES regulations require medium and large MS4s to develop stormwater management programs that the permitting authority <u>will consider</u> when developing permit conditions to reduce pollutants in discharges to the maximum extent practicable. Stormwater permitting has generally relied on the use of best management practices ("BMPs"), including both structural and non-structural controls, for achieving compliance with these requirements. The EPA also expects stormwater permits to follow an iterative process whereby each successive permit becomes more refined, detailed, and expanded as needed, based on experience under the previous permit. <u>See, 55 Fed. Reg. 47990, 48052 ("EPA anticipates that storm water management programs will evolve and mature over time.");</u> 64 Fed. Reg. 68722, 68754 (Dec. 8, 1999) ("EPA envisions application of the MEP standard as an iterative process."); Interim Permitting Approach for Water Quality-Based Effluent Limitations in Stormwater Permits (Sept. 1, 1996) ("The interim permitting approach uses BMPs in first-round storm water permits, and expanded or better-tailored BMPs in subsequent permits, where necessary, to provide for the attainment of water quality standards"). See also, "Evaluating the Effectiveness of Municipal Stormwater Programs" (January 2008) (http://www.epa.gov/npdes/pubs/region3_factsheet_swmp.pdf). While the standard of "maximum extent practicable" (MEP) allows for flexibility, that flexibility is not boundless and requires some level of vigor. EPA has created a national menu of stormwater BMPs to provide additional guidance concerning appropriate BMPs for stormwater management plans. Other factors to consider in ensuring appropriate controls include "technical feasibility, cost, public acceptance, regulatory compliance, and effectiveness." Building Indus. Ass'n v. State Water Res. Control Bd., 124 Cal. App. 4th 866, 889 (2004). See also "In re Cities of Bellflower, et al.", SWRCB 2000-11.

At the outset, I note the Los Angeles MS4 permit is a third generation Phase I MS4 permit that should be building upon the experiences from previous permits. Both of the provisions at issue here seem well within a reasonable expectation of controls that reduce pollutants to the "maximum extent practicable." EPA regulations at 40 C.F.R. §122.26(d)(2)(iv) set forth the basic elements to be included in a Phase I MS4's stormwater management program. Subparagraph (A) requires a description of "source control measures to reduce pollutants from runoff from commercial and residential areas that are discharged from the [MS4] that are to be implemented during the life of the permit." Subparagraph (B) requires a program for detection and removal of illicit discharges and improper disposal into the storm sewer, including a program for inspections and enforcement. A program for commercial and industrial facility inspection and enforcement that includes restaurants and automobile facilities, would appear to be both practicable and effective. Such an inspection program ensures that stormwater discharges from such facilities are reducing their contribution of pollutants and that there are no non-stormwater discharges or illicit connections. Thus these programs are founded in both 402(p)(3)(B)(ii) and (iii) and are well within the scope of 40 C.F.R. §122.26(d)(2)(iv)(A) and (B).[1]

Similarly, maintaining trash receptacles at all public transit stops is well within the scope of these regulations. Among the minimum controls required to reduce pollutants from runoff from commercial and residential areas are practices for "operating and maintaining public streets, roads, and highways . . . ." §122.26(d)(2)(iv)(A)(3). I believe these requirements are also practical and effective.[2] Moreover, this permit provision is consistent with EPA's national menu

---

[1]EPA's "MS4 Program Evaluation Guidance" (January 2007) envisions that an MS4 permit would include a requirement for an inspection program for common industrial/commercial businesses, such as restaurants and gas stations, within the jurisdiction of the MS4. Id. at 76 - 77, 81. The inspection requirements of the LA MS4 permit are consistent with the recommended activities in the Guide.

[2]The provision applicable to the TMDL permittees is also clearly consistent with EPA's 2002 guidance on TMDLs and storm water permitting. "Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit

of BMPs for stormwater management programs, which recommends a number of BMPs to reduce trash discharges. See http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=5. Among the recommendations is "improved infrastructure" for trash management when necessary, which includes the placement of trash receptacles at appropriate locations based on expected need. The requirements of the Los Angeles County MS4 permit are consistent with this recommendation. See also, "MS4 Program Evaluation Guidance" (January 2007) at pp. 50, 79. EPA's expectations of the programs to reduce pollutants to the maximum extent practicable specifically refer to control of litter and trash, regardless of whether the particular receiving water is already impaired for trash.

I hope that this explanation helps clarify EPA's expectations for MS4 permit requirements under the Clean Water Act. I look forward to continuing to work with the State on our shared goal of ensuring consistency and effectiveness in storm water permitting as a vital tool in protecting the quality of our waters. Should you have further questions about these issues, please have your staff contact Douglas Eberhardt of my staff at (415) 972-3420 or have your counsel's office contact Laurie Kermish of the Office of Regional Counsel at (415) 972-3917.

Sincerely,

Alexis Strauss 10 April 2008

Alexis Strauss
Director, Water Division

cc: Mr. Michael Lauffer, Chief Counsel
State Water Resources Control Board

Ms. Paula Higashi, Executive Director
Commission on State Mandates

Requirements Based on Those WLAs" (November 22, 2002) which is available at: http://cfpub.epa.gov/npdes/pubs.cfm?program_id=6

Copy

DEPARTMENT OF FINANCE
OFFICE OF THE DIRECTOR

ARNOLD SCHWARZENEGGER, GOVERNOR
STATE CAPITOL ■ ROOM 1145 ■ SACRAMENTO CA ■ 95814-4998 ■ WWW.DOF.CA.GOV

2008 APR 1 PM 12 54

March 27, 2008

Ms. Paula Higashi
Executive Director
Commission on State Mandates
980 Ninth Street, Suite 300
Sacramento, CA 95814

Dear Ms. Higashi:

Re: CSM-03-TC-04, "Transit Trash Receptacles"
CSM-03-TC-19, "Inspection of Industrial/Commercial Facilities"
CSM-03-TC-20, "Waste Discharge Requirements"
CSM-03-TC-21, "Stormwater Pollution Control Requirements"

As requested in your letters referencing the California Regional Water Quality Control Board's Executive Order #01-182 (test claim permit), the Department of Finance (Finance) has reviewed the test claims submitted by the County of Los Angeles and several cities (claimants) asking the Commission on State Mandates (Commission) to determine whether specified costs incurred under the test claim permit are reimbursable state mandated costs. Commencing with specified sections of the test claim permit, as plead in the four test claims referenced above, the claimants have identified the following as new programs or higher levels of service, which they assert are reimbursable state mandates imposed on the local agencies.

1. Identify all transit stops within its jurisdiction except for the Los Angeles River and Ballona Creek Watershed Management areas. (Part 4, F.5.c.3.)

2. Select proper trash receptacle designs and evaluate proper placement of trash receptacles. (Part 4, F.5.c.3.)

3. Design receptacle pad improvement, if needed. (Part 4, F.5.c.3.)

4. Construct and install trash receptacle units. (Part 4, F.5.c.3.)

5. Collect trash and maintain receptacles. (Part 4, F.5.c.3.)

6. Inspect certain commercial facilities to prevent those facilities from discharging waste into waters of the state and to assure compliance with state law. (Part 4, c.2.a.)

7. Inspect industrial facilities to determine compliance with the state's program that regulates discharge of storm water from industrial facilities, including compliance with State Water Resources Control Board's (Water Board) permits. (Part 4, c.2.b.)

8. Inspect construction sites to determine compliance with the state's program that regulates discharge of storm water from those sites, including compliance with the Water Board's permits. (Part 4, E.)

9. Increase street sweeping, catch basin cleaning, installing and maintaining other treatment devices to address trash impacts upon stormwater mitigation systems. (Part 4, F.5.c.3.)

10. Increase costs to comply with new industrial and construction inspection mandates. (Part 4, F.5.c.3.)

11. Increase inspections to be conducted of industrial discharges not currently regulated by the State of California. (Part 4, F.5.c.3.)

As a result of our review, Finance finds that the test claim permit does not impose a reimbursable state mandate on local agencies within the meaning of Section 6 of Article XIII B of the California Constitution. The permit conditions imposed on the local agencies are required by federal laws, and pursuant to the federal mandate exception in subdivision (c) of Section 17556 of the Government Code, the requirements of the permit are not reimbursable programs:

> Subdivision (c): The Commission on State Mandates shall not find costs mandated by the state if the "*statute or executive order imposes a requirement that is mandated by a federal law or regulation and results in costs mandated by the federal government, unless the statute or executive order mandates costs that exceed the mandate in that federal law or regulation. This subdivision applies regardless of whether the federal law or regulation was enacted or adopted prior to or after the date on which the state statute or executive order was enacted or issued.*"

When issuing a permit, the Water Board is acting as an administrator of the federal government and must require the local agencies to apply for a permit under the federal Clean Water Act (CWA) (33 U.S.C. §1342). The federal Environmental Protection Agency has delegated the federal permitting authority to the Water Board as a state-approved National Pollutant Discharge Elimination System (NPDES) permitting program. This authority allows the Water Board to act on behalf of the federal government to develop, administer, and enforce the NPDES program in compliance with Section 402 of the CWA. Pursuant to paragraph (5) of subdivision (a) of Section 402 of the CWA, "*the Administrator shall authorize a State, which he determines has the capability of administering a permit program which will carry out the objectives of this Act, to issue permits for discharges into navigable waters in the jurisdiction of such State*." This authority is extended to the nine regional boards that are the principal state agencies with the primary responsibility for the coordination and control of water quality under Section 401 of the CWA. In effect, the federal law authorized the Water Board, acting as the administrator, to exercise its federal permitting authority and set the detailed permit conditions specific to the claimants' region complying with the regulations of CWA. (Title 40, Code of Federal Regulations, Section 122, 123.25, and 124 and 33 U.S.C. § 1342(p)(3)(B)). Thus, the requirements of the permit are federally required to comply with the NPDES program. Further, compliance with the requirements is enforceable under the federal CWA (33 U.S.C § 1365).

The Water Board, acting as the federal government, is required to issue a permit to coordinate enforcement efforts of wastewater violations (Title 40 of Code of Federal Regulations, Section 122.44(k)). As stated in paragraph 22, on page 11 of the test claim permit "*...the USEPA* *guidance anticipates coordination of the state-administered program for industrial and construction activities with the local agencies program to reduce pollutant in storm water discharged to the MS4.*" The Water Board must issue a permit requiring the local agencies to carry out certain activities in order to enforce and regulate dischargers violating municipal ordinances. The permit process begins when the local agency applies for a permit and identifies the practices to be included and enforced.

Subdivisions (a) and (b) of Part 4.c.2 of the test claim permit refer to the permit condition of inspecting facilities under the *Industrial and Commercial Facilities Control Program.* The claimants allege that the permit condition requires the local agencies to inspect the facilities that have state-issued General Industrial and General Construction Stormwater permits, and claim this activity is new for the local agencies and had been the responsibility of the Water Board pursuant to the California Regional Water Quality Control Board Resolution 98-08, the Stormwater Quality Management Plan, and State Water Resources Control Board Order Nos. 97-03-DWQ and 99-08-DWQ. The claimants assert that the Water Board shifted the inspection obligations to the local agencies and imposed reimbursable new programs.

Although these inspections and other permit requirements may result in additional costs to the local agencies, those costs are not reimbursable because the conditions implement federal NPDES permit requirements and do not shift responsibilities from the state to local agencies. The claimants have not identified any state law requiring local agencies to inspect state-issued permit facilities for violating state permitting regulations, or discontinuing the state inspections of state-issued permit facilities. Therefore, Finance concludes that the municipal inspections are federally required for enforcing local ordinances and such a requirement does not shift responsibilities from the state to the local agencies.

Finance contends that the requirements of the test claim permit are federal laws imposed on the local agencies because the federal CWA mandates that local agencies must apply for and receive permits regulating discharges of pollutants from their municipal separate storm sewer systems (MS4) to the waters of the United States. The Water Board acts as the administrator for the federal government in approving these permits (Sections 13370 through 13389 of the Water Code). The local agencies first proposed permit requirements to the Water Board when submitting the application for the test claim permit. Local agencies were then allowed to publicly participate and influence the development, revision, and enforcement of any regulation, standard effluent limitation, and storm water prevention plan or program (Public Process section of the permit and Section 122.1 of Title 40 of the Codes of Federal Regulations). The Water Board approved the permit and the permit became effective when the United States Environmental Protection Agency did not veto the permit.

Additionally, the claimants had discretion over what activities and conditions to include in the permit application. First, the permittee submitted a Storm Water Quality Management Program prevention report with its application. These entities had the option to use "best management practices" to identify alternative practices to reduce pollution in water to the maximum extent practicable, but were required by federal law to include specific practices to be applicable in the particular region (subdivision (p) of Section 402 of the CWA). In some instances, agencies may elect a "rigid" numeric end-of-pipe permit limitation, where the permittee must satisfy specific effluent limitations rather than implement best management practices. Here, the local agencies prescribed the activities to be included in the permit. The permitting authority allowed the permittees to publicly participate and influence the development, revision, and enforcement of any regulation, standard effluent limitation, and storm water prevention plan or program (Public Process section of the permit and Section 122.1 of Title 40 of the Code of Federal Regulations). As a result, the permit requirements are a downstream result of the local agencies' decision to include the particular activities in the permit. Such requirements are not reimbursable mandates.

Finance notes that the courts have held that increased costs associated with downstream activities of an underlying discretionary action are not reimbursable. Specifically, in *Department of Finance v. Commission on State Mandates (2003) (30 Cal. 4th 727, 745-746),* the court affirmed that where participation in the underlying program is voluntary, the resulting new consequential requirements do not constitute a reimbursable state mandate.

Finance also notes that some local agencies have set fees to be used toward funding the claimed permit activities. Should the Commission decide a reimbursable mandate exists, these fees should be considered as offsetting revenues toward the requirements of the permit.

As required by the Commission's regulations, a "Proof of Service" has been enclosed indicating that the parties included on the mailing list which accompanied your October 29, 2007 letter have been provided with copies of this letter via either United States Mail or, in the case of other state agencies, Interagency Mail Service.

If you have any questions regarding this letter, please contact Carla Castañeda, Principal Program Budget Analyst at (916) 445-3274.

Sincerely,

Diana L. Ducay
Program Budget Manager

Enclosures

Attachment A

DECLARATION OF CARLA CASTAÑEDA
DEPARTMENT OF FINANCE
CLAIM NOs. CSM-03-TC-04, CSM-03-TC-19, CSM-03-TC-20, and CSM-03-TC-21

1. I am currently employed by the State of California, Department of Finance (Finance), am familiar with the duties of Finance, and am authorized to make this declaration on behalf of Finance.

I certify under penalty of perjury that the facts set forth in the foregoing are true and correct of my own knowledge except as to the matters therein stated as information or belief and, as to those matters, I believe them to be true.

March 27, 2008
at Sacramento, CA

Carla Castañeda
Carla Castañeda

PROOF OF SERVICE

Test Claim Number/Name:
CSM-03-TC-04 Transit Trash Receptacles
CSM-03-TC-19 Inspection of Industrial/Commercial Facilities
CSM-03-TC-20 Waste Discharge Requirements
CSM-03-TC-21 Stormwater Pollution Control Requirements

I, the undersigned, declare as follows:
I am employed in the County of Sacramento, State of California, I am 18 years of age or older and not a party to the within entitled cause; my business address is 915 L Street, 12 Floor, Sacramento, CA 95814.

On March 25, 2008, I served the attached recommendation of the Department of Finance in said cause, by facsimile to the Commission on State Mandates and by placing a true copy thereof: (1) to claimants and nonstate agencies enclosed in a sealed envelope with postage thereon fully prepaid in the United States Mail at Sacramento, California; and (2) to state agencies in the normal pickup location at 915 L Street, 12 Floor, for Interagency Mail Service, addressed as follows:

A-16
Ms. Paula Higashi
Executive Director
Commission on State Mandates
980 Ninth Street, Suite 300
Sacramento, CA 95814

Mr. Leonard Kaye, Esq.
County of Los Angeles
Auditor-Controller's Office
500 West Tempe Street, Room 603
Los Angeles, CA 90012

Ms. Tracy Egoscue
Los Angeles Regional Water Quality
Control Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013-2343

B-08
Mr. Jim Spano
State Controller's Office
Division of Audits
300 Capitol Mall, Suite 518
Sacramento, CA 95814

Mr. Evan J. McGinley, Esq.
Richards, Watson & Gershon LLP
355 South Grand Avenue, 40th Floor
Los Angeles, CA 90071

A-15
Ms. Carla Castaneda
Department of Finance
915 L Street, 11th Floor
Sacramento, CA 95814

A-15
Ms. Susan Geanacou
Department of Finance
915 L Street, Suite 1190
Sacramento, CA 95814

Mr. Howard Gest
David W. Burhenn & Gest, LLP
624 S. Grand Avenue, Suite 2200
Los Angeles, CA 90017

Ms. Emmerline Foote
City of Inglewood
One Manchester Boulevard, Suite 860
Inglewood, CA 90301

Mr. Clark Moseley
City of El Monte
11333 Valley Boulevard
El Monte, CA 91731-3293

Mr. Richard Montevideo
Rutan & Tucker LLP
P.O. Box 1950
Costa Mesa, CA 92626-1950

Mr. Allan Burdick
MAXIMUS
4320 Auburn Boulevard, Suite 2000
Sacramento, CA 95841

Mr. Scott Nichols
Albarez-Glasman & Clovin
13181 Crossroads Parkway North
Suite 400
City of Industry, CA 91746

Mr. David Wellhouse
David Wellhouse & Associates, Inc.
9175 Kiefer Boulevard, Suite 121
Sacramento, CA 95826

Ms. Juliana F. Gmur
MAXIMUS
2380 Houston Avenue
Clovis, CA 93611

Ms. Harmeet Barkschat
Mandate Resource Services
5325 Elkhorn Boulevard, #307
Sacramento, CA 95842

B-08
Ms. Ginny Brummels
State Controller's Office
Division of Accounting and Reporting
3301 C Street, Suite 500
Sacramento, CA 95816

Mr. Sergio Ramirez
City of Foster City
Estero Municipal Improvement district
100 Lincoln Centre Drive
Foster City, CA 94404

Ms. Dorothy Rice
State Water Resources Control Board
P.O. Box 2815
Sacramento, CA 95812-2815

Mr. Steve Smith
Steve Smith Enterprises, Inc.
3323 Watt Avenue #291
Sacramento, CA 95821

Mr. Glen Everroad
City of Newport Beach
3300 Newport Boulevard
P.O. Box 1768
Newport Beach, CA 92659-1768

Ms. Annette Chinn
Cost Recovery Systems, Inc.
705-2 East Bidwell Street, #294
Folsom, CA 95630

Mr. J. Bradley Burgess
Public Resource Management Group
895 La Sierra Drive
Sacramento, CA 95864

On I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that this declaration was executed on March 25, 2008, at Sacramento, California.

Kelly Montelongo

Kelly Montelongo

GUIDANCE FOR MUNICIPAL STORMWATER FUNDING

Prepared by National Association of Flood and Stormwater Management Agencies

Under Grant Provided by Environmental Protection Agency

January 2006

ACKNOWLEDGEMENTS

This project was funded by a grant from the United States Environmental Protection Agency (USEPA) to the National Association of Flood and Stormwater Management Agencies (NAFSMA). The project was funded under the USEPA Federal Water Quality Cooperative Agreements Program in the Office of Water.

Susan Gilson, Executive Director of NAFSMA was the project manager. Consultants for the project were:

David Burchmore of Squire, Sanders and Dempsey L.L.P.
Hector Cyre of Water Resource Associates, Inc.
Doug Harrison
Andrew Reese of AMEC Earth & Environmental, Inc.
Scott Tucker.

Scott Tucker and Doug Harrison were authors of Chapter 1 on Background and Introduction, Hector Cyre of Chapter 2 on Sources of Funding, David Burchmore of Chapter 3 on Legal Considerations, and Andrew Reese of Chapter 4 on Implementing User-Fee Based Funding. Hector Cyre contributed the case studies found in the Appendix. Doug Harrison and Scott Tucker provided overall coordination and editing for the project.

TABLE OF CONTENTS

Summary of Tables:

Summary of Figures:

EXECUTIVE SUMMARY

Municipal stormwater management for local governments has evolved over time from an urban flood control function, to a water and resource management function, to an environmental protection and regulatory function. All three functions now co-exist as responsibilities of local government. This evolution has forced changes in how stormwater systems are planned, designed, constructed, operated, and financed. More specifically, the stormwater function has evolved from a basic capital construction and maintenance program supported primarily by local taxes, to a program of integrated water resource management, environmental enhancement, and recreational services requiring a multi-faceted benefit based finance system.

The focus of this guidance is to provide a resource to local governments as they address contemporary stormwater program financing challenges. The guidance includes procedural, legal, and financial considerations in developing viable funding approaches. The guidance examines a range of possible approaches to paying for stormwater management, but the focus is on guidelines for developing service/user/utility fees to support these programs. The terms service fee, user fee, and utility fee may be used interchangeably in this guidance. Chapter 2 addresses various sources of funding. Chapter 3 covers legal considerations, and implementation of stormwater funding programs is discussed in Chapter 4.

SOURCES OF FUNDING

"Needs" are the key driver of stormwater programs and funding development. Without a well defined stormwater service need, there will not be basic support and success will be less likely. When considering how to develop and finance a stormwater program it is important to prepare a business plan that identifies strategic decisions and guides the program evolution and funding decisions. Emerging trends in funding practices include increasing complexity, blended funding, multi-jurisdictional funding, cost-sharing with other public programs, broader private sector participation, and increasing influence of technology and data.

Stormwater management has historically been supported by a range of funding methods and mechanisms that reflect a mix of federal, state and local programs. While the focus of this guidance is on service fees, other stormwater program funding mechanisms include general revenue appropriations; plan review, development inspection, and special user fees; special assessments; bonding for capital improvements; in-lieu of construction fees; capitalization recovery fees; impact fees; developer extension/latecomer fees; and federal and state funding opportunities such as grants, loans and cooperative programs.

There are several criteria that are commonly used to evaluate and select methods for design of service fee rate structures. They include legality, equity, revenue sufficiency, flexibility, balance of rates with level of service, data requirements, compatibility with data processing systems, consistency with other local funding and rate policies, and revenue stability and sensitivity. The fundamental objective of a service fee/utility is attainment of equity. Service fee rate methodologies are designed to attain a fair and reasonable apportionment of cost of providing services and facilities.

Design of stormwater service fees must meet general and technical standards. A rate structure analysis is performed to determine how costs might be apportioned among those who are served in various ways by expenditures for maintenance and operations, capital improvements, and support activities. Impervious area, gross area, percentage imperviousness, and land use are the parameters most frequently used to determine rate structures. Services fees are generally cost-based and are designed to reflect the impacts that each property has on stormwater service demands. Such costs are primarily a function of the peak stormwater runoff rate, the total volume of discharge, and pollutant contributions.

There are four rate structure concepts or methodologies used as examples in this guidance that are typical of those adopted in the more than five hundred communities that have established stormwater utilities. These examples base their fees on impervious area, a combination of impervious area and gross area, impervious area and the percentage of imperviousness, and gross property area and the intensity of development.

LEGAL CONSIDERATIONS

The type of funding mechanism selected for a stormwater utility or stormwater management program has a variety of legal consequences. Taxes, service fees, special assessments, impact fees and other revenue sources can be used, but each approach will have different implications in terms of who will pay, what procedures must be followed to implement and collect the charge, and how the money can be used. If the funding approach is deemed to be a tax, then tax-exempt entities such as churches, schools, state agencies and federal government facilities will contest their obligation to pay. If a service fee approach is used, the reasonableness of the rate structure and its relationship to the service being provided may be challenged. In many states special taxpayer approval must be sought.

The distinctions between the various funding approaches are often blurred. In general, a tax is an enforced burden imposed by sovereign right for the support of the government, the administration of law, and the exercise of various functions the sovereign is called upon to perform. Many states have constitutional or statutory restrictions on the ability of local governments to levy taxes, which do not apply to fees or charges.

User/service fees are charges based upon the proprietary right of the governing body permitting the use of the instrumentality involved. Fees have traits that distinguish them from taxes. First, they are charged in exchange for a particular governmental service which benefits the party paying the fee. Second, they are voluntary, in that the party paying the fee has the option of not utilizing the governmental service and thereby avoiding the charge. Third, the amount of the fee is designed to recover the actual cost of the service being provided. In some cases there may be little practical difference between a tax and a fee, but the legal distinctions between the two are important.

Stormwater service fees have been the subject of litigation resulting in reported opinions from at least 17 states, including many cases involving final decisions by the state's highest court. In addition, there have been unreported decisions from lower courts in states that have involved similar challenges to local stormwater fees. Based on these cases, certain common themes have emerged.

The question of whether a service charge is actually a "tax" has been the issue most frequently litigated. Other reoccurring issues involve whether or not the charge is voluntary, is it a fee or special assessment, is the fee "reasonable" and directly related to the cost of providing the service, are the properties charged fees receiving proportionate benefit from the services provided, and must fees be confined to cost of providing stormwater services alone or may any surplus be applied to capital improvements.

Determining the legality of a specific financing mechanism chosen will depend upon a close analysis of state law. Nevertheless, certain general principals emerge from the cases examined. First, for a stormwater service charge to be regarded as a fee, rather than a tax, the overall cost of the program must be reasonably related to the service being provided, and the funds raised must be segregated for use by the stormwater program. Second, the fee should be proportional to the property's contribution to stormwater runoff. Third, participation in the program should be characterized as "voluntary". And forth, in states with constitutional provisions governing the imposition of any new tax, it may be necessary to seek voter approval for a fee even if it is designed to be service-based.

The imposition of stormwater service fees on federal facilities involves a special consideration of the tax vs. fee issue. In principal, states cannot tax the United States (Chief Justice Marshall's opinion in *McCulloch v. Maryland*, 1819). On the other hand, it is well-established law that the United States must pay reasonable user fees. Furthermore, the Clean Water Act contains an express waiver of sovereign immunity for certain pollution control related fees. Importantly, this waiver applies only to fees or service charges, and not to taxes.

The United States Supreme Court has established a three-pronged test for determining whether fees imposed on federal facilities are "reasonable service charges" or taxes. First, is the fee or service charge non-discriminatory? Second, is it a fair approximation of the cost of the benefits received? And third, is it structured to produce revenues that will not exceed the regulator's total cost of providing the benefits?

IMPLEMENTING USER-FEE BASED FUNDING

The evolution in stormwater program expectations, which is motivating the movement to utility based funding, requires that more than just the revenue mechanism be evaluated. The function, service and performance of the stormwater program itself become a focal point in the effort to develop a stormwater funding mechanism.

A stormwater utility should be seen as an umbrella under which individual communities address their own local problems, priorities and practices. A stormwater utility provides a vehicle for:

- consolidating or coordinating responsibilities previously dispersed among several departments;
- generating funding that is adequate, stable, equitable and dedicated solely to the stormwater function; and
- developing programs that are comprehensive, cohesive and consistent year-to-year.

Implementing user fee based funding involves a related set of actions and activities occurring within a flexible process framework. That framework promotes "due diligence" in five key areas of focus; political, financial, legal, informational, and technical. Bringing about change in the current stormwater program and implementing user based funding requires an understanding of current needs and problems, a vision for the future and a process framework. The use of a citizens/stakeholder participation group and a business plan approach can help build a compelling case for action.

The process framework should include a "quick concept study" which assesses the advisability of proceeding; a "feasibility study" which conducts the detailed assessment of the stormwater program and funding and develops recommendations; and, the "utility implementation process".

The utility implementation process directs the planning and implementation effort along four tracks of activity. The "Public Track" insures stakeholder involvement and education. The "Program Track" matches program structure to stakeholder expectations. The "Finance Track" insures the legality, equity and adequacy of the funding mechanism; and, the "Database Track" determines the means to compute, deliver, collect and record the charge to be imposed on each property.

The analysis of stormwater utility funding has many policy implications. Policy making usually involves the mayor and council. Day-to-day policy decisions are often made at several levels under guidance set by the mayor and council. A recommended hierarchy for review of important issues is: key staff and consultants, other involved staff, advisory committee, manager's office, and mayor and council.

CASE STUDIES

Five case studies are examined for City of Bellevue, Washington; City of Charlotte/Mecklenburg County, North Carolina; City of Tulsa, Oklahoma; Louisville/Jefferson County Metropolitan Service District, Kentucky; and Sarasota County Stormwater Environmental Utility, Florida. For each example the following is generally provided: keynotes, community profile, formation process, service area, role and program, local government structure, organization and staffing, funding, inter-governmental cooperation, and public participation.

The City of Bellevue stormwater management program was established in 1974 and was one of the first to give equal consideration to water quantity and quality. Bellevue's Storm and Surface Water Utility provides a full range of capital infrastructure and operational services, primarily through in-house staff. Funding is primarily derived from a user fee that is based on gross property area and a factor reflecting the intensity of development of each property. Residential fees range from $3/month to over $20 per month with an average of about $10/month. The annual operating budget is approximately $6 million. The population of Bellevue was about 117,000 in 2005.

The Charlotte/Mecklenburg County approach relies on centralized funding and regional programs for major systems combined with local management of minor stormwater systems. The County, City of Charlotte, and towns have a high degree of self-determination in deciding service levels to be provided by local systems, programs and funding. Funding of the program is primarily supported by a composite stormwater service fee that includes both regional and local components with the County controlling the regional component and local governance controlling the local component. The City of Charlotte and small towns typically employ a blend of funding from several sources while the County relies almost entirely on the service fee.

In 2005 the population of Mecklenburg County was about three quarter million and the population of Charlotte was about 650,000. The County utility was instituted in 1994. The total stormwater budget for all entities in 2005 was over $85 million with a large part allocated to capital betterments. The fee for a single-family house is $1.06/month throughout the County. Local stormwater programs of the County, cities and towns are funded by a separate additional rate component which ranges from $0.30/month to $6.72/month in Charlotte.

The Tulsa Stormwater Management Utility was founded in response to a devastating flood that killed 14 people and caused nearly $220 million in property damage in 1984. A Department of Stormwater Management was established in 1985 centralizing responsibility for all City stormwater activities, and a stormwater utility fee was established by ordinance in 1986 to fund the program. The stormwater program budget has recently ranged from $12 million to $14 million per year. All residential properties are charged a single rate of $3.49/month, and fees for other properties are based on the amount of imperviousness on each property. The population of Tulsa was about 400,000 in 2005. The program includes comprehensive watershed management, dedicated funds for maintenance and operation, and a $200 million capital improvements program.

The Louisville approach involves a consolidation of flood control and stormwater management with a regional wastewater collection and treatment program provided by the Metropolitan Sewer District (MSD). Most of the smaller cities and towns in Jefferson County do not perform stormwater management functions. Funding of MSD is primarily from wastewater and stormwater service fees, which are independently structured and billed. The accounting is kept separately for each function.

The methodology of determining the stormwater fees in Louisville/Jefferson County is based on impervious area. There is flat rate for single-family residential properties, and differential rates for other properties based on a impervious area equivalency unit. The single-family residential stormwater service fee in was $4.41/month. Stormwater service fee revenues in fiscal year 2005 were expected to be nearly $24 million. There are more than 90 cities and towns in Jefferson County. Most, but not all, cities are included in the stormwater program. Louisville had a population of about 700,000 in 2005.

Sarasota County, Florida established a Stormwater Environmental Utility in 1989. Primary objectives of the Utility are to reduce flooding, improve surface water quality, and attain responsible development practices. A Florida Supreme Court decision in 1996 determined that the Sarasota County charge is a special assessment rather than a service fee. As such, it is subject to the standards applicable to assessments, which emphasize apportionment of special benefit, rather than reflecting the cost of service burden imposed on properties. The benefit assessments have three components that are consistent across the service area, and one component, system capitalization, that is variable by watershed.

The Utility budget in 2005 was approximately $23 million with about $10 million for capital projects. The benefit assessment takes both pervious and impervious areas on each property into account. On average, a medium size single-family residence is assessed $6.70/month. Sarasota County had a resident population of about 340,000 in 2005. There are four cities in the County. The city of Sarasota through an inter-governmental agreement relies on the County to improve its drainage system and perform most stormwater operations. The other three cities retain responsibility for local stormwater systems.

CHAPTER 1

BACKGROUND AND INTRODUCTION

Municipal stormwater management for local governments has evolved over time from an urban flood control function, to a water and resource management function, to an environmental protection and regulatory function. All three functions now co-exist as responsibilities of local government. This evolution has forced changes in how stormwater systems are planned, designed, constructed, operated, and financed. More specifically, the stormwater function has evolved from a basic capital construction and maintenance program supported primarily by local taxes, to a program of integrated water resource management, environmental enhancement, and recreational services requiring a multi-faceted benefit based finance system.

The focus of this guidance is to provide a resource to local governments as they address contemporary stormwater program financing challenges. The guidance includes procedural, legal, and financial considerations in developing viable funding approaches. The guidance will examine a range of possible approaches to paying for stormwater management, but the focus will be on guidelines for developing service/utility/user fees to support these programs. Chapter 2 will address various sources of funding. Chapter 3 will cover legal considerations, and implementation of stormwater funding programs is discussed in Chapter 4.

WHAT IS MUNICIPAL STORMWATER

Municipal stormwater is surface water runoff from public and private lands in urban areas. Typically municipal stormwater is collected in municipal separate storm sewer systems consisting of drains, pipes, and ditches, and conveyed to nearby streams, rivers, lakes, estuaries, basins, wetlands, and oceans carrying with it a variety of urban pollutants.

The United States Environmental Protection Administration (EPA) in their Phase I Municipal Stormwater regulations defined stormwater to mean "...storm water runoff, snow melt runoff, and surface runoff and drainage." In their Phase II stormwater regulations EPA defined a "municipal separate storm sewer" to mean in part, a conveyance or system of conveyances, including roads with drainage systems and municipal streets, that is owned or operated by a State, city, town, borough, county, parish, district, association, or other public body designed or used for collecting of conveying storm water which is not a combined sewer and which is not part of a Publicly Owned Treatment Works.

The nature of stormwater runoff from a given rainfall or snow event changes as an area urbanizes and more impervious surfaces are created and the landscape and drainage patterns are modified. The volume of runoff, rate of flow, and quality of runoff all change as a result of this urbanization.

HISTORICAL DEVELOPMENT OF STORMWATER SYSTEMS

In the late 1800's and early 1900's combined sewers were built to convey and dispose of both sanitary sewage and stormwater. Eventually, local governments began to separate storm flows from wastewater flows and separate sanitary sewer and storm sewer systems replaced combined sewer systems in many areas. Early municipal storm sewer systems were designed to discharge stormwater rapidly, and included such physical elements as curbs, gutters, inlets, storm sewers, roadside ditches, and concrete and grassed lined open channels.

Thinking began to change in the 1960's and 1970's with the recognition that efficient stormwater systems also transferred problems downstream. With a need to reduce the rate and volume of these stormwater discharges, many local governments started requiring new developments to construct stormwater detention facilities.

In the 1980's and 1990's stormwater quality became a focus of federal regulatory requirements and local governments have had to develop stormwater quality programs in response. Under an evolving regulatory mandate a few local governments are beginning to recombine dry weather flows in storm sewers with sanitary sewage and directing both to treatment plants.

NEW PARADIGM

The character of the stormwater management function has, and continues to change significantly. Originally stormwater systems were built just for conveyance, but stormwater is now a component of a comprehensive integrated urban water resource, environmental enhancement, and recreational services system. Contemporary stormwater management is a multi-dimensional function which includes quantity and quality considerations, multiple-use facilities, riparian corridors, recreation, wetland preservation and creation, and groundwater recharge.

Stormwater has become a part of the "total" water resources picture and is the third leg of the local government water service stool consisting of water development, treatment, and distribution; sewage collection, treatment, and disposal; and stormwater quantity and quality management. Other more specific changes include recognition of stormwater as a resource; restoration of streams and rivers; preservation of riparian areas and corridors; use of detention areas as parks, playfields, and wetlands; creation and/or restoration of wetlands to provide water quantity, quality, and environmental benefits; capturing stormwater to meet water supply needs; recognition that homes near greenbelts sell for a premium; and evaluation of stormwater from a comprehensive watershed perspective.

Most of these changes recognize stormwater as a resource, but liabilities have also evolved. For example, the disposal of "polluted" stormwater and of sediments accumulated in detention/retention facilities is now a performance issue for local governments. As a result of the evolving regulatory framework stormwater quality issues are now a required part of the urban water resources service sector. The reality is that stormwater quality and quantity are joined at the hip in today's stormwater management programs.

The new paradigm has introduced a whole new array of issues that has resulted in basic changes in stormwater planning, design, operation and maintenance, construction, and financing. These changes have also resulted in greater public expectations. In addition to the effective control of drainage and flooding, the public also expects riparian corridors, wetlands, recreation amenities, trails, visually pleasing facilities, and a continued maintenance effort. Stormwater managers now must find the resources to effectively satisfy these expectations as well as the regulatory requirements.

To meet the challenges of the new paradigm some urban stormwater programs are evolving into multi-functional operations. Table 1-1 provides a listing of major stormwater management components for a utility/service fee type program. Not all programs will be this comprehensive, but many local governments in order to meet public expectations will likely move in this direction over a period of time.

Table 1-1: Major Stormwater Management Functional Centers[1]

Administration
- General Administration
- Prog Planning and Development
- Interagency Coordination

Public Involvement & Education
- Public Awareness & Education
- Public Involvement
- Standing Citizen's Group

Billing and Finance
- Billing Operations
- Database Management
- Customer Service
- Financial Management
- Capital Outlay
- Overhead Costs
- Cost Control
- Support Services

Stormwater Quality Mgmt
- Quality Master Planning
- Retrofitting Program
- Monitoring Program
- Struc and Non-Struc BMP Progs
- Pest, Herb and Fertilizer
- Used Oil & Toxic Materials
- Street Maint Prog
- Spill Response and Clean Up
- Prog for Pub Ed and Reporting
- Leakage and Cross Connections
- Industrial Program
- Gen Com and Residential Program
- Illicit Con and Illegal Dumping
- Landfills and Other Waste Facilities
- Combined Sewer Overflow Program
- Groundwater & Wellhead Protection
- Drinking Water Protection
- Watershed Assessment & TMDL
- Septic and I&I Program

Engineering & Planning
- Des Criteria, Stds and Guidance
- Field Data Collection
- Master Planning
- Design, Field and Ops Engineering
- Hazard Mitigation
- Zoning support
- Multi-objective Planning Support
- GIS and Database Management
- Mapping
- Land Use Planning & Controls

Operations
- General Maintenance Management
- General Routine Maintenance
- General Remedial Maintenance
- Emergency Response Maintenance
- Infrastructure Management
- Public Assistance

Regulation and Enforcement
- Code Dev and Enforcement
- General Permit Administration
- Drainage Sys Insp & Reg
- Zoning and Land Use Reg
- Special Inspection Programs
- Flood Insurance Program
- Multi-Obj Floodplain Management
- Erosion Control Program

Capital Improvements
- Major Capital Improvements
- Minor Capital Improvements
- Land, Easement, and Right-of-Way

[1] Table 1-1 provided by Hector Cyre, Water Resource Associates, Inc., Friday Harbor, Washington, 2005

LEGISLATIVE PERSPECTIVE

Legislative action has dramatically changed the face of contemporary stormwater management. This includes passage of laws, adoption of regulations, and interpretation of laws and enforcement of regulations by the courts at local, state and federal levels. These legislative activities impact all aspects of stormwater management by local governments, as well as the private sector, such as developers who provide basic infrastructure as a part of their developments, industrial facilities that discharge stormwater from their properties, and those conducting ground disturbing construction activities.

Initially stormwater was considered a common enemy and was solely a local issue. Local governments constructed stormwater systems to address local drainage service needs and flooding problems. Property owners had the right to protect their property from stormwater as long as unreasonable harm was not inflicted on other properties. Today as a result of the Clean Water Act (CWA), stormwater is also a state and federal issue, and landowners are required to detain stormwater on their property and provide a level of treatment.

Passage of the 1972 CWA signaled the beginning of a serious national effort to improve the quality of the nation's streams, rivers, lakes, wetlands, estuaries, bays, and oceans. The CWA required dischargers of "point sources" of pollution such as sewage treatment plants to obtain National Pollutant Discharge Elimination System (NPDES) permits in order to discharge pollutants into the nation's waters. Initially municipal stormwater was considered a non-point source of pollution and NPDES permits were not required of municipal stormwater dischargers.

However, stormwater was defined as a point source of pollution in the early 1980's pursuant to a federal court decision brought by the Natural Resources Defense Council against the EPA. This marked the beginning of the municipal stormwater quality mandate through the NPDES permit program. In addition to NPDES permit requirements, municipal stormwater systems are also now subject to Total Maximum Daily Load (TMDL) requirements of the CWA.

NPDES permits typically require pollutant dischargers to meet numerical effluent limits at the end of the discharge pipe. Because it is difficult to apply this standard to stormwater systems, the CWA was amended in 1987. Section 402(p) was added to the CWA defining basic permit compliance requirements for municipal stormwater runoff that are different than those for typical point source discharges such as from sewage treatment plants. Section 402(p) required municipal storm sewer systems to reduce pollutants discharged from municipal stormwater systems to the maximum extent practicable (MEP). MEP is thus the standard of treatment for municipal stormwater and its definition is very important.

The following, from the Federal Register, December 8, 1999, p. 68754 publishing NPDES Phase II stormwater regulations, is EPA's interpretation of the meaning and intent of the MEP standard.

> "Maximum extent practicable (MEP) is the statutory standard that establishes the level of pollutant reductions that operators of regulated MS4s must achieve. The CWA requires that NPDES permits for discharges from MS4s 'shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods.' CWA Section 402(p)(3)(B)(iii). This section also calls for 'such other provisions as the (EPA) Administrator or the State determines appropriate for the control of such pollutants.' EPA interprets this standard to apply to all MS4s, including both existing regulated (large and medium) MS4s, as well as the small MS4s regulated under today's rule.
>
> For regulated small MS4s under today's rule, authorization to discharge may be under either a general permit or individual permit, but EPA anticipates and expects that general permits will be the most common permit mechanism. The general permit will explain the steps necessary to obtain permit authorization. Compliance with the conditions of the general permit and the series of steps associated with identification and implementation of the minimum control measures will satisfy the MEP standard.
>
> Implementation of the MEP standard under today's rule will typically require the permittee to develop and implement appropriate BMPs to satisfy each of the required six minimum control measures."

The federal/state/local relationship regarding stormwater management was fundamentally changed by the 1987 CWA amendments and subsequent regulations. There is now a federal mandate that local governments address stormwater quality through the NPDES permit mechanism, and there is federal and state oversight on how, and how well it is done. Drainage and flood control is still a discretionary activity, but stormwater quality management is now required of most all local governments

STORMWATER AS A SERVICE

Uncontrolled stormwater flows can be a danger to both the constructed and natural environments, and the control of stormwater and the pollutants it carries is a difficult and expensive task. Implementation of stormwater management programs and measures by local government, therefore, creates a service benefit for the lands and improvements so served.

Public and private properties are benefited in several ways through the new stormwater management paradigm. Benefits include recreation opportunities, community aesthetics, environmental enhancement, flood damage reduction, protection of transportation systems, development of urban trail corridors, handling of excess drainage from public and private properties, maintaining property access, protecting and providing water supply, providing regulatory compliance, protecting property values, and providing long term system maintenance. Also, where there is a community stormwater program with oversight and management, the service benefit can include system planning and engineering, development of design criteria, flood warning systems, NPDES compliance plans and BMP's; and publication of resource information.

It is important to realize that a long-term obligation is created when stormwater infrastructure is added and stormwater programs are developed. For example, all the stormwater facilities that have been constructed, and will be constructed as a result of new development or redevelopment, must be maintained in perpetuity. NPDES regulations require municipal permit holders to assure the maintenance and continuation of these new facilities and programs. Further, implementation of NPDES permit requirements will most likely intensify in the future.

The significant and continuing capital construction, operation and maintenance requirements for storm sewer systems, stormwater quality facilities, pollutant source control programs, flood control facilities, vector control, drainage corridors, detention facilities, wetlands, etc., is beyond the capacity of individual property owners, and are services provided by the local government stormwater service program.

ISSUES AND CHALLENGES FOR LOCAL GOVERNMENTS

The new stormwater paradigm presents many issues and challenges. What is to be the design and content of the stormwater program, what will it cost, who pays, who decides, and how will it be funded? Among these, cost and how to fund it is of significant importance to local government.

Local governments are expected by their citizens to provide and fund basic services such as police and fire protection, local transportation systems, sewage treatment, water supply, libraries, social services, and recreation. Stormwater quantity and quality must now be added to that list. The new paradigm requires the development of institutional and funding frameworks to support this long-term responsibility.

There are legal and equity issues imbedded in the funding considerations. Funding of stormwater systems must be relevant and proportional to services or benefits provided, or in other words, it must be fair and legal. It will be critical for funding options, particularly those that include utility/user fees, to be based on sound legal principals to avoid challenges.

Local governments will likely be facing changing rules. Municipal stormwater management systems will need to have flexibility to adjust to changes in regulations, regulators, legislation, public demands, and court decisions. For example TMDLs are developing as a new performance issue for local governments. If stormwater discharges contain pollutants contributing to the impairment of a water of the nation, additional control requirements may be imposed and additional costs incurred.

Cost and effectiveness are major considerations for local government when developing stormwater management programs. MEP is the current CWA regulatory standard to which stormwater programs are held. Cost and effectiveness should be factors (others include regulatory compliance, public acceptance, and technical feasibility) in the selection of BMPs and in the approval by regulators of stormwater management programs.

Partnership opportunities are available to local government in implementing stormwater quality programs. Local governments can develop individual stormwater programs to meet regulatory requirements; or they can join together in partnership with other local governments, including cities, counties, and special districts in the conduct and financing of the stormwater program. There is good potential for cost savings when local governments work with others in implementing control measures required in their permit.

There are governance decisions to be made. Local governments can implement a stormwater program through an existing organization, they can set up a new department or organization, or they can develop some combination of the two. The decision could influence the funding structure that is used.

Ultimately, all issues and challenges focus attention on cost and how it is funded. The focus of this document is on service/user/utility fees which addresses an important element of the funding challenge.

CHAPTER 2

SOURCES OF FUNDING

FUNDING STRATEGIES

Money, Revenue, and Resources

In formulating a funding strategy for any local government program it is often helpful to think of a framework of money, revenue, and resources that can be selectively applied to specific needs. Cumulatively they provide the financial support required for the mix of capital, operating, and non-operating expenditures. It is important to recognize the distinctions that influence their capability and suitability for various tasks, and how they can best be orchestrated.

"Money" encompasses a range of sources and types of funds that can be tapped to support stormwater services and facilities. Appropriations of general revenues, proceeds of bond sales and special-purpose sales taxes, and transfers from other accounts represent "money" that have all been used to support stormwater programs, either on a one-time basis, temporarily, or as a part of a long-term funding strategy.

"Revenue" is a term usually used in specific reference to the cash flow generated by user fees of various sorts and other relatively consistent income streams such as charges, assessments, rentals, fines, etc. Most stormwater utilities have a periodic charge generally applied to all customers. They may also have other revenues generated through special fees applied to individual customers or classes of customers (e.g., plan review and inspection fees), special assessments, and capital recovery fees of various sorts. In some cases, revenue supports other funding mechanisms, as in the allocation of user fee revenue to service bond debt.

"Resources" that support stormwater programs take many forms, ranging from developer-contributed capital facilities, to federal and state grants and loans, to maintenance of public drainage systems performed by homeowners' associations and private property managers, to land and easement dedications and other exactions. They also include a variety of funding mechanisms that are commonly used to structure how money and resources are applied to specific objectives, for example bond issues that are used to fund capital infrastructure and inter-fund loans to meet temporary cash flow needs.

Expensed Versus Debt Funding

Two principal categories of funding employed by stormwater management programs are expensed funding and debt funding. Most stormwater programs employ a mix of these.

Expensed funding is typified by "pay-as-you-go" strategies, in which expenditures are supported by a more or less concurrent revenue stream. For example, a city's stormwater utility may have a user fee that generates $5 million in annual revenues, an appropriation in its road budget for maintenance of roadway drainage systems of $1 million, and a total annual stormwater management budget of $6 million that essentially matches the combined income. Costs are "expensed" as they are incurred.

Debt funding is typified by bond sales, which are most commonly used to fund major capital expenditures, but debt funding may also include intergovernmental loans, warrants, and other mechanisms. Debt is sometimes also used to fund utility start-up costs, undertake system-wide remediation, or to make funds available to cooperating entities in the form of grants or loans. In all these examples, borrowing is utilized to enable a stormwater program to expedite improvements or activities so as to accomplish its goals more quickly, thereby reducing the time of exposure to certain risks. For example, bonding to build extensive flood protection works in two years rather than twenty years may be a prudent action if valuable property is protected more quickly.

CHARACTERISTICS OF SUCCESSFUL FUNDING STRATEGIES

A Business Plan Approach Is Based on Strategic Objectives

Some common characteristics are evident among successful stormwater utility programs. The most successful programs have relied heavily on a business plan model which guides both the program evolution and funding decisions. The strategy for accomplishing the program is defined, the type and magnitude of costs are projected, resource requirements are determined, and timing issues are resolved before the analysis of specific funding mechanisms takes place.

"Needs" are the key driver of program and funding strategies. Authority, capability, and a clear vision of the mission are essential, but in the absence of compelling needs local government leaders apply their attention and resources elsewhere.

The demands of the diverse stormwater management activities identified in Table 1.1 challenge local governments' funding capabilities, and encourage them to use a variety of funding sources. State constitutions and legislation, governance structures and service responsibilities, drainage problems, needs and priorities, local politics and economics, and simply the different ways that communities conduct their business all differ and influence their decisions on stormwater program and funding strategies. These influences should cause local agencies to carefully examine their needs, and the most successful have crafted a detailed business plan as a guiding document.

Effective Stormwater Business Plans Identify Linkages and Dependencies

Stormwater business plans or program strategies contain many linkages and dependencies among program components and processes. Addressing some needs may require several years as preparatory steps are accomplished. For example, even if infrastructure improvements are the highest priority, they may have to be preceded by master planning studies, prioritization processes, engineering of specific projects, land acquisition, and contracting before a system improvement is actually realized. Formal approvals by elected officials may be needed at various points in this process, potentially creating additional delays.

Such linkages and dependencies make timing very influential in structuring the business plan. An extended schedule for addressing one program priority may present an opportunity to expedite others that do not require so much preparatory work or approvals. Routine maintenance is a function most easily expedited and can have the most immediate benefit in terms of service assurance. Regulatory measures that can be adopted at the discretion of managers and that do not require extensive analyses can also be easily activated. Other regulatory activities can involve several years, as in the case of developing and gaining adoption of design manuals. Education, public participation, and other efforts to improve water quality likewise can be initiated relatively quickly, but it may take years to demonstrate results. Some remedial repairs to deteriorated infrastructure can be accomplished quickly, although the process of identifying specific projects, prioritizing them, assembling necessary resources, acquiring land or easements, and contracting with vendors can delay others.

The negative experiences of communities that didn't recognize the relationship between program and funding strategies suggest that adopting funding strategies or mechanisms, without the benefit of a clear vision of the program strategy, creates a high potential for problems. This has proven especially true in the case of instituting stormwater utility user fees. One need only review the case law decisions in Chapter 3 of this guidance manual to find strong support for the proposition that a clear program strategy buttresses funding decisions by local elected officials.

Community Expectations Are Represented in Business Plans

The most effective stormwater business plans recognize community expectations. In some cases, expectations must be elevated by convincing demonstrations that stormwater problems exist and can be solved. Stormwater management rarely captures public support unless problems impact the daily lives of citizens. Many drainage systems are underground and essentially invisible to the public. If they are designed, constructed, and maintained properly, most people are unaware of them. More visible problems such as potholes in roadways consistently rate higher than drainage problems. The most effective programs identify and publicize the problems they must address, seek public participation and support, and orchestrate the use of various tools and resources over time.

Effective Programs Respond to Change

Flexibility is an important attribute of utility user fee funding and the ability to change as circumstances dictate should be always be a consideration in formulating a business plan. User fees provide a stable revenue source, and offer equity advantages over traditional tax funding, but perhaps their most valuable attribute is their flexibility for funding a variety of operational and capital investment needs. A long-range program can be defined with a realistic expectation that funding will be available when needed and also suitable for changing priorities. However, as a primary funding source, a user fee may lend itself to a focus on short-term, rather than a long-term program strategy, which can be counterproductive.

Service Fee Rates Are Cost-Based

The funding philosophy represented by utility service fees of all types is that customers should pay in relation to the demands they impose on the services and facilities – characterized as a "user-pays" approach. This is a primary consideration in selecting parameters from which service fees will be calculated, and formulating a rate methodology that results in an apportionment of those cost deemed fair and reasonable by the responsible local officials. The most successful stormwater utilities are those that have clearly established and documented the rationale for linking their service fees to the cost of providing services and facilities.

Resources Are Dedicated and Stable

Whether in city, county, or special district entities, most successful stormwater utilities are accounted for as enterprise or special revenue funds that are separate and apart from the funding of general public services. As segregated accounts, enterprise and special revenue funds limit the use of revenues and other resources to a specific purpose, such as stormwater management. Also, since reserves can be accumulated from one year to the next, there is no pressure to expedite funding at fiscal year-end if that is not prudent. This adds to program stability and efficient management of financial resources.

TRENDS IN FUNDING PRACTICES

Increasing Complexity

The emerging trends in the 21st Century suggest that funding issues will encourage tailoring of funding to specific program objectives, and funding practices will branch out in several directions. As stormwater programs become more sophisticated, unique local concerns and priorities gain greater visibility and support. Also, as more linkages are established with other governmental and even private-sector programs, the general trend in funding is toward greater complexity, and "standard practice" is increasingly likely to be supplanted by local innovations.

Stormwater utilities established in the 1970's and 1980's tended to be funded almost entirely from their service fees. Service fee rate methodologies were relatively consistent though rarely identical. They were cost-based, and rate structures were linked to peak and/or total volume of runoff by fee calculations employing parameters such as impervious area. Use of other funding methods and mechanisms in coordination with service fees was very limited.

Beginning in the 1990's a refinement trend emerged. The basic structure of funding and service fee rates remained relatively stable, but local entities began to push for more sophisticated and detailed cost, rate, and funding analysis. In part, this was due to the rapidly increasing technical capability offered by computerization and data gathering and processing. It also reflected the fact that more large cities instituted stormwater utilities as Phase I NPDES requirements were imposed. Their expectations were generally geared to more sophisticated cost and rate analyses and they often retained management and rate consultants with experience in other disciplines.

In the first decade of the 21st Century the trends in funding have been primarily in response to Phase II of the NPDES program, which impacts many more cities and towns than Phase I. This has had two somewhat conflicting effects. The introduction of a water quality objective caused many local governments to view stormwater management more broadly. However, as an increasing number of smaller cities and towns explored stormwater fee options to meet NPDES permit obligations, they tended to demand simpler and less expensive approaches than those preferred by large communities. These factors have been further compounded by federal and state initiatives to manage watersheds holistically, which is filtering down through regulatory programs and grant and loan opportunities. As a result, the key stormwater funding trends for the next decade include the following.

Blended Funding

Blending several sources of funding to support stormwater management program strategies has been a slowly emerging trend. The most successful stormwater programs are supported by several sources of funding, enabling them to spend more money to elevate the visibility of the program and improve cost accountability of specific functions or improvements.

Other sources of funding used in combination with service fees include general budget appropriations, dedicated special taxes (property, income, sales), special assessments, fees charged in lieu of requiring compliance with standards or requirements such as on-site detention, system capitalization or development impact fees to recover past expenditures or better allocate the cost of infrastructure over a period of time, and matching funds such as federal and state grants and loans. There are few constraints on local governments' authority to combine and selectively target several types and/or sources of funds to accomplish various purposes, see Appendix for examples.

Multi-jurisdictional Funding

Cooperative funding with other entities is a hallmark of many successful stormwater programs. Several factors have induced stormwater managers to participate in multi-jurisdictional funding, especially in recent years as water quality considerations became more prominent.

Stormwater runoff doesn't conform to jurisdictional boundaries. Drainage waters flow from jurisdiction to jurisdiction based on topography. Solving an upstream community's problem may become the source of a problem in another jurisdiction located downstream. Thus, the most efficient infrastructure solution for a given drainage problem may lie outside the jurisdiction where the impacts are manifested. For example, to relieve flooding a regional detention facility built in an upstream portion of a watershed in a rural unincorporated area may be less expensive and provide better protection than extensive flood protection works installed downstream within a major urban area. This may encourage several cities and towns in the downstream portion of a watershed to fund a common solution higher in the upstream reaches rather than attempt to install independent drainage improvements in each of their communities.

The availability of federal and state grants and loans and cooperative programs has also encouraged local governments to join in conducting activities associated with stormwater management. This has been a significant inducement to local governments to establish stormwater service fee funding. For example, the City of Griffin, Georgia was able to obtain more grant, loan, and shared funding from federal, state, and county sources during the first two years of its stormwater utility operation than was generated in service fees. A key factor in gaining other agencies' financial support was the City's ability to match their grants and loans with reliable local funding.

The presence of stormwater quality program mandates of state and federal agencies has also encouraged local governments to participate in cooperative programs. The emerging emphasis on stormwater quality has created both opportunities and incentives for cities, counties, and special-purpose districts to participate in cooperative efforts. Examples include public education, water quality monitoring and sample analysis, the development of drainage, erosion control, and other technical manuals, and even consolidated development plan review.

Cost-sharing With Other Public Programs

Successful stormwater utility programs have financial strength that has enabled them to venture into cost-sharing programs with entities that have different responsibilities but shared interests. Greater funding has broadened the scope of stormwater management to include related issues such as land use and development regulation, environmental protection, and habitat preservation. This in turn has revealed more opportunities for linkages with other programs, and sharing of resources to address mutual interests and needs is increasingly common.

Wastewater treatment, especially, lends itself to cooperative funding with stormwater management, due in large part to the extensive historic use of combined sanitary/stormwater sewerage systems in many areas of the country. Stormwater separation and inflow/infiltration corrections were often funded as wastewater treatment expenses in the past. Now some communities have recognized that the expense of separating stormwater and wastewater or eliminating stormwater inflows into wastewater sewer systems may be assigned to a stormwater cost center rather than wastewater. When a stormwater utility is present, the costs shift to properties that generate substantial runoff versus those that generate substantial amounts of sewage.

Watershed management practices and water quality protection also introduce opportunities to share costs with other programs. The City of Bellevue, Washington Storm and Surface Water Utility has a primary objective of preserving small streams. Protection of wetlands and construction of regional detention ponds were key elements of the City's stream preservation strategy. The Utility purchased extensive areas of wetlands and other areas along streams, and worked closely with the City's Park Department to manage them as passive-use parks and open space. Other properties used for detention and groundwater recharge have been developed into active recreation facilities such as neighborhood playgrounds, soccer pitches, and even tennis courts.

Countless other communities have built parks, greenways, and trails along streams, including examples such as the Mingo Creek linear park in Tulsa, Oklahoma and along Cherry Creek, South Platte River, and many other drainageways in the Denver, Colorado metro area. Salt Lake City, Utah modified and improved a high school baseball field to serve as a major detention facility during severe storms and major snowmelt events.

Some communities have also used their stormwater utility funding resources to support program enhancements such as geographical information systems (GIS), upgrades to financial management and utility billing/collection systems, and transportation improvements such as construction of roadside curbs and gutters to replace open ditches. The linkage of stormwater management to other programs has justified funding in whole or in part activities such as leaf collection to reduce local flooding due to plugged inlets (e.g., Greensboro, North Carolina) and street sanding and snow removal/dumping to reduce stormwater quality pollution.

Broader Private Sector Participation

The importance of contributed capital infrastructure built by developers should not be underestimated. Though often unplanned and uncoordinated, many early components of local drainage systems that emerged in the 19th Century were built by the private sector coincidental to commercial, industrial, and residential projects. The economic boom of the 1920's spawned a major surge in private investment in public facilities, including stormwater drainage systems. In most suburban communities developed since World War II, a majority of the stormwater infrastructure has been built by developers and turned over to a public entity for long-term operation and maintenance.

More recently this approach has expanded to include cooperative efforts involving public entities and the private sector, with stormwater management requirements being integrated with other objectives. For example, a stormwater detention facility built by a developer might now be integrated with recreational facilities such as greenway corridors, golf courses, baseball fields, or soccer pitches. The financial participation in such improvements may be broadened to include several public agencies having primary responsibility for the long-term operation and maintenance of the facilities.

This trend has several important implications for stormwater managers. They will need to reach out to private-sector entities and programs to identify opportunities that serve their mutual benefit. They will need to broaden their community's vision of what stormwater management entails to ensure support for cooperative programs with private interests. Because many more developments are being built by larger, more competent and better financed development companies, local stormwater management programs will need to increase their skills and sophistication to keep pace and ensure that participation is optimized.

Increasing Influence of Technology and Data

Perhaps the most pervasive factor guiding changes in stormwater management in the past thirty years is rapid acceleration of new technology. This directly influences trends in stormwater funding practices as well as engineering and other technical endeavors involving the availability and management of data. For example, the cost of creating or gathering data required to prepare a master account file for stormwater service fee billings has plummeted in the past decade, from as much as $6/account to less than $0.25/account depending on the parameters and rate structure involved. Satellite imagery of extensive land areas now renders digital information that is at least as precise as visual interpretation of aerial photography, with far greater consistency and reliability at much less cost.

Such increased efficiency encourages local governments to seek more sophisticated stormwater service fee rate methodologies, and to combine several funding mechanisms in much more complex approaches. However, is it practical and beneficial to refine a community's stormwater service fee rate structure when other parameters are not yet as precisely quantifiable? The trend is clearly toward more sophisticated rates, but optimizing the value of the rapidly increasing technological capability has not yet been adequately addressed.

FUNDING METHODS AND MECHANISMS

Local Governments' Funding Authority

Stormwater management has historically been supported by a range of funding methods and mechanisms that reflect the mix of federal, state, and local programs. Since this guidance is directed toward the funding of local stormwater management programs, especially stormwater utilities, we focus on the approaches used primarily by cities, counties, and special-purpose districts.

Cities and counties in most states are generally authorized by state legislation to conduct stormwater management. This general authority is supplemented in some states by home rule provisions. Cities and counties adopting such powers may gain greater latitude to undertake stormwater management functions, regardless of whether specific statutory authorization is available, subject to certain limitations and ballot approval requirements.

The changing nature of stormwater management is also providing greater flexibility in stormwater funding. Undeniably, stormwater management has now become fundamentally regulatory. Federal and state laws confer a water quality regulatory role upon local governments through the NPDES permit program. Similarly, adoption of local system design criteria and on-site control requirements for runoff quantity is rooted in a regulatory purpose of preventing problems. This regulatory foundation may expand and strengthen the local authority, especially as it relates to funding decisions. Generally speaking, locally-elected officials have greater latitude in adopting fees that are associated with regulatory purposes than for other objectives.

Funding Methods and Mechanisms

Funding methods and mechanisms commonly used for stormwater programs include:

- General revenue appropriations
- Stormwater user (service) fees
- Plan review, development inspection, and special user fees
- Special assessments
- Bonding for capital improvements
- In-lieu of construction fees
- Capitalization recovery fees
- Impact fees
- Developer extension/latecomer fees
- Federal and state funding opportunities such as grants, loans, and cooperative programs

General Revenue Appropriations

Despite the proliferation of stormwater utilities, general tax revenues remain the most common source of stormwater management funding. Substantial technical analysis is normally not needed to fund stormwater management from general revenues, which local governments may use for any legal purpose. The majority of most cities' and counties' general revenues are from taxes (e.g., property, sales, and income), exactions (e.g., franchise fees on utilities), and federal/state revenue sharing, and are simply appropriated for specific purposes, including stormwater management, through the normal budget process. Because they have limited purposes and, in most states, often do not have broad general taxing powers comparable to cities and counties, special-purpose districts are more likely to be funded through limited property taxes, special assessments and service fees.

The practice of funding stormwater management from general revenues has contributed to a dispersal of stormwater management responsibilities. Stormwater management is not typically an independent municipal function, either operationally or financially. Many city and county functions are peripherally involved in or impacted by stormwater runoff. Components of what might be collectively considered a consolidated stormwater program are often embedded in operational units such as public works, engineering, transportation, street maintenance, wastewater treatment, and even recreation. The funding of stormwater management in such cases is also typically embedded in whatever resources are assigned to the primary function. They may budget for costs that are essentially stormwater management, but not readily identifiable as such in their budgets. Such dispersion of functions and costs may obscure any discernible relationship between demands for stormwater services and facilities and how the cost burden is apportioned.

General revenues have several attractive attributes for stormwater management. Most cities' and counties' general revenues are, in the absence of other demands, sufficient to support effective stormwater management. The sources of general revenues are usually well-established, fully understood, and well-accepted by citizens and business interests. They are relatively stable from year to year, though economic downturns tend to excessively impact jurisdictions whose general revenues are highly reliant on sales and other business taxes rather than property value, which is more stable.

However, general revenues also have significant disadvantages as a source of stormwater management funding. Many worthy public purposes, including public safety and social services, are commonly funded from general revenues. Stormwater management has historically struggled to compete effectively against other needs, and major long-term reallocations of general revenues simply to enhance stormwater management capabilities are rare. In the absence of a major budget reallocation, increasing general revenues to support stormwater management implies approval of a tax increase of some sort. Neither option is politically attractive for most local officials.

Because they are not earmarked or dedicated to any specific purpose, annual appropriations of general revenues shift with elected officials' and administrators' perceived priorities. Stormwater management needs are more likely to receive better treatment in a year following severe storms and drainage problems than in a year following a drought. A lack of stable funding makes it difficult to plan and carry out a consistent, long-term program.

The sources of general revenues have little if any inherent association with the origin of stormwater management demands and costs. For example, property taxes are a major source of general revenues for many cities and counties. Such taxes are usually calculated based on the economic value of land and improvements, which have little direct relationship with stormwater runoff quantity or quality. Sales taxes are typically based on retail sales, which likewise have no identifiable link to stormwater management costs. Franchise fees are normally a percentage of the gross income of the activity utilizing the franchise rights.

Because general revenues are derived primarily from taxes and exactions imposed upon businesses and individuals, other parties that impose significant demands on stormwater systems and programs may be excluded from participating financially in solutions. For example, in cities which have state-owned properties, public universities or federal military installations, a substantial demand for stormwater services may be traced to such tax-exempt properties.

The disparity between the need for stormwater services and facilities and the source of general revenues does not end with tax-exempt properties. Some private properties, for example discount retail stores, parking lots and warehouses that have large expanses of relatively low value impervious coverage, do not pay taxes commensurate with the demands they impose on the stormwater systems. Conversely, more valuable properties such as high-rise office and residential condominium towers that may have less impact on stormwater runoff pay substantial property taxes.

Stormwater User (Service) Fees

Stormwater utilities funded primarily through service fees are the focus of this guidance. Service fees are discussed only briefly in this section, but are covered in greater detail in other sections of this chapter. Specifically the sections on "Service Fee and Assessment Design Considerations" and "Service Fee Rate and Assessment Methodologies" further address this area.

Although user fee funding of stormwater programs is generally associated with the stormwater utility concept inaugurated in the 1970's, Billings, Montana adopted a "storm water charge" in June, 1964. Relying in part on that revenue stream, the voters of Billings also approved the issuance and sale of negotiable revenue bonds for the purpose of reconstructing and extending the City's stormwater and sanitary sewer systems. This action was challenged in court and was eventually upheld by the Montana Supreme Court in 1966[2]. Billings has since funded a majority of its stormwater management programs through the charge.

Billings' "storm water charge" represented a major departure from conventional stormwater funding but did not elicit widespread imitation. The transition to user fee funding did not become widespread until the early 1990's, although several cities and counties in Washington, Oregon, and Colorado established utilities during the 1970's and 1980's. The utility user fee concept has now been adopted by over five hundred cities and/or counties. It is generally referred to as the "stormwater utility" approach because it not only provides user fee funding but also incorporates accounting and management practices similar to those of other municipal utilities like water supply, wastewater treatment, and solid waste management. Similar approaches have been used in Canada and Germany.

Substantial latitude is available to local elected officials in structuring rates and fees, especially if they are associated with regulatory functions. Specific methods of calculating stormwater user fees are not mandated by law in most states, though some limitations do exist. For example, in Texas the state legislature has exempted public universities from local stormwater user fees. Most stormwater user fee rates account for conditions on properties that affect the peak rate of runoff, total volume discharged, and pollutant loadings on receiving waters. A majority are based on the amount of impervious area (roofs, paved areas, etc.),[3] which determines both the proportion of rainfall that runs off and the peak rate of discharge during and following storms.

---

[2] City of Billings v. Ralph Nore, 148 Mont. 96; 417 P.2d 458 (1966)

[3] Stormwater Utility Survey 2004 – 2005, Black & Veach, Kansas City, MO, 2005

Stormwater rates have also been based on the gross area of properties and numerical factors that reflect the intensity of development. A few cities and counties have incorporated both gross area and impervious area or the percentage of imperviousness into their rate calculation. Other stormwater service fee rate parameters include land use classes, zoning classes, and water meter size, though these are generally not considered to offer comparable equity of cost allocation relative to impervious and gross area methodologies.

A stormwater user fee is highly flexible and can easily be tailored to individual situations and coordinated with other funding methods. Revenue from user fees and other funding sources can be blended together or a fee might be applied only in a limited service area rather than the entire jurisdiction, excluding other areas which do not require service or are impractical to serve. No fixed practice prevails; though most cities apply their user fees city-wide and many counties define more limited service areas where urban/suburban conditions exist.

User fees are also authorized for some types of special-purpose districts, which may apply them district-wide or designate them only for specific service zones. Such approaches can be combined, as in the case of a stormwater utility that has both a general service fee and also administers special-purpose improvement districts to fund localized improvements or services.

The stability of a dedicated user fee revenue stream ensures that long-range scheduling of capital improvements and operations can be done with reasonable assurance. User fees may also free up general revenues and other resources allocated to stormwater management for other purposes.

The greatest potential disadvantages of stormwater user fees are high visibility of the charge and the cost of its development and implementation. Regardless of technical distinctions between "taxes", "exactions", "assessments", and "service charges", any form of government funding may be viewed by some citizens as a "tax" and thus be unpopular. However, the high visibility of a defined stormwater user fee might also be beneficial if it convinces a community that long-standing flooding or pollution problems will be addressed.

The cost of developing and implementing utilities reflects the size of a community or the complexity of processes employed. Some of the formative costs such as program and cost analyses are essentially common to all situations. Others are "unit" costs. For example, data must be assembled to populate a master account file for billing. The cost of implementing a utility user fee is a function of the number of accounts, and the total cost typically amounts to eight to twelve weeks of the revenue stream that is created. This includes all costs associated with the necessary program and financial analyses, data assembly, modification of billing and other information systems (or activation of a new system), and public education and involvement.

Plan Review, Development Inspection, and Other Special Fees

A variety of special user fees could reasonably be included under the scope of a stormwater utility or adopted separately to support regulatory measures. Most often they are related to special services provided to a limited group, as opposed to user fees that are generally applicable to utility customers. Such fees apportion the costs only among those who require the service or cause the need for the regulatory measure.

Fees for the performance of regulatory activities are usually associated with protecting the public health, safety, and welfare in some manner. Some regulatory activities may be mandated by federal and/or state requirements or as conditions of NPDES or other permits. Regardless, to the extent special fees are associated with a regulatory function (e.g., development regulation); authority to institute them is typically a product of the police powers of the governance entity.

Special fees may also have other applications, such as a cost recovery mechanism that assigns certain expenses to a specific group. For example, experience has demonstrated that maintenance of on-site detention systems is frequently ignored or deferred by property owners, or alterations may be intentionally or unintentionally made to such facilities. Inspections may be necessary to ensure that on-site systems are properly maintained and not altered from their approved design. Placing the cost of such inspections on the specific property owners through special fees relieves the general taxpayers or utility ratepayers of the expense.

Special fees typically provide only a small additional amount of revenue for a stormwater utility, but enhance the equity of cost apportionment. Adoption of such fees may require that other fees associated with regulatory reviews, inspections, or special services be evaluated to ensure that individuals are not being charged twice for the same service.

Special Assessments

Special assessments have been used to fund capital improvement and operation of stormwater systems since colonial times. The assessment concept is predicated on apportioning costs in proportion to the direct and special benefits individually derived by specific properties. It has been applied to funding of various public facilities, ranging from sidewalks and roads to flood control channels and dikes. In application to stormwater management, the special assessment mechanism has evolved as the management paradigm changed.

The chief drawback of the traditional special assessment methodology is that the distribution of costs must be proportionate with the direct and special benefit accruing to each property being assessed. Although standards differ from state to state, generally the benefits must be definable, measurable in some economic manner, and available to the property being assessed within a practical timeframe. In most cases, general benefits accruing to all properties as a consequence of a stormwater improvement or activity cannot be used to justify a special assessment.

The courts have established substantially different standards for special assessments versus service fees. Broader latitude is given to local elected officials in setting service fee rates, and especially those associated with regulatory purposes. Special assessments must conform to more restrictive technical standards based on apportioning costs to reflect the value of benefits accruing to individual properties. Fully complying with the standards the courts have set for special assessments may therefore require more precise and costly data than is needed to support a service fee, which must simply be fair and reasonable.

Special assessments for drainage are most workable in relatively localized or specific applications. For example, improving a ditch or channel that directly serves a few properties or a relatively small service area is an appropriate project for special assessment funding. A special assessment is less suitable for capital projects that serve a wide area, and may be wholly unsuited to facilities providing a general benefit to the community at large.

Much of what must be done to effectively manage stormwater quality may not be directly and specially beneficial to individual properties. Thus, special assessments are not widely used as a primary funding mechanism for that purpose, though in recent years several benefit assessment areas have been instituted in Southern California to support local water quality programs, and Florida counties fund stormwater management through assessments (as so defined in a Florida Supreme Court decision) that are similar to many stormwater service fees.

Bonding for Capital Improvements

The expense of major capital infrastructure, land, and equipment has posed a significant challenge for stormwater programs whose annual revenues and resources are limited. As a result, local governments have used bonding to fund major capital improvements for many years.

Bonds are sometimes used to fund operations as well as capital improvements, though that practice is not generally viewed as prudent and some states prohibit or limit such uses of bonding. However, some stormwater management costs can be viewed either as a capital or operating expense. For example, remedial repairs to aging infrastructure might legitimately be viewed as either a capital expenditure or an operating expense.

Bonds are not a revenue source, but rather a method of borrowing money to fund expenditures. Debt service of bonds is commonly derived from general revenues, service fees, or special assessments. In some cases, specific funding mechanisms or sources are identified in bond covenants. For example, a bond might be issued with debt service to be paid from a special local option sales tax or a special assessment upon properties served by the improvement.

The chief advantage of bonding is that it allows expenditures that far exceed current revenues and resources. Construction of major improvements can be expedited in advance of what could be funded from annual budget appropriations by spreading the costs over time, much like a home mortgage or automobile loan enables a buyer to acquire assets they could not afford to buy for cash.

In the case of stormwater management, expediting a capital project by several years through bonding may result in significant public and private savings if flooding, other damaging impacts, and inflation of land acquisition and construction costs are avoided. The major disadvantage of bonding is that it is essentially a loan that incurs an interest expense, increasing the total cost of capital projects.

Two types of bonding are available, revenue bonding and general obligation bonding. General obligation bonding incurs a debt that has first standing with regard to public assets and is backed by the "full faith and credit" of the issuing agency. All revenues and resources of the entity, including various taxes, may be used to service a general obligation debt. Revenue bonding is supported and ensured only by specified revenues, such as service fees or assessments. As a result, the bond market sometimes imposes higher interest rates on revenue bonds and/or dictates that excess revenue be generated (termed coverage) to reduce the risk of non-payment. Recent experience suggests that the bond market has recognized the stability typical of stormwater utility service fee income, and has priced stormwater revenue bonds favorably.

Cities and counties in some states are also authorized to issue bond debt that is backed by the full faith and credit of the issuer but has debt service funded from a designated revenue source. This is commonly referred to as "double-barreling" of bonds. The full faith and credit provision is simply a fall-back if the revenue stream should fall short. Such bond issues typically attain the bond rating and interest rate of the issuing agency's general obligation debt, but the entity's general tax revenues and statutory debt limits are not burdened.

In-lieu of Construction Fees

In-lieu of construction fees are not specifically authorized under most state laws, but might be adopted in some circumstances as one element of a comprehensive stormwater utility user fee rate methodology or as a regulatory fee. Such fees have been charged in lieu of requiring construction of on-site stormwater systems for many years.[4]

[4] For example, Tulsa, Oklahoma instituted fees in lieu of requiring on-site stormwater detention improvements on each and every development project in more than a dozen watersheds during the 1970's, and used the revenue to defray a portion of the expense of regional detention facilities in those areas.

In-lieu of construction fees are sometimes confused with impact fees. However, an in-lieu of construction fee is usually a substitute for requiring on-site solutions such as detention storage. They may be used even in instances when an on-site system would work but an offsite regional facility is preferable.

In contrast, impact fees are generally used to pay for off-site measures to compensate for the service-demand effects of development that are not solvable on-site. For example, the impact of a shopping center on stormwater runoff might be resolved either by requiring an on-site detention system or by building a regional facility off-sight that is paid for (in part) through the in-lieu of construction fee. Shopping center traffic that clogs nearby roads cannot be solved on-site, but an impact fee might be used to pay for additional traffic lanes and/or signalization to mitigate the impact.

The need for in-lieu of construction fees associated with stormwater management stems from problems that have emerged with on-site measures to mitigate development impacts. Experience has shown that requiring developers to install individual on-site detention and water quality facilities can lead to a regulatory and/or maintenance problem for a local government. Alternative regional solutions may be more efficient and reliable in controlling runoff volumes and pollutant discharges into public stormwater systems and streams. However, on-site systems are typically funded by the developers whereas the general public usually pays for regional systems. An issue of equity arises if general taxpayers or ratepayers have to fund regional solutions to mitigate the impacts of private development projects rather than requiring on-site control.

The flexibility to address issues either by on-site mitigation or by alternative actions elsewhere is advantageous if the financial conundrum can be resolved. An in-lieu of construction fee offers a practical option that may be preferable to both developers and local governments. Developers simply pay a fee in-lieu of designing and building an on-site system or facility, and the local government obtains financial support for more efficient and reliable regional systems.

The most significant disadvantage of in-lieu of construction fees is that they rarely generate sufficient revenue to fund construction of regional detention facilities, enlarge conveyance systems, or install water quality facilities in a timely manner. Also, they do not fund maintenance. This dictates that other revenues must be available to initially build and maintain regional facilities, and taxpayers or ratepayers are the parties burdened with those costs. However, over time, in-lieu of construction fees can contribute a meaningful component of the total long-term funding of regional facilities and equitably compensate those who have initially borne the costs.

In-lieu of construction fees are not necessarily easy to implement. They demand well-refined capital improvement plans and analyses of on-site versus regional alternatives, from which the alternative cost of the regional options can be reliably determined as the basis for setting the fees. This may necessitate detailed and costly analysis of potential regional facilities when a simple regulatory approach would suffice. At least a portion of the cost of preparing suitable analyses and documentation should be incorporated into the structure of in-lieu fees.

Capitalization Recovery Fees

Capitalization recovery fees are also known as system development charges, capital facilities fees, utility expansion charges, and by other titles. They are not specifically provided for by authorizing legislation in most states, but have been incorporated into various utility user fee rate structures for many years.

Capitalization recovery fees are sometimes confused with impact fees and even with in-lieu of construction fees. Capitalization recovery fees are most often intended to recover a fair share of the prior public investment in infrastructure capacity installed to accommodate future development. The fees are applied to developers who make use of that provisional capacity when they develop projects. In some instances, capitalization fees may also be used to attain suitable apportionment of future capital costs. This is particularly applicable in cases where funds have been accumulated in preparation for major capital projects.

There are several ways of structuring and calculating capitalization charges, including the growth-related cost allocation method, the system buy-in approach, the marginal incremental cost approach, and the value of service methodology. They differ from in-lieu of construction fees and impact fees primarily in terms of: 1) the fundamental purpose of the charges; 2) the timing of improvements versus when the charges are collected; and 3) their relationship to the specific facilities that are funded through user fees. In most cases, capitalization recovery fees are related solely to capital costs, though some justification may exist in certain circumstances for incorporating long-term operating expenses.

Capitalization charges provide a mechanism whereby developers participate in paying for capacity that was previously built into public systems in anticipation of their needs or which is planned for the future and for which funding is being accumulated in anticipation of building the improvements. In effect, they allow a deferral of participation in the capital cost of facilities until a property is developed and either makes use of the provisional capacity already in place or buys into the previously accumulated fund reserves intended to build future improvements. The use of such fees for stormwater management capital costs is clearly appropriate since most drainage systems are consciously designed to provide capacity to accommodate future development in an economical manner.

Whether a stormwater capitalization charge is appropriate in specific cases may be related to the user fee rate methodology that is employed. For example, many stormwater user fees are based solely on impervious area where only developed properties are charged. Undeveloped properties do not have impervious area and therefore are not charged. However, the capital facilities being funded by the fee are normally designed with future conditions in mind. This initially results in excess capacity being built into the system, which is paid for solely by currently developed properties. A capitalization charge may therefore be an appropriate recapture mechanism to ensure a fair and reasonable allocation of the capital costs among all properties using the facilities over time.

If the rate methodology allows user fees to be charged to undeveloped properties, a recovery mechanism may not be needed at the time properties are developed. The rate structure might have a system capitalization component that assigns an appropriate proportion of the capital costs to undeveloped properties based on expectations of the future developments and their stormwater system demands.

Impact Fees

Impact fees have been adopted by local government entities for a variety of public infrastructure components. They are based on the cost of mitigating development impacts of individual developments by building public off-site improvements where impacts can't be solved on-site. For example, traffic impact fees support the cost of additional lanes and/or signalization to accommodate the added traffic generated by projects such as shopping malls and high-rise condominiums. Such impacts cannot be effectively addressed by on-site facilities. Impact fees have also been employed to meet communities' park and recreation standards and other objectives.

Standards and requirements have evolved for adopting and applying such fees and have been institutionalized in legislation in several states. Some of these statutes impose so many administrative burdens and limitations on use of the impact fee revenues that they are essentially impractical. At least one state, Georgia, has adopted legislation that specifies limited uses of developer impact fees that do not include stormwater management. Specific applications of impact fees have also been the subject of a great deal of litigation nationally. An unusual aspect of impact fees is that state courts around the country have been notably inconsistent. Recent cases that have reached the United States Supreme Court have added some clarity. The following is a summary of pertinent cases provided by David Burchmore, author of Legal Considerations, Chapter 3.

> City of College Station v. Turtle Rock Corporation, 680 S.W.2d 802 (Texas 1982)
> College Station adopted an ordinance requiring developers to dedicate land or pay an in-lieu fee for new parks. Turtle Rock paid the fee and sued. The Texas Supreme Court ruled that the ordinance was

"reasonable" and "accomplished a legitimate goal substantially related to public health, safety, welfare."

Nollan v. California Coastal Commission, 483 U.S. 825 (1987)
Nollan wanted to replace his beachfront bungalow with a larger house. The Coastal Commission required public access across his property to the beach and an adjacent park. Nollan sued. The US Supreme Court supported Nollan, stating there was no "essential nexus" between imposed conditions and impact of use.

Northern Illinois Builders Association v. County of Du Page, 165 Ill. 2d 25 (Ill. 1995)
NIBA challenged the legality of two State enabling acts and three County ordinances imposing road impact fees. The court declared the first act and the first ordinance unconstitutional, and the second act and second ordinance constitutional. Monies collected under the first ordinance were ordered returned.

In Hillis Homes v. Snohomish County, 97 Wash. 2d 804 (Wash. 1982), the state Supreme Court invalidated an impact fee imposed on residential development to help pay for schools on the ground that the exaction was in effect a tax intended to raise revenue, rather than a fee intended to regulate land use, and that only the state legislature could levy such a tax.

Florence Dolan v. City of Tigard, 512 U.S. 374 (1994)
Ms. Dolan wanted to expand her hardware store and pave her parking lot. Tigard requested dedication of an adjacent floodplain and bikeway. Dolan refused and sued. The US Supreme Court ruled there was no "essential nexus" and that the City failed to demonstrate that the benefits justified the requirements.

Erlich v. City of Culver City, 114 S. Ct. 2731 (1994)
The Supreme Court extended the Dolan analysis from property dedications to development fee exactions. Erlich was the owner of a defunct private health and tennis club, and sought a building permit to construct condominium townhouses on the project site. The city approved the permit but conditioned it on payment of numerous fees, including $280,000 to enable the city to build tennis courts that would replace the facilities lost with the demolition of the tennis club. Erlich refused, and sued claiming that the fee exactions bore no relationship to the impact caused by the project. The Supreme Court granted certiorari, vacated the judgment of the lower court dismissing the case for failing to state a takings claim under the Fifth Amendment, and remanded the case "for further consideration in light of Dolan."

Impact fees are typically limited to situations in which the impact of new development on existing infrastructure systems is: 1) measurable and certain; 2) of definable geographic or systemic extent; and 3) quantifiable in terms of the incremental capital investment that will be required to maintain (not attain) an adequate service level in the face of the added growth attributable to the subject development. The final point is critically important in terms of stormwater management systems. Impact fees cannot be used to bring inadequate existing systems up to an adequate service level. Nor can they be used to address the impacts of other past, present, or future developments. Thus, they are not useful in correcting many deficiencies that already exist in stormwater systems. Impact fee revenues must also be earmarked for specific projects or uses, must be expended relatively quickly, and, if not, must be returned to the developer, often with interest.

Developer Extension/Latecomer Fees

Developer extension/latecomer fees are a good example of resources available to stormwater management entities that do not directly generate income but support attainment of important objectives. They are not a revenue mechanism, but rather a means of apportioning capital costs among several properties as they are developed. The most common use of this type of fee around the country is for water and sanitary sewer system extensions.

Extensions to utility systems and other infrastructure improvements are often built by developers. Under the developer extension/latecomer fee concept, the initial developer is later compensated for providing the facilities by fees applied to subsequent developers that tap onto or otherwise make use of the improvements. Although such fees are not specifically authorized in legislation in most states, they can be adopted as part of a comprehensive stormwater user fee rate structure or negotiated on a case by case basis.

A developer extension/latecomer fee works in the following way. Developer "A" proposes a project that requires a stormwater (or water, or sewer) system with "x" capacity for its own purposes. However, practical design considerations indicate that a larger system should be installed to properly serve other nearby properties that are currently undeveloped. Developer "A" therefore is required to build a larger system than necessary simply to serve his or her own property, and incurs an additional cost. Property owners subsequently tapping into the improved system when their development occurs are charged a one-time fee, and the fee is then transferred to Developer "A". This type of fee is structured so that Developer "A" and all other users of the facilities ultimately bear a fair proportion of the capital cost. The management entity typically receives no revenue from the fee, although some charge administrative expenses on top of the capital cost.

Federal and State Funding

Federal and state funding for local stormwater management takes many forms, including technical support, facility construction, cooperative programs, and grants and loans for various purposes. Local governments are generally authorized to make use of federal and state government funding, such as the State Revolving Fund Loans financed by EPA to achieve CWA objectives, for various purposes including stormwater management, flood control, and water quality protection.

SERVICE FEE AND ASSESSMENT DESIGN CONSIDERATIONS

The remainder of this chapter will focus on service fees and to a lesser extent assessments.

There are many reasons for local governments to adopt service fees to fund their stormwater programs. These include: 1) generation of sufficient revenue to meet capitalization and operational expenses; 2) customizing the apportionment of costs among various segments of the community; 3) support a growth management strategy, facilitate life-cycle asset management, or help segregate costs related to unfunded federal and/or state mandates; and 4) diminish a general revenue budget problem by moving stormwater off that source of funding and substituting service fees. Regardless of the specific motivation, the process of designing a stormwater utility funding strategy introduces the need for a higher level of analysis than that required for general fund revenue allocations.

Design of both service fees and assessments must meet general and technical standards. Standards differ between fees and assessments, and vary from state to state as a result of constitutional, legislative, and case law differences as addressed in Chapter 3. Selection of a preferred approach is not a purely technical issue. It is not required that the very best technical approach be selected. A user fee rate structure that fits local practices and meets basic industry standards may serve a community better than a highly detailed, very expensive approach that is confusing to the public. In many cases, decisions are influenced by practical considerations like public perceptions of equity, implementation and upkeep costs, timing, and ease of understanding. The following considerations are among those commonly used to evaluate and select preferred methods for design of user fee rate structures.

Legality

Nearly thirty (30) percent of the respondents to a recent national survey of stormwater utilities indicated that their stormwater utility funding decisions had been subjected to a legal challenge of some sort.[5] That such a high percentage would be contested on legal grounds is probably not surprising given that the funding decisions and user fee rate structures involve money. The legal issues are addressed more thoroughly in Chapter 3, Legal Considerations, however the following is provided to help provide context for service fee and assessment design considerations.

Stormwater management is clearly a function that falls within the general authority of cities and counties in most states. Managing and funding that function as a utility is now an accepted practice, and both cities and counties have the latitude to adopt stormwater user fees in many states. The courts in several states have determined that there are certain characteristics that determine whether a charge is a tax, service fee, special assessment, or exaction. Although the detailed findings in the various states differ, they are influenced by both intent of the legislative body and the structure and application of the funding methods and charging mechanisms. Procedural issues that may have an impact on the legality of service fees and assessments include the following:

- What was the intent of the jurisdiction in establishing the charge, and how are funds being used?
- Was the service fee adopted simply to counter a budget deficit, or was it predicated on meeting stormwater program costs?
- Does the rate structure satisfy general standards of how service fees should be applied to individual properties?
- Are similar fees charged to similarly-situated properties or customers?
- Are charges to disparate properties or parties consistent and balanced?
- Did the local board or council act with adequate knowledge and consideration of the issues?
- Were all procedural steps scrupulously followed?
- Was adequate publication of notice of intent given for all of formal actions taken by elected officials?

Equity

Attainment of equity is a fundamental objective in the design of both fees and assessments, and one of the primary justifications commonly cited for establishing a utility. Equity has both technical and perceptual aspects. Service

[5] Survey of Stormwater Phase II Communities, National Association of Flood and Stormwater Management Agencies, Washington, DC, July 1999

fee rate methodologies are designed to attain "equity" as a fair and reasonable apportionment of cost of providing the needed services and facilities. Fees are expected to have a substantial relationship to the cost of providing the services and facilities to each customer. In contrast, assessments seek to equitably apportion benefits derived from facilities or services as the means of applying the cost of them. Exactions, such as stormwater impact fees, are not necessarily required to meet standards applicable to fees or assessments, but must exhibit a rational nexus or linkage between the exaction and the purpose of the fee. Taxes generally have to meet only the standards contained in authorizing legislation.

Equity must be weighed against simplicity and clarity. The best utility rate structures generate charges that clearly and simply relate to the services and facilities being provided. A utility service fee rate structure might be highly equitable in terms of assigning costs according to service demands, yet still be deficient politically if it is too complex for the public to grasp the linkage between service, costs, and charges. In the case of stormwater management, most people can understand that replacing natural earth with impervious pavement or structures will diminish infiltration of water and increase runoff. Thus, rate structures based in some manner on impervious area and gross area are common. A realistic objective is to be consistent within generally accepted technical standards that most people will view as fair.

Courts in most states have usually deferred to the judgment of local elected officials in determining what constitutes equity in local applications and have demonstrated a reluctance to intervene in the details of rate or assessment design. Applications accepted by various courts suggest that the relationship must only be sufficient to satisfy reasonable common sense. This leaves the structure and level of service fees, assessments, and some exactions largely at the discretion of locally elected officials. As a result, details of service fee rate methodologies, assessment formulae, and some exaction charges can vary significantly. However, a governance body may not act arbitrarily and capriciously in setting rates and the resulting service fees may be illegally discriminatory or confiscatory.

Technical Foundations

Stormwater service fee rate design practices are derived from an understanding of hydrology and stormwater runoff from individual properties. A rate structure analysis is performed to determine how costs might be apportioned among those who are served in various ways by expenditures for operations, capital improvements, and support activities. Since stormwater facilities and services cannot be metered or directly measured, they must be represented by one or more parameters believed to reflect the service demands and therefore the costs.

Timing is a consideration in formulating rate methodologies and setting the amount of fees. The structure of a rate methodology is intended to recover pertinent costs over a given period of time, most commonly a budget period or, in the case of bonded capital projects, a debt service period. For example, infrastructure is provided to collect, convey, and discharge stormwater runoff in a manner consistent with prudent design and applicable water quality standards. The resulting system capitalization is generally applicable to all properties served by the improvements, ranging from those at the top of the hill to those at the bottom of the hill who are protected from upland drainage.. By using different rate parameters and finance mechanisms, a rate designer can alter the apportionment of costs among such customers over time.

Expensing capitalization costs through annual budgets focuses the financial impact on rates that customers pay during the budget period in which projects are constructed. Bonding to finance projects spreads capitalization cost over the debt service period. Accepted rate design standards do not dictate that costs be allocated on an annual, debt-service period, or service life basis. That is left to the discretion of locally elected officials. What is expected is that apportionment of costs is generally consistent with the service demands of the properties served by the facilities.

Life-cycle costing of stormwater infrastructure is an emerging issue. Because a large proportion of the cost of stormwater capital infrastructure is initially borne by private developers, their costs have not been allocated directly to stormwater ratepayers in most cost and rate analyses. However, much of the stormwater infrastructure built by developers is transferred to public stormwater service providers, and the long-term expense of recapitalizing the improvements as they wear out becomes a public cost. Cost of sustaining such infrastructure has not, however, been incorporated into financial planning and analyses of most local governments or stormwater utilities.

With the advent of the stormwater utility concept, the perspective on long-term life cycle accounting of stormwater infrastructure has begun to change. Most water, wastewater, electrical and other utilities have incorporated the life-cycle cost of capital assets in their rate projections and financial reporting for many years. In 1999 the Governmental Accounting Standards Board (GASB) introduced Statement 34 on infrastructure reporting which introduces comparable accounting for capital assets into general governmental practice. This reinforces the standard of full accounting for life-cycle costs of stormwater systems and facilities, and mandates incorporating them into cost and rate analyses.

Origin of Costs

Conditions on individual properties, which collectively dictate what types of systems, programs, and activities must be provided, are primary factors influencing stormwater costs. The objective of service fee rate design is to craft a schedule of fees for various users that reflect the cost of efficiently meeting their cumulative service demands. Modern stormwater assessment design objectives are more often reflective of the cost of providing benefits to the subject properties rather than value of the benefit, which was the traditional approach employed when assessment were based on property value.

"Service" can be defined in much broader terms than just operational activities and physical facilities directly attributable to a given property's stormwater runoff. For example, it is clearly a service to upland properties that their stormwater runoff is collected and safely conveyed to a discharge point. Such service relieves them of the responsibility of disposing of their runoff, and reduces their potential liability for downstream impacts. At the same time, a service is also clearly being provided to downhill properties in the form of protection from the upstream runoff. Flood protection and regulatory programs that protect floodprone areas reduce public emergency and recovery costs. Drainage of roads and sidewalks facilitates mobility essential for public safety services, commerce, education, and other aspects of modern life. Stormwater quality management protects and enhances environmental health.

Precision is not a defined standard in formulation of costs or service fee rates. Cost analyses produce estimates, some of which can be more exact than others. The cost of operating a particular piece of equipment can be rather accurately projected, but watershed capital infrastructure plans may provide only an engineer's estimate of the future cost of acquiring land and constructing a stormwater facility. An estimate may be a valid reference point for incorporating projected capital costs into rate structure and fee analyses, but the actual costs may vary from the estimate. And the rate structure and/or fees may have to be adjusted from time to time.

A variety of approaches are used in assigning costs among customers. Some communities have opted to localize capital costs by watershed to attain a high degree of association of their infrastructure costs with the property owners served. Localizing capital costs by watershed is also common practice when stormwater utilities employ special assessments. Most, however, have determined that their system capitalization costs are relatively consistent, that the service provided by such improvements is not limited to individual properties in specific areas, and allocation of the costs can reasonably be applied to the entire jurisdiction or utility service area. They reason, for example, that adequate drainage system capitalization along roadways is a service to the entire community.

A community's historic approach to capitalizing stormwater infrastructure may influence rate design. Many communities have historically funded stormwater system capitalization from general revenues, spreading the cost throughout the community, though facilities may not have been equally capitalized throughout the jurisdiction. After spreading the cost community-wide for years but not attaining uniform service capability, it would be inappropriate to localize future capital costs by watershed even if that approach more closely reflects the origin of cost for specific facilities to be built by the stormwater utility.

Revenue Sufficiency

If a service charge is adopted, it is essential that the enhanced stormwater program provide visible results. A new fee that doesn't achieve a higher level of service is more likely to face opposition than one that provides demonstrable improvements. In order to ensure that is attained, a service fee, along with any other funding sources, must generate sufficient revenue.

Flexibility

A service fee offers extraordinary flexibility compared to other funding methods. Within reason, a rate structure can be designed to apportion costs as a board, council, or commission wishes. There is no absolute prescription that must be followed. For example, some communities charge properties located in floodplain areas less than upland areas, but the City of Boulder, Colorado imposes a surcharge for floodplain properties. Some communities only charge developed properties, while others also charge service fees to undeveloped lands.

The latitude given to local elected officials to make various decisions regarding the design of a rate structure is a distinct contrast to taxation concepts based on property value and assessments based on benefit. Taxation methods generally allow little flexibility, and cannot be selectively applied or tailored to specific needs. Although assessment methodologies are generally more flexible than taxes, they must reflect direct and special benefit.

A service fee rate structure can also be augmented by secondary funding mechanisms and altered by modifications to tailor the cost allocation to the local situation. For example, many stormwater utilities use credits to recognize on-site control systems or activities that reduce the public expense of stormwater management. Such credits can be creative. The City of Griffin, Georgia negotiated a service fee credit with the local school district. The district agreed to teach an environmental education program that satisfied most of the City's NPDES permit public education mandate. Mecklenburg County (Charlotte), North Carolina offers a partial service fee credit to industrial properties that have their own NPDES permits.

Balance of Rates with Level of Service

A general legal standard for a utility service fee rate structure is that it must be fair and reasonable. The resultant charges must bear a significant relationship to the cost of providing services and facilities. The balance between rates and service levels does not have to be precise or perfectly consistent. If significant differences in service levels prevail over time, however, a rate structure should reflect the variance to a reasonable degree. This can be accomplished in several ways. The rate structure itself might be altered in some way. The rate charged per equivalent unit of the service might be reduced or increased. A modifying factor or surcharge might be applied to the basic rate to reflect a lower or higher service level provided to a specific geographical area or customer group.

Data Requirements

The data requirements of various rate structures differ, sometimes significantly. Two general rules usually prevail: 1) new data costs more than existing data; and 2) each additional increment of precision costs more than the previous one. As a result, many communities prefer to use existing data and apply a rate structure that is relative simple and gross. The number of parameters necessary to calculate a service fee for each customer is an important cost consideration, but it is not necessarily less costly to use a single parameter rather than two or more. If complete and accurate data is readily available from an existing source, it does not necessarily cost more to assemble a master account file based on a more precise parameter or several parameters, though that is usually the case.

Industry standards for stormwater service fee rate structures have coalesced around a few data parameters that have a demonstrated relationship to the cost of stormwater services and facilities. Impervious area is a common parameter, not only because it is closely related to runoff rates and pollutant loadings but also because many communities already have that data in the form of planimetric polygons defining building footprints, paving, etc contained in their geographical information systems. If, however, the data is available only as line definitions and not in closed polygons, the polygons have to be created to measure the area. This may involve interpreting satellite imagery, aerial photographs and property line maps, and may make impervious area a more expensive parameter to implement. In some cases, an algorithm can be applied to the line segment data to join segments into polygons that can be measured, but that approach requires a significant amount of quality assurance review.

The data requirements associated with implementing and maintaining a stormwater service fee depend more on the subtleties of the rate methodology and the use of modifying factors than on the basic parameters selected. If an impervious area method were to be applied to all properties individually, impervious area information would have to be generated for residential as well as non-residential parcels. However, if a simplified residential service fee is utilized, data requirements and costs might be reduced by as much as 70 percent regardless of the type of rate methodology employed.

Implementation costs of a tiered residential rate structure are usually higher than for a single flat-rate residential service fee. A two-tier or three-tier simplified rate structure for residences requires some additional analysis of the residential housing stock subject to the charge. If information available from other databases could be used to determine the proper assignment of residential properties to different tiers, the impervious area of individual properties would not have to be carefully measured. However, experience has shown that grouping residential properties is only slightly less demanding than precisely measuring the impervious area on each property.

The cost of implementing an impervious area rate structure is a function of the number of properties that must be measured, the accuracy standards adopted for data, and the measurement technique employed. Techniques available for determining the impervious area and gross area of individual properties range from very time-consuming and expensive on-site measurements to photo-interpretive methods using scaled aerial photographs or satellite imagery. Cost of developing impervious area data has ranged from less than $1 to over $6 per unit, depending primarily on whether or not a simplified residential rate is used.

Accuracy standards also influence the cost of both initial implementation and subsequent data maintenance. Use of an equivalency unit for grouping properties into ranges subject to a rate schedule allows less exacting data standards to be used without diminishing the percentage of properties that are correctly charged according to the rate schedule. Automating the maintenance of the data file can significantly reduce the on-going administrative expense. If building permit applicants are required to provide impervious area coverage figures, the information can be transferred directly to a service fee master account file.

Some counties and cities use both gross and impervious area or gross area and a second data parameter reflecting the intensity of development (percentage of imperviousness) instead of the actual impervious area. These approaches involve two parameters, but do not necessarily increase the cost of implementation and upkeep if the required data is readily available from existing sources. Intensity of development can be interpreted relatively quickly and cheaply for each property, and properties can be assigned to general categories instead of assigning unique development intensities to each one.

A mistake sometimes made by cities and counties when they first adopt a rate structure is to use a parameter simply because they have an existing database, not because it correlates with the cost of stormwater services and facilities. For example, at least a few cities and towns have used water meter size or even water use as a stormwater service fee parameter, simply because the data was readily available. This can lead to serious problems if the stormwater rate structure is challenged in court because there is little if any correlation between such factors and the cost of providing stormwater management.

Compatibility with Data Processing Systems

The cost of implementing and applying a stormwater utility service fee includes the work required to assemble a master account file comprised of customer names and the data required to calculate a billing. A master account file must also be linked to or integrated in some manner with a billing system that enables the service fee to be delivered to the proper party, payments received and processed, and proper accounting to be performed. All of these typically involve extensive use of a computer data processing system and one or more databases.

Degree of compatibility of a preferred service fee rate methodology with existing databases and data processing systems directly influences the cost of long-term maintenance and operation of utility funding. Service fee billing, collection, and accounting costs are often less if a stormwater charge can be added to an existing system rather than creating a new means of delivering the billing and processing payments.

A majority of city stormwater utilities bill their service charges on water, wastewater, solid waste, electric, gas, and other municipal utility service bills. Many counties are primarily rural service governments that do not operate such utilities, so another approach is needed. Most counties have local property tax assessment, billing, and collection responsibilities. Therefore, county stormwater utility service fees in some states are added to their property tax billings. Some counties have opted to prepare separate service fee billing systems so as to avoid any confusion between property taxes and stormwater service fees. Special service districts either integrate the master account file and billing with existing water, wastewater, or other billing systems or, in some states, they are able to attach stormwater billing to a county or city property tax billing.

Consistency with Other Local Funding and Rate Policies

Most urban communities have a variety of funding mechanisms in place and adopted policies that portray local practices. If, for example, a community has water and sewer service fee rate structures that use residential flat rates, a simple residential stormwater fee would probably be very acceptable. If, however, local water and sewer rates are very complex, the general public's expectations are likely to be geared to that level of refinement. A flat-rate stormwater service fee for all residential properties might not be perceived as sufficiently accurate.

Revenue Stability and Sensitivity

Fortunately, stormwater service fee rate structures are not prone to some of the revenue stability and sensitivity problems of water and wastewater (sewer) methodologies. Stormwater costs and rates are generally associated with providing and maintaining a provisional system capacity that is fully utilized only infrequently, rather than with delivering a certain amount of water or collecting and treating a relatively consistent quantity of wastewater each day. As a result, the revenue stream of a stormwater service fee is not susceptible to conservation measures like water and wastewater utilities. Stormwater utilities do not have to increase rates as a result of customers reducing their consumption of a commodity like potable water.

SERVICE FEE RATE AND ASSESSMENT METHODOLOGIES

Rate Design

Conventions are emerging as stormwater utility service fees and assessments become increasingly common. Impervious area, gross area, percentage imperviousness, and land use are the most frequently used parameters.

Service Fees

In most instances, service fees are cost-based, i.e., they are designed to reflect the impacts that each property has on stormwater service demands and thus the cost of providing facilities and operational and support activities. Such costs are primarily a function of peak stormwater runoff rate, total volume of discharge, and pollutant contributions, but design practices for stormwater service fees and assessments have yet to settle upon a single common standard or even a generally-accepted best model for calculating charges.

Empirical studies have demonstrated that impervious surface area on a property is the single most significant factor influencing all of these impacts. Impervious area is also relatively easy to identify and quantify numerically and is the most common parameter used in stormwater service fee calculations. However, the impact of a given area of impervious surface may also be influenced by its shape, slope, surface condition, vegetation, and nature of its discharge to a conveyance conduit or channel.

Location of impervious and pervious areas on a given site is also important in determining the degree of runoff mitigation that results due to the presence of pervious areas. Runoff from an impervious parking area draining across a broad grass slope of permeable soil to a roadside ditch may be significantly less compared to that of a similar impervious area collected and drained by storm sewers. This has led some to focus on "directly-connected impervious area" in their stormwater rate structures.

Percentage of imperviousness is also significant because pervious surfaces may mitigate runoff impacts from a given property. Relatively few stormwater service fee methodologies employ impervious percentage directly in the calculation of service fees, but it is indirectly accounted for in methodologies that use a combination of gross area and impervious area or gross area and intensity of development.

Permeability of soil and vegetative conditions may also influence the mitigation effects attained from pervious areas. However, soil and vegetative conditions are rarely considered because they can vary dramatically, even across a single site. There are very few reliable and accurate soil inventories, soil conditions may be altered in the course of development, and vegetative effects vary significantly from season to season.

Assessments

Modern urban stormwater benefit assessment parameters are different than those employed in earlier times. Stormwater assessments were historically derived from ditch law practices applied to drainage and protection of agricultural areas. Since agricultural income was closely tied to the area protected or improved by the drainage practices, property area was the most common parameter for apportioning the benefit and impervious area was not a common consideration. Because the systems subject to drainage and ditch law assessments were geographically and functionally limited, built to protect acres owned by relatively few farmers, assessments would typically be based on acreage each owned. In later periods, property value was often used as the parameter for assessment calculations.

In contrast, the service area of modern urban stormwater districts or utilities is typically much larger with thousands of properties and owners. In addition, urban stormwater management may not always have a distinct benefit that is direct and special to individual properties. Therefore, use of the special assessment process for urban drainage projects must carefully evaluate area to be served, benefit to be provided, and relationship of benefit to individual parcels which might be assessed. Present-day assessment calculations are frequently based on parameters similar to those employed for stormwater service fees, i.e., impervious area, gross area, and development intensity. Additional discussion of this topic is included in the section covering Special Assessments in this chapter.

Uniform and Tiered Charges

A majority of rate structures currently in force employ uniform (flat-rate) or tiered fees for some or all customers rather than a calculated charge based on conditions on each property. The most common form is a flat-rate for detached single-family residential properties, coupled with discrete rates applied to non-residential properties. Two or three tiers of residential rates are common in communities that have a diverse housing stock. Some rate methodologies also apply uniform or tiered rates of various sorts to other classes of customers. For example, individual mobile home parks, condominiums and townhouses are sometimes billed flat rates per unit.

Rate structures that classify and group properties by development intensity or land use and apply a fixed rate to the classes are a form of tiering. For example, gross area/intensity of development rate structures commonly group properties into five to ten descriptive classes ranging from undeveloped or very lightly developed to very heavily developed. Such rate methodologies also typically group customers into gross area increments, so dual tiers of area and development intensity are used in the fee calculation formulae. A few communities have adopted very simple rate structures that charge residential properties one flat rate and all other properties another. Given the diversity of non-residential development conditions, this approach does not attain a high degree of equity in apportionment of costs of service.

Service and Equivalency Units

Many communities have opted to use various service units or equivalent unit values in their utility rate methodologies. For example, water rates are often based on metered use of gallons or cubic feet of water, which are units of service. Solid waste charges are frequently based on service units such as the size and number of bins or the tonnage of waste dumped at a transfer station. Stormwater service units or equivalency unit values are usually based on impervious area or gross area, and are most commonly derived from the typical or average condition on a single-family residential property. Terms like "equivalent residential unit" or "equivalent service unit" are commonly used to describe these values.

Service units or equivalency units are typically applied as "block charges", where customers are billed for increments of use. Water customers may be billed in increments of 1000 gallons or 100 cubic feet, rather than for a precise number. Such practices have been adapted to stormwater service fees. For example, Columbia County, Georgia uses an impervious area stormwater rate structure and charges each customer a fixed rate for each 100 square feet of impervious coverage.

Some communities have opted to use a combination of flat rates for single-family residential customers with an equivalency unit applied to other types of properties. For example, an average residential property in a given community might be determined to have 3,000 square feet of impervious area (including roofs, drives, walks, patios, etc), and this value might be used as a service or equivalency unit for other customers. All single-family residential properties might be charged for one equivalent unit, or two or more tiers of that increment might be applied to residential properties. The impervious area on other types of properties would be measured and that figure divided by 3,000 to determine the number of equivalent units that each should be charged. It is common practice to bill for each equivalent unit or fraction thereof, effectively rounding up to the next full unit.

Water and sewage rate structures often include increasing or declining fee schedules to encourage or discourage consumption, in which incremental "blocks" are defined. For example, in water and sewer rates the first 10,000 gallons used or discharged in a month would be charged at one rate, the next 10,000 gallons at another, and so on. This practice is not common in stormwater rates, though a few jurisdictions that bill undeveloped as well as developed properties employ declining rates to moderate the charges on large undeveloped tracts of land.

One of the benefits of a service or equivalency unit value is that it allows easy comparisons of charges among dissimilar customers. For example, under the assumptions used in describing an impervious area rate methodology previously, a commercial or other non-residential property with ten times as much impervious area as a typical residence (assumed to be 3,000 square feet) would be charged for ten units of use. A "big-box" retail store (or small shopping center or industrial site) with 600,000 square feet of impervious coverage (about fourteen acres) would be billed for 200 units.

Classification and Grouping of Like Customers

Classification and grouping of like customers having similar characteristics and/or service demands is a common practice in utility service fee rates. For example, wastewater treatment demands and costs are related not only to the volume of the waste to be treated, but also to the type of constituents found in the wastewater and their strength or concentration. Some users discharge wastes to public sewers that are radically different than a typical residence. Therefore, wastewater rates for some commercial and industrial customers may include both a volume component and a strength component.

This particular wastewater rate practice has not been directly adapted to stormwater rates, but a comparable classification or grouping of like customers based on their impacts on stormwater services and facilities has been incorporated into some rate structures. For example, all single-family detached residential properties are often grouped in a single user class or into tiers and each class is then billed a common rate. In a gross area/intensity of development rate methodology, properties having like land use may be grouped in a single intensity of development classification, e.g., all commercial office properties might be deemed heavily developed for rate calculation purposes. Industrial properties or those undergoing land disturbance activities might be grouped for NPDES impacts and erosion/sediment control service demands.

Service Fee Credits

Many communities have modified basic stormwater rate design practices to accommodate local circumstances. Perhaps the most widely-used modification to basic rate structures is application of a credit adjustment to service fees. Credits are typically conditional, i.e., they are premised on continuing specified performance by the customer. If the specified performance is not maintained, credits may be rescinded. The concept is similar to industrial pre-treatment credits commonly provided wastewater customers to reduce strength of sewage discharged into public systems.

Stormwater service fee credits are most commonly provided for properties that have on-site detention or retention facilities. In most cases detention or retention systems are designed to approximate pre-development conditions or to meet capacity limitations of downstream facilities. Such controls reduce capacity requirements (and cost) of downstream systems and may, if properly designed and maintained, enhance water quality. Credits have also been given for facilities or activities that assist in provision of services or reduce the public cost of providing services.

Credits have also been adopted in some jurisdictions for properties subject to and in compliance with National Pollutant Discharge Elimination System (NPDES) permits and for public and private schools providing approved water quality education programs. The rationale for the latter credit is that education is a minimum control measure in NPDES Phase 2 stormwater discharge permits. If not provided by local schools educational programs the service would have to be performed by the stormwater management entity at additional cost to the ratepayers.

Various means are employed to provide service fee credits to properties having on-site detention. For example:

- Boulder, Colorado, for properties providing on-site detention, has administratively adopted the practice of reducing the normal service fee twenty (20) percent for an on-site detention system that meets standards for a 5-year storm. Systems that meet 100-year storm requirements are eligible for an eighty (80) percent reduction.

- Bellevue, Washington changes the intensity of development classification of properties with detention systems to that of very lightly developed land, resulting in a variety of percentage reductions, depending on the intensity of development classification that would normally be applied to the subject property.

- Charlotte, North Carolina allows up to fifty (50) percent credit for peak runoff attenuation and up to twenty-five (25) percent credit for flow volume reductions.

Practices elsewhere reduce service fees between thirty-three (33) percent and seventy-five (75) percent in recognition of on-site control that reduces runoff rates. In most situations the long-term impact on revenue resulting from this type of adjustment is minor, typically no more than one or two percent. Ratepayers who do not have on-site systems have to pay slightly more to cover the minor deficit resulting from the credits.

The primary intent of credits is to recognize reductions in the cost of public stormwater services and facilities that can be attributed to private systems or activities. Credits only partially compensate developers who install and properly maintain facilities. Rarely do they offset loss of space such facilities occupy or the degree to which on-site systems disrupt the layout of commercial properties and subdivisions. Nor do most credits consider water quality impacts of on-site systems, or their influence on the cost of stormwater quality management. However, they do marginally improve equity of service fee cost allocations.

The balance of fees with level of service required and provided is, at least in theory, improved by use of credits. On-site control of peak flow of stormwater runoff means that a property requires less service from the public stormwater system. Downstream reductions in peak runoff allow a higher level of service from a given size of facility or enable a community to build smaller systems in the future. A reduction in pollutant discharges into the public system could translate into lower NPDES permit compliance costs.

Developers' engineers can provide the information required to incorporate a credit for on-site measures. An allowable runoff release rate based on pre-development conditions and required on-site storage capacity can be used to determine the effectiveness of each on-site facility for crediting purposes.

Example Stormwater Rate Methodologies

The rate structure concepts used as examples in this guidance are typical of those adopted in the more than five hundred communities that have established stormwater utilities or special districts. Direct comparison with rate methodologies used in specific communities is not productive, however, since the general approaches examined in this guidance should be viewed in the specific context of the local needs, priorities, and circumstances of each community.

Generally speaking, any rate methodology that incorporates gross area tends to reduce the proportion of the service costs allocated to commercial and other intensely developed properties and increase the proportion of costs assigned to residential and less intensively developed properties.

Example stormwater rate methodologies examined in this guidance base stormwater fees on:

- impervious area;
- a combination of impervious area and gross area;
- impervious area and the percentage of imperviousness; and
- gross property area and the intensity of development.

Impervious Area

Stormwater rate structures based solely on impervious area have been widely used. They are simple, the concept is easily understood by the general public, and is generally perceived as equitable.. Impervious area rate methodology reflects a philosophy of allocating costs based on each property's contribution of runoff to the system. Large expanses of roofs and paving in shopping centers and other commercial and industrial business areas are highly visible to the general public, and most people understand the hydrologic impact of covering natural ground with paving and rooftops. The approach is generally consistent with local service fee rate practices for wastewater services, wherein fees are based on the amount of water used and strength of effluent discharged to the public treatment works.

Numerous technical studies, references, and citations in engineering literature technically validate the equity of an impervious area rate methodology. The coefficient of runoff value in hydrologic engineering tables closely approximates the percentage of impervious coverage. Empirical evidence gathered in the field by monitoring changes in runoff before and after development verifies that impervious coverage is the key factor influencing peak stormwater runoff. Data gathered during the National Urban Runoff Program (NURP) in the 1970's and 1980's and subsequent research showed that impervious area is the most dominant factor in pollutant loadings conveyed by stormwater runoff.

The impervious area approach may introduce a "timing" problem in the acquisition of capital assets. Impervious area service fees typically are applicable only to developed properties, but stormwater capital improvements are designed to accommodate future growth. Present ratepayers may be paying for capacity provisions far beyond their own use, and undeveloped properties (not subject to an impervious area fee) would not be charged for their future needs. Other funding mechanisms, such as development impact fees or system development charges, can be used in concert with an impervious area rate methodology to ensure that undeveloped properties ultimately participate in the cost of capital improvements designed with capacity to serve them.

An impervious area rate methodology is highly stable and insensitive to property alterations by ratepayers. The rate of revenue growth using an impervious area methodology would more or less correspond to the pace of development. Economic downturns would tend to diminish the addition of new impervious area and the stormwater revenue growth, while rapid growth would add to it. Reductions in impervious coverage on individual properties are rarely justified merely to reduce stormwater fees. Alterations that would reduce stormwater fees are essentially infeasible under all the rate structure scenarios examined in this guidance.

Most impervious area rate structures include simplified single-family residential service fees, often applied as flat-rate charges. Charges to non-residential properties may be structured in a variety of ways under an impervious area methodology. In some cases the single-family residential property, "equivalent unit" value, or ranges of impervious area (100, 500, or 1,000 square feet) are used as a billing unit.

Impervious area service fees are usually calculated by dividing the amount of impervious area on each parcel by an equivalent unit or a range value to determine the number of billing units and multiplying a charge per unit. Very few use the exact amount of impervious area on each property because the accuracy of the impervious area data typically available does not support such a precise calculation.

The following example illustrates how service fees based on impervious area might be calculated. Assume that a typical single-family residential property is determined to have 3,000 square feet of impervious area including driveway and patio area as well as roof coverage. An annual rate of $.02 per square foot of impervious coverage would result in a typical residence being charged $60.00 per year, or $5 per month.

If a flat-rate fee were applied to all single-family residences, an equivalency value equal to the impervious area of the typical single-family residence might be used to determine charges to other properties, including multi-family apartments. The 3,000 square foot increment might also be used as a range value in the rate structure, with all non single-family residential properties grouped into impervious area ranges of 3,000 square feet which serve as a billing unit.

All properties in a given range are typically charged the same fee even though they might have slightly different impervious area. For example, using an equivalency unit of 3,000 square feet of impervious coverage, two commercial properties with 21,000 square feet of impervious area would be charged for seven equivalent units (7 X $60 = $420/year) even if their gross property areas differed. A large shopping center or discount store with 600,000 square feet of impervious coverage would be charged $12,000.

An impervious area rate methodology is not highly flexible or subject to judgment in its application to specific properties. It is based on a single parameter that can be accurately measured, although modifying factors might be applied to the basic rate calculation. Approaches based on parameters like intensity of development allow substantially more judgment to be applied, both in the design of the rate methodology and in its application to specific properties.

Other funding mechanisms can be blended with an impervious area service fee. For example, a system development charge could be adopted to recapture a system capitalization component from properties as they are developed. Other revenue sources can be used to supplement service fees, such as general revenue support for an NPDES stormwater quality program.

Impervious Area and Gross Area

Both total property area (gross area) and impervious coverage of properties influence amount, peak rate, and make up of stormwater discharged to public drainage systems. A combined impervious area and gross area rate methodology can account for both factors. Most stormwater rate methodologies utilize one or the other parameter in calculation of fees. A few (including Denver, Colorado) use both parameters to derive percentages or ratios used in rate calculations.

The concept underlying an impervious/gross area rate methodology is relatively easy to explain and grasp. It is consistent with the public's general understanding of hydrology and the impact that both gross area and impervious coverage have on stormwater runoff. This type of rate methodology tends to allocate more of the cost burden to lightly developed and undeveloped properties than methodologies that are based strictly on impervious area. Depending on the weighting factors and/or cost allocations, however, smaller properties that are almost entirely covered with impervious surfaces could conceivably be charged more than larger properties that are undeveloped or very lightly developed with little impervious coverage.

An impervious/gross area rate methodology requires that the mix of impervious and gross area in the service fee calculation be "tuned" to properly reflect the significance accorded to each parameter. This can be achieved in at least two ways: 1) by applying weighting factors to gross and impervious area; or, 2) by allocating certain costs of service to each parameter. Weighting assigned to gross and impervious area should be consistent with the local hydrologic conditions, patterns of development, program requirements (e.g., operating versus capital needs), balance of stormwater quantity and quality program costs, and the community's perceptions.

Rates could be structured in a variety of ways under this approach to reflect the importance assigned to each parameter. Units of gross area might be charged a basic rate, with a surcharge applied to units of impervious coverage. Alternatively, cost of service might be apportioned between impervious area and gross area instead of assigning specific costs to each parameter. For example, eighty (80) percent of total stormwater cost of service might be allocated to impervious area and twenty (20) percent to gross area.

Coefficients of runoff used in hydrologic engineering suggest that gross area to impervious area ratios in a service fee calculation might be as low as 1:4 or as high as 1:40. If costs are allocated to the two parameters, the significant influence of impervious coverage on peak runoff and pollutant loading suggests that seventy-five (75) percent or more of the costs should be assigned to the impervious area component of the rate.

Solely for the purpose of illustrating how fees might be calculated using an impervious/gross area methodology, assume that each 100 square feet of gross area might be charged $.10 (ten cents) per year. A surcharge of $1.60 per year might be applied to each 100 square feet that is covered by impervious area. This would yield an effective ratio of 1:17 between areas that are pervious and those that are impervious (i.e., areas covered by impervious surfaces would be charged seventeen times as much as areas that are not). That ratio is generally consistent with the difference in peak runoff between undeveloped and developed properties.

Applying the example values cited above to a twelve thousand (12,000) square foot residential property with 3,000 square feet of impervious coverage would result in a total service fee of $60 per year or $5 per month. The charge for the gross area of the property (12,000/100 @ $.10 = $12/year) would be added to the charge for the impervious coverage (3,000/100 @ $1.60 = $48/year). An undeveloped 12,000 square foot property would be charged $12/year in this scenario.

Applying the same values to a small commercial property of 30,000 square feet having 21,000 square feet impervious (70 %), the annual service fee would be $366 per year (30,000 sq ft / 100 x $0.10 = $30/year for the gross area and 21,000 sq ft / 100 x $1.60 = $336/year for the impervious coverage). Thus, the stormwater service fee would be more than six times as much as that for the example 12,000 square foot residential property even though the example commercial property is only two and one-half times larger in gross area. The proportionately greater increase reflects more intense development of the larger parcel in this example (70 % impervious coverage versus 25 % for the residential example).

Using the same formula, if it is assumed that a 600,000 square foot shopping center is completely covered with impervious rooftops and paving, the annual service fee would be $10,200 (600,000 sq ft / 100 x $0.10 = $600 for the gross area plus 600,000 sq ft / 100 x $1.60 = $9,600 for the impervious coverage). In both commercial examples cited, the gross area/impervious area rate methodology results in slightly lower fees for the non-residential properties than does the impervious area methodology examined previously, but that is purely a function of assigned values and is subject to modification.

A gross area/impervious area rate methodology facilitates charging undeveloped properties a service fee. Charging undeveloped properties would broaden the rate base, especially if extensive rural areas were included in the utility service area. It would also enable some operating and capital expenses to be distributed among all properties, although system development charges or other funding methods to recapture financial participation in infrastructure capitalization may still be needed. Using the above example values, an undeveloped 12,000 square foot property might be charged $ 12 per year (12,000 sq ft / 100 x $0.10), an undeveloped 30,000 square foot property would be charged $ 30 per year (30,000 sq ft / 100 x $0.10), and an undeveloped 600,000 square foot would be charged $600 per year (600,000 sq ft / 100 x $0.10). Because charges to very large undeveloped acreages quickly escalate, such rate methodologies might need to have a schedule of incrementally declining charges as the size of properties increases.

A residential flat-rate charge could also be used with this methodology, using a sample of residences to determine how much gross and impervious area is typical in a given community. The residential rate could constitute equivalent unit values for both parameters. Obviously, different rates for gross area and impervious area might be applied in all of the above examples to meet the cost of services and facilities or apportion costs differently.

Both gross area and impervious area data are needed for this methodology, adding to the cost of developing a master account file, although fee calculations could be relatively simple. The gross area on each property might be divided by a billing unit increment (100 square feet in example above) and multiplied times a charge per unit. The same could be done for impervious area, with the two sub-totals added together to generate service fee amounts. Adjustments and credits might be applied to either or both of the parameters.

Cost of implementation and upkeep of this type of rate methodology is influenced by the cost of assembling data for a master account file and the computer programming associated with billing/collection and billing inquiry processes. Using a flat-rate charge for one or more classes of properties would substantially reduce costs. Maintenance of information might also be simplified by requiring data from developers' engineers and/or architects when plans are submitted.

Potential revenue capacity of this type of rate structure is somewhat greater than the impervious area approach because it could conceivably charge both undeveloped and developed properties. For the residential component, the revenue stream would probably be equal to or greater than other methods described in this guidance, depending on weighting factors and rates assigned and/or allocation of costs.

This approach is comparable to the other rate structure options in its stability and insensitivity to external influences. Being based on gross area and impervious area, there is little that can be done by a property owner to reduce parameters that drive the amount of the service fee.

Applying weighting factors or allocating costs to gross area and impervious area makes this approach especially flexible. A broad range of weights could be assigned to gross area and impervious area to account for unusual conditions, presence of modifying considerations like on-site detention or water quality impacts, or runoff mitigation normally realized on large undeveloped tracts. System development charges and other secondary funding methods could also be coordinated with parameters used in this type of rate structure.

Impervious Area and Percentage of Impervious Coverage

This type of rate methodology is currently used by the City/County of Denver, Colorado. Under this rate structure amount of impervious area and impervious percentage are both used to calculate service fees, dictating that data on both impervious and gross area be used. Gross area is not relevant to the service fee calculation, except that it is needed to determine the percentage of imperviousness. Under this approach impervious area of each property is charged at varying rates depending on the percentage of imperviousness of the subject property. Each square foot of impervious area is typically charged more as the percentage of imperviousness increases. Because this rate methodology is based on impervious area, undeveloped lands are often not charged.

Some anomalies may occur in service fees that result from this type of rate methodology. Consider two properties of different sizes with the same amount of impervious coverage. Because its percentage of imperviousness could be a lot higher, the smaller property could be charged more than the larger property.

The key determinant of charges to individual properties (and of overall revenue capacity) under this rate concept is the schedule of charges per unit of impervious coverage. Properties may be divided into several classes based on their percentage of imperviousness (referred to as "ratio groups" or "imperviousness classes"), and a varying rate per impervious area unit might be applied to each class. For example, properties having ten (10) percent imperviousness or less might be charged $.06 per year for each 100 square feet of impervious coverage, while properties with eleven to twenty percent imperviousness might be charged $.15 per year for each 100 square feet. Proportionately higher values are usually applied as the percentage of impervious coverage increases.

Being based on two parameters which are accurately measurable, impervious area and gross area, from which the percentage of imperviousness is calculated, this approach gives an impression of greater accuracy than some other options. Judgment is introduced to the service fee calculation in the form of different charges for various imperviousness classes.

A community's perception of equity resulting from this rate methodology may be mixed, and may depend on the number of classes or ranges used for percentage imperviousness and schedule of rates assigned to them. To the extent that a shift in the distribution of costs toward heavily developed properties benefits single-family residences, homeowners would likely see a lower bill than under other rate structures. They might view the balance of services and charges favorably. However, charges for intensely developed commercial properties would not be as favorable as they would bear a much higher proportion of cost of service.

Table 2-1, below, presents a schedule that is typical of what might be applied under this approach.

Table 2-1: Example Schedule of Rates

(per 100 square feet of Impervious Coverage)

Impervious Percentage	*Annual Rate/100 Sq. Ft. of Impervious Area*
1 to 10 %	$.50
11 to 20 %	$1.35
21 to 30 %	$2.00
31 to 40 %	$2.70
41 to 50 %	$3.35
51 to 60 %	$4.00
61 to 70 %	$4.70
71 to 80 %	$5.40
81 to 90 %	$6.00
91 to 100 %	$7.70

A typical residential property has between twenty and forty percent impervious coverage. Some houses are much larger but have a much lower percentage of imperviousness because they are on very large lots or acreage. Recent trends toward very large residential subdivisions with smaller lots and larger structures are resulting in much more intense residential development and increased stormwater runoff. This is being mitigated to some extent by the use of green design practices, such as retention of stormwater in rain gardens and detention ponds.

Both the size and density of residential development are common reference points in the design of impervious area/percentage of impervious area stormwater rates. An average residence in an urban community might have a 12,000 square foot lot and 3,000 total square feet of impervious area (25 %) including driveways and patios. When an impervious area/percentage of impervious area methodology is used, an annual service fee for such a residence under the example schedules of charges might be $60/year (3,000 sq ft/100 x $2), or $5.00/month. The previously-cited example of a commercial property of 30,000 square feet with 21,000 square feet of impervious coverage, 70 % imperviousness, would be billed $987/yr under this methodology with the schedule of rates shown in the table (21,000 sq ft/100 x $4.70 = $987). The 600,000 square foot commercial shopping center example property (100 % impervious) would be charged $46,200/yr. (600,000 sq ft / 100 x $7.70 = $46,200).

This example illustrates just one approach to a schedule of rates for different percentages of impervious coverage. With the same residential service fee as in the impervious and gross area/impervious area rate methodology examples

($60/year), the service fee both for the small commercial and the large retail shopping center would be much greater. It is entirely a function of the rate assigned to each range of imperviousness.

Obviously, care must be taken in designing the schedule of rates to ensure that appropriate allocations of cost of service result. It must also be recognized that this methodology can create anomalies relative to service fees as compared to other rate methods. These calculations are a function of specific schedule of rates used in this example and could be changed by adjusting the schedule.

This rate concept would require that both gross area and impervious area data be gathered. Incorporating a simplified charge for single-family residences could significantly reduce the number of properties requiring specific data. Future maintenance of data for developing properties could be accomplished by requiring that gross area and impervious area data is supplied by each developer's engineer or architect as part of project plans.

This approach would require that the file record be larger than for some other options in order to accommodate use of two parameters. A rate methodology could be written to calculate percentage of imperviousness and assign a property to a classification, or ratio group, based on the data. Some specialized programming might be required for this, but programming expenses would not be significantly greater than for other options.

Revenue capacity of this type of rate structure is greater than most of the other options examined in this guidance, especially if a highly progressive schedule is used. In Denver, Colorado this methodology generates perhaps twice as much revenue per square mile as some of the other rate methodologies because the very heavy weighting applied to the percentage of imperviousness results in much higher charges for intensely developed properties.

The stability and sensitivity of this rate methodology is consistent with the other options considered. Even using a highly progressive schedule of rates, the level of service fees would probably not induce property owners to remove impervious area from their properties. It simply is not cost-effective for most property owners to reduce the impervious area just to reduce a stormwater service charge.

Despite being based on two parameters, this rate concept retains a fair degree of flexibility. Flexibility is directly related to how classes of imperviousness are defined and the schedule of rates assigned. By tailoring number and size of the classes and schedule of rates, flexibility comparable to the other rate structures is achievable. Modifying factors and secondary funding methods such as system development charges can also be used.

Gross Area and Intensity of Development

Rate structures based on the gross area of each property and its intensity of development are currently used by the cities of Bellevue and Tacoma, Washington and Cincinnati, Ohio. An intensity of development factor is usually very similar to the coefficient of runoff. The term "intensity of development factors" is commonly used rather than a "coefficient of runoff", because the relationship of intensity of development to stormwater runoff is easily grasped.

If applied to every parcel, this type of rate methodology requires that gross area be determined for all residential as well as non-residential properties and an intensity of development rating be assigned to each. Most communities using this method have opted to apply a simplified service fee or schedule of fees to one or more categories of single-family residential parcels, but there is no uniform practice. Non-residential properties are usually categorized into five to ten descriptive groups ranging from "undeveloped" to "very heavily developed". If a flat-rate residential charge is not used, all residential properties are typically assigned to one or two of the intensity of development categories.

Local development patterns may influence how residential properties are treated under this rate methodology. Only one residential intensity of development category might be needed in a community that has highly uniform residential development. More categories might be appropriate in another community that has residential lots ranging from 3,000 square feet to several acres.

Typically, the intensity of development values range from a low figure ranging between .02 and .20 for undeveloped or lightly developed properties up to .85 or even .95 for industrial and commercial uses. This approach groups similar properties and applies average values to all assigned to a given classification. For example, all apartments might be classified as multi-family residential with an intensity of development factor equal to .65 instead of assigning individual ratings ranging from .50 to .85 to individual apartment developments. The gross area parameter is the controlling element of rate calculation for all parcels in a given classification. An apartment building on 40,000 square feet of gross lot area would usually be billed one-half the amount charged to an equivalent apartment building on an 80,000 square foot property.

Calculation of service fees can be structured in several ways under a gross area/intensity of development rate structure. When a simplified residential charge is used, the service fee usually compares conditions on non-residential properties to a defined average specified for residential properties. For example, a typical residence is assumed to have a gross lot area of 12,000 square feet and an intensity of development of 0.25, and a commercial property of 30,000 square feet has an intensity of development of 0.70. The commercial property has an area 2.5 (30,000 sq ft/12,000 sq ft) times larger than the residential lot, and has an intensity of development 2.8 (0.70 / 0.25) times greater. The example commercial property's stormwater charge would, therefore, be seven times that of the charge to a typical single family residence (2.5 x 2.8 = 7.0).

Using the example properties previously cited, the 12,000 square foot residential property assigned an intensity factor of .25 would be charged $5/month or $60/year (12,000 sq ft x 0.25 / 100 x $2.00/sq ft = $60/year). The 30,000 square foot commercial property with 21,000 square feet of impervious coverage assigned an intensity factor of 0.70 would be charged $35/month or $420/year (30,000 sq ft x.70 / 100 x $2.00/sq ft = $420/year). A 600,000 square foot shopping center property fifty times as large as the single-family residential property assigned an intensity of development factor of .90 would be charged $900/month or $10,800/year (600,000 sq ft x .90 / 100 x $2.00/sq ft = $10,800/year).

This approach allows service charges to undeveloped as well developed properties. For example, Bellevue, Washington assigns a very low intensity of development factor to undeveloped lands. It results in service fees that are about one-ninth (11 percent) of charges for comparably sized residential properties and even a lower percentage when compared with more intensely developed commercial or industrial parcels. Even at relatively low rates, this could generate a substantial amount of additional revenue compared to the impervious area rate methodology applicable only to developed properties when used in jurisdictions with extensive undeveloped areas.

The perceived equity of this type of rate structure is normally equal to or greater than that of other approaches, but the methodology requires a careful explanation to the community. Simplifying terminology associated with the rate methodology is desirable. That is why many jurisdictions use a phrase like "intensity of development factor".

Adjustments to individual bills or even entire classes of properties can be achieved by reducing or increasing the intensity of development factor for an individual parcel or for a class or other grouping. It is common for jurisdictions using this approach to assign an "effective" intensity of development to individual properties in response to service fee appeals, leaving the door open for adjustments that achieve a fair and reasonable rate when anomalous conditions exist.

Data requirements associated with this type of rate methodology would be less than for other options. Gross area information can often be extracted from existing databases and/or maps. Assignment of an intensity of development factor would require that judgment be used in reviewing conditions on each parcel, possibly using aerial photographs. Some additional work would be needed in the event that undeveloped properties were to be charged.

This type of rate structure tends to push a greater proportion of the cost of service onto residential and other lightly developed properties than methodologies based on impervious area, although the differential has diminished as average housing size has increased. Overall revenue capacity could be increased by also charging undeveloped properties. Like other stormwater rate structures examined in this guidance, revenue capacity of the gross area/intensity of development approach is relatively stable and insensitive to external influences

Flexibility of an intensity of development rate structure is equal to or somewhat better than other methods because of latitude available in defining categories and assigning intensity of development factors. A great deal of engineering judgment is involved in determining the intensity of development (coefficient of runoff) of a parcel in a given situation, and the engineering literature offers rather broad ranges of development intensity values. For example, values from .25 to .45 are not unusual for single-family residential parcels.

CHAPTER 3

LEGAL CONSIDERATIONS

OVERVIEW

The type of funding mechanism selected for a stormwater utility or stormwater management program has a variety of legal consequences. Taxes, user fees, special assessments, impact fees and other revenue sources can be used, but each approach will have different implications in terms of who will pay, what procedures must be followed to implement and collect the charge, and how the money can be used. If the funding approach is deemed to be a tax, then tax-exempt entities such as churches, schools, state agencies and federal government facilities will contest their obligation to pay. In many states special taxpayer approval must be sought. If a user fee approach is used, the reasonableness of the rate structure and its relationship to the service being provided may be challenged. If impact fees or special assessments are used, there will be limitations on how and where the funds can be applied.

The distinctions between the various funding approaches are often blurred. In general terms, a tax is an enforced burden imposed by sovereign right for the support of the government, the administration of law, and the exercise of various functions the sovereign is called upon to perform. In some cases there may be little practical difference between a tax and a fee, but the legal distinctions between the two are important. Many states have constitutional or statutory restrictions on the ability of local governments to levy taxes, such as requirements for special voter approval or super-majority votes in the state legislature, which do not apply in the case of fees or charges that are levied by the exercise of local regulatory authority.

State-imposed limits on property taxes have been part of the fiscal landscape for decades, but the nature of those limits changed dramatically in 1978, when California voters adopted Proposition 13, which rolled back property taxes to 1 percent of market value and limited annual increases in property values for tax purposes. Arizona, Massachusetts, New Mexico and Washington adopted very strict limits soon after passage of Prop 13, and Colorado, Missouri, Montana and Oregon followed suit. Many states that do not fall under the strict limitation category require voter approval for local tax increases, and others require super-majority approval for tax hikes in the state legislature.

User fees are charges based upon the proprietary right of the governing body permitting the use of the instrumentality involved. Such fees have certain common traits that distinguish them from taxes. First, they are charged in exchange for a particular governmental service which benefits the party paying the fee in a manner not shared by other members of society. Second, they are voluntary or paid by choice, in that the party paying the fee has the option of not utilizing the governmental service and thereby avoiding the charge. Third, the amount of the fee is designed to recover the actual cost of the service being provided, rather than to raise general revenues for other government purposes.

The boundary between special assessments and user fees is not always clear. Generally, a fee is exchanged for a service rendered or a benefit conferred, and some reasonable relationship exists between the amount of the fee and the value of the service or benefit, while a special assessment is a specific levy designed to recover the costs of improvements that confer local and peculiar benefits upon property within a defined area.

Impact fees are one-time payments from property developers to municipal, county or school district governments for off-site improvements necessitated by new development. Such fees may be authorized by state enabling statutes or, in some states, may be imposed without legislative approval under the general home rule or regulatory authority granted by state constitutions and statutes. Impact fees differ from user charges in that they typically fund capital expenditures, not current services.

The legality of various funding mechanisms for stormwater management programs is primarily a question of state law. This guidance cannot survey or analyze the legal implications of different approaches in all 50 states, but it can highlight certain common issues that have arisen to date. Careful research will be needed to determine an appropriate fee structure in your jurisdiction, which will depend on the constitutional and statutory provisions governing the authority of local governments and special purpose districts in your state, as well as the case law interpreting those provisions.

For example, *City of Wichita, Kansas v. Kansas Taxpayers Network,* 874 P.2d 667 (Kan. 1994) involved the interpretation of certain substantive and procedural aspects of the city's home rule authority under Kansas law. Similarly, in *Densmore v. Jefferson County,* 813 So. 2d 844 (Ala. 2001), the Plaintiffs challenged a 1995 state statute as a "local" act (under Alabama state law) that had not been properly advertised under the state constitution. The Alabama Supreme Court held that the statute had been properly enacted in accordance with the applicable state procedures. In *Billings v. Nore,* 148 Mont. 96; 417 P.2d 458 (1966), the Montana Supreme Court was called upon to determine, among other things, whether a stormwater ordinance enacted by the City of Billings was an administrative function or a legislative action that could be subject to repeal by special voter initiative under Montana law.

Stormwater management program fees have been the subject of litigation resulting in reported opinions from at least 17 states, including many cases involving final decisions by the state's highest court:

- Montana – 1966
- Colorado – 1986 and 1993
- Kentucky – 1989 and 1996
- Ohio – 1990
- Oregon – 1992 and 1993
- Kansas – 1994
- Florida – 1995, 1998 and 2003
- Washington – 1997
- Virginia – 1998
- Tennessee – 1998
- Michigan – 1998 and 2001
- North Carolina – 1998 and 1999
- South Carolina – 1999
- Alabama – 2001
- California – 2002
- Georgia – 2004
- Illinois – 2005

In addition, there have been unreported decisions from the lower courts in these and other states that have involved similar challenges to local stormwater fees, for example cases involving the cities of Tacoma and Bellevue, Washington (ca. 1984); and Atlanta, Georgia (1999).

In several instances, the results of such litigation have required a legislative "fix" to provide the proper authorization for the financing mechanism employed by the local stormwater utilities. In the state of Washington, for example, Washington RCW 90.03.525 was enacted to impose a stormwater charge on the Washington Department of Transportation at a level equal to 30% of the rates charged to other landowners. In North Carolina, GS Ch. 153A-277 was enacted in the wake of the 1999 state supreme court decision, in order to authorize the collection of fees for compliance with federal and state environmental regulations as well as for more traditional drainage services. In other cases, the courts have been called upon to determine the applicability or legality of existing statutory provisions authorizing the creation and funding of local stormwater utilities, such as Fla. Stat. § 403.031 and S.C. Code Ann. § 48-14-10.

COMMON THEMES

Based upon these cases, certain common themes or central issues have emerged. The question whether a stormwater service charge is actually a "tax" has been the issue most frequently litigated, along with related inquiries into whether the charge is actually a special assessment that cannot be levied against the parties challenging the fee. Subsidiary issues such as whether the charge is reasonably related to the cost of the services provided, and whether it is fairly imposed on the properties that are benefited by those services, have also been explored.

Tax vs. Fee

The most commonly litigated issue is whether a municipal stormwater service charge is a valid user "fee" or an impermissible "tax." This issue has frequently arisen in cases brought by tax exempt organizations such as churches, schools, and state agencies such as departments of transportation. As discussed in further detail below, it is also the central issue when local stormwater fees are levied against federal government facilities, which are exempt from local taxation but not from the requirement to pay normal utility charges.

The great majority of recent cases favor the position that stormwater service charges are a fee. Such cases continue to be filed because public perception has been shaped by the historical fact that stormwater drainage costs have traditionally been financed through general revenues, and, as noted above in Chapter 2, any new form of government funding is likely to be viewed as a "tax" regardless of technical distinctions in the manner in which it is structured. This phenomenon can be observed in cases such as those from California and Michigan where taxpayer groups are the plaintiffs and stormwater utility fees are derided as a "rain tax." In Oregon, where a state constitutional amendment (section 11b) defined a "tax" as "any charge imposed by a governmental unit upon property or upon a property owner as a direct consequence of ownership of that property except incurred charges and assessments for local improvements," the state tax court characterized a city storm drainage fee as follows:

> Respondent's storm drainage charge is exactly the kind of "johnny-come-lately" charge on property the public anticipated and intended to limit. Storm drainage systems are traditional municipal facilities. Like city streets, parks, street lights and street signs, storm drains are viewed as part of the infrastructure benefiting the public generally. Local governments may not avoid the limits of section 11b simply by calling something a "service" and requiring payment of a "fee." If that were the case, a city could impose a fire or police protection fee on all persons using improved property. These kinds of serpentine maneuvers, if accepted, would eviscerate the constitutional limitation. . . . [S]ection 11b was adopted as an

> initiative measure by angry, frustrated voters. Local governments which use sophistry, rationalization and self-justification in an attempt to evade the impact of [that section] do their citizens a disservice. *Roseburg School District v. City of Roseburg*, 12 OTR 329; 1992 Ore. Tax LEXIS 33 (Ore. Tax. Ct. 1992).

Although this decision was subsequently reversed by the Oregon Supreme Court, as described below, it is illustrative of the sentiment that continues to inspire protracted litigation on this issue in states across the country.

Found Not to Be a Tax

Stormwater funding mechanisms have been upheld as valid user fees in the cases arising in Kentucky (1989), Colorado, Florida, Washington, Tennessee, South Carolina, Georgia and Illinois.

In *Long Run Baptist Ass'n v. Louisville MSD*, 775 S.W.2d 520 (Ky. App. 1989), the Plaintiffs challenged the constitutionality of a stormwater service charge that was based on an "Equivalent Surface Unit" approach (1 ESU for all residential parcels; 1 ESU per 2500 sq. ft. for commercial and industrial parcels). The court of appeals found that the service charge was not a "tax" and was reasonable and uniform in its application.

In *City of Littleton v. State,* 855 P.2d 448 (Colo. 1993), the City sought to collect unpaid stormwater management fees from state-owned school properties. The Colorado Supreme Court found the charge was not a tax or special assessment, but a service fee reasonably designed to meet the overall costs of the service provided. The court also found that the portion of fee used to construct and maintain the drainage system was essential to provision of the services.

In an earlier case, *Zelinger v. City and County of Denver,* 724 P.2d 1356 (Colo. 1986), the Colorado Supreme Court denied a class action challenge to the City and County of Denver's Ordinance No. 160, which dealt with fees and service charges assessed for the city's storm drainage facilities. The plaintiffs claimed that the ordinance unconstitutionally denied equal protection and due process guarantees to property owners and also contended the ordinance was an unconstitutional property tax. The supreme court disagreed and affirmed the trial court's decision that the ordinance was rationally related to a legitimate state purpose of financing the maintenance and construction of new storm sewers, and that it established a valid service charge rather than an unconstitutional tax because the funds raised by the fee were not used for general revenue purposes but were segregated and used solely to pay for the costs of the "operation, repair, maintenance, improvement, renewal, replacement and reconstruction of storm drainage facilities."

In *Smith v. Spokane County,* 948 P.2d 1301 (Wash. App. 1997), the state court of appeals found that a fee charged for funding certain "Aquifer Protection Areas" was not an unconstitutional tax and would be upheld if it was reasonable and designed to cover only the costs of the program. In reaching this decision, the court relied upon an earlier Washington Supreme Court decision, in *Teter v. Clark County,* 704 P.2d 1171 (Wash. 1985), which held that charge for a county storm and surface water utility was not a tax but a valid regulatory fee.

In *Vandergriff v. City of Chattanooga,* 44 F. Supp. 2d 927 (E.D. Tenn. 1998), city taxpayers challenged validity of a local stormwater ordinance on various state and federal constitutional grounds. The federal District Court found the ordinance imposed a fee, not at tax, because the charges were based on use of the stormwater system, and applying a portion of fees to construct or expand facilities as well as to defray cost of operating the system was explicitly authorized by state statute.

In *South Carolina v. City of Charleston,* 513 S.E.2d 97 (S.C. 1999), the State of South Carolina brought a declaratory judgment action to determine whether city was authorized to impose stormwater fees on state facilities pursuant to a state statute, S.C. Code Ann. § 48-14-10, which authorized local governments to establish a "stormwater utility" and to fund it either through a fee or a tax assessment. The City of Charleston created its utility by local ordinance, and opted to fund it through a fee. The state argued that although denominated a fee, the charge involved was really a tax. The state supreme court found that the plain, ordinary and unambiguous language of the statute allowed local governments to fund the utility through either a fee or an assessment, and that the city had chosen to use a fee, which could properly be imposed on State property.

In *McCleod v. Columbia County,* 599 S.E. 2d 152 (Ga. 2004), the County imposed a stormwater fee based on impervious area of developed property. Property owners challenged the fee as an invalid tax. Noting that a charge is generally not a tax if it provides compensation for services rendered, the Georgia Supreme Court held in a unanimous decision that the fee was "not arbitrary and bears a reasonable relationship to the benefits received by the individual developed properties in the treatment and control of stormwater runoff."

An earlier, unpublished decision from the Georgia Superior court, *Fulton County Taxpayers Association v. City of Atlanta*, No. 1999CV05897, 1999 WL 1102795 (Ga. Super. Ct. Sept. 22, 1999), came to a different conclusion. However, the City of Atlanta stormwater utility charge, unlike the charge involved in the *McLeod* case, contained no provision for a landowner who has no street frontage or a landowner who has his or her own manner of disposing of stormwater runoff, such as ponds or other systems, to "opt out" or obtain a credit against the stormwater fee. The fee was also struck down because it was similar to a tax used to raise money for general purposes. The city did not satisfy the court that the funds were dedicated to stormwater and water quality improvements.

In *Church of Peace v. City of Rock Island*, 2005 Ill. App. LEXIS 448 (2005), an Illinois appeals court found that the stormwater fee levied by the City of Rock Island is not a tax and that churches are not exempt from payment of the fee. The court found that, under Illinois law, a tax may be distinguished from a fee by observing that a tax is a charge having no relation to the service rendered and is assessed to provide general revenue rather than compensation. A fee, on the other hand, is proportional to a service or benefit rendered. Using this analysis, the court found the stormwater service charge was clearly a fee, because there was a direct and proportional relationship between imperviousness and stormwater runoff, thus creating a rational relationship between the amount of the fee and the contribution of a parcel to the use of the stormwater system. The court also found that the fee at issue was "voluntary," because the "opt-out" provisions in the ordinance meant that persons choosing not to avail themselves of the stormwater drainage system provided by the city could do so and avoid paying the fee.

Found to Be a Tax

Stormwater fees have been struck down as invalid taxes requiring explicit voter approval under specific state laws or constitutional amendments ("taxpayer rebellion" provisions) in California and Michigan, and were also rejected in two lower court decisions interpreting a similar provision in Oregon before the later of those decisions was reversed by the Oregon Supreme Court.

In *Howard Jarvis Taxpayers Ass'n v. City of Salinas*, 98 Cal. App. 4th 1351 (2002), the City established a storm drainage fee on all developed property, based on impervious area. Taxpayers challenged the fee as a "property related" fee requiring voter approval under the Article XIII.D of the state constitution, which was added in the 1996 elections as a result of Proposition 218, the "Right to vote on Taxes Act." The trial court found that the fee met an exception in the constitutional provision for "water and sewer services," but the appellate court reversed because the fee was not directly based on or measured by use.

In *Bolt v. City of Lansing,* 587 N.W.2d 264 (Mich. 1998), the City established a stormwater fund to pay for sewer separation costs, based on an "equivalent hydraulic area" formula. The Appeals Court (1997) found it was a "user fee" and not a "tax." The Michigan Supreme Court, in a divided 4-3 decision, found that City was charging landowners a "rain tax," requiring voter approval under the so-called "Headlee Amendment" to the state constitution, because the charge was being used to pay for the capital investment on the utilities and services. On remand to the lower court, the decision was found to be prospective only, and no refunds of previously collected fees were required. That decision was upheld by the Supreme Court in 2001.

However, in *Roseburg School District v. City of Roseburg,* 851 P.2d 595 (Or. 1993), the Oregon Supreme Court found that city's storm drainage utility fee was not a tax on property that would have been subject to the limitations of Article XI.11b of the Oregon Constitution (adopted in 1990 by a initiative petition known as "Ballot Measure 5"). The city had structured the utility fee in an effort to avoid the constitutional restriction, by making it "a fee for service and not a charge against property." The court found it significant that unpaid charges did not become a lien against the property, and that the person responsible for payment could seek a reduction or elimination of the storm drainage service charge by demonstrating that the service was not being used.

An earlier case decided by the Oregon Tax Court went the other way. *Denney v. City of Gresham*, 12 OTR 194, 1992 Ore. Tax LEXIS 7 (1992). In that case the user charge was related to the amount of impervious surface area on a property: $2.75 per month for all "residential property," and $2.75 per month for each 2,500 square feet of impervious surface on all other property, such as multifamily, commercial and industrial. The tax court found that the only way an owner of an improved property could avoid the charge was to destroy the improvements, removing impervious surfaces. The court also found that the charge could not be "controlled" or "avoided" by any practical means.

The City of Roseburg explicitly designed its ordinance to avoid the outcome in *City of Gresham*. The Oregon Tax Court was not persuaded, finding the charge to be a tax as it had in the *Gresham* case. *Roseburg School District v. City of Roseburg*, 12 OTR 329; 1992 Ore. Tax LEXIS 33 (1992). However, the Oregon Supreme Court found the refinements made in Roseburg's ordinance sufficient to distinguish it from the *City of Gresham* case and reversed the tax court's decision.

Voluntary Service and "Opt-Out" Provisions

One element that has been found to influence the question whether a stormwater service charge is a tax or a fee is whether the user has a choice to accept or decline the service (sometimes phrased in terms of whether there is a "voluntary contractual relationship" between the user and the service provider). In the *City of Roseburg* case, for example, the tax court found that it was "unrealistic to speak as if the property had a choice as to whether it allows runoff. Where the charge is being imposed on existing property, the 'choice' which can be obtained only through modification of the property is not a real choice." The tax court was not persuaded by the city's argument that the owner could control the fee by reducing or eliminating the discharge or water from the subject property. (The Oregon Supreme Court avoided the issue, and reversed the tax court on the ground that the Roseburg fee was not imposed upon the owner of real property as a direct consequence of ownership; rather, the fee was imposed on the occupant to whom the city water service was billed.)

In the recent *City of Rock Island* case, on the other hand, the Illinois appeals court found that the opt-out provisions of a similar ordinance were sufficient to make the charge voluntary. The Illinois court held that, "[w]hile it might be cost prohibitive for each plaintiff to construct its own storm water run-off containment system, each would certainly be able to calculate the cost of doing so versus the cost of paying for the use of the City's system. Voluntary participation involves nothing more than weighing the competing costs of participation."

The federal courts have addressed the same issue on several occasions. In *United States v. Columbia, Missouri*, 914 F.2d 151, 155-56 (8th Cir. 1990), the Eighth Circuit found that even the profit component of the city's water and electric utility rates was not an impermissible tax on the federal government, because [t]he United States' obligation to pay the [fee] arises only from its consensual purchase of the City's property; it does not arise automatically, as does tax liability, from the United States' status as a property owner, resident, or income earner. When the United States purchases water, electricity, and related services, and then pays the utility bill, it does so as a vendee pursuant to its voluntary, contractual relationship with the City."

On the other hand, in *United States v. City of Huntington, West Virginia*, 999 F.2d 71, 72-73 (4th Cir. 1993), the Fourth Circuit concluded that a city ordinance imposing a "fire service fee" and a "flood protection fee" on the United States, premised "on the basis of square footage of the buildings" was a tax, and not a user fee, based in part upon the fact that the charge was an "enforced contribution to provide for the support of government." The court found that "liability for the 'user fee' charged by the City arises from the General Services Administration's and United States Postal Service's status as property owners and not from their use of a city service." *Id.* at 74.

In the ongoing litigation involving the stormwater fees imposed by the City of Cincinnati (discussed further below), the courts have sent conflicting signals as to the importance of the "voluntary" nature of the fee. In the original Court of Claims decision, *City of Cincinnati v. United States,* 39 Fed. Cl. 271 (1997), the court held that the storm drainage charge, which was imposed on all property owners within the city and was not the product of a voluntary purchase decision by the federal government, constitutes a tax, not a fee for services, and therefore could not be exacted from a federal entity such as NIOSH.

On appeal, the Court of Appeals for the Federal Circuit agreed that the storm drainage service charge was not imposed as a result of a consensual arrangement between the city and the United States, as would be true in the case of a voluntary purchase of utilities or other services, and found that the stormwater drainage service charge was an assessment imposed on the United States involuntarily, by virtue of its status as a property owner. However, the Court of Appeals did not agree that this fact was dispositive of the question whether the service charge was a permissible fee for services or an impermissible tax. The Court of Appeals stated that "[t]here may be some instances in which a municipal assessment is involuntarily imposed but would nonetheless be considered a permissible fee for services rather than an impermissible tax." *Cincinnati v. United States*, 153 F.3d 1375, 1378 (6th Cir. 1998).

Whether or not a service charge is mandatory or voluntary is thus a factor to be considered, but is not necessarily determinative of the question whether the charge is a tax or a fee. The Georgia Supreme Court has suggested that whether a charge is voluntary is a factor because, if it is not mandatory, it cannot be a tax. *McCleod v. Columbia County,* 599 S.E. 2d 152 (Ga. 2004) (finding that the county stormwater ordinance was not a tax in part because property owners could reduce the amount of the charge by creating and maintaining private stormwater management facilities).

The reverse, however, is not necessarily true – a charge which is mandatory may or may not be deemed a tax, depending on the circumstances of the particular case. Thus, mandatory fees for various types of municipal services have been upheld by a number of courts in recent years. *See, e.g., Bloom v. City of Fort Collins*, 784 P.2d 304, 304-05 (Colo. 1989) (approving mandatory transportation utility fee); *State of Hawaii v. Medeiros*, 973 P.2d 736, 741-42 (summarizing the declining importance of voluntariness in fees in many state courts); *Hochstedler v. St. Joseph County Solid Waste Mgmt. Dist.*, 770 N.E.2d 910, 916 (Ind. Ct. App. 2002) (approving mandatory recycling charge as a permissible fee); *Rogers v. Oktibbeha County Bd. of Supervisors*, 749 So. 2d 966, 967 (Miss. 1999) (upholding mandatory garbage disposal fee on residents who did not use county's disposal system). *See generally* Reynolds, "Taxes, Fees, Assessments, Dues, and the "Get What You Pay For" Model of Local Government," 56 Fla. L. Rev. 373, (April, 2004).

Fee vs. Special Assessment

The issue whether a stormwater service charge is a "user fee" or a "special assessment," giving rise to different procedural requirements, has arisen in Florida (2003) and Colorado.

In *Gainesville v. State of Florida,* 863 So. 2d 138 (Fla. 2003), the state DOT refused to pay the city's stormwater fee, and the city sued. A settlement was reached in 2001, but when the city sought to validate a bond issue for its stormwater utility in 2003 the state DOT objected, arguing that the fee (based on impervious area using an "Equivalent Residential Unit" formula) was not a "user fee" but a "special assessment" that did not apply to state agencies. The bonds that were issued by the city could not be approved if fees were invalid, since the stormwater fees were pledged as collateral for those bonds. The Florida Supreme Court found that the fees were valid user fees, and the bonds were validated. The city was supported in the Supreme Court by an *amicus* brief jointly filed by the Florida Stormwater Association and several environmental groups, including Earthjustice and the Audubon Society.

In the earlier case of *City of Cocoa v. School Board of Brevard County*, 711 So. 2d 1322 (Fla. App. 1998), a Florida appeals court found that a stormwater utility fee was neither a "special assessment" nor an "impact or service availability fee," from which school districts were exempted by statute. The trial court had apparently determined that no portion of the fees sought by the city were "user" fees, but the appeals court determined that the record was not sufficient to establish that the school districts were "involuntary" users of the stormwater utility and remanded the case for further proceedings to determine whether the program established by the city was a valid utility established pursuant to the statutory authority granted by the Florida legislature in Fla. Stat. § 403.031(17). That statute authorized the funding of local stormwater management programs "by assessing the cost of the program to the beneficiaries based on their relative contribution to its need," with regular service bills "similar to water and wastewater services."

In *City of Littleton v. State, supra*, both the trial court and the state appeals court had found that the city's stormwater management fee constituted a special assessment under Colorado state law, which could not be charged against the state agencies involved in the case. The Colorado Supreme Court reversed, after reviewing the factors to be considered in determining the nature of a charge imposed by a municipality against property owners within its jurisdiction. Distinguishing between ad valorem property taxes, excise taxes, special assessments, and special fees, the court recognized that the essential characteristic of a special assessment is that it confers some special benefit to the subject property.

In this case, the services for which the fees were charged did not specially benefit the property owned by the agencies. The court stated that "[c]reating the capacity to remove excess water from property and prevent flooding are general services benefiting all property owners. While the performance of these services prevents diminution of the value of land, such services and the facilities necessary to the performance thereof do not directly enhance the value of the property . . . ." Consequently, the court concluded that the city's stormwater charge was not a special assessment, but a service fee reasonably designed to meet overall costs of the service for which the fee was imposed. Although a portion of the fee billed by the city was used to defray costs of constructing and maintaining a drainage system, such costs were found to be reasonably related and essential to the provision of the contemplated services.

Related to Cost of Services

Inquiry into whether the amount of the fee is "reasonable" and directly related to the cost of providing the services rendered has been conducted in cases from Kentucky, Colorado, Virginia, North Carolina and Georgia. One aspect of this question that is often examined is whether the fees are reasonably related to the actual contribution of the property to the volume of stormwater runoff, or whether all properties are assessed a fixed amount regardless of size.

In *Twietmeyer v. City of Hampton*, 497 S.E. 2d 858 (Va. 1998), the City sued owners of seven residential properties for failure to pay fee based on flat rate. The property owners argued a flat rate fee was not based on contribution to stormwater runoff. The Court found that the city ordinance was not unreasonable because non-residential properties were charged a fee 5 times higher than residential properties ($12.50 per month rather than $2.50 per month).

In one case in North Carolina, the costs of complying with certain elements of U.S. EPA's "Phase II" municipal stormwater permit program were found to go beyond the costs to construct and operate the stormwater drainage system, and the city was ordered to refund that portion of the fee. *Smith Chapel Baptist Church v. City of Durham*, 517 S.E. 2d 874 (N.C. 1999). The City assessed fees on all developed property, based on impervious area. The state Supreme court found in a 1998 opinion that such fees were not covered by a particular state statute, but were nevertheless authorized under the state constitution. However, in its subsequent 1999 opinion after rehearing, the Supreme Court held that the applicable state statute limited fees to the actual cost of providing the stormwater drainage system, and did not cover the entire stormwater management program – in particular, costs incurred solely for compliance with federal environmental regulations (the Phase II stormwater permit requirements). A subsequent amendment to the statute was required to address this issue.

Properties Benefited

The question whether the properties burdened by the fees are receiving a proportionate benefit from the services provided has been examined in Florida (1995), Kentucky (1996) and Alabama.

In the often-cited case of *Sarasota County v. Sarasota Church of Christ*, 667 S. 2d 180 (Fla. 1995), the City imposed a stormwater utility fee on all developed property. The Church argued that the ordinance imposed a tax because it benefited the community at large and church received no specific benefit. The Florida Supreme Court held that the fee was valid because all properties with impervious surfaces benefited from the stormwater services.

In *Kentucky River Authority v. City of Danville, Kentucky,* 932 S.W.2d 374 (Ky. App. 1996), the city argued that it received no benefit from the activities of the Authority. The court disagreed, holding that the preservation of the watershed was a benefit that accrued to all within its boundaries. The court likened the fee to emission fees collected from entities that emit air pollutants and are used to fund the state air program, noting that although there may be no direct or immediate benefit to the payer of the fees, the use of the air and the contamination of it are sufficient to justify the imposition of the fee.

In *Densmore v. Jefferson County, supra*, the Plaintiffs alleged that a county stormwater fee was an unconstitutional tax with no relationship to benefit received by property owners. The Alabama Supreme Court held that the fees were valid because the benefit conferred on property owners need not relate directly to the exact amount paid.

Application to Capital Improvements

Whether or not the fees must be confined to the actual cost of providing stormwater services alone, or whether any surplus can be collected and applied to the cost of system expansion and capital improvements has been litigated in Ohio, Tennessee, Colorado and North Carolina.

In *Wooster v. Graines,* 556 N.E. 2d 1163 (Ohio 1990), the City of Wooster adopted an ordinance to establish a storm drainage utility for maintaining, repairing and improving the sewer system (fees were based on impervious area). The owner of a shopping center refused to pay, claiming the fee was invalid because city accumulated a surplus to fund capital improvements in new areas. The Ohio Supreme Court held that the ordinance was valid because sewer funds were segregated and reserved for future sewer projects in Wooster.

Application of stormwater fees to capital construction costs was also upheld in the *City of Littleton, Vandergriff,* and *Smith Chapel Baptist Church* cases, discussed above.

FEDERAL FACILITIES

The imposition of stormwater fees on federal facilities involves a special consideration of the tax vs. fee issue. The general principle that states cannot tax the United States derives from Chief Justice Marshall's opinion in *McCulloch v. Maryland*, 17 U.S. (4 Wheat.) 316, 4 L. Ed. 579 (1819). Although the immunity of the federal government and its instrumentalities has been the source of often conflicting decisions, "the one constant . . . is simple enough to express: a State may not, consistent with the Supremacy Clause, U.S. Const., Art. VI, cl. 2, lay a tax 'directly upon the United States'. . . . The Court has never questioned the propriety of absolute immunity from state taxation." *United States v. New Mexico*, 455 U.S. 720, 733, 71 L. Ed. 2d 580 , 102 S. Ct. 1373 (1982).

On the other hand, it is well-established law that the United States must pay reasonable user fees. For instance, charges for services from city-owned utilities are clearly fees for which the federal government would be liable to the same extent as any other customer. *See United States v. Harford County, Maryland,* 572 F. Supp. 239, 241 (D. Md. 1983) ("The federal government has . . . recognized its obligation to pay state or county charges based on the quantum of water or sewer services rendered.")

Furthermore, the Clean Water Act contains an express waiver of sovereign immunity for certain pollution-control related fees. Clean Water Act § 313(a) ("Federal facilities pollution control") expressly provides that:

> Each department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal Government . . . shall be subject to, and comply with, all Federal, State, interstate, and local requirements . . . respecting the control and abatement of water pollution in the same manner, and to the same extent as any nongovernmental entity <u>including the payment of reasonable service charges</u>. . . . This subsection shall apply notwithstanding any immunity of such agencies, officers, agents, or employees under any law or rule of law.

Importantly, this waiver applies only to fees or service charges, and not to taxes. As seen in the numerous state cases discussed above, this distinction is often difficult to make in practice. The United States Supreme Court has established a three-pronged test for determining whether fees imposed by local governments on federal facilities are "reasonable service charges" or taxes (*Massachusetts v. United States*, 435 U.S. 444 (1978)):

- Is the fee or service charge non-discriminatory?
- Is it a fair approximation of the cost of the benefits received?
- Is it structured to produce revenues that will not exceed the regulator's total cost of providing the benefits?

Under the *Massachusetts* case, 1) the federal government must not be treated any differently in the enforcement of the fee requirement than other regulated entities; 2) the fee charged must be a fair approximation of the benefits received to be considered "reasonable;" and 3) the fee must be structured to produce revenues that will not exceed the total cost to the state of the benefits supplied. This test has been applied to environmental fees in several cases, most notably the long-running litigation involving the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Department of Energy (USDOE).

That series of cases involved the question of whether certain hazardous waste regulatory charges imposed by New York on federal installations were "reasonable service charges" within the meaning of the sovereign immunity waiver provision in the Resource Conservation and Recovery Act, 42 U.S.C. 6961. In January 1989, NYSDEC brought four consolidated actions in New York State Supreme Court against USDOE to recover unpaid environmental program regulatory charges, including hazardous waste program and waste transporter program charges, assessed by the NYSDEC against ten federal facilities from 1983 to 1989. USDOE counterclaimed for a refund of approximately $ 400,000 and related relief for regulatory charges already paid. Those actions were subsequently removed to the District Court for the Northern District of New York.

Arguing that the waste regulatory charges were unreasonably high, USDOE asserted that in every year between 1983 and 1989, "total waste regulatory charges exceeded [NYSDEC]'s actual services [to the ten federal facilities] by a ratio of approximately nine to one ($1,163,591.58 vs. $ 126,792.13)." The District Court denied both parties' motions for summary judgment because neither party had submitted evidence "as to the value of the overall benefits the facilities receive in light of the programs and services made available to them by [NYSDEC] should the need for such assistance ever arise." *New York State Department of Environmental Conservation v. United States Department of Energy*, 772 F. Supp. 91, 99-100 (N.D.N.Y. 1991).

In later proceedings, the District Court granted NYSDEC's motion for partial summary judgment and denied USDOE's motion for summary judgment. *New York State Department of Environmental Conservation v. United States Department of Energy*, 850 F. Supp. 132 (N.D.N.Y. 1994) ("NYSDEC II"). The District Court explained that the *Massachusetts* test "requires only a rational relationship between the method used to calculate the fees and the benefits available to those who pay them." *Id.* at 143. The Court found such a relationship in this case because (1) larger facilities are more expensive to regulate and require more services than smaller facilities; (2) all services which NYSDEC provides pursuant to these regulatory programs, whether used or not, are available to the United States should they be needed in the future; and (3) the total receipts from these regulatory fees have been substantially less than the actual costs of these programs – all of which demonstrates that NYSDEC's method of calculating its charges results in a fair approximation of the cost of the use of the system.

Following two additional decisions by the district court in 1997 and 1999, the case reached the Second Circuit Court of Appeals. *Jorling v. United States Department of Energy*, 218 F.3d 96 (2d Cir. 2000). At that point, only the reasonableness of the hazardous waste fee was at issue. USDOE did not dispute the first or third parts of the *Massachusetts* test. It acknowledged that NYSDEC's waste regulatory charges were non-discriminatory and were not structured to produce revenues that would exceed the total cost to NYSDEC of the benefits to be supplied. However, it disputed the second part of the *Massachusetts* test, challenging the District Court's finding that no reasonable jury could find that the waste regulatory charges did not meet the "fair approximation" component of the *Massachusetts test*. USDOE argued that the charges cannot meet that component of the test because the charges from 1983 to 1989 exceeded the cost of supplying the services actually received by a nine to one ratio.

The Court of Appeals found that, under *Massachusetts*, a fair approximation of the use of the service adequately serves as a surrogate for an otherwise complicated and expensive attempt to allocate costs. The court cited *Brock v. Washington Metropolitan Area Transit Authority*, 254 U.S. App. D.C. 190, 796 F.2d 481, 485 (D.C. Cir. 1986) for the proposition that "*Massachusetts* did not hold that a user fee must represent retrospectively a close approximation of the actual, historical benefit to the user. Rather, *Massachusetts* held only that the method used to calculate the fee must rationally be designed to approximate prospectively the benefit to the user." The court also found that the *Massachusetts* test applies not only to services used but also to services available for use. Based on these principles, that court found that NYSDEC's waste regulatory charges meet the "fair approximation" component of the *Massachusetts* test, because the method of calculating the hazardous waste program charges was reasonably designed to fairly approximate use of the hazardous waste system's available services, and thereby to approximate the cost of supplying such services to particular generators of waste or operators of waste facilities.

The principles established in the *Massachusetts* case and explored in the *NYSDEC* litigation are currently the subject of ongoing litigation between the City of Cincinnati and the U.S. Department of Health & Human Services (HHS). The National Institute of Occupational Safety and Health (NIOSH), a part of HHS, refused to pay stormwater fees due under a 1985 city ordinance using formula based on size of property and "intensity of development" factor to determine "equivalent runoff units." The city initially attempted to bring suit in Federal Court of Claims based on "implied contract" for services. In *City of Cincinnati v. United States,* 39 Fed. Cl. 271 (1997), the Court of Claims dismissed the claim as an unconstitutional "tax" based on property size rather than services actually used. In *City of Cincinnati v. United States,* 153 F.3d 1375 (Fed. Cir. 1998), the Court of Appeals for the Federal Circuit upheld the lower court's dismissal of the case, but only because there was no "implied in fact" contract between the city and the federal government, and the Court of Claims therefore lacked jurisdiction to hear the case. The Court of Appeals expressly declined to rule whether or not the city's storm drainage service charge was a tax or a fee.

In October 2003, the City re-filed its claim in U.S. District Court, asserting jurisdiction under the Tucker Act and the Declaratory Judgment Act. *City of Cincinnati v. United States,* Case No. 03-731 (S.D. Ohio, filed 10/23/03). The United States filed a Motion for Judgment on the Pleadings in February 2004, arguing *res judicata* and lack of subject matter jurisdiction. In May 2004, the City moved for leave to file an Amended Complaint based on its local ordinance and the waiver of sovereign immunity in CWA § 313. The case was still pending before the District Court for the Southern District of Ohio as of October 2005.

SUMMARY AND CONCLUSIONS

Although stormwater management fees have been upheld in the majority of states where they have been challenged, the passions inspired by the general public perception that any new governmental fee is a disguised and unlawful tax ensures that challenges to such fees will continue to arise. Determining the legality of the financing mechanism chosen for any municipal or county stormwater program will depend upon a close analysis of local state law. Nevertheless, certain general principles emerge from the cases discussed above.

(1) In order for a stormwater service charge to be regarded as a fee, rather than a tax, the local government should be prepared to demonstrate that the overall cost of the program is reasonably related to the value of the service being provided, and that the funds raised are segregated for use by the stormwater program and not for general revenue purposes.

(2) The fee should be structured so that the amount charged to particular properties is proportional to those properties' contribution to stormwater runoff. The distinction may be as simple as a different fee for residential and commercial properties, or as elaborate as a sliding scale based upon "impervious area" or degree of development.

(3) Some provision should be made so that participation in the program can be characterized as "voluntary," whether it is accomplished through an "opt-out" provision for properties with their own stormwater management facilities or a more complex system of credits or offsets based upon the amount of volume actually contributed to the public stormwater system.

(4) In states such as California, Michigan and others with special constitutional provisions governing the imposition of any new tax, it may be wise to seek the requisite voter approval for implementation of local stormwater funding programs even if they are designed and intended to be fee-based rather than tax supported.

CASES CITED (in chronological order)

STATE:

City of Billings v. Nore, 148 Mont. 96; 417 P.2d 458 (Mont. 1966)
Teter v. Clark County, 704 P.2d 1171 (Colo. 1985)
Zelinger v. City and County of Denver, 724 P.2d 1356 (Colo. 1986)
Long Run Baptist Ass'n v. Louisville MSD, 775 S.W.2d 520 (Ky. App. 1989)
Wooster v. Graines, 556 N.E. 2d 1163 (Ohio 1990)
Dennehy v. City of Gresham, 12 OTR 194; 1992 Ore. Tax LEXIS 7 (Ore. Tax Ct. 1992)
City of Littleton v. State, 855 P.2d 448 (Colo. 1993)
Roseburg School District v. City of Roseburg, 851 P.2d 595 (Ore. 1993)
City of Wichita, Kansas v. Kansas Taxpayers Network, 874 P.2d 667 (Kan. 1994)
Sarasota County v. Sarasota Church of Christ, 667 S. 2d 180 (Fla. 1995)
Kentucky River Authority v. City of Danville, Kentucky, 932 S.W.2d 374 (Ky. App. 1996)
Smith v. Spokane County, 948 P.2d 1301 (Wash. App. 1997)
City of Cocoa v. School Board of Brevard County, 711 So. 2d 1322 (Fla. App. 1998)
Twietmeyer v. City of Hampton, 497 S.E. 2d 858 (Va. 1998)
Vandergriff v. City of Chattanooga, 44 F. Supp. 2d 927 (E.D. Tenn. 1998)
Bolt v. City of Lansing, 587 N.W.2d 264 (Mich. 1998)
Fulton County Taxpayers Association v. City of Atlanta, No. 1999CV05897, 1999 WL 1102795 (Ga. Super. Ct. Sept. 22, 1999).
Smith Chapel Baptist Church v. City of Durham, 517 S.E. 2d 874 (N.C. 1999)
South Carolina v. City of Charleston, 513 S.E.2d 97 (S.C. 1999)
Densmore v. Jefferson County, 813 So. 2d 844 (Ala. 2001)
Howard Jarvis Taxpayers Ass'n v. City of Salinas, 98 Cal. App. 4th 1351 (2002)
City of Gainesville v. State of Florida, 863 So. 2d 138 (Fla. 2003)
McCleod v. Columbia County, 599 S.E. 2d 152 (Ga. 2004)
Church of Peace v. City of Rock Island, 2005 Ill. App. LEXIS 448 (2005)

FEDERAL:

Massachusetts v. United States, 435 U.S. 444 (1978)
New York State Department of Environmental Conservation v. United States Department of Energy, 772 F. Supp. 91 (N.D.N.Y. 1991)
Jorling v. United States Department of Energy, 218 F.3d 96 (2d Cir. 2000)
City of Cincinnati v. United States, 39 Fed. Cl. 271 (1997)
City of Cincinnati v. United States, 153 F.3d 1375 (Fed. Cir. 1998)
City of Cincinnati v. United States, Case No. 03-731 (S.D. Ohio, filed 10/23/03)

CHAPTER 4

IMPLEMENTING USER-FEE BASED FUNDING

OVERVIEW

The dynamic change which has occurred in the expectations placed on the municipal stormwater program has overwhelmed traditional stormwater program funding. This has driven the exploration of new funding strategies and given rise to the increasing popularity of user fee/utility based approaches.

The breadth of the changes motivating this exploration has required that not just funding mechanisms be explored. The services delivered by the municipal stormwater program, the quality of those services, the degree to which they satisfy local expectations, and the degree to which they satisfy stakeholders needs, become critical elements in structuring user fee based funding. In the eyes of stakeholders, implementing a new stormwater funding mechanism is secondary to receiving good stormwater system service. The performance of the stormwater program, as perceived by the program's stakeholders, therefore, becomes a focal point of the effort to develop a functional stormwater funding program.

Implementation of user fee based funding involves a related set of actions and activities. These occur within a flexible framework that promotes due diligence in five key areas of focus: political, financial, legal, informational and technical. In some communities a simple vote of the governing body is all that is needed to implement a funding mechanism. In these cases, little program education, stakeholder involvement, and background information may be needed to secure the necessary authorization. In most cases, however, a much more involved process is necessary to bring about program and funding actions. This chapter discusses this framework and process.

FORCES DRIVING ACTION

As described in Chapter 1, over the last thirty years stormwater programs have gone through significant shifts in basic philosophy, approach and service expectation. Originally stormwater programs were intent on efficient drainage, taking runoff quickly to nearby streams. Resulting flooding then caused local communities to change their basic philosophy from "efficient drainage" to one of "flood control" through the imposition of detention requirements and stricter floodplain controls.

Later still the concept of "stormwater master planning" began to replace ineffective detention programs. Then, in the late 1980's stormwater program managers were faced with the need to also address stormwater quality through NPDES and other regulatory programs.

Today there is a convergent set of stormwater program forces that has moved stormwater to a full-fledged urban utility service stature similar to water and wastewater. These forces can vary from community to community, but generally can include:

- ✓ aesthetic and regulatory demands for "greener" environmentally friendly stormwater systems, sometimes without clear definition of what that means, or a track record in concept performance or sustainability;
- ✓ multi-objective disaggregated stormwater system components that integrate conservation and preservation practices, sometimes called, Low(er) Impact Development;
- ✓ integration of stormwater infrastructure planning and design with site layout and function, sometimes called Better Site Design;
- ✓ redevelopment that incorporates "micro-systems" of pollution removal
- ✓ a plethora of commercial and industrial site controls;
- ✓ the need, often mandated through endangered or threatened species considerations, to integrate ecological assessments and designs;
- ✓ mandated public education and involvement in stormwater program conception and implementation, and the emergence of non-profit interest groups;
- ✓ demanding regulatory requirements evolving in a fast changing legal arena, and on again/off again numeric pollutant criteria;
- ✓ ongoing program needs for maintenance and capitalization of the system, often with extended levels of service; and
- ✓ significant reductions in general fund dollars for stormwater programs concurrent with the doubling of stormwater program costs.

THE STORMWATER UTILITY, PROGRAM CONCEPT AND DUE DILIGENCE

Utility Program Concept

The stormwater utility is an umbrella under which individual communities can address their own specific needs in a manner consistent with local problems, priorities, and practices. A stormwater utility provides a vehicle for:

- ✓ consolidating or coordinating responsibilities that were previously dispersed among several departments and divisions;
- ✓ generating funding that is adequate, stable, equitable and dedicated solely to the stormwater function; and
- ✓ developing a program that is comprehensive, cohesive and consistent year-to-year.

A stormwater utility is equitable because the cost is borne by the user on the basis of demand placed on the drainage system. It is stable because it is not as dependent on the vagaries of the annual budgetary process as are taxes. And it is adequate because a typical stormwater program can be financed with charges within the limits of the customer's willingness to pay.

No two successful utilities are identical just as no two cities are just alike. Therefore, it is not prudent to follow a pre-fabricated "one size fits all" approach, but to carefully seek to understand the make-up of the community, its problems, its goals, and its resources. There must be a clear understanding of the community's stormwater related systems, capabilities, and issues.

Some communities have simply attempted to clone a stormwater program or utility rate methodology of another city or county. Some consulting firms have attempted to sell a uniform approach. A local community should carefully guard against such a temptation. A stormwater program, rate structure, or billing methodology cloned from somewhere else rarely can sustain intense scrutiny by a staff, advisory committee, elected officials, or interest groups or the community at-large if the program utility doesn't meet local needs. Such programs often fail.

The real danger of the cloning approach is that it inevitably falls short of meeting the local stormwater program expectations because it is not founded on addressing them. As was mentioned in Chapter 2, the local problems, needs, and circumstances must drive the form, priorities, and pace of the program. The success of leading stormwater utility programs is based on tailoring the program and financing strategies to the local needs and solving real short-term and long-term stormwater problems.

Due Diligence

"Due diligence" is the process of insuring that the community's program and funding expectations will be met. It includes the formulation and execution of a plan with appropriate levels of investigation, establishment of facts, estimation of future prospects, framing of assumptions and risks, and establishment of a plan of action and funding. It can also result in a decision not to act.

Attempted stormwater utility implementations have failed for a number of reasons, most of which have to do with inadequate due diligence. For example, some key reasons given in failure post mortems include:

- ✓ Not understanding the process and cutting key corners
- ✓ Failure to establish stakeholder support
- ✓ Failure to identify and account for hurdles
- ✓ Inadequate legal assessment of the authority for a particular rate structure
- ✓ Failing to work with media
- ✓ Inability to focus the stormwater program on citizen felt needs
- ✓ Inaccurate databases without ability to appeal
- ✓ Poor citizen or customer service
- ✓ Rate structures without rational nexus
- ✓ Rate structures too complex to explain and seemingly inequitable
- ✓ Failure to understand political timing

Due diligence must be pursued along four major areas of concern, or tracks. These tracks, which are foundational to the utility implementation process and which are discussed in the implementation section of this chapter, are as follows:

- ✓ **Public** – are there appropriate levels of involvement of key stakeholders, is the general public handled correctly, is the media appropriately involved, is customer service accounted for, are staff and political leadership elements accounted for and handled appropriately?
- ✓ **Program** – does the program make sense, is it compelling, is it within the community's ability and willingness to pay, does it meet citizen perceptions, is it action oriented?
- ✓ **Finance** – are legal tests satisfied, is it simple yet fitted to the local situation, does it have the perception of equity, are proper steps followed, does it support the stormwater program?
- ✓ **Database** – is the database accurate within legal requirements, is there an appeals process, is it maintainable within reasonable cost constraints, are anomalies accounted for, is customer service appropriate and responsive?

The cost of appropriate due diligence is not insignificant but should be kept in perspective. Experience has shown that, should a stormwater utility fail it takes five to seven years for there to be a staff and political willingness to make another attempt. The opportunity cost of failure is then five to seven years of lost revenue. For example, for a stormwater utility that raises $2,000,000 per year the opportunity cost of failure is $10 to $14 million. The cost to do a thorough job of due diligence in this example, however, is rarely more than $350,000, one to three months' revenue.

Additional benefits of appropriate up front due diligence include:

- ✓ Better initial and long-term public knowledge and cooperation leading to greater support and participation.
- ✓ A funding rate structure that matches and meets short and long term program needs leading to stable, adequate funding.
- ✓ A stormwater program that can meet both the capital and operations needs of the local community, leading to better services and ability to meet regulatory demands.
- ✓ More efficient long-term database maintenance, leading to lower operating costs and better customer service.

Those communities that have cut corners in due diligence normally find themselves hampered in their ability to manage the database, meet customer expectations, solve flooding problems, meet regulatory needs, and modify the program or utility to meet changing demands. A process can be developed that facilitates such change while maintaining the effectiveness of the stormwater program and the utility.

CREATING MOMENTUM AND A PROCESS FOR PROGRAM ACTION

The ability to bring about action that moves a stormwater program forward and produces the necessary funding, depends on the ability to bring key leaders to an understanding of the problems, and a vision of the solutions. To achieve this understanding and to create such a vision requires a logical and acceptable process which leads a community to action.

Understanding Problems

Understanding of the problems involves building a "compelling case for action". In every community there are good, even compelling, reasons to improve the way stormwater programs are executed. It might be a popular stream that is becoming increasingly impacted, a lack of riparian park space, decaying drainage infrastructure and mounting complaints, unfunded regulatory mandates, local flooding, financial pressures, loss of fish, beach closings, a roadway or bridge collapse, or law suits. Such issues draw the attention and energy of stakeholders and leaders to opportunities for action.

Assembling a "compelling case" is step one in developing this understanding and bringing about action. People in general are motivated along two complimentary courses of persuasion – information (data) and stories. Some people want facts and statistics (data), while others are moved to action by horror stories and pictures. When we begin to quantify the community's perception of program need or make the case for change and new funding, we seek to address both types of people. Table 4-1 gives some examples taken from successful stormwater utilities.

Information	Stories
• Statistics on repair costs • Cost information • Infrastructure information • Lost revenue or tourist dollars • Regulatory Facts • Backlog information on flooding • Unfunded mandate information	• Flooding pictures • Horror stories • Movies • Testimonials • Environmental or aesthetic appeals • Drawings of a future greenway, trail, etc.

Table 4-1: Building Blocks for a Compelling Case

Building a compelling case and knowing when, how, and to whom to present it is more of a political and technical art form than it is a science. But taking time to build informed consent to move forward and to support program change and new funding methods is vitally necessary.

Vision for the Future

People rarely rally around simply solving problems. It is in creating a vision for what could or should be that causes people to begin to support the concept of a stormwater utility as a vehicle for action.

Building vision is a process of moving from recognizing problems, needs, issues and opportunities to seeing the way things could be. It involves seeing what others have done and showing how practical solutions can create significant improvement in the quality of life.

An artist's rendering of what an ugly polluted stream could become can help rally people. A seminar or workshop with representatives from other places telling about wonderful changes in their community gets people leaning into change. Sometimes simply showing how problems would be solved brings about a determination to move forward.

Bringing About Action

Leaders often agree that there must be action to bring about recommended improvements but are not sure how to begin. The use of a citizen's stakeholder group is an effective technique which facilitates development of problem understanding and of the vision for the future, and is a useful part of the process for action. Ten to fifteen people who adequately represent key positions or ideas can move together through the process.

Sometimes these meetings are over-controlled by well-meaning facilitators, or a citizen's group is asked to merely react to a fully developed solution. In both cases creativity can be stifled, citizen's can lose interest, and input can deteriorate. But if allowed true input, the group will have ownership of the plan and will often help sell it.

An effective tool in bringing about action is the business plan approach as discussed in Chapter 2. Facts are fine, but process, such as that produced by a stormwater business plan, moves things forward, formulating a road map and structure for action.

Business planning has not been a normal approach for local government. Local government has not typically thought of itself in terms of what it is selling, how it measures success, and who the customer is. A generic business plan asks and answers the following questions:

- Who we are?
- What business are we in?
- What's going on now?
- Where do we want to go?
- How do we want to get there?
- What are the steps to make it happen?
- How will we know when we have arrived and, how can we demonstrate it to someone else?
- How we will pay for it?

The business plan model, which measures goals in "program efficiency" and "program effectiveness", must be somewhat modified for local government use. Resistance to getting lost in too many technical details will help move the business plan to a useful conclusion.

Process Framework

The development of problem understanding and a future vision, and the exercise of such tools and techniques as a stormwater business plan and citizens impact groups require a structured format to insure a successful outcome. In this case, that outcome would be a utility structure for a comprehensive stormwater program. Figure 4-1 illustrates an overall process framework for development of a utility funding mechanism. Only the first and third steps might be considered absolutely necessary. The steps are:

- ✓ Quick Concept Study – answers the question: "does the proposal make sense", and if the answer is "yes" the work goes forward.
- ✓ Feasibility Study – creates both information and momentum for implementation, and is used as an intermediate step if success is not fairly certain.
- ✓ Utility Implementation – is the process of working in a coordinated and logical way through the details of planning implementation and due diligence.

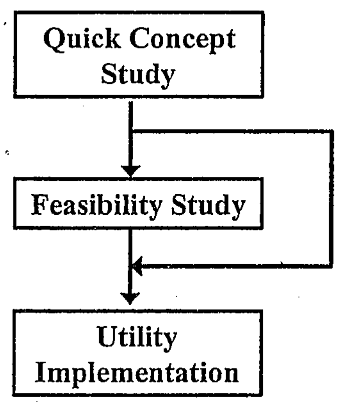


Figure 4-1: Overall Process Framework

PROCESS FRAMEWORK, QUICK CONCEPT STUDY

The purpose of this step is to assess the basic advisability of pursuing a stormwater program and funding assessment with the potential of implementing a stormwater user fee. Designed to be low cost, fast paced, and focused, it:

- ✓ Tests the water with very little political, financial, or emotional investment,
- ✓ Can normally be authorized without an RFP,
- ✓ Operates "under the radar" as an internal quick study,
- ✓ Builds internal vision for going forward,
- ✓ Can happen very quickly, taking only days to complete.

A consultant team or in-house facilitator typically takes the staff through a consideration of the following questions, and the answers leading to both a program and funding direction:

- ✓ What is the local government currently doing in terms of stormwater management?
- ✓ Why should the local government pursue a study and potential funding method like this, what is the compelling case?
- ✓ What stormwater program priorities should guide the local government in the next three to five years?
- ✓ What larger program improvements should be made and what would be the costs? What is the revenue potential of a utility fee or other major revenue source?
- ✓ What are the major hurdles or potential "show stoppers" to going forward?
- ✓ What are the immediate next steps should a "GO" decision come out of this study?

Integrated into this study is the potential for staff presentation of the findings and an educational/informational overview of a stormwater utility funding mechanism.

PROCESS FRAMEWORK, FEASIBILITY STUDY

The purpose of the feasibility study is to assess the local government's existing stormwater management program, to make recommendations for future directions and changes, and to assess the feasibility of funding the program with a stormwater utility (user fee) and other methods.

Figure 4-2 illustrates a typical "roadmap" for the feasibility study.

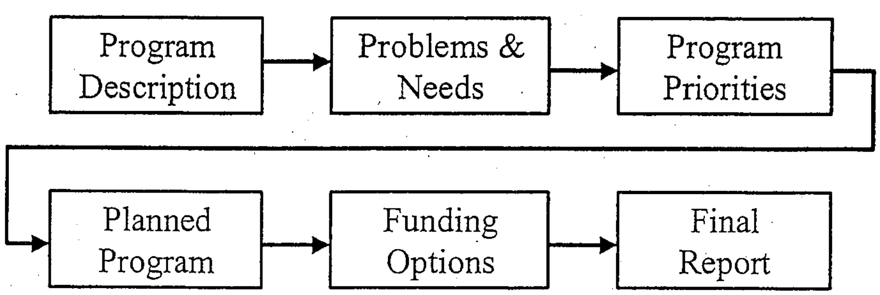


Figure 4-2: Feasibility Study Roadmap

Typically a group of citizens and staff are taken through a consideration of the following questions, the answers leading to both a program and funding direction:

- ✓ What is the local government currently doing in terms of stormwater management?
- ✓ What are the stormwater related problems, issues, needs, resources, and opportunities currently faced by the local government?
- ✓ What stormwater program priorities should guide the local government in the next three to five years?
- ✓ What specific program improvements should be made and what will be the costs?
- ✓ What is (are) the best way(s) to pay for these program improvements?
- ✓ How should the funding method(s) be implemented?

The feasibility study is used when there is an inclination to go forward with a stormwater utility but sufficient support has not been developed to insure adoption of a utility ordinance. The feasibility study essentially accomplishes the first few steps in establishing a stormwater utility without the commitment from elected officials to make the final decision.

The feasibility study can be a worthwhile endeavor because it:

- ✓ is low risk; even if implementation of a utility is found infeasible, the study is a success because it accurately determined a "no go" decision was best;
- ✓ tests the water before committing to a user fee, giving political leaders a sense of safety because the approach is phased and involves others in the "go" decision;
- ✓ provides broader backing and wider support among the community and brings them into the process early;
- ✓ builds momentum and support toward a "go" decision through logical consideration of program needs and concerns;
- ✓ provides an early warning of hurdles and pitfalls;
- ✓ saves time and money because implementation costs can be defined and may be lowered by anticipation and planning; and
- ✓ develops sufficient legal due diligence to allow for borrowing of the implementation costs, with later payback from the user fee revenue stream.

The advantage of this kind of feasibility study over some other approaches is its initial focus on problem solving. The focus of the feasibility study is not just revenue generation but program improvement. This initial concentration on identifying and solving problems is key, and follows the process for bringing about action discussed previously.

Often the use of a citizen's group serves as the vehicle for taking the local government through the business plan approach and the roadmap in Figure 4-2. This can be accomplished in four to seven meetings and can be very participation oriented.

Other forms of stakeholder participation in the feasibility study can involve:

- ✓ citizen review of a previously completed consultant study where it is presented in a series of meetings with comment sought;
- ✓ public forums where issues are openly discussed by a panel with questions and input sought from the audience; or
- ✓ study groups where a specific need, such as flooding, is investigated leading to solution concepts and identification of funding needs.

PROCESS FRAMEWORK, UTILITY IMPLEMENTATION

Regardless of the use of a feasibility study, the implementation of a successful user fee follows four "tracks" of activity. Figure 4-3 outlines these four tracks in an overall utility implementation flow chart. It is crucial that these four tracks are coordinated and timed to occur as shown. While there are almost infinite variations on this figure, the key activities within the figure are all important and should not be skipped.

For larger communities there can be a manager for each of the four tracks. For smaller projects a single manager can handle multiple tracks, though it often makes sense and increases project success for each track to have an experienced expert in the lead.

The Public Track

Though not resulting in an "operational" part of the utility, this track serves the whole process. It involves four basic phases: planning the public involvement and information process; conducting the involvement and public education process; carrying out the implementation campaign; and monitoring utility implementation and customer service.

Often a citizen's stakeholder group is involved. A citizens group can assist in the work of all four tracks and is particularly useful in establishing policy and priorities and to serve as eventual proponents of the recommended action.

Stormwater utilities are rarely infeasible technically, and legal constraints can usually be overcome. It is in development of public, stakeholder, and political support that the difficulties often arise. Thus the Public Track is often the key to success of utility development efforts.

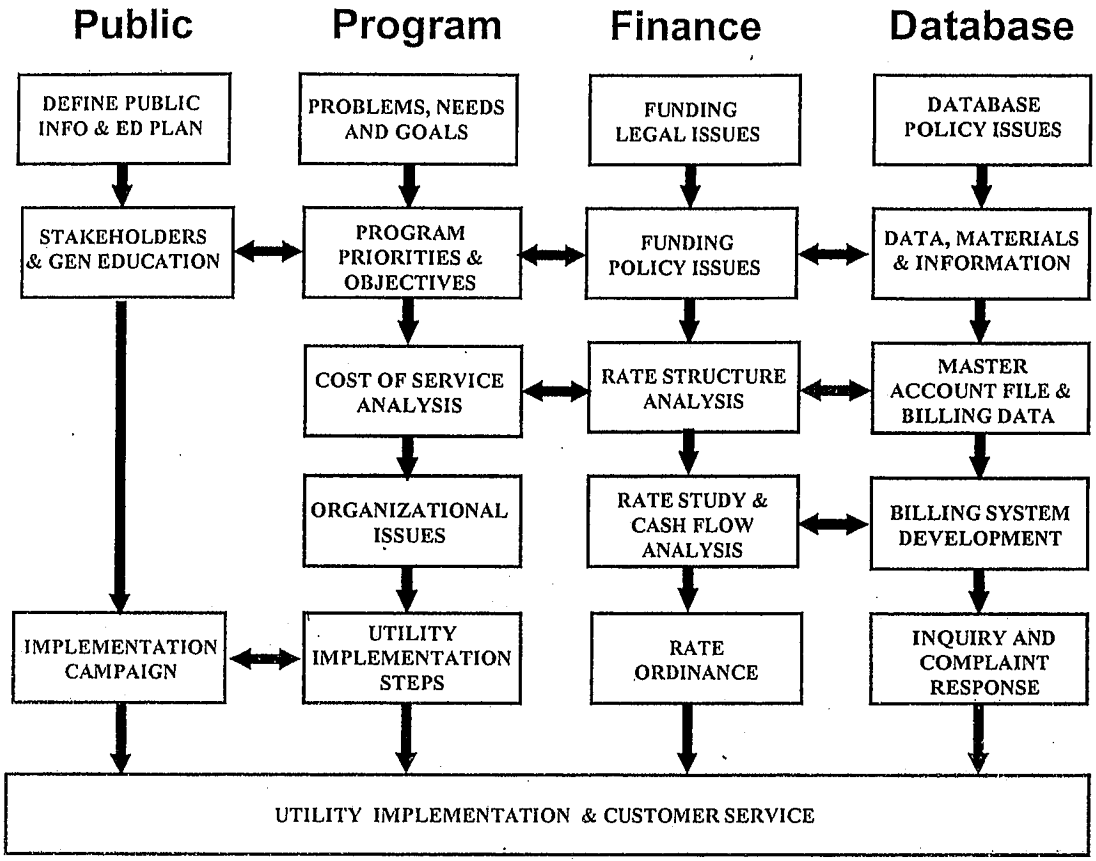


Figure 4-3: Utility Implementation Approach

It is important to remember that there are many "publics" in a local community, and that each has a stake or special interest in a stormwater utility with reasons to both support and oppose it. The following are examples:

"Public"	"Special Interest"
✓ Developers	Regulatory and Financial
✓ Environmentalists	Stormwater Quality, Habitat
✓ Neighborhoods	Flooding, Convenience, Property Values
✓ Clubs	Participation, Voice
✓ Social, Ethnic, Economic	Locations, Jobs, Costs
✓ Tax Exempt Entities	Utility vs. Tax
✓ Political Leaders	Timing, Message, Process
✓ Media	Is it "News"?
✓ Commercial/Industrial Entities	Costs, Credits, Service
✓ Technical Specialists	Standards, Criteria and Procedures

Early in the process, preferably during a feasibility study, a Public Information and Education Plan (PI&E Plan) which asks the following questions should be developed. This plan serves as the roadmap for the work of the Public Track.

- ✓ Who is the public?
- ✓ What is the message?
- ✓ When do we send the message?
- ✓ How is the message sent?
- ✓ What is the emergency response when trouble occurs?

Well crafted information, strong media involvement, a speakers' bureau, videos, citizen speakers, billboards, mailers, and public meetings, have all been used in effective public information programs. There is no one right approach as each community and sub-element within the community, may obtain its information and make decisions differently. In one, key decisions are made by leading business leaders. In another the council may make the decisions with little input. In one community environmental interests prevail; while in another, solving flooding is key. In some places environmental justice and the economically disadvantaged are primary, while for others it is not. Thus, it is important to understand the character and makeup of the community.

The Program Track

This track assesses the basic problems, needs and goals, establishes program priorities, lays out a three to five year program, develops a costing of that program, and finally, sets up implementation steps. The program is the final determinant of the revenue plan, utility rate and rate structure, although due regard must be given to the customer's willingness to pay for stormwater given other demands on citizens' resources.

The program is also what sells the utility concept, and it is the Program Track process which addresses the most fundamental of questions. How do we convince citizens and stakeholders of the need for an alternate funding source? Or, how do we craft a stormwater program that meets the needs of the local community without exceeding available funding?

The program track begins by identifying the compelling case discussed previously (problems/needs). This is translated into three to seven key program priorities and the new stormwater program is formulated with a cost of service analysis, into a detailed three to five-year program plan. Longer term planning in less detail is also useful.

Normally, for multiple jurisdiction utilities, the governance questions must be addressed in a preliminary way, early in the process. But it is normally prudent to address organizational and management issues at the end of the Program Track. It is better to first focus on the functions of the stormwater program rather on who might perform them. This defers potential organizational issues to the end where they are more easily resolved by the completed program planning information.

The basic elements of a stormwater management program, which must be addressed by the Program Track, include both operational and financial functions. These might include:

- ✓ Operations and Maintenance
- ✓ Regulation and Enforcement
- ✓ Engineering and Planning
- ✓ Capital Construction
- ✓ Administration and Finance
- ✓ Regulatory Compliance
- ✓ Billing and Collections

The final assessment and planning step in the Program Track is the identification of the steps required to implement a utility. Those steps include a determination of the mix of revenue types to be used, the structure of the utility rate and the administrative functions which will implement and support the utility. These factors/elements are addressed in more detail in Chapter 2 of this guidance. The legal foundations of the revenue mix are addressed in Chapter 3 and are a principal focus of the Finance Track of the Utility Implementation Approach shown in Figure 4-3 of this chapter.

The Finance Track

The Finance Track sets up the legal and financial basis for the stormwater funding program. In this track the planning process examines legal parameters of the revenue options, explores and establishes policies which will govern the revenue program, analyzes factors which will determine the structure of the rates to be levied, determines the revenue needed, and develops ordinances needed to implement revenue policies, rates, enforcement and equities.

It is in this track that fundamental questions concerning financing of the stormwater program are addressed. Who should pay for the stormwater program? What is the appropriate cost share to be borne by each benefited segment of the community? When or how frequently should payment occur; and what mix of revenue types or methods should be used to accomplish this payment such as fees, assessments, taxes, and/or utility?

In addition to these policy questions, the Finance Track also addresses legal questions. What revenue authority already exists? What legal authority is needed to implement the desired revenue mix; and what legal foundation is needed to support the levy of each of the individual revenue types (nexus, benefits, service)? A more detailed discussion of these issues is found in Chapter 2 and 3 of this guidance.

It is very important to have established a logical and rational nexus for each revenue policy decision, for the rates to be charged, and for ancillary charges, credits, and offsets. The Finance Track establishes the myriad of basic financing policies needed. Then, based on appropriate legal authorities and foundations, and on program input, it moves from development of a revenue structure to meet the program needs, to a rate structure study and cash flow analysis and finally to an ordinance.

It must be stressed that the Finance Track must work in support of the Program Track. The development and implementation of a stormwater funding program in general, and a utility in particular, must be intricately linked to the functions, goals and beneficiaries of the stormwater program to assure both equity and adequacy of the revenue levies. Revenue levies not consistent with benefits or services received; or not adequate to address identified heeds, will quickly lose community support.

The Database Track

The Database Track has application to many stormwater revenue types, but is of foundational importance to the implementation of a stormwater utility. This tract has five main purposes:

- ✓ to determine the appropriate database and fields,
- ✓ to develop the master account file,
- ✓ to develop a mechanism to deliver the bill to the customer,
- ✓ to determine database maintenance processes, and
- ✓ to monitor customer service.

The Database Track is that portion of the planning process in which the decisions made in the preceding tracks are used to create the administrative infrastructure which will compute the revenue levy for each parcel, deliver the bill, record the payment, and monitor the results. The process involves policy assessment and development, evaluation of database options, design of the master account file and selection of a billing and record system. A database can also provide the means to track complaints and service deficiencies. During the Database Track, the revenue program policy decisions made in the Finance Track are given form and application, producing an actual revenue levy on real properties.

The master account file is a derivative of the rate methodology selected. For example, an impervious rate methodology requires the estimation of the impervious surfaces on each parcel. However, the availability of data could also influence the rate methodology decision. Should, for example, land use data be available then it might make sense to construct a rate methodology that uses development intensity factors to reflect the impervious fraction. In some cases the tax assessors file has sufficient number of relevant fields and accuracy to allow for a surrogate of development intensity without a lot of hand work. Addressing these decisions necessitates the connectedness of the Database

Track and the Finance Track as shown in Figure 3. An expanded discussion of rate methodologies is found in Chapter 2.

Some data sources may not be helpful. GIS coverage's, not made to generate stormwater billings and "impervious coverage's", may not contain all the impervious areas of properties. Often they simply approximate buildings and use lines to outline parking lots. Also, parcel information, scanned from paper files, is often warped in relation to the real world. The database developer must search for the best available information or develop information from scratch.

Newer methods involving satellite imagery are coming into popularity for larger areas, low tree cover, and limited budgets. There are, however, significant accuracy problems and the success of such a method depends on the image processing skills of the technician as much as technical specifications of the imagery.

There are generally four options for billing systems. The most common is to use an existing utility system, such as water or wastewater. This has advantages in that stormwater looks like water and wastewater and the charge is clearly a fee for service, not a tax. Another advantage is that delinquencies are low, and it may be possible to turn off water for partial payment of the combined bill even though the customer may have intended to pay the non-stormwater portion of the bill.

Billing the fee on a tax bill may have advantages and disadvantages as well. Using the tax parcel file has the advantage that stormwater is essentially a parcel-based function, creating a direct relationship to the vast majority of the parcels. A disadvantage is that the tax bill is mailed once per year for the majority of properties complicating program cash flow.

The stormwater bill can be placed on another type of utility bill (e.g. electric) but that typically lacks a clear nexus. The last option is to create a stand-alone billing system. This has all the advantages of control and focus, and all the disadvantages of high cost and lack of ability to enforce collections.

Recently local communities are looking at integrating the database support of many of their functions related to infrastructure and customer service. For example, some, or all of the following functions can use overlapping databases:

- ✓ Utility Billing systems
- ✓ Geographical Information Systems
- ✓ Dedicated Stand-alone Systems
- ✓ Maintenance Management Systems
- ✓ Customer Service Systems
- ✓ Complaint Tracking
- ✓ Accounting and Financial Management
- ✓ Property Tax Systems

Depending on the rate methodology the following fields may be required in the database:

Occupant	Impervious area*
Owner	Parcel ID number
Service address	Runoff coefficient*
Property address	Equivalent stormwater units*
Customer type	Customer account number
Land use code*	User fee
Gross area*	Optional fee or information fields

[* Factors which are required for various stormwater fee rate methodologies.]

POLICY ISSUES

The implementation of user fee or utility based funding for stormwater has numerous policy implications. The policies aggregate around the key issue of deciding how service charges should be implemented and applied to specific properties in a consistent and fair manner.

Timing of policy analysis is also important. Some issues must be decided early in the process, such as the extent to which a utility is to be the sole, primary, or secondary revenue source. Other issues will be addressed much later, such as the choice of the billing systems. Still other issues will not arise until the utility is functioning, such as the disposition of specific appeals and requested rate/levy adjustments.

Thought must also be given as to who will make specific policy decisions. The Council formally adopts through ordinance or policy edict many of the major policies which guide the municipality's stormwater revenue program. Although policy-making in the highest sense is reserved to the Mayor and Council, day-to-day policy decisions are, in fact, often made at several levels.

The Mayor may make some policy decisions based on Council positions. Other policy decisions are made by municipal management and staff administrators pursuant to general directives spelled out by the Mayor and Council. It is important to recognize the need for and functioning of this dispersed policy-making environment, and create a defined hierarchy for the review of important issues. The following is a sample of possible decision levels. Issues which could be decided at each level must be determined by each community.

- ✓ key staff and consultants
- ✓ other involved staff
- ✓ advisory committee
- ✓ manager's office
- ✓ municipal council/mayor

An initial screening of issues for the purpose of weighing their significance and determining the appropriate decision level must consider the following:

- ✓ impacts of policy decision alternatives on costs and manpower;
- ✓ the potential impact on the equity of the utility rate;
- ✓ the relationship of each specific issue to other policy issues;
- ✓ the priority and timing associated with the issue given the municipality's objective of implementing alternative funding for stormwater management,
- ✓ the appropriate level(s) of municipal government at which the issue should be addressed and resolved.

Policy issues in the development of a stormwater utility can be divided into those dealing primarily with program, funding, and billing technical issues. Following is a list of typical policy issues in these three tracks:

Program Related Policy Issues (Program Track):

Program Mission	Major Program Priorities
Program Service Description	Service Area
Extent of Service	Levels of Service
Stormwater Quality Strategy	Organization and Staffing
Privatization	Interlocal Agreements and Responsibilities
Relationship with other Programs	Public Input or Advisory Groups
Public Relations	

Funding Related Policy Issues (Finance Track):

Types of Stormwater Services Funded	Basis for Cost Distribution
Prior Investment	Future Use of Stormwater Systems
Accounting Method	Rate Methodology
Basic Funding Methodology	Modification Factors
Secondary Funding Methods	Overall Funding Strategy
Credits	Equivalent Residential Unit (ERU) Base
Public Streets and Property	State and Federal Property

Billing Related Policy Issues (Database Track):

- Billing and Collection Methods
- Independent Database system Tie-in
- Appeals and Adjustments
- Collections and Delinquencies
- Property Liens
- Management Reporting
- Use of other Databases
- Number and Type of Data Fields
- Rounding and Ranges
- Impervious Measurement Accuracy
- Customer Service Procedure
- Information to Put on Bill
- Billing Cost Allocations
- Case Exceptions Including:
  - Multiple Owners
  - Multi-Story Condominiums
- Consolidated Billing
- New Stand-alone System
- Modification of Existing Billing System
- Billing Period
- Water or Tax Bill Tie-in
- Enforcement Procedural Issues
- Master Account File Development Process
- Accuracy Requirements
- Resolution Procedures for Discrepancies
- Impervious Area Methodology
- Use of Street Centerline Data
- Master Acct File Database Maintenance and Updating Process
- Billing Owners or Tenants
- Undivided Interest, Common Areas
- Stormwater Only Accounts
- Use of GIS, Mapping or CADD

SCHEDULE

Figure 4-4 illustrates a typical schedule using the four track process for utility establishment. The schedule shows that a comfortable time frame is 18 months from start to finish. The "M" letters indicate milestone meetings.

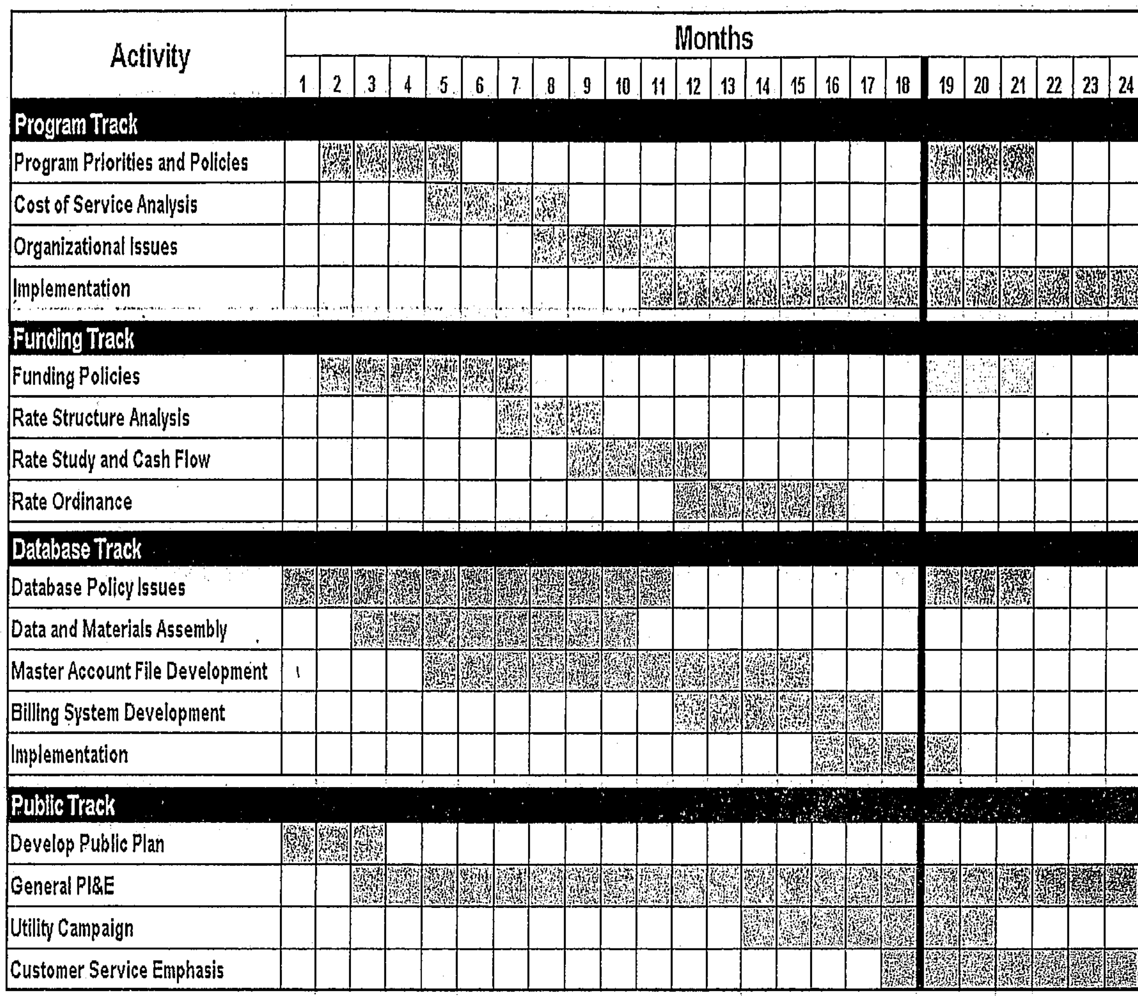


Figure 4-4: Utility Implementation Schedule

The critical path through the process can shift due to the requirements for citizen involvement, political timing, billing timing, and database development.

A003904

APPENDIX

EXAMPLE STORMWATER UTILITY PROGRAMS

CITY OF BELLEVUE, WASHINGTON

Keynotes

- The Bellevue stormwater management program was one of the first in the United States (established in 1974) and also the first to give equal consideration to water quality and quantity (flood) control.

- Bellevue's Storm and Surface Water Utility provides a full range of capital infrastructure and operational services, primarily through its in-house staff. In addition to roadway drainage systems, it is responsible for an extensive stream system outside road rights-of-way. It also provides an erosion and sediment control program.

- The Bellevue Utility is governed by the City Council and administered by professional staff as part of a consolidated Utilities Department (water, wastewater, stormwater management, and solid waste).

- Funding of the Bellevue stormwater program is primarily derived from a user fee.

- Key funding policies include:

  - a user fee rate methodology based on gross property area and a factor reflecting the intensity of development of each property, with residential fees being discrete to each property and ranging from less than \$3/month to more than \$20/month;
  - retiring debt from an earlier very aggressive bonding program that constructed capital infrastructure improvements to the urban stormwater systems in the city.
  - A forward looking R& R funding program to replace infrastructure as it nears the end of its usable life (now pay-as-you-go R & R fund)

  Key operational practices include:

- consistent, watershed-based, master planning of stormwater systems with emphasis on water quality and quantity control and aquatic wildlife habitat management; and
- stormwater management functions performed by a staff responsible only for stormwater management, including NPDES permit compliance.

Community Profile

Bellevue is a city of 117,000 citizens. It is the business and cultural center of an area of more than 250,000 referred to in local parlance as "The Eastside", in reference to its location on the east shore of Lake Washington across from Seattle. Two major highway bridges cross Lake Washington to connect The Eastside with Seattle and thousands of people commute across the bridges each morning and evening. Bellevue is just 10 miles by road from Seattle across either bridge, and has emerged in the past twenty years as a business center in its own right. It has a daytime population of 172,000, with approximately 131,000 jobs, and is home to five of the top twenty-five publicly-traded business corporations in Washington State. Other major corporations such as Microsoft and Costco are headquartered in nearby Eastside communities.

Bellevue is a relatively young community, both in terms of history and demographics, although its population is aging now that the suburbanization has spread even farther east toward the Cascade Mountains. The current median age is Bellevue is 37, up from 28 just 25 years ago. It is an affluent community with high quality of life expectations, and ranks second in Washington State in both retail sales and property values. The per capita income is approximately $42,000/year.

Founded as a community in 1869, Bellevue was incorporated as a city government in 1953, with a population of less than 3,000. As suburban sprawl emanated from Seattle and multi-lane highway bridges spanned Lake Washington, Bellevue quickly transformed from a market crop agricultural area (primarily fruits and vegetables) to the local business center for The Eastside area. It became a preferred address in the region and underwent rapid suburban development in the 1960's. By 1970 the population had reached 60,000.

The City expanded to its current 31 square miles through several annexations. As it grew, the City absorbed more than a dozen special-purpose agencies that provided local water and sewer services to the neighborhoods that now comprise Bellevue. These formed the basis of its Utilities Department. The City assumed governance responsibility for a full slate of urban community services, including stormwater management. However, other than storm sewer system construction improvements built by residential subdivision and commercial developers and in association with road construction projects, the community did very little stormwater management until about 1970.

Fortunately, the City had developed so rapidly that most of its open streams remained and served as the primary drainage conduits for stormwater runoff. Unfortunately, by 1970 the increased runoff from new pavement and roof tops was overtaxing the capacity of the natural channels that had evolved over thousands of years. Runoff was also causing extensive erosion, sedimentation in the streams, pollution of Lake Washington, and local flooding problems.

Formation Process

The Bellevue Storm and Surface Water Utility is generally regarded as the first stormwater utility in the United States. It was established in January, 1974. A master account file was developed and service fees were initiated as the primary funding mechanism later that year. The Utility was charged with developing and implementing a comprehensive program strategy that would address both water quantity control and water quality protection. Its first priorities were to enforce erosion and sediment control standards and prepare watershed master plans for system capitalization in nearly a dozen small drainage basins in the city.

Service Area

The Bellevue Storm and Surface Water Utility is responsible for stormwater management, flood control, and erosion and sediment control throughout the City's 31 square mile incorporated area.

Role and Program

Bellevue's Utility has broad authority for all aspects of stormwater quantity and quality management. Much of the success the Bellevue Utility experienced is attributed to the detailed program strategy that was assembled by the staff following its formation in 1974 and continuously refined since. It has provided a clear, cohesive vision of the City's objectives and priorities, and drove the transition in organization and funding. The program strategy proved to be critically important in retaining the support of the City Council when the initial service fee (1974) was challenged by citizens and businesses who perceived it to be "just another tax".

During the 1970s the Utility prepared a Drainage Master Plan (capital projects only) and initiated a program to acquire properties and easements and build the facilities identified in the Plan. The Plan consciously sought to preserve the open drainage system by limiting the peak flow of runoff into and through the streams. Engineering estimates suggested that significant savings would result if the open system could be retained by installing regional detention storage facilities at various points along the watercourses. That analysis proved correct, despite rapidly inflating land prices that drove costs up quickly.

The regional detention control strategy was augmented by regulatory standards requiring on-site detention on new development and aggressive soil erosion control measures. The design standards reduced post-development peak runoff to approximately the same as pre-development conditions. Implementation of the

Utility, plus the Master Plan project, justified the initial assembly of the City's geographical information system (GIS), which was then incrementally expanded to serve other City programs.

Other priorities were also addressed while the Master Plan was being developed. The Utility staff immediately became directly involved in land use and development reviews. Routine maintenance of drainage systems was significantly increased. In the late 1970s the City became the largest grantee of the National Urban Runoff Program (NURP), the Environmental Protection Agency's first major investigative study of water quality/stormwater runoff relationships. This placed Bellevue on the leading edge of stormwater quality management in the United States. It also attracted cooperative projects and funding from other state and federal agencies, most notably for stream monitoring and system construction. The Bellevue stormwater program continues to be one of the most highly regarded in the United States. The Utility service fees have evolved through several iterations, and are now relatively more sophisticated and precise than most.

Following the initial formation and implementation period, the Utility continued to expand its programs and build capital projects during the 1980s and 1990s. The infrastructure improvements identified in the initial Master Plan and subsequent updates were completed. A remedial maintenance program was initiated to repair and replace aging drainage systems before they failed. Aggressive development review and inspection efforts were instituted. Bellevue now has eleven major regional detention sites with 650 commercial and 335 neighborhood detention facilities in residential subdivisions. There are also several hundred on-site detention systems located on commercial properties. Several of the regional and neighborhood systems are wetlands that contribute environmental benefits as well as flood control during storms.

The maintenance program attained a fully preventive level of service within ten years. It was rigorously programmed, and remedial repairs became increasingly important as the systems aged and deteriorated. A permanent citizens' advisory commission was established to provide the City Council with community perspectives on stormwater issues. Public information and education morphed into public participation, with "stream teams" composed of interested citizens conducting various projects and activities to protect and improve the City's many small stream corridors. Volunteers are trained to collect scientific data at low cost for monitoring and adaptive management purposes.

One incident dramatically demonstrates the success that Bellevue achieved through its utility. In 1990 the Puget Sound region in western Washington State was struck by an intense and extended rain event over the four-day Thanksgiving holiday weekend. More than $20 million of flood damage occurred in other parts of King County, which is the 1,200 square mile governance jurisdiction that includes Seattle, Bellevue, and other cities. Snohomish County (immediately north of King County) had more than twenty bridges damaged. One of the multi-lane Lake Washington floating bridges was under repair at the time. Stormwater invaded the floating structure and caused it to sink in rather dramatic fashion. Replacement of the bridge cost over $200 million.

In spite of such widespread problems during this extended storm event, Bellevue's stormwater system worked so effectively during and following the storm that the City did not even have to call out its maintenance crews in response to any problems. Several of the Utility's regional detention systems filled to their capacity, but they worked as designed together with the privately owned commercial systems and overflow was minimal. The drainage and stream systems absorbed the impact without major damage.

Governance Structure

The Bellevue Storm and Surface Water Utility program is guided by policies set by the seven-member City Council. Overall city administration is directed by a professional city manager who supervises a number of major departments including Utilities.

Organization and Staffing

The stormwater management program in Bellevue is administered by the Utilities Department, which also provides water and wastewater management services. The staffing level for stormwater management has been relatively constant for the last decade, fluctuating between 45 and 50 full-time equivalent (FTE) positions.

Funding

The Bellevue Utility is supported primarily by periodic user fees charged to virtually all properties in the city, including the roads and highways. The Utility's annual operating budget now is approximately $6 million. Capital expenditures for the latest fiscal year (FY 2003/2004) were budgeted to be $2 million on projects having a total estimated cost of $21 million. Several of the capital projects are long-term, incremental efforts to stabilize lengthy sections of stream channels and replace aging infrastructure. Total annual expenditures from the Storm and Surface Water Utility fund are nearly $10 million, including debt service payments on capital improvement bonds.

The initial service fee was based on impervious area, and billed only developed properties. In response to the citizen's committee formed to examine the fee concept in 1975, the City shifted to a rate methodology based on gross area and development conditions of every property. As a result, both developed and undeveloped properties are charged for stormwater management in Bellevue. The City Council has also enacted several rate increases over the years as the program revenue requirements grew.

Regardless of whether a property is in residential or commercial use, the rate methodology employs increments of one hundred (100) square feet to calculate the fees for each property, resulting in highly discrete charges. Service fees for single-family residential properties now range from less than $3 to more than $15/month, with a typical charge of approximately $10/month. The Utility is fully self-supporting and has never received allocations of general City revenues. A majority of its revenues are generated by the service fees, but the Utility also continues to receive federal and state grants and loans in support of specific activities and facilities. It also sponsors cooperative projects with private developers, other public agencies such as the local school district and neighboring general governments, and homeowners' associations in residential neighborhoods.

Inter-governmental Cooperation

The Bellevue Utility works closely with other jurisdictions in the region, but its physical location on a ridge between two major lakes reduces the degree to which it shares watersheds with neighboring cities and King County. The development of one major regional detention area illustrates the type of cooperation that the Utility has been able to obtain from other agencies. The Municipality of Metropolitan Seattle (Metro) (now King County) wished to locate its Eastside Transit Maintenance Facility in Bellevue in the mid-1970s because of the site's favorable central location. The City required that Metro (which coincidentally was also the wastewater treatment provider for the Greater Seattle area) preserve a small stream that traverses the property. Utility staff worked with Metro to optimize the use of the site for bus maintenance while also enhancing the stream corridor and installing containment controls to provide peak flow attenuation in the stream. Much of the collaborative effort was directed toward water quality management. Today, the utility works with other jurisdictions to develop capital facilities, protect water quality, manage lakes, and enhance aquatic habitat.

Public Participation

Public participation has been a hallmark of the Bellevue Utility since its inception in the late 1960s. A group of citizen activists approached the Bellevue City Council in 1969, requesting that the City government initiate studies and other actions to solve emerging drainage problems. They were especially concerned with the environmental impacts on the streams, their habitat, and riparian resources. The City Council appointed several of the citizens to an advisory committee to recommend a strategy for meeting with the challenge. Over the next three years the committee reported back to the City Council with a series of recommendations, the most significant of which (in hindsight) was that the City should establish a dedicated source of funding for its stormwater management program. The recommendations emerged as Bellevue's Storm and Surface Water Utility early in 1974.

In response to complaints about the initial user fees, a second citizen advisory committee was established that included several critics of the service fees, one of whom was challenging the Utility in court. That committee reviewed the initial decision to form the Utility. They concluded that the objectives, program strategy and policies were appropriate and recommended that the City continue with the service fee approach, but that citizens vote on the funding. This reassessment of the concept was pivotal in the ultimate success of the Utility concept in Bellevue. In their report to the City Council the committee cited the strategic plan developed for the Utility as a principal reason for supporting the concept. A series of advisory elections followed, which guided the evolution of the service fee funding methodology.

The public's participation in the work of the Bellevue Utility continues to be a hallmark of the community's approach and a key factor in its success. A permanent Storm and Surface Water Utility Commission formed in the late 1970's. It now guides Utility policy and advises the City Council on program and funding decisions not only for stormwater management issues, but for other utility programs as well. Volunteer groups are sponsored by the Utility and provide support for stream protection, collection and disposal of household waste and hazardous materials (paint, etc), and multiple use of riparian corridors along the City's streams.

CITY OF CHARLOTTE/MECKLENBURG COUNTY, NC

Keynotes

- The Charlotte/Mecklenburg County approach to stormwater management relies on centralized funding and regional programs for large systems combined with local management of minor stormwater systems and associated program elements. The County and individual towns have a high degree of self-determination in deciding the service level to be provided by local systems and programs, funding, and assignment of functional activities.

- Mecklenburg County provides the smaller towns with the option of a menu of available services, but the decision to use the County, City of Charlotte, in-house, or privately contracted vendors resides with the individual local entities. The City of Charlotte has a Phase 1 NPDES permit and the County and smaller communities have a Phase 2 permit.

- North Carolina statutes allow both counties and cities to establish stormwater utilities and adopt service fees to fund stormwater quantity and quality control efforts. However, a specific limitation in the statute prohibits creation of overlapping county and city utilities. Initially, the City of Charlotte established a utility. A year after, the utility was restructured to provide a countywide utility, with complementary programs run by the City and County to avoid any conflict with the statute.

- The Mecklenburg County Stormwater Utility is governed by the Board of County Commissioners and administered by professional staff. The City of Charlotte also has a substantial stormwater management program governed by the City Council and administered by the City Engineering and Property Management Department. Other City departments such as the Department of Transportation are also important players since they often provide maintenance of the stormwater systems in the roadways. City and town councils in the smaller communities in Mecklenburg County govern their local stormwater programs.

- Funding of the Charlotte/Mecklenburg County stormwater program is primarily supported by a composite stormwater service fee that includes both major (draining larger than one square mile) and minor (draining less than one square mile) components. The individual towns more often employ a blend of funding from several sources.

- Policies are adopted by the Board of County Commissioners and the city and town councils in the respective communities that are involved in stormwater management. Key funding policies include:

    - a composite regional major and minor service fee based on a consistent impervious area rate methodology;
    - County control of the major component of the composite service fee; and
    - local governance (county/city/town) control of the local component of the minor service fee.
    - the City of Charlotte has initiated a very aggressive bonding program to construct $198 million in improvements to the local urban stormwater systems in the city over five years.

  Key operational practices include:

    - consistent, watershed-based, planning of stormwater systems;
    - centralized stormwater quality management, including NPDES permits; and
    - a stormwater services menu provided to smaller entities by the County
    - Billing and collections and customer service are provided throughout all jurisdictions countywide by the City of Charlotte.

- Stormwater management staffing in the County and towns varies widely. Mecklenburg County and the City of Charlotte have relatively large and skilled staffs capable of managing both stormwater quantity and quality programs, while the smaller towns typically have few staff and rely on the County, City of Charlotte, or private vendors to provide contracted services. The combined Charlotte/Mecklenburg County staffing exceeds 150 full-time equivalent positions.

Community Profile

Charlotte/Mecklenburg County is the largest urban center between Washington D. C. and Atlanta. Major businesses include banking, transportation, distribution, communications, and manufacturing. The City of Charlotte, Mecklenburg County, and smaller neighboring towns have collaborated in the development of one of the most highly regarded stormwater management programs in the United States.

Mecklenburg County is the core of a six-county metropolitan area that has a total population of 1.5 million. Approximately one half reside within Mecklenburg County, with 650,000 people residing in the City of Charlotte. Only 70,000 Mecklenburg County residents live in areas that are not within incorporated cities or towns.

The County encompasses about 526 square miles, nearly 280 of which are in Charlotte. Charlotte and the smaller towns in the County have adopted policies for on-going annexation. It is anticipated that there will be no remaining unincorporated areas of the County within a decade or so, but County government will continue to provide designated services such as floodplain management county-wide.

Mecklenburg County established a storm drainage district early in 20th century which built and maintained large, open-channel drainage systems to serve those portions of local watersheds with a tributary area of more than one square mile. Improved channels were provided throughout the County, regardless of whether the channel was located in an incorporated city or town government or in the unincorporated area. Of course many of the channels crossed the jurisdictional boundaries of the cities, towns, and county.

Improvement and operation of drainage systems to serve areas smaller than one square mile in the incorporated jurisdictions were left up the local government. The City of Charlotte and the smaller towns were nominally responsible for the small watershed systems. The County improved and maintained the smaller systems in the unincorporated area. Many of the smaller systems were installed by developers as residential subdivisions and commercial projects were constructed. This approach was employed for over seventy years, with mixed success. The larger channels tended to be funded adequately and were improved from time to time, while the smaller systems were largely ignored unless specific problems developed.

Today Mecklenburg County and the City of Charlotte manage different but complementary stormwater programs. The City and County work together in order that services to the community will not be duplicated. The County remains responsible for managing FEMA regulated floodplains and their channels county-wide. This is comprised of a network of "named" large creeks (like McMullen Creek, Little Sugar Creek, and Briar Creek) that drain watersheds larger than one square mile. The City of Charlotte and the smaller towns are responsible for maintaining the smaller creeks and tributaries that feed into the large creeks. Both the county and town stormwater programs provide services for drainage pipes, ditches and drains on public property and within easements on private property in their respective jurisdictions.

Formation Process

Formation of the Mecklenburg County stormwater utility involved a relatively complex, and occasionally contentious, process that spanned over three years. This was in large part a function of local politics, but the North Carolina legislative authorization for stormwater utilities heavily influenced the process.

Initially, the County and City of Charlotte attempted to cooperatively identify a mutually agreeable approach to instituting a utility. An advisory committee comprised of County, City, and diverse interest group representatives met for more than a year to assess how local needs might best be addressed. Unfortunately, they reached a stalemate regarding which entity should be the lead management entity. This reflected the past history and differing needs of the County and City.

Since the early 1900's, Mecklenburg County had provided and maintained drainage improvements along creeks throughout the County below the point where the tributary area totaled 640 acres (one square mile). Such regional systems were locally termed the "regulated floodways". Drainage systems serving smaller watersheds in the unincorporated areas were also the responsibility of the County, but the cities and towns were responsible for the local drainage systems within their jurisdictions. The City of Charlotte Department of Transportation had maintained its urban stormwater systems associated with roads for many years, but drainage systems located outside road corridors had not been aggressively managed or maintained. When discussion of the utility option began in 1989, the County's principal priority was to enhance its regional systems, while the City's priority was to improve the local drainage systems. Both entities were concerned about their upcoming NPDES permits at that point.

North Carolina legislation was adopted in the late 1980's which allowed counties and cities to establish stormwater utilities. However, it specified that only one entity could establish a utility where two or more local entities provided drainage systems and services. Because Mecklenburg County managed the regulated floodways throughout the County, including areas in incorporated cities and towns, the County staff wished to have a utility that was county-wide. However, there was some reluctance among the County Commissioners to lead that approach. Once it was clear that a cooperative approach was not moving forward, the City of Charlotte determined that it could not defer its solutions and would institute a stormwater utility to support its local drainage system programs including funding for compliance with Phase I stormwater requirements. The City utility was instituted by the City Council and service fees were initiated in January, 1993.

Once it became clear that the City was proceeding independently, the County Board of Commissioners determined that it would proceed with formation of its utility. This caused both entities to revisit the issue of a single county-wide utility. It was determined that the County utility would supplant the City utility as a legal entity when it was formally instituted in 1994. The structure and control of budgets, rates, and fees was a key to this agreement. This process was facilitated by the fact that the County and City had retained the same consultant team to assist both parties from the beginning of the process. That enabled the entities to arrive at consistent governance, rate, and program decisions, and implementation of the master account files and billing systems was eased.

Another aspect of the County and City of Charlotte negotiations involved the provision of services in the smaller towns that surround Charlotte. In order to obtain their agreement to participate in regional solutions and application of County utility service fees within their jurisdictions, the County agreed to extend control over many key policy issues such as rates to their elected Councils.

A permanent, nine-member Storm Water Advisory Committee (SWAC) is appointed by the Charlotte City Council, Mecklenburg County's Board of Commissioners, and Town Councils of Cornelius, Davidson, Huntersville, Matthews, Mint Hill, and Pineville. SWAC members represent diverse neighborhood, business, institutional, and environmental interests.

Service Area

The total area of Mecklenburg County is approximately 526 square miles. The City of Charlotte is approximately 280 square miles of the County, while the smaller six towns collectively contain (or maintain through Extra Territorial Jurisdiction) the remaining area of the County. North Carolina annexation laws allow aggressive annexation policies to be pursued by cities and towns. At the time the stormwater utility was being formed Charlotte and the satellite cities and towns had reached separate agreements on their respective spheres of influence which will control future annexations as urban/suburban development occurs. The County remains essentially a rural services provider, and the city and towns are urban services providers. Annexations tend to occur each year to two as urban/suburban development spreads into the unincorporated areas. This has directly influenced the initial division and gradual shift of stormwater management responsibilities.

Pursuant to state legislative limitations, the Mecklenburg County stormwater utility is the single, county-wide stormwater utility and encompasses the controlled by a series of dams and impoundments such as Lakes Norman and Wylie. The County's efforts focus on the regulated floodways of the major creeks throughout the County. Drainage systems in the unincorporated areas that are not within road corridors are also managed, but these are a lower priority. The State of North Carolina Department of Transportation is responsible for roadway drainage systems throughout the unincorporated area, and for some systems in the incorporated cities and towns.

Mecklenburg County recently consolidated several previously dispersed functions into a Land Use and Environmental Services Agency (LUESA). Its scope of responsibility includes floodplain management, stormwater services, water quality, land development, zoning, groundwater protection, on-site wastewater management, private water well permits, and others that were integrated in a Water and Land Resources organization. The County's objective in consolidating these programs in one operating unit is to ensure a clean and livable environment through the protection and enhancement of water and land resources.

The County's program also provides floodplain management county-wide. Federal flood insurance provisions mandate that floodplains be delineated where tributary watershed areas exceed 640 acres, which corresponds to the drainage area definition employed by Mecklenburg County for the major streams management program throughout the cities, towns, and unincorporated areas. The program relies on regulations that limit intrusions into the floodplain. The County's Water and Land Resources group maintains the flood insurance mapping for the entire County. Improvements to and maintenance of the major drainage channels carried out by the County provide effective flood control during most storms. The County also performs floodplain and stormwater service inspections for the cities and towns and is responsible for the small drainage systems in unincorporated areas.

The City of Charlotte program focuses on local drainage systems both within and outside road corridors. Its program heavily oriented toward infrastructure management, and the City recently initiated a capital improvement program that will invest $198 million in construction of system betterments to the local urban stormwater systems over the next five years, utilizing bonds and service fees.

Governance Structure

Mecklenburg County has a single, county-wide stormwater utility governed by the nine-member Stormwater Advisory Committee created for the purpose of levying varying service charges across the County and seven municipal jurisdictions. The utility service fees within incorporated areas are levied pursuant to inter-governmental agreements with the respective city and town councils. Decisions on program content, level of service fees, and how to provide service (in-house, inter-agency, outside contract, etc) in the incorporated areas are the province of the cities and towns. The seven city and town councils set the stormwater service incorporated areas by inter-governmental agreement. The individual cities and towns are stormwater service agencies within their respective jurisdictions, but utility service fees to support their programs are levied by the Board of County Commissioners.

It was decided that the County and, to a lesser degree, the City of Charlotte would support the smaller cities and towns stormwater management efforts by offering a "menu" of services to them. Since Mecklenburg County remained responsible for the regional drainage facilities throughout the County and also for the rural drainage systems in the unincorporated areas, it was judged to be best suited to provide those services to the smaller towns. Since the City of Charlotte performs street drainage maintenance, it was determined that it would offer similar services to the smaller cities and towns, though most currently maintain those systems in-house. (It should be noted that county governments in North Carolina do not operate road systems. There are state highways and city streets and highways only – no county roads. Thus, the State of North Carolina Department of Transportation is an important player in road-associated stormwater management in unincorporated areas of the state and is also responsible for some roads within incorporated cities and towns.)

One of the most notable differences in stormwater services in Charlotte/Mecklenburg is that systems located outside road rights-of-way and easements are also maintained by the City if "public water" is present. That includes runoff from any public street or property. This policy enables the City to actively manage nearly all of the drainage systems rather than just those components located in roadways. As a result, the County and municipal stormwater programs apply much more effort to stream protection and enhancement than in most communities.

Role and Program

Mecklenburg County and the City of Charlotte both continue to have substantial stormwater management roles and programs. The County has an engineering and operational staff geared to management of major drainage systems serving watersheds of more than one square mile and rural drainage systems serving smaller watersheds in the unincorporated areas. The City of Charlotte has a stormwater engineering staff in the City Engineering and Property Management Department and an operational staff in its Department of Transportation. Charlotte has a Phase 1 NPDES permit, which is supported by contracted County forces that provide water quality monitoring and data management. The County and towns have a Phase 2 permit.

Although the County focuses its program on the larger creeks, the role of both agencies is primarily urban stormwater management simply because the area is now extensively urbanized. Flood protection is an important objective, but the area is subject only to small drainage system flooding rather than major river flooding along the Catawba River, which traverses the County. The Catawba is fees applicable to improvement and maintenance of the smaller systems within their limits, and the County Council adopts them as part of their rate methodology.

This stormwater management governance structure has now been in place for over a decade, and has enabled all of the local jurisdictions to perform stormwater management at the level desired by their local elected officials. Most of the smaller towns simply use the same rates that the County applies in the unincorporated area, although the Town of Davidson has opted to charge a lower service fee.

Organization and Staffing

The organization and staffing of the stormwater management units in Mecklenburg County, the City of Charlotte, and the smaller satellite cities and towns varies greatly. The County and City of Charlotte have in-house staffs of approximately thirty and seventy-five people (respectively) with the full range of engineering and operational skills required to administer their respective programs. Both also make substantial use of outside consultants and contractors. In addition, the City stormwater program pays the City's annually to maintain drainage systems located in roads. The smaller towns' stormwater staffs range from a portion of one full time equivalent position to several people dedicated to the stormwater management function. They rely heavily on the County, City of Charlotte, and outside contractors for engineering and operational support. Day to day activities associated with NPDES compliance, including extensive monitoring, is provided primarily by the County.

The differences in and dispersion of responsibilities among the County and the towns has resulted in the creation of some innovative concepts. For example, the City of Charlotte developed a program to expedite construction of small capital projects and remedial repairs. A list of pre-qualified local construction firms is maintained, and unit price bids are obtained annually for certain common activities and materials. When a complaint about a drainage problem is received, a City stormwater inspector determines the priority ranking of the problem. If it is in a high priority category (such as home flooding, street flooding, or other safety issue), a qualified vendor on the list is called in, any required engineering is done immediately (often in the field), and a work order is issued. This program enables the City to respond to many complaints within 30 to 60 days, which has gained high community and City Council approval. The County has a similar program.

Funding

The County stormwater utility service fee is the primary source of funding for stormwater management in Mecklenburg County. The total stormwater budget for all entities in Mecklenburg is over $85,000,000. A large part of this is for capital betterments to the systems primarily within the City of Charlotte. The

City's budget for capital projects in the current fiscal year is over $40 million, and the City's annual stormwater operating budget is an additional $32 million.

A consistent impervious area rate methodology is used throughout the County, with a flat rate for single-family detached residential properties and an equivalency unit of 2,613 square feet of impervious coverage applied to all other properties. Single-family residential customers are billed for one equivalent unit. The equivalent unit flat rate applied to single-family residential customers for the regional component of the program is $1.06/month throughout the County. The local stormwater program elements provided by the County and City and towns are funded by a separate rate component.

Because Mecklenburg County has a composite fee comprised of the regional system component and local fees determined by the City and towns, the rates vary by jurisdiction. Charlotte and Mecklenburg County have a dual flat-rate user fee for single-family residential properties, with the break being at 2,000 square feet of impervious coverage. The City's current single-family charges are $5.18/month and $6.72/month. The County's are $3.33/month and $4.03/month for the local component of the rates in the unincorporated areas. The local component of the rates applied in the other towns range from $.30/month to over $2.00/month.

Additional funds have also been appropriated for stormwater management by many of the entities, resulting in some novel blending and dedication of resources. For example, even after its utility service fee was adopted, the Charlotte City Council decided to continue to appropriate approximately the same amount from general revenues for stormwater management as was previously budgeted (about $5 million annually). Those funds were specifically assigned to water quality programs to avoid a potential problem within the state authorizing legislation (which was later rectified by statute). This allowed the City's initial service fee rate to be approximately sixteen (16) percent lower than would otherwise have been required to meet the cost of services and facilities. After the stormwater utility had been in place for three years, one-half of the general revenue support for stormwater management was incrementally reduced over a four year period, which transformed the City's general government capital program. The City continues to make a general fund contribution to the stormwater program..

Inter-governmental Cooperation

The strong emphasis on local control of the small-watershed programs combined with the regional responsibilities of Mecklenburg County has resulted in a great deal of collaboration and mutual support by the participating entities. Financial management offers a good example. Administration of the service fee master account file billing and collection is provided by the City of Charlotte's Finance Department. Accounting for the individual programs is performed separately by each entity.

This approach extends to engineering and operational functions as well. The County and City of Charlotte perform master planning and engineering for watersheds and drainage systems, often by employing outside consultants. Because the local watersheds cross many jurisdictional boundaries, this function commonly involves and benefits the smaller towns as well. The City of Charlotte is undertaking a $198 million capital projects program that will construct new drainage systems, improve existing facilities, and repair known deficiencies over five years. Some improvements will be done outside the City to attain the most efficient solutions to problems within Charlotte, resulting in incidental service benefits to other entities. The County and City of Charlotte operational forces also provide various services to the smaller towns per operating agreements or on an ad hoc basis at their request. The County performs over $1 million of monitoring, analysis, and data processing services for the City's Phase 1 NPDES compliance program. The water quality programs, including NPDES compliance efforts, also involve the County, City of Charlotte, and satellite communities in many cooperative efforts such as public education.

The City and County have also consolidated stormwater customer service. Service requests are coordinated through a single telephone contact number, [704] 336-RAIN (which translates to [704] 336-7246). Regardless of which local governance jurisdiction a person resides in, he or she can file complaints or inquiries and receive service assistance from the customer service center.

The Charlotte/Mecklenburg stormwater program receives support from several federal and state agencies for various program components. For example, the United States Geological Survey (USGS) operates a dense hydrologic data-collection network of seventy two (72) rain gauges and forty five (45) stream flow gauges within the city and County. The network of gauges provides valuable data for the documentation and interpretation of water-resources information, including rainfall and flooding events. During a rain event, data is transmitted from these gauges to base stations located at USGS and the Charlotte Mecklenburg Government Center (CMGC) where developing flood conditions are monitored by emergency services staff. In addition to rainfall and stream level data, four stations in the system are also set up to continuously collect water quality indicators such as temperature, conductivity, PH and dissolved oxygen levels in a stream. The cooperative program with the USGS has been in place without interruption since 1961.

Public Participation

Perhaps one of the most outstanding features of the Charlotte/Mecklenburg experience has been the high level of on-going public participation in the stormwater utility program from its formative stage. The County and City of Charlotte assembled a community advisory group and a technical guidance committee to assist with the feasibility investigation when they first considered a combined program. The City continued that effort with a committee of more than twenty persons representing diverse interests as it formulated its initial utility concept. The County then initiated its own utility implementation effort, again with support and guidance from a committee.

Prior to its initial stormwater utility billing, the City conducted an extensive (and costly) public education program to explain the purpose of the stormwater utility and service fee concept. They also introduced the program to the media in the city with factual materials, and obtained strong support from the editorial board of influential local newspaper. Prior to the initial billing, notifications were sent to the largest ratepayers and explanations of the fee and its associated credit system were provided in several general and personal meetings with businesses and the local Chamber of Commerce. As a result, the Chamber of Commerce supported the utility program with its membership. A series of public information brochures were prepared and placed in public buildings, and articles highlighting drainage problems in the city were placed in the print media. A guest commentary article authored by the City was printed in a weekend edition of the major Charlotte newspaper.

After a detailed study of billing alternatives, the City decided to append the stormwater service fee to the Charlotte/Mecklenburg Utilities Department water and sewer billing as a separate line item. On the day the first stormwater service fee billings were mailed, a ground-breaking ceremony was held for a construction project to resolve a highly-visible, long-standing drainage problem. It received heavy coverage by local television news programs. The message of the day was that the City had begun to address its substantial backlog of known drainage problems, "And, by the way, you (i.e., the public) will be receiving a new line item on your utility bill to support this effort". It might have easily been "There's a new fee in town. What are they doing with your money?"

The City also prepared very well for public response to the initial service fee billing by assembling and training a cadre of special customer service agents, retained through a temporary employment agency. A contact telephone number was printed on the billings to direct calls to this group of specialists, relieving the potential burden on the utility billing customer service staff that normally responded to water and sewer billing inquiries. The twelve special customer service agents were retained for sixty days, or two full billing cycles. As the inquiries tapered off, the number of special agents was reduced accordingly, with all inquiries eventually being shifted to the in-house customer service staff, who had also received training on the proper responses to various questions.

In total, the City of Charlotte spent approximately $250,000 (in the early 1990s) to educate the community about the local stormwater needs and utility program, and prepare for the initial service fee billing. This represented approximately two weeks of the utility service fee revenue stream at that time, but resulted in a high level of public acceptance. There was (of course) some opposition by tax-limitation advocacy groups, but the high level of accountability provided by the dedication of funding dispelled most of their objections. Within two years, a City Council member who represented that interest tax-limitation group stated publicly that, if every City program was as well run as efficiently and responsively as the stormwater utility, there would be no need for tax-limitation advocacy.

The high level of community education and involvement continues, with many educational materials, activities, and actively-involved support groups. The City commonly provides hyetographs from its rain gauging network on its website following severe rainfall events that cause flooding. This has educated the general public regarding the high variability of intense thunderstorm rainfall that occurs across Mecklenburg County, and reassures the public that the staff is aware of what is happening. The City's stormwater capital improvements program, funded in large part by sale of bonds, also features extensive public education and participation programs, such as Adopt-A-Stream and Storm Drain Marking.

CITY OF TULSA, OKLAHOMA

Keynotes

- The Tulsa Stormwater Management Utility was founded in response to a devastating one-day urban drainage system flood that killed 14 residents and did nearly US$200 million damage to public and private properties in 1984.

- Tulsa's Stormwater Management Program provides a full range of capital infrastructure and operational services. In addition to roadway drainage systems, it is responsible for an extensive stream system outside road rights-of-way. The City has a Phase 1 NPDES permit.

- Since forming its Utility, Tulsa has received over $100 million in federal support for capital infrastructure improvements, removal of structures from flood-prone areas, and hydrological data gathering.

- Funding of the Tulsa day-to-day stormwater program is primarily derived from a user fee.

- Key funding policies include:

    - a user fee rate methodology based on the impervious area of each property, with residential fees being a single rate;
    - use of general obligation bond sales and sales tax revenues to fund construction of capital infrastructure improvements; and
    - aggressive pursuit of federal grants and loans to supplement local resources.

Key operational practices include:

- watershed-based master planning of stormwater systems throughout the City, with emphasis on flood control; and
- stormwater management functions performed by in-house staff, including NPDES permit compliance.

Community Profile

The City of Tulsa was incorporated as a municipality in 1898. With the discovery of oil in nearby Red Fork in 1901, Tulsa grew quickly and reached a population of more than 7,000 by 1907. After Oklahoma became the 46th state in the United States in 1907, the City voters adopted its first city charter on July 3, 1908. The City was governed by three elected commissioners from 1909 through 1989, when the voters amended the charter to adopt a mayor/council form of government. The Mayor is now elected every four years (at large) and nine City Council members are elected to two-year terms from geographic districts.

Tulsa lies in the heart of a fertile forested region of rolling hills in northeastern Oklahoma. It is the second largest city in Oklahoma, located 90 miles northeast of the state capital, Oklahoma City. The average annual rainfall is thirty-nine (39) inches. The region is sometimes referred to as "Tornado Alley" in recognition of the severe storms that often occur in the Spring. Violent windstorms are often accompanied by extraordinarily intense rainfall, which has been a key factor in Tulsa's stormwater management problems and search for solutions.

The land area of the City today is approximately 198 square miles. It has a population of 392,000. The economy of the community is highlighted by higher education (seven universities), energy, telecommunications, and transportation/warehousing. Tulsa has an in-land deep-water port located on the McClellan-Kerr Arkansas River Navigation System, offering a Foreign Trade Zone, two industrial parks and liquid and dry cargo storage.

Tulsa has grown up with flooding. Some consider it a "poster child" example of the stormwater management struggles that local governments experience. Many of the causes of Tulsa's problems are a function of its location: the city is on a major river (the Arkansas), in a region of violent storms, and was initially developed on the American frontier, where one had a right to do as he (or she) wished with the land - including building structures in inappropriate, flood-prone locations.

Local flood records are sparse before 1900. In 1908, only a year after statehood, Arkansas River flooding at Tulsa caused $250,000 in damages (over $25 million in 2004 dollars). By 1920, the town had outgrown its raw, boomtown youth. As riches mounted from the oil industry and investors and speculators poured in, Tulsa grew into a wealthy city of 72,000. But development edged ever closer and closer toward the river banks. On June 13, 1923, the Arkansas River flooded Tulsa's waterworks, caused $500,000 in damages ($20 million in 1994 dollars), and damaging homes leaving 4,000 citizens homeless. City fathers responded with Tulsa's first land-use plan, which envisioned upland boulevards and housing. In the lowlands, such as the Mingo Creek riparian stream corridor east of town, the plan indicated there would be generous parks and recreational trails.

Significant flooding occurred again in 1943. In response to the flooding, the U. S. Army Corps of Engineers (COE) built levees around Tulsa's oil refineries along the Arkansas River as a World War II national defense measure. By 1950, in the post-war building boom, housing fanned out onto the floodplains to the south and east of the downtown area. Land that had periodically flooded with little harm now was awash in wave after wave of development and, periodically, urban flooding. By the late 1950's, flooding of newly developed subdivisions along the Arkansas River spurred calls for flood control. In 1964, the COE completed Keystone Dam on the Arkansas River, fifteen miles upstream from Tulsa. For years to come, Tulsans would believe that the Arkansas River was forever tamed.

Tulsa enjoyed another economic boom based on energy resources in the 1960s, when the city's population grew 25 percent. Tulsa's rapid growth resulted in the paving and piping of vast areas of pastures and meadows, and new buildings continued to spill into the lowlands along the creeks and streams that etch the area. The rapidly urbanizing Mingo Creek watershed was annexed to the city in 1966. Localized floods struck every two to four years during the 1960s and early 1970s, but the response was classic "flood relief": emergency response and recovery, reconstruction as quickly as possible, and denial of the possibility that damaging floods could reoccur. Victims petitioned for neighborhood flood control, with limited success.

A flood in the Spring of 1970 caused $163,000 in damages in the rapidly developing Mingo and Joe Creek watersheds. The City responded by joining the federal government's National Flood Insurance Program's (NFIP) "emergency program" and promising to adopt federal floodplain regulations. In August 1971, the NFIP issued its block rate maps. A month later, floods hit Flat Rock, Bird and Haikey Creeks inundating many suburban neighborhoods once again. In December that year, Bird Creek flooded again. Tulsa joined the NFIP's "regular" program, adopted a new 100-year flood standard, and promised to regulate floodplain land use.

In April and May, 1974 floods left $744,000 in damages (over $6 million in 2004 dollars) on Bird Creek. Violent storms June 8 of that year caused widespread flooding on Joe, Fry, Haikey and Mingo Creeks, with more than $18 million in damages ($80 million in 2004 dollars). On September 19, 1974 Mingo Creek flooded yet again. For some citizens, it was the third flood in less than a year. Angry, drenched victims waded out of the floods to demand help from City officials. They contended the City wasn't enforcing its NFIP regulations. They tried to halt development, to avoid deeper flooding until existing problems could be solved. Developers objected strenuously. Thus began a community debate over floodplain management, locally called "Tulsa's great drainage war," that was destined to last more than a decade. The city responded with a plan to widen part of Mingo Creek, including clearance of 33 houses in the most flood-prone area. The houses were removed just before the next flood in May, 1976.

The May, 1976, flood marked a milestone in Tulsa's search for solutions. A three-hour, 10-inch deluge was centered over the headwaters of Mingo, Joe and Haikey Creeks. The resulting flood killed three citizens and caused $40 million in damages ($140 million in 2004 dollars) to more than 3,000 buildings. By this time, the victims were becoming skilled lobbyists and gathering sympathizers citywide. They virtually stormed City Hall to demand solutions. Newly elected city commissioners responded with a wave of actions. They enacted a floodplain building moratorium; hired the city's first full-time hydrologist; developed comprehensive floodplain management policies, regulations and drainage criteria; enacted stormwater detention regulations for new developments; instituted a fledgling flood alert and warning system; and began master drainage planning for major creeks. In 1978, an earth change (erosion and sediment control) ordinance was also adopted, giving the city control over alterations to Tulsa's landscape, including floodplains and stream channels.

In the early 1980s the federal United States government developed the federal Inter-agency Hazard Mitigation process to curb repetitive flood losses. After flood disasters, federal teams were dispatched to identify hazard mitigation opportunities, i.e., ways to make the response to each disaster reduce the scope of the next one. The mitigation concept focused on correcting the causes of losses, including removing, raising, or flood proofing the most vulnerable of the damaged buildings. Tulsans worked with the Federal Emergency Management Agency (FEMA) to develop the process. Tulsa's early exposure to the new FEMA mitigation program was to have a significant impact on the city's response to future floods.

On the three-day weekend marking the Memorial Day holiday in May, 1984, the worst flood in Tulsa's history struck. After a muggy Sunday a stalled cool weather front produced thunderstorms that dumped some fifteen (15) inches of rain overnight in just twelve hours. The rainfall was centered over the Mingo Creek watershed, but also extended across most of the city. The results were disastrous. The flooding killed 14, injured 288, damaged or destroyed nearly 7,000 buildings, and left $180 million in damages ($425 million in 2004 dollars). The Mingo Creek corridor alone accounted for $125 million of the damages. It was truly a localized, urban stormwater system flood. Local streams flooded while the nearby Arkansas River remained well below flood levels.

Problems continued in the years following despite formation of Tulsa's stormwater utility in 1985. In 1986, a major flood of the Arkansas River tested the new stormwater management program. It also served as a reminder of the finite protection provided by the Keystone Dam upstream from the city. Between September and October 1986, unrelenting upstream rains filled the Keystone Reservoir to capacity, forcing the COE to release water at the rate of 310,000 cubic feet per second. Downstream flooding was inevitable. At Tulsa, a privately maintained levee failed, causing $1.3 million ($5million in 2004 dollars) in damages to 64 buildings. The City fielded its hazard-mitigation team and cleared 13 substantially damaged structures, and more widespread damage was avoided.

Formation Process

A newly elected mayor and street commissioner had been in office for only 19 days when the Memorial Day flood struck in May, 1984, but both knew the issues well. In the darkest hours of their community's worst flood, they pledged to make their response reduce the likelihood that such a disaster would ever be repeated. Before daylight, they had assembled the city's first Flood Hazard Mitigation Team to develop the City's strategy. Within days, a new approach to Tulsa flood response and recovery was born.

The flood response effort was only the beginning. A unified stormwater program was created, with City leaders committing to make Tulsa flood-safe. As ultimately completed, the program included relocation of 300 flooded homes and a 228-pad mobile home park, $10.5 million in flood control works, and $2.1 million for master drainage plans. The total capital program topped $30 million, mostly from local capital sources, flood insurance claim checks, and federal funds.

The devastation of the 1984 flood persuaded Tulsans that a coordinated, comprehensive stormwater management program was needed from the rooftop to the river. A Department of Stormwater Management was established in 1985, centralizing responsibility for all city flood, drainage, and stormwater programs. A stormwater utility fee was established by ordinance in 1986 to fund the program. The utility fee ensured stable funding for maintenance and management, independent of fickle political winds. The service fee ordinance allots all fee revenues exclusively for floodplain and stormwater management activities. Over several years an extensive system of recreational greenways was created along the Mingo Creek and other streams, providing bicycle and walking paths as well as green space areas. When the Memorial Day flood devastated Tulsa in 1984, the City had 57 detention ponds. By 2000, there were 85 detention ponds plus many other stormwater facilities including improved conveyance channels.

Service Area

The Tulsa Stormwater Utility is responsible for stormwater management throughout the City's 198 square miles.

Role and Program

Simply establishing a stormwater utility could not instantly correct Tulsa's stormwater and flooding problems. A comprehensive, long-range stormwater program strategy was formulated by the utility staff, coupled with extensive capital infrastructure master planning during the 1980s. The City's objective was to manage stormwater both within public rights-of-way and easements and along the many creeks that drain the hilly terrain of the community.

The Public Works Department, in conjunction with a Stormwater Drainage Advisory Board and numerous citizen groups, developed a phased implementation program for projects identified in the City's basin drainage plans. The projects were funded in part by a combination of stormwater fees, sales tax revenues or bond issues. Construction of the improvements identified in the master planning project proceeded quickly based on the assured funding capability provided by the stormwater service fee. The City was also able to obtain more than $100 million of COE funding for various capital improvements to the stormwater systems.

By the early 1990s, FEMA ranked Tulsa first in the nation for its floodplain management program, allowing Tulsans to enjoy the nation's lowest flood insurance rates. The program was also honored with FEMA's 1992 Outstanding Public Service Award; and the Association of State Floodplain Managers has twice given Tulsa its Local Award for Excellence. This represented a significant turn around in just eight years following the devastating flood of 1984. Since adoption of the FEMA community rating system, Tulsa has had one of the best ratings including a 2.0 rating in 2005.

Today, Tulsa's floodplain and stormwater management program is based on respect for the natural systems. It is nationally regarded as a pacesetting program, and includes comprehensive watershed management, dedicated funds for maintenance and operation, a prototype flood alert system, and a $200 million capital improvements program.

Tulsa's drainage systems have not been tested by a catastrophic rainfall since 1986, but the system has handled less intense rainfall events well. City leaders believe improved maintenance, continuing capital projects, stringent regulations, and aggressive citizen awareness programs will reduce but cannot entirely eliminate future flood losses.

A powerful testimony to the program is that, since comprehensive regulations were adopted in 1977, the city has no record of flood damages to any building that complies with those regulations. Implementation of the user-pays service fee funding is also given enormous credit by staff and elected officials because it enabled the City to elevate its capital investment and operational expenditures to a level that complements regulatory measures by resolving inadequacies in the systems that had existed for decades.

Tulsa has instituted an aggressive floodplain program. The City's long experience with flooding showed that the National Flood Insurance Program's minimum standard is insufficient for Tulsa. Therefore, the city's regulations exceed NFIP's standard in several important ways. The NFIP floodplain maps are based on existing development. However, unless plans and regulations are based on future watershed urbanization, new development may well flood as uphill urbanization increases runoff. Tulsa enforces the NFIP minimum regulations and maps to retain eligibility for federal flood insurance but, in addition, the City enforces its own more extensive maps and regulations. Those regulations are based on ultimate watershed urbanization as forecast in the City's comprehensive plan.

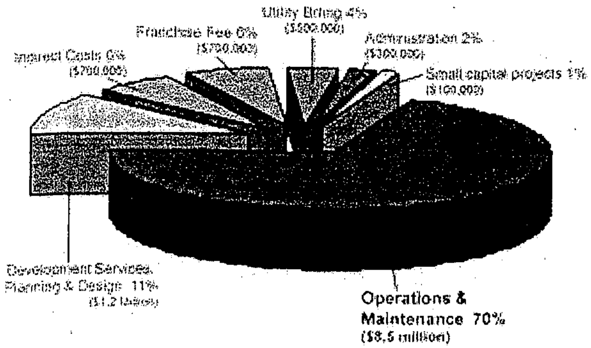
The Tulsa stormwater program is much more than flood control. The City is also building parks in the floodplains, sports fields in stormwater detention basins, and greenway trails on creek banks. It has forged strong partnerships with federal and state agencies. Tulsans now enjoy the lowest flood insurance rates in the country, and the community is reaping benefits from national awards and favorable publicity. Tulsa's progress has been called an example of what can happen when a community fully commits to solving urban stormwater problems.

Organization and Staffing

The City staff was reorganized following a City Charter change in 1989 that substituted the mayor/council for a government for the commission approach. A new Department of Public Works consolidated all public works services, including stormwater management, but the dedicated stormwater service fee funding was retained. Today, stormwater management is an accepted and integrated part of the city's services.

Funding

The City's stormwater management program budget has ranged from $12 million to $14 million during the past three years. Current service fees are based on impervious area and are set at $3.49/month per "equivalent service unit" (ESU). The ESU is defined as 2,650 square feet of impervious coverage, representative of the average condition on single-family residential properties. Service fee revenues total over $12 million. Where does the stormwater fee money go?



Total Annual Stormwater Budget: $12 Million

Expenditures for the City's FY 2002 are shown in the pie chart to the left. As it shows, stormwater fees are used primarily for maintenance of stormwater detention facilities, stream channels, pumping stations, culverts, ditches and other drainage facilities. After storms and when needed at other times, crews remove material blocking stormwater flow in channels and detention sites. On average, the City crews clean more than 22 miles of ditches and clear about 5 miles of drainage pipe each year. They remove tons of silt from channels and reconstruct eroded earthen channels.

Inter-governmental Cooperation

Tulsa assists the suburban satellite communities that surround it in their stormwater management efforts, but most of its attention to inter-governmental cooperation has involved federal agencies that offer funding for specific priorities such as flood protection and hydrologic monitoring and analysis.

Public Participation

The City of Tulsa involved the community in many of the major decisions as it formulated and implemented its stormwater utility program and associated funding mechanisms. A citizen advisory committee guided the initial response to the devastating flood in May, 1984, which included assembling a consulting team to assist with utility feasibility analysis and implementation.

Once the utility was formed and user fees were in place, the citizen advisory group shifted its attention to the content of the program and, especially, the capital improvement planning to address flooding problems. They have continued to be a major political force in support of the utility. The City also instituted a variety of community education and involvement initiatives aimed at improving flood emergency awareness, water quality management, and utilization of water resources in the riparian corridors.

LOUISVILLE/JEFFERSON COUNTY (KY) METROPOLITAN SERVICE DISTRICT (MSD)

Keynotes

- The Louisville approach involves a consolidation of flood control and stormwater management with a regional wastewater collection and treatment program provided by the Metropolitan Sewer District, or MSD. Most of the smaller cities and towns in Jefferson County do not perform stormwater management functions.

- The MSD was authorized by special state legislation in 1946, and established by Jefferson County and the City of Louisville. The MSD service area is virtually county-wide. Its Board is appointed by the now consolidated Metro government council which directs the amalgamated County and City.

- MSD is funded principally by wastewater and stormwater service fees, which are independently structured, billed, and accounted for.

- Stormwater service fee attributes include:

    - an impervious area rate methodology;
    - a flat rate charge for single-family residential properties; and,
    - differential rates for other properties based on an impervious area equivalency unit.

- Key operational practices include:

    - watershed-based master planning throughout the County;
    - a consolidated NPDES permit administered by MSD; and
    - a broad range of functions that include a major flood control program responsible for approximately 29 miles of levees and protection works and fifteen large pump stations along the Ohio River.

- The MSD has a staff of more than 600 that performs both wastewater and stormwater administrative, engineering, operational, regulatory, and infrastructure improvement/management functions. The staff is extensively cross-trained to obtain efficient operations.

Community Profile

Louisville, 365 square miles and population 700,000, is the largest city in Kentucky. It is located on the south shore of the Ohio River, and was founded in 1778 by frontier explorer and military hero George Rogers Clark. It is located in Jefferson County, which is named for Thomas Jefferson, who was the Governor of Virginia when the city was founded and later served as the third President of the United States. It soon became a major shipping center along the Ohio River, which reaches almost 1,000 miles into the Midwest of the United States. Among other noteworthy claims to fame, it is the home of the Louisville Slugger baseball bat and hosts the Kentucky Derby, one of the premier annual horse races in the world. The county and city governments were recently consolidated into a "metro" government as provided for by state law.

As a community located on a major river, Louisville has always been concerned about flood control and stormwater management. Repetitive major flooding incidents of low areas along the river led eventually to the construction of more than 20 miles of flood protection levees and large pump stations beginning in the early 1900s. In the 1980's local officials determined that effective management of both the major flood control works and the smaller urban drainage systems required a consolidated program. The Louisville/Jefferson County Metropolitan Sewer District (MSD), then the regional wastewater service provider, was tapped to take over all stormwater management responsibilities.

Following detailed studies, MSD adopted a dedicated stormwater service fee to fund a full range of stormwater management and flood control services and facilities. The MSD stormwater service fee is separate from the agency's wastewater fee, though the staff is extensively cross-trained to efficiently perform both functions. The user fee has been tested in court and sustained at the Kentucky Court of Appeals level. MSD's responsibilities have been expanded to include stormwater quality in recent years in response to federal NPDES requirements.

Formation Process

The MSD was formed by the City of Louisville and Jefferson County pursuant to a state authorizing statute. Shifting the County's and City's flood control and stormwater management responsibilities to the MSD was accomplished by actions of the Board of County Commissioners and City's Board of Aldermen. The political decision to shift flood control and stormwater management to MSD was essentially made before the program and funding development and implementation work began, which enabled the process to be completed in just eight months. There was very little public participation in the formation process, though a concentrated effort to inform and educate the public about the new service fees was initiated immediately prior to the first MSD stormwater service fee billing.

Jefferson County had more than ninety cities and towns when the stormwater management function was appended to the MSD wastewater program. Towns of the fourth, fifth, and sixth class (per population as specified by state statutes) had no option whether or not to be included in the MSD stormwater program. Cities of the third and second class had statutory authority to decline to be included, but there were no second class cities in the County at that time (1986). A few of the third class cities declined to be included, and still are not. This created gaps and inconsistencies in stormwater services across the County as MSD's program grew. Those gaps still create some problems for both MSD and those cities.

Service Area

MSD's stormwater service area is now approximately 280 square miles and encompasses nearly all of Jefferson County. It is similar to but not precisely the same as the wastewater collection and treatment service area. Substantial portions of the former City of Louisville have combined wastewater/stormwater sewers. Outlying areas have separated sewers and many open drainage components (creeks, ditches, roadside drainage).

Role and Program

MSD has two major program responsibilities, wastewater collection/treatment and stormwater management/flood control. Flood control is particularly important because Jefferson County is located on the Ohio River. Large areas of Louisville were historically flooded by the Ohio River, and an extensive system of flood protection levees and pump stations was constructed following the flood of record in1937. Maintenance of the flood protection works was originally a county responsibility under U.S. Army Corps of Engineers oversight. That function was transferred to MSD along with stormwater management responsibilities. MSD also assumed responsibility for development-associated erosion and sediment control programs, though it does not have land use authority.

Governance Structure

MSD has a seven member Board of Directors, included a chairperson, appointed by the Louisville/Jefferson County Mayor and Metro Council. The MSD Board guides policy and sets service fee rates.

Organization and Staffing

MSD has an appointed administration and a substantial staff of over 600 management, engineering, operational, and support personnel. It has reduced staff count from more than 860 in 1995 in part by outsourcing some operations. MSD continues to perform many stormwater management functions in-house. Outside contracting is used to attain greater efficiency or when special expertise or equipment is required. The engineering and operational staffs are highly cross-trained to perform both wastewater and stormwater services.

Funding

The wastewater and stormwater components of the MSD program are funded by separate service fees that are independent and dedicated to each purpose in terms of rates, revenues, expenditures, and accounting. The current single-family residential stormwater service fee is $4.70/month. Rates are based on impervious area, and an equivalency unit of 2,500 square feet is used to normalize non-residential charges to the single-family residential flat rate. Each equivalent unit on developed non-residential properties is charged $4.70/month. Consistent with MSD's wastewater rate practices, the stormwater service fee rate is adjusted annually to meet budget projections. Total stormwater service fee revenues in Fiscal Year 2006 (July 2005) are expected to be nearly $26,700,000.

Inter-governmental Cooperation

Because MSD provides a centralized flood control/stormwater management program for nearly all of Louisville/Jefferson County, the need for inter-government collaboration is low in comparison to the other communities cited in this guidance document. Coordination with the cities that opted out of the MSD stormwater service area is sought, and MSD performs many planning, public education, and other development review functions that are beneficial to those cities.

Public Participation

MSD's stormwater program was initiated with little public participation, but the agency has sought out public involvement in many aspects of its stormwater services over the years since then. Infrastructure management, most notably construction and remedial repair programs, is administered by teams that work closely with local elected officials and community groups to prioritize and undertake projects. Community relations are facilitated by a telephone hot line for service inquiries and complaints, and a designated staff is assigned to assuring effective response to customers. The staff maintains close contact with elected officials as capital improvement and remedial repairs projects are developed and undertaken. MSD also conducts numerous community involvement efforts associated with stormwater quality programs, and has developed brochures and other materials that are available throughout the community.

SARASOTA COUNTY (FL) STORMWATER ENVIRONMENTAL UTILITY

Keynotes

- The Sarasota County approach provides a strong, centralized stormwater management planning, improvement and operations program conducted by a large staff of more than 120 persons, with additional support for related activities performed by about 50 employees of other County work groups. The primary objectives of the Stormwater Environmental Utility are to reduce flooding, improve surface water quality, and attain responsible development practices.

- A Florida Supreme Court decision in 1996 determined that the Sarasota County stormwater charge is a special assessment rather than a service fee. As such, it is subject to the standards applicable to assessments, which emphasize the apportionment of special benefit (that not available generally to all) and rational nexus rather than the reflecting the demand burden (cost of service) imposed by each person or property on the public stormwater systems and programs.

- Sarasota County is a charter county governed by a five-member Board of Commissioners and directed by a professional County Administrator. The Public Works Business Center includes the Stormwater Environmental Utility. There are four cities in Sarasota County. The city of Sarasota relies on the County to improve its drainage system and perform most stormwater operations. The other three cities retain responsibility for local stormwater systems.

- The Sarasota County stormwater utility is funded by benefit assessments on properties in the County and by inter-governmental agreement in the City of Sarasota. The assessments have three components that are consistent across the service area, and one component (system capitalization) that is variable by watershed. The benefit assessments are billed on the County's property tax bills.

- Under constitutional changes adopted in 1968, Florida counties may adopt charters that give local elected officials great latitude in determining the functions of their county and the preferred method of funding. Sarasota County has adopted such a charter. The Florida Statutes Chapters 125 (County Government), 163 (Intergovernmental Programs), 197 (Tax Collections, Liens, and Sales), and 403 (Environment Control) also specifically enable both cities and counties to establish utilities and adopt service fees and special assessments, or otherwise influence how they organize for and fund stormwater management. The Florida Statutes also enable counties to use such other revenues as they determine to be appropriate, or guide their manner of doing so.

- Key policies adopted by the Board of Commissioners and practices instituted by the staff are applicable throughout Sarasota County and in the City of Sarasota. Core funding policies include:

    - Capital investments will be funded by benefit assessments peculiar to each watershed; and
    - funding of customer service and administration, master planning, and maintenance will be funded by benefit assessments that are the same for all watersheds.

  Key operational practices include:

    - watershed-based master planning has been conducted throughout the County (26 watersheds), and capital improvements are being made;
    - centralized stormwater quality management is performed by the County stormwater utility to ensure compliance with the local NPDES permit; and
    - a flood protection and response program is provided county-wide.

- Sarasota County has a large staff (120 +/-) within the Stormwater Environmental Utility and also allocates substantial portions of other employees' time to stormwater management activities (50 +/-). Master planning is contracted to private vendors.

Community Profile

Sarasota County is located on the Gulf of Mexico on Florida's West Coast approximately sixty miles south of Tampa. It was formed when Sarasota County separated from Manatee County in 1921. The area was first homesteaded in the 1840's, but true development did not occur until the railroads arrived at the beginning of 20th century. Citrus fruit growing, other agriculture, and tourism were the basis of the economy for many years, and the County was the winter home of the famed Ringling Brothers circus for decades. The County has become a regional healthcare and commercial business center since the end of World War II.

Sarasota County encompasses 620 square miles and has a resident population of 340,000. The population swells significantly during the winter months when many "snow birds" flee the harsh winters of the Northeast and Midwest United States for the balmy climate of Florida. There are three incorporated cities and one town in the County.

Stormwater management in Sarasota County was not a high priority before the 1980's, when the County increased regulatory activities in response to the pressures of urban/suburban development and the problems associated with drainage in a low-lying coastal community. A Stormwater Environmental Utility was formed in 1989, and studies led to the adoption of a user fee. Sarasota County's stormwater utility is perhaps best known for a Florida Supreme Court decision in 1996, which found that the County was authorized by state statutes to establish the utility and enact a special assessment to support capital improvements and operational programs.

Formation Process

Sarasota County's initial stormwater management program was an outgrowth of its Aquatic Plant Control Department, which was consolidated into the Transportation Department in 1981. In 1989 the Board of County Commissioners established the Stormwater Environmental Utility. An inter-governmental agreement was signed with the City of Sarasota in 1991 and revised in 1997.

Service Area

The Sarasota County stormwater service area encompasses the unincorporated portion of the County plus the city of Sarasota. The County is not responsible for areas lying within other incorporated municipalities in the County.

Role and Program

The Stormwater Environmental Utility is responsible for the County's NPDES permit, and performs master planning for those portions of watersheds that lie wholly or partially in the County. However, it does not perform monitoring associated with the NPDES permit. The Utility is also responsible for capital improvements to and maintenance of the stormwater systems in the unincorporated areas and within the city of Sarasota. County programs are limited to those facilities located in publicly-owned properties and rights-of-way and those within dedicated easements. Systems located on private property and not subject to easements are the responsibility of the property owners. The Utility is also responsible for regulation of the use, storage, and disposal of sediments, herbicides, and other materials, and performs public relations, customer service, development review, and administration of the master account files for benefit assessments. Street sweeping is done by the Road and Bridge Division (Public Works) using sweepers purchased by the Stormwater Environmental Utility. Water Quality monitoring and enforcement is performed by the County's Environmental Services/Pollution Control Department.

Governance Structure

The Stormwater Environmental Utility is a separate account unit operating as a division of the Public Works Business Center. It is governed by the five-member Board of County Commissioners and is within the County Administrator's organizational control.

Organization and Staffing

As a division of the Public Works Business Center, the Stormwater Environmental Utility interacts extensively with other County units. The Utility staff numbers 120 (+/-), and it also financial supports a portion of the personnel expense associated with nearly 50 other County employees whose roles involve them in various aspects of stormwater management.

Funding

The Stormwater Environmental Utility budget in 2005 is approximately $20,000,000, with about $6,000,000 being for capital projects. Funding for the Stormwater Environmental Utility is derived primarily from a composite special benefit unit assessment that has four components. The benefit assessment is based on a calculation methodology that takes both pervious and impervious areas on each property into account. An equivalency unit approach is employed that has several rate classifications for residential properties and individual charges for non-residential that reflects the hydrology of each property. The equivalency unit is referred to as the "Equivalent Stormwater Unit", or ESU, and represents an "effective impervious area" of 3,153 square feet.

The ESU was determined by statistical analysis to be the average condition on single-family residences in the County, i.e. the total area and condition of an average single-family residence burdens the stormwater systems and programs in the manner attributable to 3,153 square feet of impervious coverage. The effective impervious area for non-residential properties is determined by applying a formula that considers both impervious and pervious areas on each property and the conditions present in each case. For example, the pervious areas of citrus groves and orchards are treated differently than pervious areas in pasture or meadow because of the land management practices in the citrus groves and orchards which alter the hydrology. "Urban pervious" surfaces, such as contoured mown lawns, have a much higher effective impervious value than other pervious conditions.

Three benefit unit assessment components are uniform throughout the service area, customer service (administration), master planning, and maintenance. The customer service benefit assessment is a fixed value for each account rather than a charge per ESU, and is presently $3.20/year. The master planning and maintenance benefit unit assessments are uniform throughout the County, and are based on the number of ESU on each property. The master planning assessment is currently $17.92/ESU/year, and the maintenance assessment is $59.33/ESU/year. On average, a medium size single-family residence is assessed $80.45 annually for these three components of the benefit assessment, or approximately $6.70 per month.

The capital infrastructure investment component of the benefit unit assessment is reflective of the costs in each designated watershed, and currently varies from $12 to $141 per ESU per year across the County. The result is that the total assessment applicable to comparable properties in different watersheds may be significantly different.

Credits are provided for in the County's assessment methodology, primarily in relation to the capital improvement benefit assessments. Calculation of the credits is based on three factors, runoff quantity, runoff quality, and peak discharge rate. The stormwater assessments are billed annually along with the County's property taxes. Collection of delinquent billings is accomplished by a lien process similar to that applicable to property taxes.

Inter-governmental Cooperation

The Sarasota County stormwater program is closely coordinated with the cities' programs in the area, especially in terms of NPDES permit compliance, master planning and construction of major systems, and flood control/emergency response. The city of Sarasota has contracted with the County to provide stormwater management services, but three other municipalities retain responsibility for management of the local drainage systems in their communities.

Public Participation

Public participation is focused primarily on NPDES education/involvement mandates, master planning, flood and emergency awareness, and capital project construction. The Utility conducts two public meetings during the master planning process (26 watersheds), and local meetings in areas where capital projects are to be built. The staff also makes presentations at the request of neighborhood association, professional organizations, and special interest groups. The County also responds to inquiries from the city council in the City of Sarasota.

Initial Proposal for Funding from the Water Quality Cooperative Agreements under the Clean Water Act Section 104 (b) (3) (submission deadline 4/22/05 at 2400 EST)

Name of Project: Quantifying the Effectiveness of Site Design / Low Impact Development Best Management Practices in Southern California

Points of Contact:

Matt A. Yeager
San Bernardino County Flood Control District
825 East Third Street, Room 201
San Bernardino, CA 92415-8320
Voice: (909) 387-8112; Fax: (909) 387-7876
myeager@dpw.sbcounty.gov

Kenneth Schiff
So. Cal. Coastal Water Research Project
7171 Fenwick Lane
Westminster, CA 92683
(714) 894-9202
kens@sccwrp.org

This is a new project, not previously funded.

Proposed Award Amount: \$200,000. (funding for the first two years of the project)

Proposed Awardee Cost Share: \$40,000. (proposed for the first two years of the project)

Description of General Budget:

For this proposal—first two years of the project:

- Year 1: Literature review; site reconnaissance, develop detailed workplan: \$70,000
- Year 2: Select field sites; conduct monitoring; preliminary data evaluation: \$170,000

For project completion—years 2 – 5—funds committed from the SMC.

- ~~Year 3: Continue monitoring, evaluation and develop recommendations: \$65,000~~
- Year 4: Comprehensive technical and economic evaluation; develop recommendations; develop Scope of Work for training: \$105,000
- Year 5: Prepare guidance document; conduct training and outreach: \$55,000

Project Area: Storm Water Programs

Project Description:

Background--Stormwater pollution is a leading cause of surface water quality impairments in southern California. To address technical issues relating to stormwater, in 2000 the municipal stormwater management agencies in southern California (including all those listed in Table 1) and the State permitting authorities that issue their stormwater permits formed the Stormwater Monitoring Coalition (SMC). The SMC members represent most of the urbanized areas in southern California. The goal of the SMC is to develop technical information necessary to better understand stormwater mechanisms and impacts, and to develop tools that will effectively and efficiently improve stormwater decision-making. The proposed project will be in part funded by, and conducted under the guidance of the SMC via a stakeholder advisory committee. The San Bernardino County Flood Control District is a member of the SMC and is submitting this proposal on their behalf.

Stormwater regulations imposed by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCBs) require stormwater dischargers to implement Best Management Practices (BMPs) to reduce these pollutants, and to evaluate the effectiveness of implemented BMPs in reducing stormwater pollution. Municipal stormwater dischargers in southern California include the incorporated cities and county jurisdictional areas in the coastal watersheds of Ventura, Los Angeles, Orange, San Diego, Riverside and San Bernardino Counties. Municipal

A003939

stormwater regulations in southern California also require stormwater BMPs to be identified for new and redevelopment projects prior to project plan approval[1]. (Table 1).

Table 1: Southern California municipal permit area information and development requirements.

County	Approximate Population	Approximate Area (sq. mi.)	Number of Municipalities / Permittees	Document Name	Date Implemented
Los Angeles	9.5 million	3,100	85	SUSMP	March 8, 2000
Orange	2.8 million	790	33	WQMP	October 1, 2003
Riverside	1.5 million	1,850	14	WQMP	January 1, 2005
San Bernardino	1.5 million	990	18	WQMP	June 1, 2004
San Diego	2.5 million	Not available	20	SUSMP	June 12, 2002
Ventura	0.8 million	209	12	SQUIMP	January 27, 2001

One of the key requirements of many municipal stormwater permits is the implementation of site design/low impact development (SD/LID) techniques for development projects. SD/LID requires that projects be designed to reduce the proportion of impervious surfaces, enhance/preserve their infiltration capacity, and reduce the direct connectivity of the site's discharges to the local storm drain systems and receiving streams. SD/LID is described in detail in several sources, including Low Impact Development Design Strategies, An Integrated Design Approach (Prince George's County, Maryland; Department of Environmental Resources, 1999). This report and other LID resources were developed with support from the USEPA (see http://www.epa.gov/owow/nps/lid/). The proposed study will build on these efforts.

To comply with the regulatory requirements for new and redevelopment projects, numerous projects in southern California are implementing SD/LID features. The stormwater treatment effectiveness of SD/LID features of a particular site is typically estimated using models that include various assumptions and estimated properties (e.g., design storms and runoff coefficients), resulting in significant uncertainty in the actual water quality improvements derived from these BMPs.

Although widely available fact sheets provide general information on the suitability of proposed BMPs for particular applications and on pollutant removal and maintenance requirements, and studies have evaluated individual components of SD/LID (such as vegetated swales or filter strips); the performance of a suite of SD/LID features, *in-situ*, has not been characterized for southern California. The proposed project will provide new, field-verified effectiveness data for SD/LID BMPs to aid in determining suitable site designs for development projects. Local jurisdictions and regulatory agencies need a higher level of confidence in the performance of proposed SD/LID features as they review and approve projects.

Project Objectives

1. Assess of the effectiveness of a range of common SD/LID features that have been, or are likely to be, widely implemented in southern California to comply with the new/redevelopment stormwater requirements described above. The key question to be answered is: What pollutants can be removed, and at what efficiencies?
2. Evaluate the costs and benefits of the use of SD/LID BMPs for selected areas in southern California.

[1] Los Angeles County requirements are contained in the Standard Urban Storm Water Mitigation Plans (SUSMPs). Ventura County requirements are contained in the Stormwater Quality Urban Impact Mitigation Plan (SQUIMP). Orange, San Bernardino and Riverside County requirements are contained in Water Quality Management Plans (WQMPs).

3. Develop and provide training for planners, designers, plan review staff, inspectors and other appropriate groups on the findings of the project. Aggressively communicate the study results to all appropriate groups.
4. Prepare a guidance document for the use of SD/LID in southern California.

Description of Work
The project has been phased for completion over five years. However, actual implementation of each task may vary to achieve optimum efficiency. Federal funds are sought to implement the first two years of the project.

Table 2: Project tasks by year.

Year	Task	Description	Product
1	1-1	Literature/Project Review: Review existing literature on SD/LID performance and identify current ongoing projects designed to evaluate BMP effectiveness.	**Report**
	1-2	Regional Site Reconnaissance and Site/BMP Inventory: Search the southern California region to develop an inventory of existing projects with and without SD/LID features (potential future field study sites) and analogous undeveloped sites.	**BMP Inventory**
	1-3	Develop Field Study Workplan: Prepare a field study workplan to address the overall study objectives and present to the SMC for review and approval. The workplan should include the following tasks: Contaminant Evaluation: Develop a monitoring/sampling program for the sites that includes stormwater outfalls, inflow or outflow from any site treatment features, roof drains, parking areas etc. Develop a list of appropriate constituents (including standard parameters, organics, metals and pathogen indicators) for analysis that will be adequate to determine removal rates/efficiency for the common stormwater pollutants. Hydrologic Evaluation: Develop a detailed hydrologic model of the selected site(s) and obtain hydrologic model results from the original project submittal and/or from a hydrologic model typical of those submitted for plan review. Determine appropriate number of sites for study based on available resources.	**Field Workplan**
2	2-1	Select Study Sites: Candidate study sites will be selected based on similar characteristics including size, land use, and physical factors (topography, rainfall, elevation, geology). Sites must be characterized with respect to the implemented SD/LID features, pollutants of concern and hydromodification. Present candidate study sites to the SMC for final site selection.	**List of Selected and Candidate sites**
2-3	2-2	Conduct Field Monitoring: Prepare sites to monitor appropriate site hydrologic parameters (precipitation, flow, infiltration, evaporation, etc). Monitor the selected sites for two hydrologic years according to the Workplan. Monitoring will include sampling and analysis of the approved constituent list and hydrologic parameters for wet and dry weather flows.	**Monitoring Data**
	2-3	Preliminary Evaluation: Conduct preliminary evaluation after results from first wet season and discuss with SMC. Evaluate any necessary project modifications in preparation for second wet season.	**Interim Report**
	2-4	Develop Recommendations: Provide analysis of empirical data and recommendations for Phase 3. Develop Phase 3 Workplan based on input from SMC.	**Progress Report /Recommendations**
4	4-1	Comprehensive Field and Model Data Evaluation: Evaluate field and model data per Phase 3 Workplan to determine BMP performance/effectiveness for pollutant removal and reduction of hydromodification.	
	4-2	Economic Evaluation: Determine expected costs for implementing and maintaining selected SD/LID BMPs. Perform comparative cost/benefit analysis among selected BMPs.	

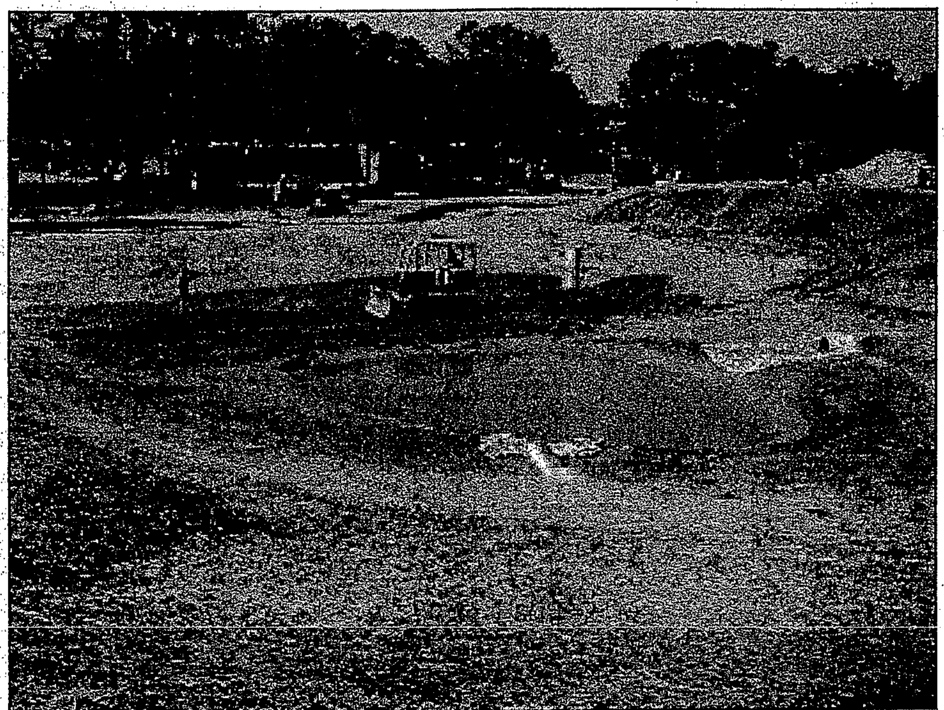
	4-3	Develop Report/Recommendations: Prepare draft project report that includes performance evaluation for pollutant removal and hydromodification reduction, along with preliminary recommendations for preferred SD/LID BMPs/features. An analysis of initial construction and long-term maintenance costs should be included. Present findings to SMC and prepare final report that incorporates comments from the SMC. The report will include a detailed evaluation of the cost of SD/LID, the maintenance requirements and how maintenance affects performance, and the overall transport and fate of contaminants at sites implementing SD/LID.	**Draft and Final Reports**
	4-4	Training Recommendations/Scope of Work: Provide recommendations and Scope of Work to address training needs identified in Objectives and Task 3-3, above.	**Scope of Work for Training**
5	5-1	Conduct Training: Develop training materials and conduct training to target audience, selected with input from the SMC. All SMC members and regional practitioners will be targeted for training.	**Training Materials and Sessions**
	5-2	Prepare Guidance Document: Integrate results from all phases of project and prepare guidance materials for project designers and plan review staff. Distribute guidance to all appropriate southern California groups.	**Guidance Document**

Table 3: Description of how the project meets the evaluation criteria.

Criteria	Explanation
1	The project will develop effectiveness data for BMPs implemented pursuant to NPDES Municipal Stormwater Permits. The particular BMPs under study are post-development features that will provide long-term water quality improvement for new and redevelopment projects. The new effectiveness information will improve the BMP selection process and result in the implementation of BMPs best suited to the site-specific pollutants of concern throughout southern California.
2	The effectiveness data and BMP recommendations will be applicable to all of southern California, and similar areas. BMP performance ratings will be transferable to most areas of the U.S. Although the funds requested will support only the first two years of the project, training material will be developed and training sessions and outreach will occur in years 4 and 5.. The project findings and recommendations will also be incorporated into a guidance document that will be made widely available. One of the project objectives is to aggressively communicate the results to appropriate groups.
3	The project will monitor water quality directly, both as influent to and effluent from stormwater treatment BMPs. The project will also produce recommendations to directly improve the selection of BMPs for numerous development projects in southern California, and possibly other areas.
4	The project will be conducted under the direction of the SMC as described above. Since 2000, the SMC has successfully completed several projects including an interlaboratory calibration study and development of a model stormwater monitoring program (http://www.sccwrp.org/tools/model_monitoring2.html?PHPSESSID=c20b05a877c1dd633613ac6b30dac88f) and is currently directing a study of impacts from increased stormwater runoff volume and velocity on stream channels.
5	By improving the knowledge of actual water quality improvements from BMPs and by facilitating selection of the most effective BMPs, long-term cost saving will be achieved. The project will also evaluate maintenance cost over different timescales and contribute to maximized cost/benefit ratios for BMPs. The proposed evaluation methods are well known.
6	The project has been approved to be funded in part by the SMC. As outlined in the general budget, the SMC will provide $40,000 in matching funds for the first two years, followed by $225,000 to fund the final three years of the project. The requested federal funding will leverage the SMC resources and allow the project to conduct a more rigorous evaluation of BMP effectiveness, and an enhanced economic analysis.

NC STATE UNIVERSITY

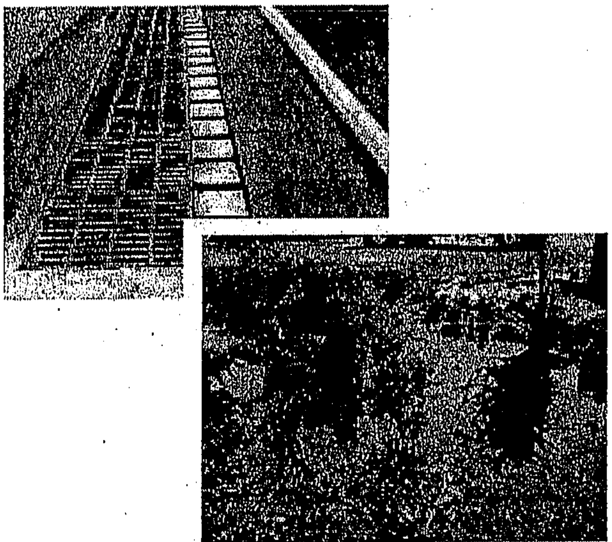
AN EVALUATION OF COST AND BENEFITS OF



Structural Stormwater Best Management Practices

IN NORTH CAROLINA

A003943



Two structural stormwater BMPs: a sand filter at NC State University (top) and a nearly full bioretention/raingarden in Chapel Hill.

Introduction

Clearing land, laying pavement, and constructing buildings increase the volume and speed of stormwater runoff. These actions contribute to flooding and may damage property and habitat, with the damage known as stormwater quantity impacts. Clearing and construction also contribute to lowering of water quality by increasing the flow of human pollutants (such as oil, fertilizers, and pesticides) and natural elements (such as nitrogen, phosphorus, and sediment). When these substances get into the water, they create stormwater quality impacts. Degradation of lakes, streams, and wetlands by urban stormwater runoff reduces property values, raises bills from public water utilities, and reduces tourism and related business income.

Urban stormwater runoff can be controlled by the use of various best management practices (BMPs). BMPs are either nonstructural, such as reduced road widths and elimination of sidewalks, or structural, varying from small, site-specific practices to large-scale regional practices. Research results outlined here focus on which structural BMPs work best at removing selected pollutants and their relative costs for North Carolina conditions. This information offers decision-makers an *economic* tool to aid them in choosing the *best* BMP for a particular location and pollutant type.

Structural stormwater BMPs

An urban stormwater BMP is believed to be a "best" way of treating or limiting pollutants in stormwater runoff. The stormwater treatment practices investigated here include wet ponds, stormwater wetlands, sand filters, and bioretention areas.

Wet ponds, also called wet detention ponds, have been used in North Carolina longer than any other stormwater BMP. Wet ponds are runoff-holding facilities that have standing water in them constantly. Storm flows are held in the ponds temporarily and then released to minimize large-scale flooding. The primary pollutant-removal mechanism is settling (sedimentation), while stormwater runoff resides in the pool. Nutrient uptake also occurs through biological activity. Wet ponds can be designed to look like natural lakes to enhance the value of surrounding property. They have been and can be used for commercial sites as small as 1 acre and for watersheds as large as 100 acres or more. The example on the cover is at a construction site at NC State University in Raleigh.

Stormwater wetlands, also called constructed wetlands, are comparable to wet ponds but are much shallower and more heavily vegetated with wetland plants. They serve as a natural filter for urban runoff, help to slow the flow of water to receiving waters, and replenish groundwater. As stormwater runoff flows through the wetlands, sedimentation, adsorption, and biological processes achieve pollutant removal. In North Carolina, constructed stormwater wetlands have been located on watersheds as small as 4 to 5 acres, but they are more commonly used for larger drainage areas and typically serve watersheds ranging from 15 acres to more than 100 acres. Thanks to the vegetative cover, wetland effluent is typically cooler than that of wet ponds, minimizing the impact of thermal pollution. Wetlands consume a relatively large amount of space and thus have limited applicability in highly urbanized settings.

Sand filters are usually two-chambered stormwater treatment practices. Water enters the first chamber, where debris settles out, and then moves to a second chamber, where a filter bed filled with sand or another filtering medium removes other forms of pollution. At the bottom of the sand layer, an underdrain pipe typically connects the treated water with the existing drainage network. Sand

Table 1. Structural stormwater BMPs by relative size of commercial/residential drainage area.

BMP	*Relative size of commercial/residential drainage area*	
	Large	*Small*
Wet pond	X	X
Stormwater wetland	X	
Sand filter*		X
Bioretention/raingarden**		X

* *Only effective with a significant drop in elevation (for perimeter sand filter, at least 2 feet).*
** *In clay soils, a significant drop in elevation (4 feet) is typically required.*

filters are particularly well-suited for treating stormwater runoff in ultra-urban areas because they can be designed to be walked over or driven on, thus preserving expensive land. Typically, the sand filter will treat a drainage catchment of only a few acres. This practice is designed for impervious watersheds in particular.

Bioretention/raingardens in many respects are landscaped and vegetated filters for stormwater runoff. Surface runoff is directed into shallow, landscaped depressions. Trees and shrubs are planted in bedding material consisting of a high percentage of sand and lesser amounts of silt, clay, and/or organic matter. During rain events, stormwater pools above the mulch and soil in the system. The remaining runoff filters through the mulch and prepared soil mix. Typically, the filtered runoff is collected in a perforated underdrain and is returned to the storm drain system. Bioretention systems are ideally suited to many ultra-urban areas as they will fit existing parking lot islands or other landscaped areas. Because bioretention potentially can fulfill two purposes—water quality control and landscaping requirements—their use is expected to increase. Bioretention areas typically serve very small watersheds, such as (portions of) parking lots or residential runoff areas.

Table 1 summarizes the four structural stormwater BMPs discussed above, keying on the relative size of the associated drainage area. A more extensive summary of these and other stormwater practices can be found in *Urban Stormwater Structural BMPs*, AG-588-1.

Land opportunity costs

Construction of BMPs may reduce the availability or the size of a (re-)development site, and this is a frequent concern of real-estate interests. Land opportunity costs must take into account any lost opportunity to use the land for other commitments. In highly urbanized areas, dedicating land to stormwater BMPs involves a loss of development profit, and this loss is likely to be the most important cost of a BMP.

Land requirements vary by type of BMP and are also dependent on watershed composition and precipitation. An important indicator is runoff, which is determined by precipitation and curve number (CN). CN reflects the ability of a watershed to store water through initial storage and subsequent infiltration. A high CN suggests a very impervious area with limited storage capacity. The lower part of Table 2 summarizes the general sizing rules for BMPs, which were developed by the Department of Biological and Agricultural Engineering at North Carolina State University (see *Designing Stormwater Wetlands for Small Watersheds*, AG-588-2, for an explanation of these rules). They are location-specific. Note that a specific practice for a specific development may require more or less land, depending on site-specific conditions. The sizing rules in Table 2 were used in the cost calculations.

Table 2. Summary of construction cost curves, maintenance cost curves, and required surface area for stormwater BMPs in North Carolina.

	Wet ponds	*Stormwater wetlands*	*Sand filters*	*Bioretention in clay soils*	*Bioretention in sandy soils*
Construction cost	$C=13{,}909X^{0.672}$	$C=3{,}852X^{0.484}$	$C=47{,}888X^{0.882}$	$C=10{,}162X^{1.088}$	$C=2{,}861X^{0.438}$
20-year maintenance cost	$C=9{,}202X^{0.269}$	$C=4{,}502X^{0.153}$	$C=10{,}556X^{0.534}$	$C=3{,}437X^{0.152}$	$C=3{,}437X^{0.152}$
Required surface area of BMP in acres					
Residential development					
• Piedmont (CN 80-90)	SA=0.015X	SA=0.02X		SA=0.025X	SA=0.025X
• Coastal Plain (CN 65-75)	SA=0.0075X	SA=0.01X		SA=0.015X	SA=0.015X
Highly impervious area with CN 80	SA=0.02X	SA=0.03		SA=0.03X	SA=0.03X
100% impervious areas (CN 100)	SA=0.05X	SA=0.065X	SA=0.017X	SA=0.07X	SA=0.07X

C=cost in $; X=size of watershed in acres; SA=surface area of BMP in acres

Source: Wossink and Hunt (2003)

Prices of land vary to a large extent, and three situations were distinguished in the evaluation of the cost of stormwater BMPs:

- Undeveloped land for commercial use with an average opportunity cost of $5 per square foot ($217,800 per acre).
- Undeveloped land for residential use with an average opportunity cost of $50,000 per acre.
- Undeveloped land with zero opportunity cost because of the requirement for open space.

Construction, maintenance, and inspection costs

Construction and maintenance costs were collected for more than 40 stormwater BMPs, principally from North Carolina. From this data, cost equations were formulated, relating costs to watershed size. Table 2 summarizes these equations.

Statistical analysis indicated that the relationship between the size of the watershed and the construction cost as presented in Table 2 is not that strong. There are other factors that affect construction cost, such as watershed composition, required excavation depths, and many other engineering aspects that were not included in the construction cost curves. Note that bioretention construction costs were significantly different with regard to soil types: clayey or sandy.

Total annual costs

The total cost of a stormwater BMP is made up of the following three components: construction costs + maintenance and inspection costs + land opportunity costs. When comparing stormwater BMPs and deciding which practice to install, consider the long-term maintenance cost. By accounting for the value of future expenditures, the net total cost of each stormwater BMP can be calculated. A discount rate of 10 percent for the private developer was used in these calculations. This rate includes the risks associated with the specific industry. The net total cost value of a BMP is then to be converted to annualized costs per acre treated and annualized costs per percent of pollutant removed. Thus, BMPs of different duration, treatment area, and removal effectiveness can be compared.

Developers may be able to use the costs of structural stormwater BMPs as a deduction for tax purposes. Operating costs generally are fully deductible as expenses in the year incurred. Capital investments associated with compliance generally must be depreciated over some number of years. Tax advantages are highly dependent on the marginal tax rate and were not accounted for in the calculations.

Removal effectiveness

Data were collected from 60 BMPs in the Southeast and Mid-Atlantic states on removal of total suspended solids (TSS), total phosphorus (TP), nitrate (NO_3^-), total nitrogen (TN), and zinc (Zn). Based on a statistical analysis of these data, each practice was assigned a single removal rate (the median removal efficiency) in the cost-effectiveness analysis. That is, it can be assumed that the practice will work comparably well whether it serves a small or a large watershed. The median pollutant removal efficiencies for each of the practices are reported in Table 3. The negative and low removal efficiencies for nitrate-nitrogen when using a sand filter and bioretention area are due in great part to the design configuration. These BMPs are designed to drain freely, and the lack of an anaerobic zone is responsible for the low to negative removal rates of nitrate-nitrogen (Davis *et al.*, 2001).

An example: Cost comparison for a 10-acre watershed (CN 80).

For a 10-acre watershed with CN 80, we compare the installation of a wet pond, a stormwater wetland, and a bioretention area on the basis of the cost per acre treated and the cost per percent TSS and TN removed. A sandfilter is not an option: such a practice is applicable only to areas that are 100 percent impervious (see Table 2).

Table 4 shows that a bioretention area would be the least expensive BMP if this practice could be installed in sandy soil. Both the cost per acre treated and the cost per percent TN removed are less for this practice than if a wet pond or a wetland were used. A comparison based on the cost per percent TSS is not possible because data on TSS removal effectiveness was not available for bioretention areas. A stormwater wetland would be the least expensive solution if clay soil were to prevail. In that situation, bioretention in sandy soils is no longer an option. Of the three remaining BMPs, a wetland has the lowest annualized cost per acre of watershed.

Table 3. Median removal effectiveness and number of sites analyzed for 4 BMPs from studies in the Southeast and Mid-Atlantic.

BMP type	TSS		TP		NO_3^-		TN		Zn	
	Rmvl. Effic. (%)	No. Sites	Rmvl. Effic. (%)	No. Sites	Rmvl. Effic. (%)	No. Sites	Rmvl. Effic. (%)	No. Sites	Rmvl. Effic. (%)	No. Sites
Wet ponds	65	27	46	28	42.5	16	28	27	51	24
Stormwater wetlands	61	14	32.5	14	55	8	22	14	49	6
Sand filters	79	12	59	11	(56.5)	11	41	12	64	11
Bioretention areas	N/A	—	71	5	16	4	45	4	89	4

Source: Wossink and Hunt (2003)

Table 4. Cost comparison of 4 BMPs for a 10-acre watershed (CN 80)

Practice	*Wet pond*	*Wetland*	*Bioretention in clay soils*	*Bioretention in sandy soils*
Construction cost	65,357	11,740	124,445	7,843
Annual maintenance cost	4,411	752	583	583
Opportunity cost of land ($217,800/acre)	43,560	65,340	65,340	65,340
Present value of total cost	146,474	83,486	194,751	78,137
Annualized cost per acre watershed	1,721	981	2,288	918
Annualized cost per percent pollutant removed				
• TSS	26	15	N/A	N/A
• TN	61	45	51	20

Conclusion

The economic decision-making tool described here will help people dealing with stormwater runoff make an informed choice about which BMP will be most effective for the different conditions that exist in watersheds across North Carolina.

The size of the watershed, the soil type, the imperviousness of the watershed as described by CN range, the pollutant of main concern, and the amount and price of land for the structure all influence the selection of a BMP. The complexity of these factors makes it impossible to summarize in a few sentences just which BMP is to be preferred from an economic perspective in each situation. A full research report (Wossink and Hunt, 2003) is available that includes the results of systematic applications of this economic decision-making tool to the various N.C. conditions (Report Number 344 of the Water Resources Research Institute of the University of North Carolina; also available on the Internet at http://www.ag-econ.ncsu.edu/faculty/wossink/outreach.html).

However, the information presented in Tables 2 and 3 offers some general findings with respect to cost, pollution removal efficiency, and watershed management, namely:

- There are large differences in the total-cost-per-acre-treated among the BMPs analyzed.
- All BMPs, except for bioretention not in sandy soil, display economies of scale within the practice—the construction cost and the maintenance cost-per-acre-treated decrease as the size of the watershed increases.
- The effectiveness of wet ponds and stormwater wetlands with regard to removing the pollutants TSS, TP, and NO_3^- was found to be comparable. In North Carolina before this study, it generally had been assumed that wetlands work better.
- For the four BMPs analyzed, no significant relationship was found between pollution-removal efficiency and watershed size.
- All BMPs need to be maintained, and money should be set aside up-front for this purpose. Approximate amounts for each type of BMP can be estimated from Table 2.

This small bioretention/raingarden in Chapel Hill has filtered and drained most of its stormwater.

A stormwater wetland in Alexander County, heavily vegetated with wetland plants to filter rain runoff, is also an educational site.

References

Davis, A. P., M. Shokouhian, H. Sharma, and C. Minami. 2001. "Laboratory study of biological retention for urban stormwater management." *Water Environment Research* 73(1): 5-14.

Wossink, Ada, and Bill Hunt. 2003. *The Economics of Structural Stormwater BMPs in North Carolina*, WRRI Research Report Number 344. Also available at http://www.ag-econ.ncsu.edu/faculty/wossink/outreach.html.

Funding for this economic analysis of stormwater BMPs was provided through the Water Resources Research Institute of the University of North Carolina.

Prepared by
Ada Wossink, Associate Professor and Extension Specialist,
Department of Agricultural and Resource Economics, North Carolina State University
and
Bill Hunt, Assistant Professor and Extension Specialist,
Department of Biological and Agricultural Engineering, North Carolina State University

Published by
North Carolina Cooperative Extension Service

11/03—2M—JL/DC
E04-43938

AG-642

WATERSHED COUNTIES

WATERSHED COUNTIES

State	County	FIPS Code
AL	Baldwin County	01003
AL	Clarke County	01025
AL	Covington County	01039
AL	Escambia County	01053
AL	Geneva County	01061
AL	Mobile County	01097
AL	Monroe County	01099
AL	Washington County	01129
AK	Aleutians East Borough	02013
AK	Aleutians West Census Area	02016
AK	Anchorage Municipality	02020
AK	Bethel Census Area	02050
AK	Bristol Bay Borough	02060
AK	Dillingham Census Area	02070
AK	Haines Borough	02100
AK	Juneau City and Borough	02110
AK	Kenai Peninsula Borough	02122
AK	Ketchikan Gateway Borough	02130
AK	Kodiak Island Borough	02150
AK	Lake and Peninsula Borough	02164
AK	Matanuska-Susitna Borough	02170
AK	Nome Census Area	02180
AK	North Slope Borough	02185
AK	Northwest Arctic Borough	02188
AK	Prince of Wales-Outer Ketchikan Census Area	02201
AK	Sitka City and Borough	02220
AK	Valdez-Cordova Census Area	02261
AK	Wade Hampton Census Area	02270
AK	Wrangell-Petersburg Census Area	02280
CA	Alameda County	06001
CA	Contra Costa County	06013
CA	Del Norte County	06015
CA	Humboldt County	06023
CA	Los Angeles County	06037
CA	Marin County	06041
CA	Mendocino County	06045
CA	Monterey County	06053
CA	Napa County	06055
CA	Orange County	06059
CA	Riverside County	06065
CA	Sacramento County	06067
CA	San Benito County	06069
CA	San Bernardino County	06071
CA	San Diego County	06073
CA	San Francisco County	06075
CA	San Joaquin County	06077
CA	San Luis Obispo County	06079
CA	San Mateo County	06081
CA	Santa Barbara County	06083
CA	Santa Clara County	06085
CA	Santa Cruz County	06087
CA	Siskiyou County	06093
CA	Solano County	06095
CA	Sonoma County	06097

WATERSHED COUNTIES

State	County	FIPS Code
CA	Sutter County	06101
CA	Trinity County	06105
CA	Ventura County	06111
CA	Yolo County	06113
CT	Fairfield County	09001
CT	Hartford County	09003
CT	Litchfield County	09005
CT	Middlesex County	09007
CT	New Haven County	09009
CT	New London County	09011
CT	Tolland County	09013
CT	Windham County	09015
DE	Kent County	10001
DE	New Castle County	10003
DE	Sussex County	10005
FL	Baker County	12003
FL	Bay County	12005
FL	Brevard County	12009
FL	Broward County	12011
FL	Calhoun County	12013
FL	Charlotte County	12015
FL	Citrus County	12017
FL	Clay County	12019
FL	Collier County	12021
FL	DeSoto County	12027
FL	Dixie County	12029
FL	Duval County	12031
FL	Escambia County	12033
FL	Flagler County	12035
FL	Franklin County	12037
FL	Gadsden County	12039
FL	Gilchrist County	12041
FL	Glades County	12043
FL	Gulf County	12045
FL	Hardee County	12049
FL	Hendry County	12051
FL	Hernando County	12053
FL	Hillsborough County	12057
FL	Holmes County	12059
FL	Indian River County	12061
FL	Jackson County	12063
FL	Jefferson County	12065
FL	Lafayette County	12067
FL	Lake County	12069
FL	Lee County	12071
FL	Leon County	12073
FL	Levy County	12075
FL	Liberty County	12077
FL	Madison County	12079
FL	Manatee County	12081
FL	Marion County	12083
FL	Martin County	12085
FL	Monroe County	12087
FL	Nassau County	12089

WATERSHED COUNTIES

State	County	FIPS Code
FL	Okaloosa County	12091
FL	Okeechobee County	12093
FL	Orange County	12095
FL	Osceola County	12097
FL	Palm Beach County	12099
FL	Pasco County	12101
FL	Pinellas County	12103
FL	Polk County	12105
FL	Putnam County	12107
FL	St. Johns County	12109
FL	St. Lucie County	12111
FL	Santa Rosa County	12113
FL	Sarasota County	12115
FL	Seminole County	12117
FL	Sumter County	12119
FL	Suwannee County	12121
FL	Taylor County	12123
FL	Volusia County	12127
FL	Wakulla County	12129
FL	Walton County	12131
FL	Washington County	12133
GA	Appling County	13001
GA	Atkinson County	13003
GA	Bacon County	13005
GA	Brantley County	13025
GA	Bryan County	13029
GA	Bulloch County	13031
GA	Camden County	13039
GA	Charlton County	13049
GA	Chatham County	13051
GA	Coffee County	13069
GA	Decatur County	13087
GA	Effingham County	13103
GA	Glynn County	13127
GA	Grady County	13131
GA	Irwin County	13155
GA	Jeff Davis County	13161
GA	Jenkins County	13165
GA	Liberty County	13179
GA	Long County	13183
GA	McIntosh County	13191
GA	Montgomery County	13209
GA	Pierce County	13229
GA	Screven County	13251
GA	Tattnall County	13267
GA	Thomas County	13275
GA	Toombs County	13279
GA	Ware County	13299
GA	Wayne County	13305
HI	Hawaii County	15001
HI	Honolulu County	15003
HI	Kalawao County	15005
HI	Kauai County	15007
HI	Maui County	15009

WATERSHED COUNTIES

State	County	FIPS Code
IL	Cook County	17031
IL	Lake County	17097
IN	Elkhart County	18039
IN	Kosciusko County	18085
IN	LaGrange County	18087
IN	Lake County	18089
IN	LaPorte County	18091
IN	Noble County	18113
IN	Porter County	18127
IN	St. Joseph County	18141
IN	Steuben County	18151
LA	Acadia Parish	22001
LA	Ascension Parish	22005
LA	Assumption Parish	22007
LA	Avoyelles Parish	22009
LA	Beauregard Parish	22011
LA	Calcasieu Parish	22019
LA	Cameron Parish	22023
LA	East Baton Rouge Parish	22033
LA	East Feliciana Parish	22037
LA	Evangeline Parish	22039
LA	Iberia Parish	22045
LA	Iberville Parish	22047
LA	Jefferson Parish	22051
LA	Jefferson Davis Parish	22053
LA	Lafayette Parish	22055
LA	Lafourche Parish	22057
LA	Livingston Parish	22063
LA	Orleans Parish	22071
LA	Plaquemines Parish	22075
LA	Pointe Coupee Parish	22077
LA	Rapides Parish	22079
LA	Sabine Parish	22085
LA	St. Bernard Parish	22087
LA	St. Charles Parish	22089
LA	St. Helena Parish	22091
LA	St. James Parish	22093
LA	St. John the Baptist Parish	22095
LA	St. Landry Parish	22097
LA	St. Martin Parish	22099
LA	St. Mary Parish	22101
LA	St. Tammany Parish	22103
LA	Tangipahoa Parish	22105
LA	Terrebonne Parish	22109
LA	Vermilion Parish	22113
LA	Vernon Parish	22115
LA	Washington Parish	22117
LA	West Baton Rouge Parish	22121
LA	West Feliciana Parish	22125
ME	Androscoggin County	23001
ME	Cumberland County	23005
ME	Franklin County	23007
ME	Hancock County	23009
ME	Kennebec County	23011

WATERSHED COUNTIES

State	County	FIPS Code
ME	Knox County	23013
ME	Lincoln County	23015
ME	Oxford County	23017
ME	Penobscot County	23019
ME	Sagadahoc County	23023
ME	Somerset County	23025
ME	Waldo County	23027
ME	Washington County	23029
ME	York County	23031
MD	Anne Arundel County	24003
MD	Baltimore County	24005
MD	Calvert County	24009
MD	Caroline County	24011
MD	Carroll County	24013
MD	Cecil County	24015
MD	Charles County	24017
MD	Dorchester County	24019
MD	Harford County	24025
MD	Howard County	24027
MD	Kent County	24029
MD	Montgomery County	24031
MD	Prince George's County	24033
MD	Queen Anne's County	24035
MD	St. Mary's County	24037
MD	Somerset County	24039
MD	Talbot County	24041
MD	Wicomico County	24045
MD	Worcester County	24047
MD	Baltimore city	24510
MA	Barnstable County	25001
MA	Berkshire County	25003
MA	Bristol County	25005
MA	Dukes County	25007
MA	Essex County	25009
MA	Hampden County	25013
MA	Middlesex County	25017
MA	Nantucket County	25019
MA	Norfolk County	25021
MA	Plymouth County	25023
MA	Suffolk County	25025
MA	Worcester County	25027
MI	Alcona County	26001
MI	Alger County	26003
MI	Allegan County	26005
MI	Alpena County	26007
MI	Antrim County	26009
MI	Arenac County	26011
MI	Baraga County	26013
MI	Barry County	26015
MI	Bay County	26017
MI	Benzie County	26019
MI	Berrien County	26021
MI	Branch County	26023
MI	Calhoun County	26025

WATERSHED COUNTIES

State	County	FIPS Code
MI	Cass County	26027
MI	Charlevoix County	26029
MI	Cheboygan County	26031
MI	Chippewa County	26033
MI	Clare County	26035
MI	Crawford County	26039
MI	Delta County	26041
MI	Dickinson County	26043
MI	Eaton County	26045
MI	Emmet County	26047
MI	Gogebic County	26053
MI	Grand Traverse County	26055
MI	Hillsdale County	26059
MI	Houghton County	26061
MI	Huron County	26063
MI	Ionia County	26067
MI	Iosco County	26069
MI	Jackson County	26075
MI	Kalamazoo County	26077
MI	Kalkaska County	26079
MI	Kent County	26081
MI	Keweenaw County	26083
MI	Lake County	26085
MI	Lapeer County	26087
MI	Leelanau County	26089
MI	Lenawee County	26091
MI	Livingston County	26093
MI	Luce County	26095
MI	Mackinac County	26097
MI	Macomb County	26099
MI	Manistee County	26101
MI	Marquette County	26103
MI	Mason County	26105
MI	Mecosta County	26107
MI	Menominee County	26109
MI	Missaukee County	26113
MI	Monroe County	26115
MI	Montcalm County	26117
MI	Montmorency County	26119
MI	Muskegon County	26121
MI	Newaygo County	26123
MI	Oakland County	26125
MI	Oceana County	26127
MI	Ogemaw County	26129
MI	Ontonagon County	26131
MI	Osceola County	26133
MI	Oscoda County	26135
MI	Otsego County	26137
MI	Ottawa County	26139
MI	Presque Isle County	26141
MI	Roscommon County	26143
MI	Saginaw County	26145
MI	St. Clair County	26147
MI	St. Joseph County	26149
MI	Sanilac County	26151
MI	Schoolcraft County	26153
MI	Tuscola County	26157

WATERSHED COUNTIES

State	County	FIPS Code
MI	Van Buren County	26159
MI	Washtenaw County	26161
MI	Wayne County	26163
MI	Wexford County	26165
MN	Carlton County	27017
MN	Cook County	27031
MN	Lake County	27075
MN	St. Louis County	27137
MS	Amite County	28005
MS	George County	28039
MS	Hancock County	28045
MS	Harrison County	28047
MS	Jackson County	28059
MS	Lamar County	28073
MS	Marion County	28091
MS	Pearl River County	28109
MS	Pike County	28113
MS	Stone County	28131
MS	Walthall County	28147
MS	Wilkinson County	28157
NH	Belknap County	33001
NH	Carroll County	33003
NH	Hillsborough County	33011
NH	Merrimack County	33013
NH	Rockingham County	33015
NH	Strafford County	33017
NJ	Atlantic County	34001
NJ	Bergen County	34003
NJ	Burlington County	34005
NJ	Camden County	34007
NJ	Cape May County	34009
NJ	Cumberland County	34011
NJ	Essex County	34013
NJ	Gloucester County	34015
NJ	Hudson County	34017
NJ	Hunterdon County	34019
NJ	Mercer County	34021
NJ	Middlesex County	34023
NJ	Monmouth County	34025
NJ	Morris County	34027
NJ	Ocean County	34029
NJ	Passaic County	34031
NJ	Salem County	34033
NJ	Somerset County	34035
NJ	Sussex County	34037
NJ	Union County	34039
NY	Albany County	36001
NY	Bronx County	36005
NY	Cattaraugus County	36009
NY	Cayuga County	36011
NY	Chautauqua County	36013
NY	Clinton County	36019

WATERSHED COUNTIES

State	County	FIPS Code
NY	Columbia County	36021
NY	Dutchess County	36027
NY	Erie County	36029
NY	Franklin County	36033
NY	Genesee County	36037
NY	Greene County	36039
NY	Hamilton County	36041
NY	Herkimer County	36043
NY	Jefferson County	36045
NY	Kings County	36047
NY	Lewis County	36049
NY	Livingston County	36051
NY	Monroe County	36055
NY	Nassau County	36059
NY	New York County	36061
NY	Niagara County	36063
NY	Onondaga County	36067
NY	Ontario County	36069
NY	Orange County	36071
NY	Orleans County	36073
NY	Oswego County	36075
NY	Putnam County	36079
NY	Queens County	36081
NY	Rensselaer County	36083
NY	Richmond County	36085
NY	Rockland County	36087
NY	St. Lawrence County	36089
NY	Schenectady County	36093
NY	Suffolk County	36103
NY	Ulster County	36111
NY	Wayne County	36117
NY	Westchester County	36119
NY	Wyoming County	36121
NC	Anson County	37007
NC	Beaufort County	37013
NC	Bertie County	37015
NC	Bladen County	37017
NC	Brunswick County	37019
NC	Camden County	37029
NC	Carteret County	37031
NC	Chowan County	37041
NC	Columbus County	37047
NC	Craven County	37049
NC	Cumberland County	37051
NC	Currituck County	37053
NC	Dare County	37055
NC	Duplin County	37061
NC	Edgecombe County	37065
NC	Gates County	37073
NC	Halifax County	37083
NC	Hertford County	37091
NC	Hyde County	37095
NC	Jones County	37103
NC	Lenoir County	37107
NC	Martin County	37117
NC	New Hanover County	37129

WATERSHED COUNTIES

State	County	FIPS Code
NC	Northampton County	37131
NC	Onslow County	37133
NC	Pamlico County	37137
NC	Pasquotank County	37139
NC	Pender County	37141
NC	Perquimans County	37143
NC	Pitt County	37147
NC	Richmond County	37153
NC	Sampson County	37163
NC	Scotland County	37165
NC	Tyrrell County	37177
NC	Washington County	37187
NC	Wayne County	37191
NC	Wilson County	37195
OH	Ashland County	39005
OH	Ashtabula County	39007
OH	Crawford County	39033
OH	Cuyahoga County	39035
OH	Defiance County	39039
OH	Erie County	39043
OH	Fulton County	39051
OH	Geauga County	39055
OH	Hancock County	39063
OH	Henry County	39069
OH	Huron County	39077
OH	Lake County	39085
OH	Lorain County	39093
OH	Lucas County	39095
OH	Marion County	39101
OH	Medina County	39103
OH	Ottawa County	39123
OH	Portage County	39133
OH	Sandusky County	39143
OH	Seneca County	39147
OH	Summit County	39153
OH	Trumbull County	39155
OH	Wood County	39173
OH	Wyandot County	39175
OR	Benton County	41003
OR	Clackamas County	41005
OR	Clatsop County	41007
OR	Columbia County	41009
OR	Coos County	41011
OR	Curry County	41015
OR	Douglas County	41019
OR	Josephine County	41033
OR	Lane County	41039
OR	Lincoln County	41041
OR	Multnomah County	41051
OR	Tillamook County	41057
PA	Adams County	42001
PA	Berks County	42011
PA	Bucks County	42017
PA	Chester County	42029

WATERSHED COUNTIES

State	County	FIPS Code
PA	Delaware County	42045
PA	Erie County	42049
PA	Lancaster County	42071
PA	Lebanon County	42075
PA	Lehigh County	42077
PA	Montgomery County	42091
PA	Philadelphia County	42101
PA	Schuylkill County	42107
PA	York County	42133
RI	Bristol County	44001
RI	Kent County	44003
RI	Newport County	44005
RI	Providence County	44007
RI	Washington County	44009
SC	Allendale County	45005
SC	Beaufort County	45013
SC	Berkeley County	45015
SC	Charleston County	45019
SC	Chesterfield County	45025
SC	Clarendon County	45027
SC	Colleton County	45029
SC	Darlington County	45031
SC	Dillon County	45033
SC	Dorchester County	45035
SC	Florence County	45041
SC	Georgetown County	45043
SC	Hampton County	45049
SC	Horry County	45051
SC	Jasper County	45053
SC	Kershaw County	45055
SC	Lancaster County	45057
SC	Lee County	45061
SC	Marion County	45067
SC	Marlboro County	45069
SC	Sumter County	45085
SC	Williamsburg County	45089
TX	Aransas County	48007
TX	Austin County	48015
TX	Bee County	48025
TX	Brazoria County	48039
TX	Brooks County	48047
TX	Calhoun County	48057
TX	Cameron County	48061
TX	Chambers County	48071
TX	Colorado County	48089
TX	DeWitt County	48123
TX	Duval County	48131
TX	Fayette County	48149
TX	Fort Bend County	48157
TX	Galveston County	48167
TX	Goliad County	48175
TX	Harris County	48201
TX	Hidalgo County	48215
TX	Jackson County	48239

WATERSHED COUNTIES

State	County	FIPS Code
TX	Jasper County	48241
TX	Jefferson County	48245
TX	Jim Hogg County	48247
TX	Jim Wells County	48249
TX	Kenedy County	48261
TX	Kleberg County	48273
TX	Lavaca County	48285
TX	Liberty County	48291
TX	Live Oak County	48297
TX	Matagorda County	48321
TX	Newton County	48351
TX	Nueces County	48355
TX	Orange County	48361
TX	Refugio County	48391
TX	San Patricio County	48409
TX	Starr County	48427
TX	Tyler County	48457
TX	Victoria County	48469
TX	Waller County	48473
TX	Washington County	48477
TX	Webb County	48479
TX	Wharton County	48481
TX	Willacy County	48489
VA	Accomack County	51001
VA	Amelia County	51007
VA	Appomattox County	51011
VA	Arlington County	51013
VA	Buckingham County	51029
VA	Caroline County	51033
VA	Charles City County	51036
VA	Chesterfield County	51041
VA	Cumberland County	51049
VA	Dinwiddie County	51053
VA	Essex County	51057
VA	Fairfax County	51059
VA	Fauquier County	51061
VA	Fluvanna County	51065
VA	Gloucester County	51073
VA	Goochland County	51075
VA	Hanover County	51085
VA	Henrico County	51087
VA	Isle of Wight County	51093
VA	James City County	51095
VA	King and Queen County	51097
VA	King George County	51099
VA	King William County	51101
VA	Lancaster County	51103
VA	Louisa County	51109
VA	Mathews County	51115
VA	Middlesex County	51119
VA	New Kent County	51127
VA	Northampton County	51131
VA	Northumberland County	51133
VA	Nottoway County	51135
VA	Orange County	51137
VA	Powhatan County	51145

WATERSHED COUNTIES

State	County	FIPS Code
VA	Prince Edward County	51147
VA	Prince George County	51149
VA	Prince William County	51153
VA	Richmond County	51159
VA	Spotsylvania County	51177
VA	Stafford County	51179
VA	Surry County	51181
VA	Westmoreland County	51193
VA	York County	51199
VA	Alexandria city	51510
VA	Chesapeake city	51550
VA	Colonial Heights city	51570
VA	Fairfax city	51600
VA	Falls Church city	51610
VA	Fredericksburg city	51630
VA	Hampton city	51650
VA	Hopewell city	51670
VA	Manassas city	51683
VA	Manassas Park city	51685
VA	Newport News city	51700
VA	Norfolk city	51710
VA	Petersburg city	51730
VA	Poquoson city	51735
VA	Portsmouth city	51740
VA	Richmond city	51760
VA	Suffolk city	51800
VA	Virginia Beach city	51810
VA	Williamsburg city	51830
WA	Clallam County	53009
WA	Clark County	53011
WA	Cowlitz County	53015
WA	Grays Harbor County	53027
WA	Island County	53029
WA	Jefferson County	53031
WA	King County	53033
WA	Kitsap County	53035
WA	Lewis County	53041
WA	Mason County	53045
WA	Pacific County	53049
WA	Pierce County	53053
WA	San Juan County	53055
WA	Skagit County	53057
WA	Skamania County	53059
WA	Snohomish County	53061
WA	Thurston County	53067
WA	Wahkiakum County	53069
WA	Whatcom County	53073
WI	Ashland County	55003
WI	Bayfield County	55007
WI	Brown County	55009
WI	Calumet County	55015
WI	Door County	55029
WI	Douglas County	55031
WI	Florence County	55037
WI	Fond du Lac County	55039

WATERSHED COUNTIES

State	County	FIPS Code
WI	Forest County	55041
WI	Iron County	55051
WI	Kenosha County	55059
WI	Kewaunee County	55061
WI	Manitowoc County	55071
WI	Marinette County	55075
WI	Menominee County	55078
WI	Milwaukee County	55079
WI	Oconto County	55083
WI	Outagamie County	55087
WI	Ozaukee County	55089
WI	Racine County	55101
WI	Shawano County	55115
WI	Sheboygan County	55117
WI	Washington County	55131

Coastal Zone Counties

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
AL	Baldwin County	01003
AL	Mobile County	01097
AK	Aleutians East Borough	02013
AK	Aleutians West Census Area	02016
AK	Anchorage Municipality	02020
AK	Bethel Census Area	02050
AK	Bristol Bay Borough	02060
AK	Dillingham Census Area	02070
AK	Haines Borough	02100
AK	Juneau City and Borough	02110
AK	Kenai Peninsula Borough	02122
AK	Ketchikan Gateway Borough	02130
AK	Kodiak Island Borough	02150
AK	Lake and Peninsula Borough	02164
AK	Matanuska-Susitna Borough	02170
AK	Nome Census Area	02180
AK	North Slope Borough	02185
AK	Northwest Arctic Borough	02188
AK	Prince of Wales-Outer Ketchikan Census Area	02201
AK	Sitka City and Borough	02220
AK	Valdez-Cordova Census Area	02261
AK	Wade Hampton Census Area	02270
AK	Wrangell-Petersburg Census Area	02280
CA	Alameda County	06001
CA	Contra Costa County	06013
CA	Del Norte County	06015
CA	Humboldt County	06023
CA	Los Angeles County	06037
CA	Marin County	06041
CA	Mendocino County	06045
CA	Monterey County	06053
CA	Napa County	06055
CA	Orange County	06059
CA	Sacramento County	06067
CA	San Diego County	06073
CA	San Francisco County	06075
CA	San Joaquin County	06077
CA	San Luis Obispo County	06079
CA	San Mateo County	06081
CA	Santa Barbara County	06083
CA	Santa Clara County	06085
CA	Santa Cruz County	06087
CA	Solano County	06095
CA	Sonoma County	06097
CA	Ventura County	06111
CA	Yolo County	06113
CT	Fairfield County	09001
CT	Middlesex County	09007
CT	New Haven County	09009
CT	New London County	09011

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
DE	Kent County	10001
DE	New Castle County	10003
DE	Sussex County	10005
FL	Alachua County	12001
FL	Baker County	12003
FL	Bay County	12005
FL	Bradford County	12007
FL	Brevard County	12009
FL	Broward County	12011
FL	Calhoun County	12013
FL	Charlotte County	12015
FL	Citrus County	12017
FL	Clay County	12019
FL	Collier County	12021
FL	Columbia County	12023
FL	DeSoto County	12027
FL	Dixie County	12029
FL	Duval County	12031
FL	Escambia County	12033
FL	Flagler County	12035
FL	Franklin County	12037
FL	Gadsden County	12039
FL	Gilchrist County	12041
FL	Glades County	12043
FL	Gulf County	12045
FL	Hamilton County	12047
FL	Hardee County	12049
FL	Hendry County	12051
FL	Hernando County	12053
FL	Highlands County	12055
FL	Hillsborough County	12057
FL	Holmes County	12059
FL	Indian River County	12061
FL	Jackson County	12063
FL	Jefferson County	12065
FL	Lafayette County	12067
FL	Lake County	12069
FL	Lee County	12071
FL	Leon County	12073
FL	Levy County	12075
FL	Liberty County	12077
FL	Madison County	12079
FL	Manatee County	12081
FL	Marion County	12083
FL	Martin County	12085
FL	Miami-Dade County	12086
FL	Monroe County	12087
FL	Nassau County	12089
FL	Okaloosa County	12091
FL	Okeechobee County	12093
FL	Orange County	12095
FL	Osceola County	12097
FL	Palm Beach County	12099
FL	Pasco County	12101
FL	Pinellas County	12103
FL	Polk County	12105

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
FL	Putnam County	12107
FL	St. Johns County	12109
FL	St. Lucie County	12111
FL	Santa Rosa County	12113
FL	Sarasota County	12115
FL	Seminole County	12117
FL	Sumter County	12119
FL	Suwannee County	12121
FL	Taylor County	12123
FL	Union County	12125
FL	Volusia County	12127
FL	Wakulla County	12129
FL	Walton County	12131
FL	Washington County	12133
GA	Brantley County	13025
GA	Bryan County	13029
GA	Camden County	13039
GA	Charlton County	13049
GA	Chatham County	13051
GA	Effingham County	13103
GA	Glynn County	13127
GA	Liberty County	13179
GA	Long County	13183
GA	McIntosh County	13191
GA	Wayne County	13305
HI	Hawaii County	15001
HI	Honolulu County	15003
HI	Kalawao County	15005
HI	Kauai County	15007
HI	Maui County	15009
IL	Cook County	17031
IL	Lake County	17097
IN	Lake County	18089
IN	LaPorte County	18091
IN	Porter County	18127
LA	Catahoula Parish	22025
LA	Concordia Parish	22029
LA	Evangeline Parish	22039
LA	Jackson Parish	22049
LA	Jefferson Parish	22051
LA	St. Tammany Parish	22103
LA	Winn Parish	22127
ME	Cumberland County	23005
ME	Hancock County	23009
ME	Kennebec County	23011
ME	Knox County	23013
ME	Lincoln County	23015

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
ME	Penobscot County	23019
ME	Sagadahoc County	23023
ME	Waldo County	23027
ME	Washington County	23029
ME	York County	23031
MD	Anne Arundel County	24003
MD	Baltimore County	24005
MD	Calvert County	24009
MD	Caroline County	24011
MD	Cecil County	24015
MD	Harford County	24025
MD	Kent County	24029
MD	Queen Anne's County	24035
MD	St. Mary's County	24037
MD	Somerset County	24039
MD	Talbot County	24041
MD	Wicomico County	24045
MD	Worcester County	24047
MA	Barnstable County	25001
MA	Bristol County	25005
MA	Dukes County	25007
MA	Essex County	25009
MA	Middlesex County	25017
MA	Nantucket County	25019
MA	Norfolk County	25021
MA	Plymouth County	25023
MA	Suffolk County	25025
MI	Alcona County	26001
MI	Alger County	26003
MI	Allegan County	26005
MI	Alpena County	26007
MI	Antrim County	26009
MI	Arenac County	26011
MI	Baraga County	26013
MI	Bay County	26017
MI	Benzie County	26019
MI	Berrien County	26021
MI	Cass County	26027
MI	Charlevoix County	26029
MI	Cheboygan County	26031
MI	Chippewa County	26033
MI	Delta County	26041
MI	Dickinson County	26043
MI	Emmet County	26047
MI	Gogebic County	26053
MI	Grand Traverse County	26055
MI	Houghton County	26061
MI	Huron County	26063
MI	Iosco County	26069
MI	Kalkaska County	26079
MI	Keweenaw County	26083
MI	Lake County	26085
MI	Lapeer County	26087
MI	Leelanau County	26089

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
MI	Luce County	26095
MI	Mackinac County	26097
MI	Macomb County	26099
MI	Manistee County	26101
MI	Marquette County	26103
MI	Mason County	26105
MI	Menominee County	26109
MI	Monroe County	26115
MI	Muskegon County	26121
MI	Oceana County	26127
MI	Ontonagon County	26131
MI	Ottawa County	26139
MI	Presque Isle County	26141
MI	Saginaw County	26145
MI	St. Clair County	26147
MI	Sanilac County	26151
MI	Schoolcraft County	26153
MI	Tuscola County	26157
MI	Van Buren County	26159
MI	Wayne County	26163
MI	Wexford County	26165
MN	Cook County	27031
MN	Lake County	27075
MN	St. Louis County	27137
MS	Hancock County	28045
MS	Harrison County	28047
MS	Jackson County	28059
NH	Rockingham County	33015
NH	Strafford County	33017
NJ	Atlantic County	34001
NJ	Cape May County	34009
NJ	Cumberland County	34011
NJ	Middlesex County	34023
NJ	Monmouth County	34025
NJ	Ocean County	34029
NJ	Salem County	34033
NJ	Union County	34039
NY	Bronx County	36005
NY	Cayuga County	36011
NY	Chautauqua County	36013
NY	Erie County	36029
NY	Jefferson County	36045
NY	Kings County	36047
NY	Monroe County	36055
NY	Nassau County	36059
NY	Niagara County	36063
NY	Orleans County	36073
NY	Oswego County	36075
NY	Queens County	36081
NY	Richmond County	36085
NY	St. Lawrence County	36089
NY	Suffolk County	36103

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
NY	Wayne County	36117
NC	Beaufort County	37013
NC	Bertie County	37015
NC	Brunswick County	37019
NC	Camden County	37029
NC	Carteret County	37031
NC	Chowan County	37041
NC	Craven County	37049
NC	Currituck County	37053
NC	Dare County	37055
NC	Gates County	37073
NC	Hertford County	37091
NC	Hyde County	37095
NC	New Hanover County	37129
NC	Onslow County	37133
NC	Pamlico County	37137
NC	Pasquotank County	37139
NC	Pender County	37141
NC	Perquimans County	37143
NC	Tyrrell County	37177
NC	Washington County	37187
OH	Ashtabula County	39007
OH	Cuyahoga County	39035
OH	Erie County	39043
OH	Lake County	39085
OH	Lorain County	39093
OH	Lucas County	39095
OH	Ottawa County	39123
OH	Sandusky County	39143
OH	Wood County	39173
OR	Benton County	41003
OR	Clatsop County	41007
OR	Columbia County	41009
OR	Coos County	41011
OR	Curry County	41015
OR	Douglas County	41019
OR	Lane County	41039
OR	Lincoln County	41041
OR	Polk County	41053
OR	Tillamook County	41057
OR	Washington County	41067
OR	Yamhill County	41071
PA	Erie County	42049
RI	Bristol County	44001
RI	Kent County	44003
RI	Newport County	44005
RI	Providence County	44007
RI	Washington County	44009
SC	Beaufort County	45013
SC	Berkeley County	45015
SC	Charleston County	45019

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
SC	Colleton County	45029
SC	Dorchester County	45035
SC	Georgetown County	45043
SC	Horry County	45051
SC	Jasper County	45053
TX	Aransas County	48007
TX	Brazoria County	48039
TX	Calhoun County	48057
TX	Cameron County	48061
TX	Chambers County	48071
TX	Galveston County	48167
TX	Harris County	48201
TX	Jackson County	48239
TX	Jefferson County	48245
TX	Kenedy County	48261
TX	Kleberg County	48273
TX	Matagorda County	48321
TX	Nueces County	48355
TX	Orange County	48361
TX	Refugio County	48391
TX	San Patricio County	48409
TX	Victoria County	48469
TX	Willacy County	48489
VA	Accomack County	51001
VA	Arlington County	51013
VA	Caroline County	51033
VA	Charles City County	51036
VA	Chesterfield County	51041
VA	Essex County	51057
VA	Fairfax County	51059
VA	Gloucester County	51073
VA	Hanover County	51085
VA	Henrico County	51087
VA	Isle of Wight County	51093
VA	James City County	51095
VA	King and Queen County	51097
VA	King George County	51099
VA	King William County	51101
VA	Lancaster County	51103
VA	Mathews County	51115
VA	Middlesex County	51119
VA	New Kent County	51127
VA	Northampton County	51131
VA	Northumberland County	51133
VA	Prince George County	51149
VA	Prince William County	51153
VA	Richmond County	51159
VA	Spotsylvania County	51177
VA	Stafford County	51179
VA	Surry County	51181
VA	Westmoreland County	51193
VA	York County	51199
VA	Alexandria city	51510
VA	Chesapeake city	51550
VA	Colonial Heights city	51570

Coastal Zone Counties

STATE	COUNTY	FIPS CODE
VA	Fairfax city	51600
VA	Fredericksburg city	51630
VA	Hampton city	51650
VA	Hopewell city	51670
VA	Manassas city	51683
VA	Manassas Park city	51685
VA	Newport News city	51700
VA	Norfolk city	51710
VA	Petersburg city	51730
VA	Poquoson city	51735
VA	Portsmouth city	51740
VA	Richmond city	51760
VA	Suffolk city	51800
VA	Virginia Beach city	51810
VA	Williamsburg city	51830
WA	Clallam County	53009
WA	Grays Harbor County	53027
WA	Island County	53029
WA	Jefferson County	53031
WA	King County	53033
WA	Kitsap County	53035
WA	Mason County	53045
WA	Pacific County	53049
WA	Pierce County	53053
WA	San Juan County	53055
WA	Skagit County	53057
WA	Snohomish County	53061
WA	Thurston County	53067
WA	Wahkiakum County	53069
WA	Whatcom County	53073
WI	Ashland County	55003
WI	Bayfield County	55007
WI	Brown County	55009
WI	Calumet County	55015
WI	Door County	55029
WI	Douglas County	55031
WI	Iron County	55051
WI	Kenosha County	55059
WI	Kewaunee County	55061
WI	Manitowoc County	55071
WI	Marinette County	55075
WI	Milwaukee County	55079
WI	Oconto County	55083
WI	Ozaukee County	55089
WI	Racine County	55101
WI	Shawano County	55115
WI	Sheboygan County	55117

DEVELOPING BETTER ECONOMIC INFORMATION ABOUT COASTAL RESOURCES AS A TOOL FOR INTEGRATED OCEAN AND COASTAL MANAGEMENT

Judith T. Kildow, University of Southern California
Brian Baird, State of California
Charles S. Colgan, University of Southern Maine
Hauke Kite-Powell, Woods Hole Oceanographic Institution
Rodney Weiher, NOAA, Department of Commerce

"...we don't have enough information about the oceans' impact on our economy. A complete and accurate assessment of the ocean bounty has never been done, and I think this has been a serious handicap in our decision making over the past number of years. We need such information to make decisions on how to responsibly use our ocean resources. And we need it to protect the marine environment. We need it if we're going to give the public a better understanding of how the oceans directly affect our lives." The honorable William M. Daley, Secretary of Commerce, Monterey, June, 1998.

I: Practical Uses of Economic Data

Ocean and coastal managers, legislators, members of congress, industry representatives, and academics are all concerned with a variety of questions regarding ocean and coastal resource protection, economics, research, monitoring and governance. Although economics is an important factor in any management analysis, studies of the value of ocean and coastal resources and their uses are generally lacking. In developing its Ocean Resources Management Program, the State of California conducted a first-ever analysis of the economic contribution of seven ocean-dependent industries to the State's economy in 1992. The resulting information, developed by the California Research Bureau, has been critical in the policy arena for demonstrating the role that the ocean plays in shaping the state's economy. Policy makers and other interested parties have clearly established the link between the economic value of ocean dependent industry and the need to manage and protect the resources that support it. This economic analysis was included in the 1997 strategy, *California's Ocean Resources: An Agenda for the Future* (California Ocean Agenda) and has been cited extensively by representatives of government, academia, the private sector, public non-profit organizations, and the media ever since.

The California Ocean Agenda and its economic conclusions had a substantial impact on ocean and coastal management in California. In the year that followed, California's Governor issued an executive order directing a series of new actions recommended in the document and fifteen new laws were enacted to improve the management and protection of the state's ocean and coastal resources. Administratively, the Department of Fish and Game was re-organized to establish a new marine region with additional marine enforcement capability dedicated to ocean and coastal issues. In the 3-4 years that followed, a series of additional legislative efforts and budget initiatives directed to the coast and ocean have been enacted. Governor Davis has made the ocean and coastal protection one of the top priorities of his administration, which has been reflected in new legislation and substantial budget increases for these programs. Proponents of ocean and coastal protection in California have continued to cite the findings from this single economic study, because little else exits. Other states and the federal government could benefit from the development of such economic data.

California's experience demonstrates the potential impact of economic data in driving public policy decisions. However, it was clear from the start that the analysis conducted was limited. For example, the economic studies focused strictly on market transactions of the industries studied. In the case of tourism, much of the recreation value was left out entirely. Estimates were based on travel spending data and reflected actual spending, not imputed data that might have represented something like the value of a day at the beach. Studies have been done and are currently underway to capture those values. It is the data from such studies that can provide a substantially enhanced understanding of the impact of the ocean and coast on state and national economies. This enhanced level of analysis is what should be conducted at the state, regional, and national levels to help support informed decision making regarding the management of ocean and coastal resources.

II: Utility and Justification for Baseline Economic Data for the Coast and Coastal Ocean

California is not alone in recognizing the importance of the oceans to their economy. Since the International Year of the Ocean (1998) raised America's consciousness about the coast and the ocean, there has been that same recognition at the national level, where there has been a proliferation of government and business reports about this bountiful and popular area of the United States. Many of those reports have tried to attribute values to coastal resources, real estate, recreation and tourism, fisheries of all kinds, or to estimate the cost of coastal erosion and other damage to the shore and waters. These estimates generally have large margins of error, depending on how these activities are defined, what was measured, and when it was measured. The need for reliable economic information for decision making is made even more urgent as the pace of technological change increases, investment patterns change, and mergers reinvent industry infrastructures. Tracking the economic implications of these trends over periods of time would indicate fluctuations in revenues, expenditures, and employment that could help direct decisions in the future. Indeed, at all levels of government, decision-makers have carved out a formal role for economics in federal, state, and local law and regulations. The most common economic tool to inform environmental decision-making--cost benefit analysis—depends critically upon sound economic information, including quantitative estimates of the value of coastal environmental assets, not normally traded in markets such as beach recreation. Currently, the ocean sector has little data with which to do this.

The coast and ocean are critical areas that demand better understanding of their economics, particularly because we don't know how large an economic engine is driven by the ocean and coastal zone. Yet we do know that many economic activities depend on and impact coastal and ocean resources; that pressures on these resources are testing their sustainability. Over the past three decades, the interaction between environment and economy has received increased attention. As our ability to measure both environmental and economic changes has improved, serious attempts have been made to integrate environmental and economic information for decision-making purposes. Some of this effort has been directed at the creation of integrated economic and environmental accounts within the national income accounting framework. Such integrated accounts provide a consistent conceptual framework and a more level "playing field" for decisions about conservation and development.

Most decisions are made with incomplete economic information that emphasizes the values associated with development, such as housing, and miss many of the values associated with conservation, such as habitat stability and recreation. This is because data have traditionally been gathered on the market-oriented activities, but not for non-market values. At the root of the problem is the limited scope of the national income accounting system of the United States – the accounting system from which measures such as gross domestic and gross national product, GDP and GNP, are derived. These national income and product accounts (NIPA), the most fundamental measure of the overall size of the US economy, include only limited information about recreational values and changes in environmental resources. And they give no special attention to coastal or ocean-related economies

Some of the most obvious uses for this information are

- Economic impact assessments for regulations, controversial decisions, predictions and projections.
- Management and investment decisions in coastal areas
- Conservation decisions regarding marine protected areas, no-take zones, and setting aside green space.
- Sustainable policies for natural resources management

The Nature Conservancy and the Natural Heritage Program recognize that wise conservation management cannot proceed without a thorough understanding of the stocks and condition of biodiversity around the world. Hence, Conservation Data Centers that document, measure, and track biodiversity are now an integral part of conservation efforts throughout the Western Hemisphere. The conservation of coastal and ocean resources also requires similar documentation. But coastal conservation requires an understanding of how coastal resources are used, how these resources generate economic value, and how stocks of coastal environmental and economic resources have changed over time. [1] Informed coastal conservation in the 21st century will require an information system that can provide policymakers with important and accurate information about coastal resources and their values. Providing this data is the role of the National Ocean Economics Project, headquartered at the University of Southern California.

III: Using Economic Data for Baseline Comparisons: A Sample of the Data

Federal Ocean Expenditures, 1970 – 2000

We have completed a preliminary assessment of federal ocean expenditures from 1970 to the present. The primary data source is the U.S. Office of Management and Budget's annual *Budget of the United States Government* publication. In some instances, data have also been obtained directly from federal agencies. The data include information on marine expenditures in the following federal functions and activities:

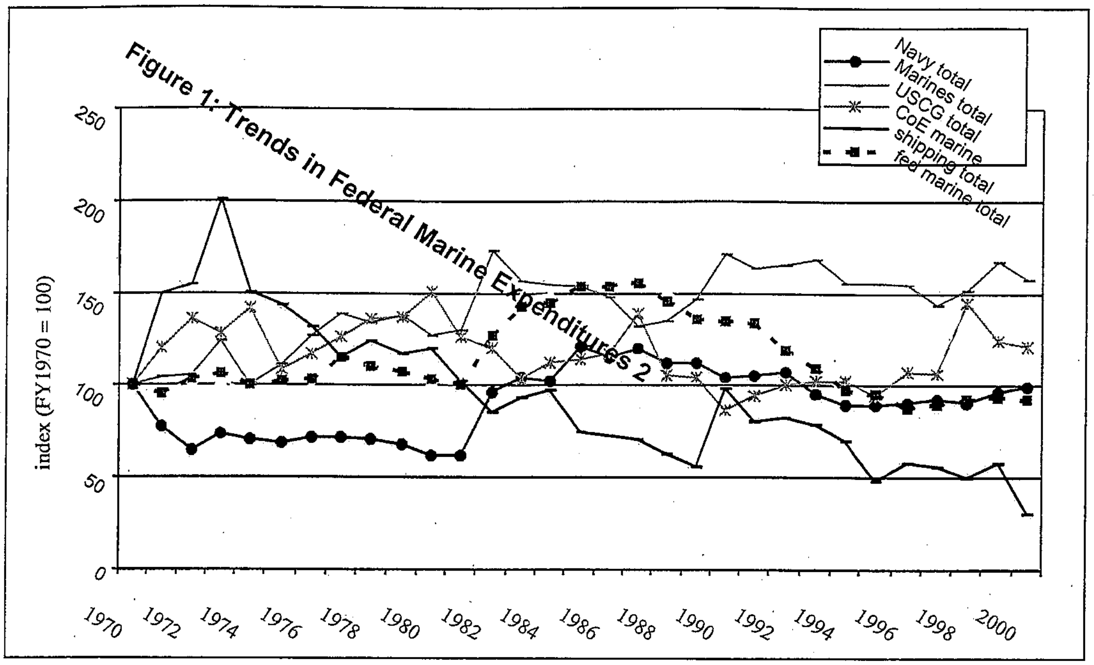
- Department of Defense (Navy, Marines)
- U.S. Coast Guard (USCG)
- U.S. Army Corps of Engineers (ACoE)
- National Oceanic and Atmospheric Administration (NOAA)
- Maritime Administration
- Panama Canal Zone government
- St. Lawrence Seaway Development Corporation
- Federal Maritime Commission
- Marine Mammal Commission
- Minerals Management Service
- Environmental Protection Agency

Some budget entries are considered to be entirely "marine" expenditures, while others are "mixed" (some part of the funds was spent on non-marine related activities). For "mixed" expenditure categories, we have made preliminary estimates of the marine fraction. These estimates will be refined in the course of the project.

When the aggregate expenditures from 1970 to the present are normalized to 2000 dollars, we find that federal marine expenditures have been fairly constant around $100 billion per year. Of this, about 80% are Navy expenditures and another 12% are the Marines. The Coast Guard accounts for 4%, and other civilian expenditures make up the remaining 4%. Figure 1 illustrates the trend in some expenditure categories over the 30-year period.

The $100 billion annual federal marine expenditures represent from 10 to 50% of typical "coastal GDP" or "ocean GDP" estimates. The $4 billion in purely civilian federal marine expenditures represent from 0.5 to 2% of coastal/ocean GDP estimates. The percentage of the federal budget devoted to civilian marine expenditures decreased by two thirds from 1970 to the late1990s. Total federal marine expenditures accounted for about 12% of the overall budget in 1970 and dropped to just over 5% by 2000.

[1] Linwood Pendleton, December, 1999, internal document.



IV: Using Economic Data in the Decision Making Process: A More Complete Cost-Benefit Calculation

Federal laws, court rulings, and Executive Orders, as well as a plethora of state and local laws and regulations, increasingly call for assessing the costs and benefits of proposed environmental management and policy interventions and initiatives.. Fortunately, over the last few decades, economists have developed tools and methods to value many of these so-called non-market environmental assets, to quantify these values, and to add them up and include them in the cost benefit equations. This gives a much richer picture of the nature of the tradeoffs involved in environmental decision making. These tools include travel cost models, hedonic price models, and contingent and conjoint valuation techniques. Further, better understanding and wider acceptance of metrics to deal with risk, uncertainty, and discounting, particularly as applied to environmental issues, has made the cost benefit framework more transparent and less controversial as a decision tool.

The convergence of requirements to consider cost benefit analysis and our ability to paint a much broader picture of the choices involved in environmental decision making has led to intense interest on the part of coastal and marine planners and managers to understand and apply modern cost benefit techniques. The National Oceanic and Atmospheric Administration has conducted a series of regional environmental workshops for state and local planners and managers, NGOs, and the private sector on methods and techniques of applying environmental valuation to environmental management. NOAA is now actively partnered with Sea Grant institutions, leading environmental and natural resource economists, and NGO's to develop regionally specific Environmental Valuation Guidebooks. These include economic concepts such as tradeoffs and willingnesss-to-pay, economic tools such as cost benefit analysis and economic impact analysis; valuation tools like travel cost models; and regionally specific case studies such as sediment remediation in the Great Lakes. Regional Handbooks in preparation cover the Great Lakes, South Florida, and New England.

V: Measurement Strategies and Past Studies: How to formulate the database.

Now that we have discussed the impetus for creating the database for the coastal and ocean economy, it is important to understand the theoretical and intellectual underpinnings for this work. There is, in fact, a great deal of economic information about the ocean and its resources available in myriad public and private databases and in a large amount of literature both peer reviewed and "gray". But this large array suffers from a series of major flaws. Data is inconsistently estimated, utilizes a variety of measures from output to employment to income, and is sometimes constructed using techniques that are controversial among economists and poorly understood by non-economists. A major task of the NOEP will be to develop and apply consistent rules for measuring and describing the economic values associated with the ocean, and then providing the data in a way that users understand both the strengths and limitations of the various approaches.

The core strategy to sorting the data is to use the framework for measuring the economy that underlies the measurement of most economic activity in the U.S.: the National Income and Product Accounts. These accounts measure the total output of goods and services in the economy (gross domestic product), the income earned from producing those goods and services (gross domestic income), and the sales of the individual industries (gross product originating). The NIPA framework provides the consistent set of rules, which help avoid the dangers of counting the same activity twice. NIPA measures both the annual flows of economic activity and changes in the value of assets used by the economy (stocks), and permits measurement of economic activity related to the ocean at both the regional and national level. The result is a "satellite" account of the NIPA that measures the "ocean GDP" of a type increasingly being developed by the U.S. and other countries to focus attention on particular areas of the economy..

The concept of an "ocean GDP" is not new. In 1974, the Bureau of Economic Analysis, the agency responsible for maintaining the National Income and Product Accounts undertook to identify the contribution of the ocean to the Gross National Product (Nathan Associates, 1974). In that study, BEA developed estimates for Gross Product Originating from the ocean using the economic census data for 1972. Two follow-up studies used a similar approach to estimate this value for 1977 and 1987 (Pontecorvo et.al, 1980; Pontecorvo, 1988).

Creating an "ocean GDP" requires that the national data be disaggregated in two ways: by industry and geography. Certain industries, like fisheries or marine construction, are clearly ocean related. Other industries, like tourism, are related to the ocean only by virtue of geographic proximity. The task, therefore, is to identify the interaction of industry and geography that defines the sectors associated with the ocean, then measuring these sectors output and income. Though not formally part of the NIPA data, employment is also of interest and will be included as well. Estimates at both the national and regional (state and county) levels can be derived from existing federal data sets.

The NIPA framework is the foundation for the Project's data collection. It will provide a wealth of critical information about how the national and regional economies are affected by the ocean, about how these effects change over time, and, when linked with other data sets that measure the ocean, how changes in the marine environment affect the economy. But it is not a complete picture, so the NOEP will extend the core NIPA account in several ways. These "extended accounts" will provide additional details on major industry sectors associated with the ocean, about the ocean economy of a number of key states, and the assembly of economic information concerning the ocean that is not accounted for by government or industry (non-market values).

A number of key industries must be studied in significant detail in order to provide the best estimates of activity within the NIPA framework, and these industry studies can then be used as stand-alone products. The industries to be examined include fishing and aquaculture (including commercial fish processing); minerals (oil and gas); tourism/recreation, including beach use and boating; construction (including expenditures on restoration, maintenance, repair and rehabilitation of coastal lands); marine transportation; real estate; ship and boat building; and government.

Interest about the ocean and its economic activities is not confined to the national level. State and local decision makers need to know about ocean related economic values as well, and a number of studies at the this level have been conducted. A recent example is the economic data cited from "California's Ocean Resources: An Agenda for the Future," sponsored by the State of California. Other studies for the state, multi-state, or sub-state level Luger (1993); Colgan and Plumstead, (1993) and Colgan (1990). The NOEP data will update these studies at the state and county levels. Where funding is available, more detailed analysis of individual states will be undertaken, focusing particularly on activities that are best examined at the sub-county level like tourism and recreation and the ocean's effects on real estate values.

Measuring economic activity associated with the ocean through examination of the goods and services produced by specified industries and in coastal locations will provide answers to many of the most commonly asked questions about the ocean economy. But even this data will still be incomplete. Beyond are a variety of "non-market" values, which are needed to complete the picture. When someone goes to the beach in Florida or boats on Chesapeake Bay, there may be little that is directly purchased on that day. But the popularity of such activities is testament to their underlying value. Economists have developed a variety of techniques to measure such values, and a large number of studies have been done throughout the country using these techniques. The Project intends to compile the results of these studies into the ocean economy database to provide researchers with access to the information that has been generated.

The resulting integrated, web-accessible database will provide as comprehensive a picture as possible of the economic values associated with the ocean. It will provide historical data, and because it is estimated as much as possible on a consistent basis, it can be used to compare these values across time and space. But there will still be important limitations. Requirements to maintain confidentiality of data will require that many smaller geographic areas cannot be described in the same level of detail as larger regions. The surveys of industries conducted by the Census Bureau that underlie the national data and which will be used to disaggregate to the industrial and geographic level will have sampling limitations that will require some indirect estimating techniques. The non-market values are estimated using complex techniques that can result in widely varying figures for the same resources.

Therefore a key part of NOEP will be to develop approaches to quality assurance and quality control (QA/QC) for the data. Thorough documentation of sources and estimating techniques available on line as part of the data distribution system will be one key element. The other element will be primers on the techniques and professional review of estimates made by others (particularly the non-market data) that will allow users to better understand what the data is and how it might be used.

In summary, many decisions about the use and conservation of ocean and coastal resources hinge on economic assumptions. Frequently, the arguments revolve around conflicting statements about the real or perceived "value" of the oceans and coastal zone. Despite the magnitude of these arguments and the importance of the decisions, the fact is there is no systematic accounting of the market and non-market values of the marine environment. This work intends to fill that void.

VI: References

Bell, Frederick W. and Vernon R. Leeworthy 1986, "An Economic Analysis of the Importance of Saltwater Beaches in Florida." Report Number 82. Tallahassese, Fl. Florida Sea Grant college
Bureau of Economic Analysis. 1974. Gross Product Originating from Ocean-Related Activities. Washington.
Bureau of Economic Analysis. 1994a. " Integrated Economic and Environmental Satellite Accounts" Survey of Current Business, April.

Bureau of Economic Analysis. 1994b. A Satellite Account for Research and Development. Survey of Current Business. November.
Bureau of Economic Analysis, 1994c. Accounting for Mineral Resources: Issues and BEA's Initial Estimates. Survey of Current Business. April.
Colgan, C.S. 1990. *Valuing Coastal Zone Management.* Newport, Oregon: National Coastal Resources Research and Development Institute. Publication NCRI-T-90-005. 1990
Colgan, C.S. and Plumstead, J. 1993. Economic Prospects for the Gulf of Maine Augusta, Maine: Gulf of Maine Council on the Marine Environment.
Luger, Michael I., 1991-92 "The Economic Value of the Coastal Zone," Journal Environmental Systems, Vol. 21(4), pp. 279-301, 1991-92.
Moller, Rosa and Joe Fitz,1997. The Resources Agency of California, California's Ocean Resources: An Agenda for the Future, Chapter 2: Economics of Ocean Dependent Industries, March 1997.
National Research Council. 1999. Nature's Numbers: Expanding the National Economic Accounts to Include the Environment. Washington: National Academy Press.
Pontecorvo, G., M. Wilkinson, et al. (1980). "Contribution of the Ocean Sector to the United States Economy." Science(208): 1000-1006.
Pontecorvo, G. (1988). "Contribution of the Ocean Sector to the United States Economy: Estimated Values for 1987 -- A Technical Note." MTS Journal 23(2): 7-14.
United States Senate, 1974. The Economic Value of Ocean Resources to the United States. USGPO (prepared by Nathan Associates)

Dr. Judith T. Kildow
Senior Research Scientist
The Wrigley Institute for Environmental Studies
AHF 331
University of Southern California
Los Angeles, CA 90089-0371
Phone: 213-740-5539
Fax: 213-740-6720
email- jkildow@usc.edu

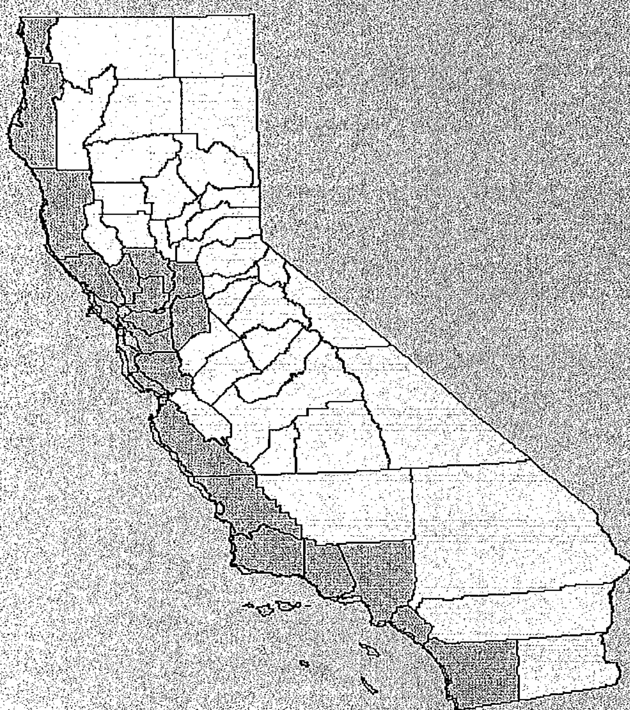
CA Biodiversity Council Ocean and Coastal Economic Summit Meeting held July 22, 2005

Major Findings of California's Ocean Economy Report presented by Judy Kildow and Charlie Cogan to the Resources Agency prepared by the National Ocean Economics Program.

- Number 3 of the Governor's Action Plan calls for a summit to evaluate ways to use economic processes to guide our interest to manage.
- California's Ocean Economy Report contained data on the 1999-2000 decade.
- California's the ocean economy makes up 42 billion of the gross state product (GSP), up 10% in a decade.
- All manufacturing and production sectors declined in the decade reviewed, while the services sectors have grown.
- Coastal tourism and recreation sectors have grown the fastest, contributing 20 billion to the GSP. There has been a transition of the coastal economy from mineral extraction to tourism.
- Sectors paying the lowest salaries grew (<$18,000) and sectors paying the highest salaries declined.
- Within California's coastal counties there is 81% of the state's employment, 77% of its and all within 25% of the state's land.
- Limited land availability is contributing to upper watersheds being developed and long commutes to coastal areas, which causes an increase to transportation and limits services.
- California's share of the nations' fish landings was 25%, it is now >5% and continues to decline. Fisheries have little value to the State's economy, but a lot is spent on studying it and management it. Fisheries have a low market value and a high non-market value.
- California is the wealthiest Coastal State in the nation. It is the number 1 tourist destination, has a unique coastline.
- It appears that over estimation of availability of resources and under estimating their value has and is occurring.
- Study measured 6 sectors: 1) Tourism & Recreation (spatially extensive) 2) Transportation (spatially extensive) 3) Ship & Boat Building 4) Minerals 5) Living Resources and 6) Marine Construction.
- Study did not measure 3 sectors: 1) Scientific Research 2) Real Estate 3) Government Activities.

- The real estate sector represents 15% of the state budget, government is 2nd at 11%. Prime real estate in California is coastal property; real estate has not been effectively measured to assess its contribution to the state's budget.
- Economic growth in a sector is measured by employee output. In the Tourism & Recreation sector growth is achieved by increasing the number of employees due to their low output, which relates to wage factor.
- Increased Tourism & Recreation employees' means that they will have to move around more within the coastal zone resulting in increased transportation (spatially extensive) due to wage factor/housing.
- Employment within the ocean economy is proportionally more important in Northern California's economy and its rural communities than Southern California's economy.
- Coastal economy is divided into 1) near shore and far shore areas within coastal zone counties, 2) watersheds include coastal zone and upland areas, and 3) inland areas.
- Housing and population growth is occurring in the upland areas of the watersheds.
- Economic growth is occurring in near shore areas.
- Economic change is more important than focusing on population change.
- Health and quality of the beaches (resources) is vital to understanding the codependent relationship, the feedback loops between the environment and the economy. Environmental change is related to economic change, this report/model is in the beginning process of looking in a broad scale at conceptual facts and models of California's natural resources.
- California's beach economy is estimated at 5 billion, this is a gross estimate.
- Can take this report's data and use it to lobby for funding due to California being the largest ocean economy in the nation, thus important to the National Economy, the Global Economy.
- Non-point source pollution related to the economy and impervious surface relationship of non-point pollution to the economy is just being looked at.
- The ocean economy is a new concept and it is a national study. Decisions effecting the ocean economy have been made with good scientific data, but no economic and social data.
- Report's data is useful in forecasting, it gives you a benchmark of were you come from and were you were are, and you want to know were you are going and what you can do about it.
- Data for 2004 will be available in August on the web site www.oceaneconomics.org
- Coastal State's summaries will be updated every few months on the web site.

California



1990-2000 State Summary of Coastal and Ocean Social and Economic Trends

National Ocean Economics Program

State Summary

This report provides summary information on the economy and demographics of the California coast*.

The map on the front separates the coastal from inland counties.

This is one of an ongoing series of reports prepared by the National Ocean Economics Program (NOEP) to provide state overviews of the available data on the economic and social characteristics of America's coasts and coastal oceans.

Funding for this work comes from the Coastal Services Center, NOAA, Department of Commerce and the State of California Resources Agency.

* Some of the values in this summary report are slightly different from those found in the full California Ocean Economics Report because it reflects recently updated data from the BLS site. Values continue to change over time as the government revises its original figures.

Important information before reading…

Coastal Economy and Ocean Economy are not the same.

Coastal Economy

- **The *Coastal Economy* is the sum of all economic activity occurring in counties defined as part of a state's coastal zone management program.**
  - Employment data "excludes proprietors, self-employed, unpaid family or volunteer workers, farm workers, and domestic workers."

Ocean Economy

- **The *Ocean Economy* comprises economic activity for the state that uses the resources of the ocean, directly or indirectly, as an input.**
  - Because of data limitations or legal restrictions, the current data series on the Ocean Economy excludes government ocean related activities, the marine research sector, real estate, and fisheries harvesting employment. Thus, the employment numbers, wages and salary, and GSP(see page 4) estimates for fisheries are undervalued in this Summary.
  - Ocean Economy is measured only in coastal counties at this time, however Ocean Economy activities extend throughout the United States.

Geography

- **Coastal Watershed**
  - As defined by NOAA (http://www.census.gov/geo/landview/lv6help/coastal_cty.pdf)
- **Coastal zone program counties**
  - As indicated for the Federal Coastal Zone Management Program
- **Shoreline counties**
  - Defined as those counties which touch the ocean
- **Near-shore**
  - Defined by coastal zip codes along the shoreline

Economic and Social Indicators

Five indicators* describe changes in both the **Coastal** and **Ocean Economies**.

Economic indicators:

- **Employment**
  - Annual average wage and salary employment excluding self-employment.
- **Wages and Salaries**
  - The total wages and salaries paid.
  - All wages are shown in 2000 dollars.
- **Gross State Product (GSP)**
  - GSP is the total value of goods and services produced in a state.
  - Unless otherwise indicated, all measures are stated as direct values.
  - All values are shown in 2000 dollars.
- **Multipliers**
  - Indirect and induced values. Multipliers affect the estimates of employment, wages, and output within the region. Indirect effects include both the change in economic activity in industries within the region that buy or sell from ocean industries and the change in economic activity resulting from the spending of the wages earned by those employed by the ocean industries within the region. All indirect values or multiplier effects are based on IMPLAN, a standard and widely used economic impact model.

Social indicators:

- **Population**
- **Housing Patterns and Trends**
  - Includes all housing units, both single and multi-family, including seasonal and year round, owner occupied and rental.

*A sixth indicator, number of establishments, appears on the NOEP website

California Quick Facts

Geographic Notes

- There is great diversity in regional activity along the 840 mile coastline. In 2000, the largest concentration of coastal economic activity was located in the southern coastal counties.
- The northern coastal counties experienced the highest population growth rate from 1990 to 2000.

Coastal Economy

- Between 1990 and 2000, California's coastal population grew more slowly than the overall state population: 11.3 % compared to 13.7%, a difference of 2.4%.
- In 2000, 77% of California's population lived in coastal counties, which represent 25% of the land.
- Coastal employment in California increased by 9.7% from 1990 to 2000, representing more than 80% of the state's total employment.

Ocean Economy

- California has the largest Ocean Economy in the US, ranking first for employment, wages, and GSP.
- In 2000, California Ocean Economy provided over 400,000 jobs, or 4.9% of employment in California's Coastal Economy, and more than 690,000 jobs when multiplier effects are considered.
- In 2000, the direct market value (GSP) of California's Ocean Economy was $21.4 billion, and the total market value (GSP) of California's Ocean Economy was $42.9 billion.
- Between 1990 and 2000, the Coastal Tourism & Recreation sector far outperformed all other ocean sectors in growth rates.

Coastal Economy and Social Indicators

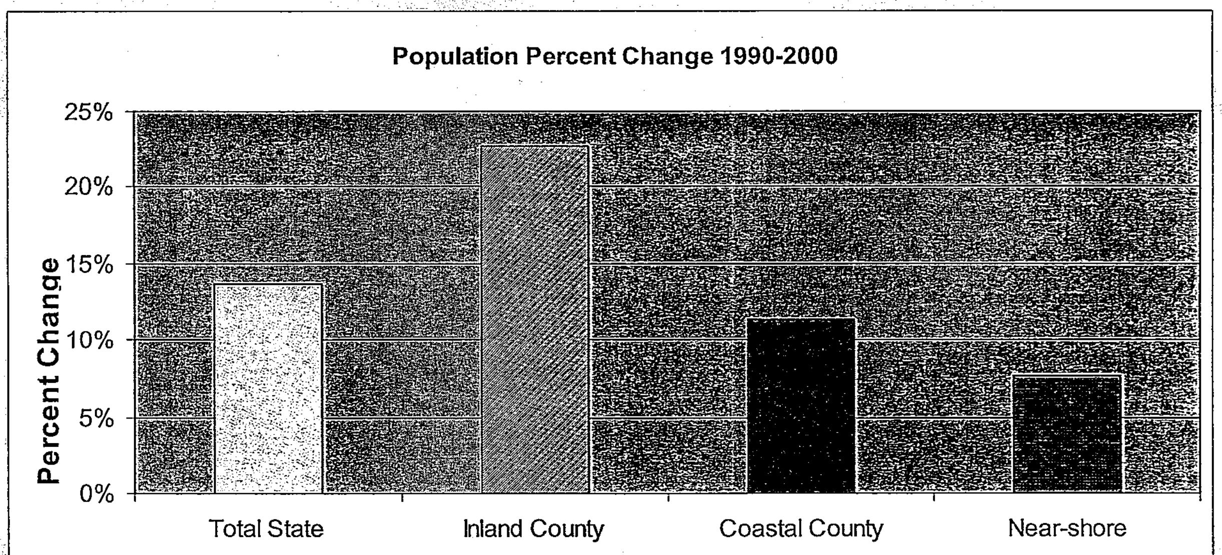
California Coastal Counties

Alameda	San Francisco
Contra Costa *	San Joaquin *
Del Norte	San Luis Obispo
Humboldt	San Mateo
Los Angeles	Santa Barbara
Marin	Santa Clara
Mendocino	Santa Cruz
Monterey	Solano *
Napa	Sonoma
Orange	Ventura
Sacramento *	Yolo *
San Diego	

* Watershed/delta counties with ports and ocean related industries

California Population Growth

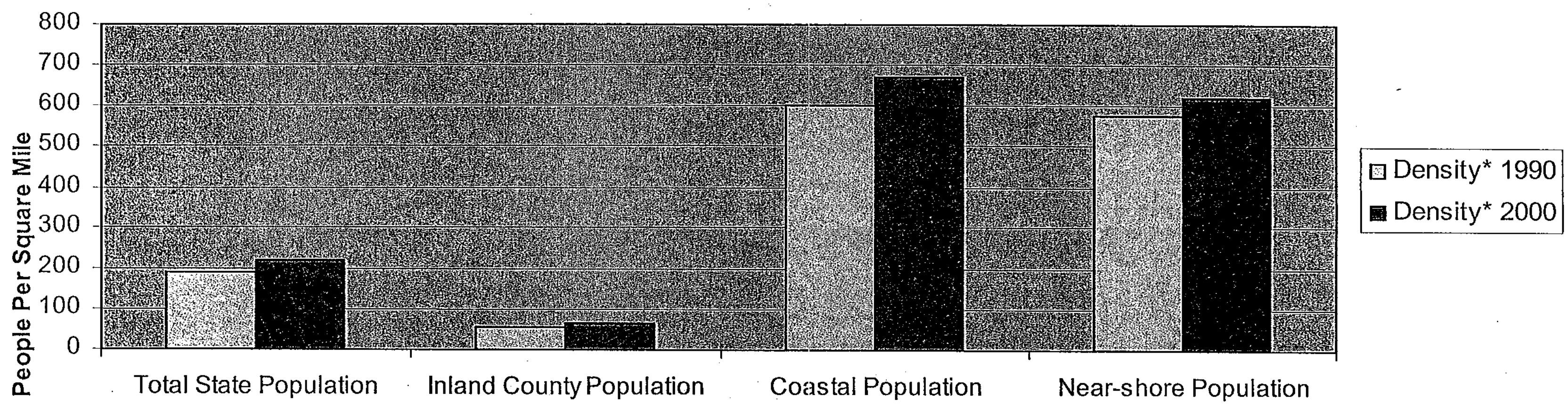
Year	Total State Population	Inland County Population	Coastal Population	Near-shore Population
1990	29,785,857	6,239,170	23,546,687	4,481,996
2000	33,871,648	7,655,792	26,215,856	4,828,228
Change	4,085,791	1,416,622	2,669,169	346,232
Percent Change	13.7%	22.7%	11.3%	7.7%



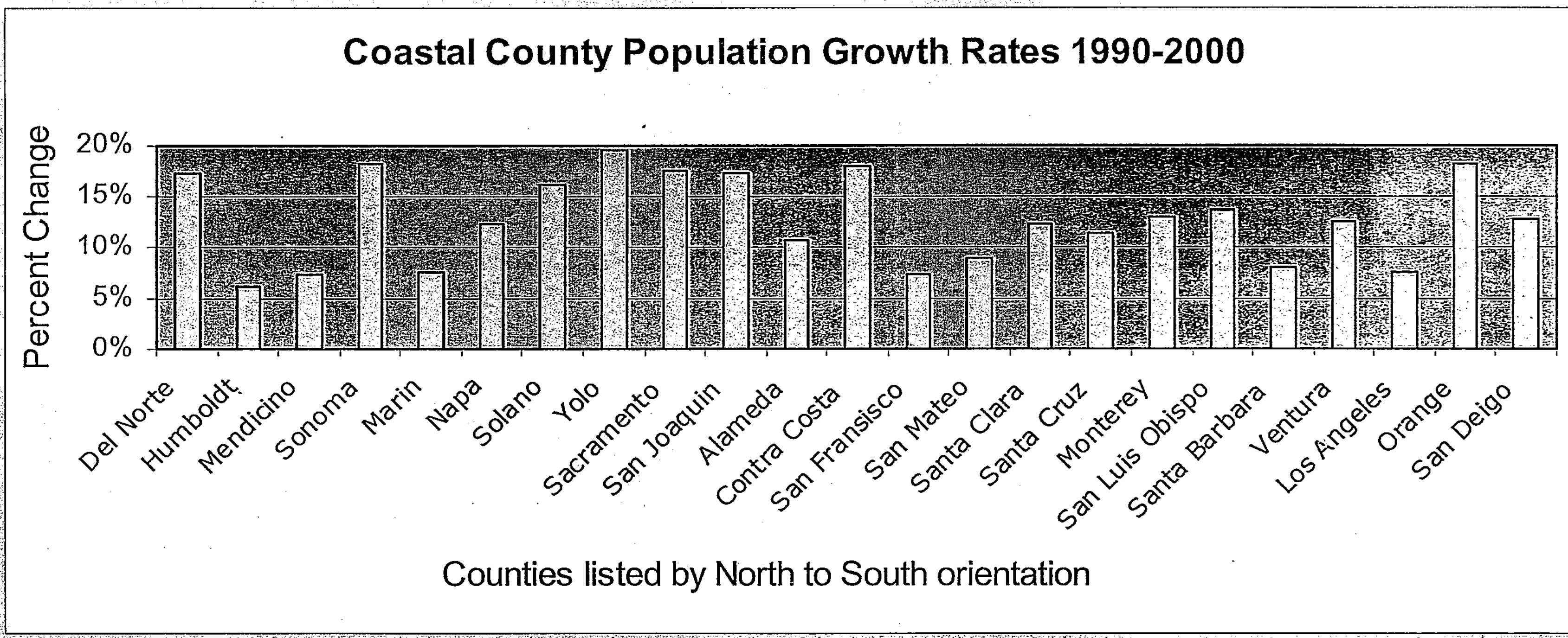
California Population Density

Year	Total State Population	Inland County Population	Coastal Population	Near-shore Population
Density* 1990	191.0	53.4	602.3	578.5
Density* 2000	217.2	65.9	670.6	623.2
Change	26.2	12.5	68.3	44.7
Percent Change	13.7%	23.4%	11.3%	7.7%

* Density = per square mile



California Coastal County Population Growth Rates 1990 - 2000



- Population across California coastal counties grew from 6.2% to 20% over the 1990 – 2000 period.
- Yolo county had the highest growth rate.
- Humboldt and San Francisco counties had the lowest growth rate.
- In 2000, 77.4% of California's population was living in coastal counties, or 25% of the land.

NATIONAL OCEAN ECONOMICS PROGRAM

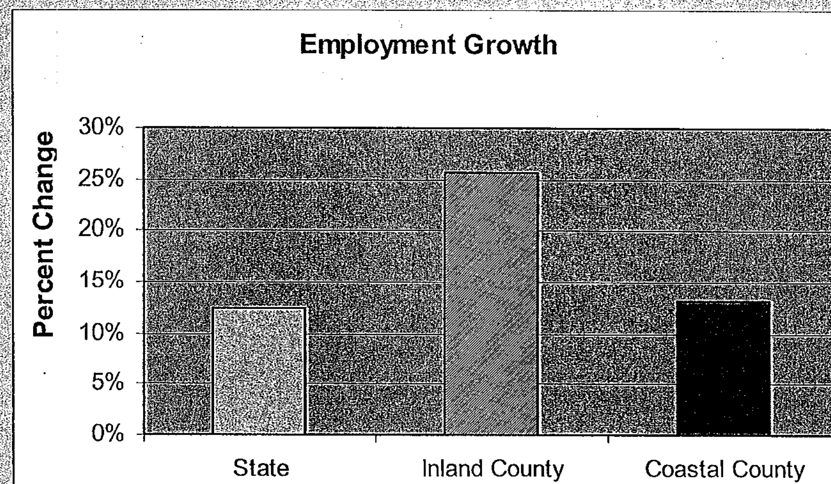
A003992

California Employment Growth

Year	Total State Employment *	Inland County Employment	Coastal County Employment	Coastal County % of State Employment	Inland County % of State Employment
1990	13,262,696	2,034,935	11,092,302	79.2%	15.3%
2000	14,905,055	2,557,295	12,025,424	80.7%	17.2%
Change	1,642,359	522,360	933,122		
Percent Change	12.4%	25.7%	13.2%	1.5%	1.8%

* Because of differences in BLS data reporting, Coastal County and Inland County do not equal Total State.

- In 2000, coastal county employment was 12,025,424 or nearly 81% of the state employment.

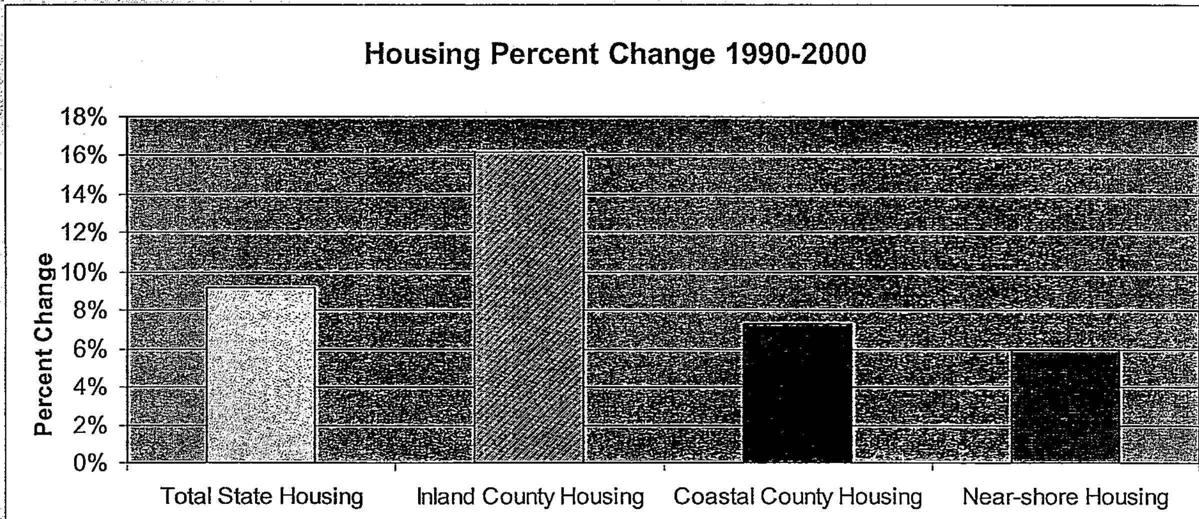


A003993

California Housing Growth

Year	Total State Housing Units	Inland County Housing Units	Coastal County Housing Units	Near-shore Housing Units
1990	11,182,882	2,432,253	8,750,629	1,858,485
2000	12,214,549	2,825,292	9,389,257	1,969,411
Change	1,031,667	393,039	638,628	110,926
Percent Change	**9.2%**	**16.2%**	**7.3%**	**6.0%**

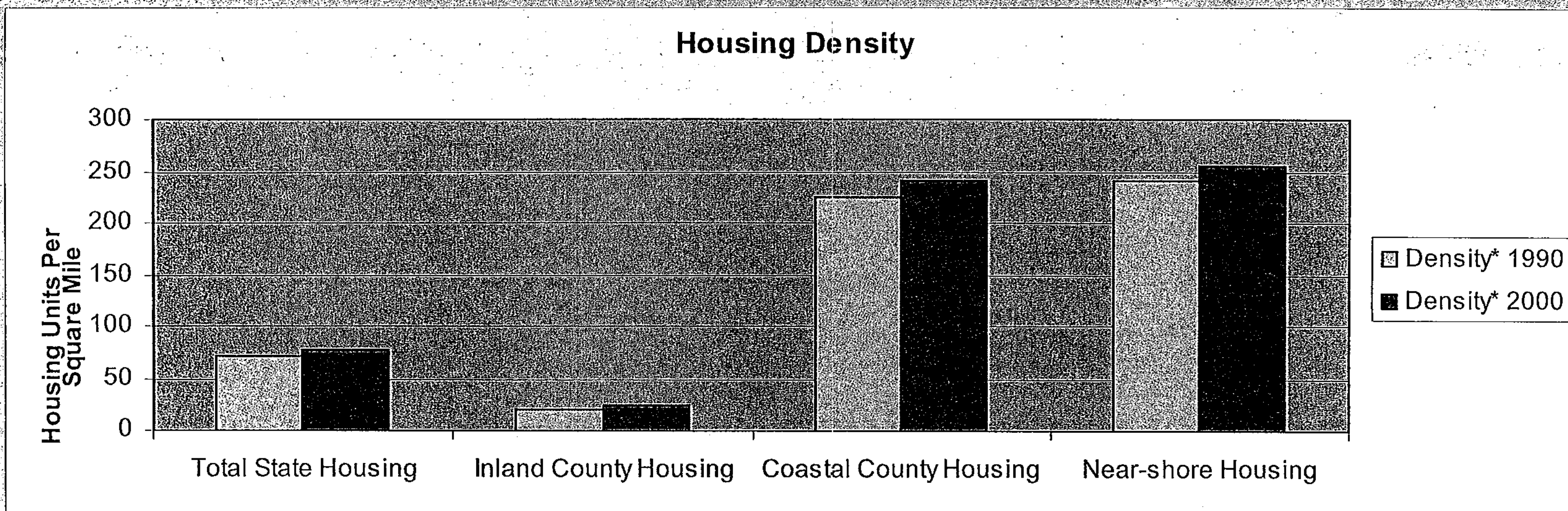
- In 2000, the coastal county housing was about 9.4 million or 76.8% of the total state housing.



California Housing Density

Year	Total State Housing	Inland County Housing	Coastal County Housing	Near-shore Housing
Density* 1990	71.7	20.8	223.8	239.9
Density* 2000	78.3	24.3	240.2	254.2
Change	6.6	3.5	16.4	14.3
Percent Change	9.2%	16.8%	7.3%	6.0%

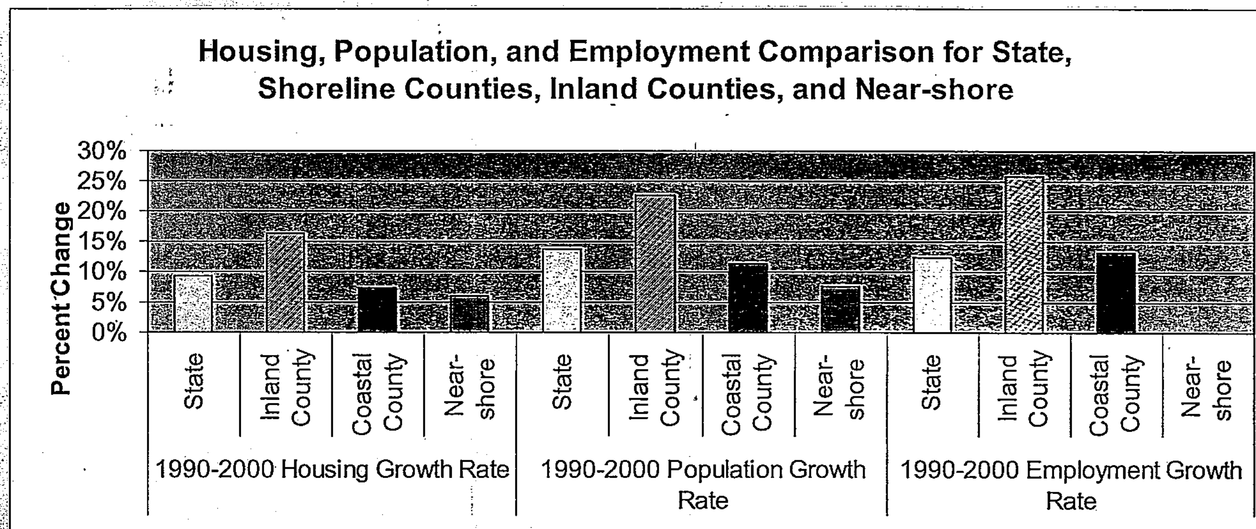
* Density = per square mile



Comparison of Housing, Population, and Employment

[illegible]				[illegible]				[illegible]			
State	Inland County	Coastal County	Near-shore	State	Inland County	Coastal County	Near-shore	State	Inland County	Coastal County	Near-shore
9.2%	16.2%	7.3%	6.0%	13.7%	22.7%	11.3%	7.7%	12.4%	25.7%	13.2%	N/A

- Compared to Inland Counties, the Coastal County and Near-shore areas have experienced relatively lower housing, population, and employment growth.
- Population and Housing density increased more in Coastal Counties, but at the Near-shore areas it remained the same.



NATIONAL OCEAN ECONOMICS PROGRAM

Ocean Economy

Sectors and Industries of Ocean Economy

[According to Bureau of Economic Analysis (BEA) Standard Industrial Classification (SIC) codes]

Construction - Marine	*Boat Dealers*
Heavy Construction	*Eating and Drinking Places*
Living Resources - Marine	*Hotels and Lodging*
Fish Harvesting	*Marinas*
Fish Hatcheries and Aquaculture	*Recreational Vehicle Parks and Campgrounds*
Seafood Processing	*Sporting Goods Retailers*
Minerals - Offshore	*Zoos and Aquaria*
Limestone, Sand, and Gravel	**Transportation - Marine**
Oil & Gas Exploration	Deep-sea Freight Transportation
Oil & Gas Production	Marine Passenger Transportation
Ship & Boat Building	Marine Transportation Services
Boat Building and Repair	*Petroleum and Natural Gas Pipelines*
Ship Building and Repair	Search and Navigation Equipment
Tourism & Recreation - Coastal	*Warehousing*
Amusement and Recreation Services	

Not Currently Available: Real Estate, Scientific Marine Research, or Government data.

Note: Industries in *italics* are defined as *Ocean* if establishment is located in near-shore zip code.

Ocean-related GSP of Coastal States for 2000

State	Rank	GSP (2000)	State	Rank	GSP (2000)
California	**1**	**$21,434,428,141**	Michigan	15	$2,002,302,949
			Mississippi	16	$1,785,750,627
Louisiana	2	$15,248,432,508	Maine	17	$1,519,896,601
Florida	3	$11,676,830,383	South Carolina	18	$1,422,939,938
Washington	4	$7,683,892,713	Wisconsin	19	$1,241,080,165
New Jersey	5	$6,848,544,553	Georgia	20	$1,167,788,146
Texas	6	$6,446,339,764	North Carolina	21	$1,097,149,561
Alaska	7	$5,239,162,298	Indiana	22	$994,142,073
New York	8	$5,092,727,554	Ohio	23	$942,681,414
Hawaii	9	$4,030,681,483	Rhode Island	24	$862,983,177
Virginia	10	$3,565,652,519	Alabama	25	$766,574,374
Illinois	11	$3,324,045,497	Oregon	26	$710,837,378
Pennsylvania	12	$2,867,222,029	New Hampshire	27	$519,075,829
Connecticut	13	$2,454,068,194	Minnesota	28	$454,283,828
Maryland	14	$2,363,494,739	Delaware	29	$362,687,784

Note: Summary excludes Massachusetts, which does not permit access to its data.

Percentage of Total GSP added by Ocean-related GSP by State for 2000

State	Rank	% of Total GSP (2000)	State	Rank	% of Total GSP (2000)
Alaska	1	18.99%	New Hampshire	15	1.19%
Louisiana	2	11.32%	Texas	16	0.89%
Hawaii	3	10.03%	Delaware	17	0.86%
Maine	4	4.26%	Pennsylvania	18	0.73%
Washington	5	3.47%	Illinois	19	0.72%
Mississippi	6	2.78%	Wisconsin	20	0.70%
Rhode Island	7	2.55%	Alabama	21	0.67%
Florida	8	2.48%	New York	22	0.66%
New Jersey	9	1.99%	Oregon	23	0.63%
California	**10**	**1.66%**	Michigan	24	0.59%
			Indiana	25	0.51%
Connecticut	11	1.53%	Georgia	26	0.40%
Virginia	12	1.37%	North Carolina	27	0.40%
Maryland	13	1.31%	Ohio	28	0.25%
South Carolina	14	1.26%	Minnesota	29	0.24%

Note: Summary excludes Massachusetts, which does not permit access to its data.

Contribution of the California Ocean Economy in 2000

2000 Ocean Economy				
Indicator	Direct Value	Indirect and Induced	Total	Multiplier
Employment	408,127	285,689	693,816	1.7
Wages	$11,441,454,062	$12,585,599,468	$24,027,053,530	2.1
GSP	$21,434,428,141	$21,434,428,141	$42,868,856,282	2.0

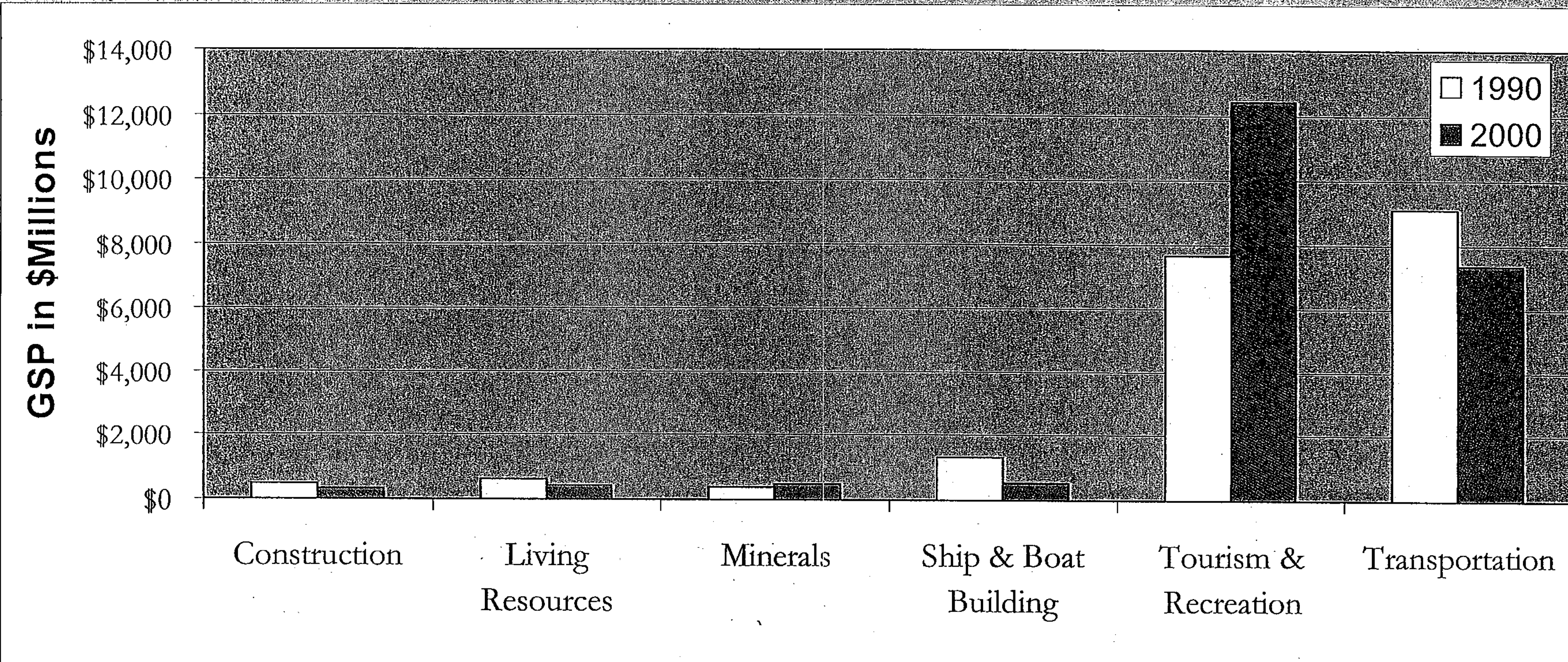
- ❑ California's Ocean Economy generated almost $42.87 billion in total GSP during 2000.

Ocean Economy GSP by Sector

California's Ocean Economy GSP by Sector 2000				
Sector	Direct GSP in Millions	Indirect and Induced GSP in Millions	Total GSP in Millions	Multiplier
Tourism & Recreation	$12,426.6	$9,941.3	$22,367.9	1.8
Transportation	$7,386.8	$10,341.6	$17,728.4	2.4
Ship & Boat Building	$493.1	$394.5	$887.6	1.8
Living Resources	$403.3	$322.6	$725.9	1.8
Minerals	$415.5	$290.8	$706.3	1.7
Construction	$309.1	$309.1	$618.2	2.0

Ocean Economy GSP Growth

- The fastest growing sectors were Tourism & Recreation (61.6%) and Marine Minerals (30.9%), while the total Ocean Economy grew by 10.6% or about $6.8 billion.



A004003

GSP Contribution per Employee for 2000

Ranking	Sector	Ocean Economy GSP	Employment	GSP Contribution per Employee
1	Minerals	$415,487,797	1,014	$409,751
2	Construction	$309,081,043	2,833	$109,100
3	Transportation	$7,386,839,629	74,289	$99,434
4	Living Resources	$403,284,093	6,015	$67,046
5	Ship & Boat Building	$493,135,966	10,557	$46,712
6	Tourism & Recreation	$12,426,599,613	313,417	$39,649

Ocean Economy Contribution to Wages by Sector

California's Ocean Economy GSP by Sector 2000				
Sector	Direct Wages in Millions	Indirect and Induced Wages in Millions	Total Wages in Millions	Multiplier
Transportation	$5,121.4	$7,170.0	$12,291.4	2.4
Tourism & Recreation	$5,545.0	$4,436.0	$9,981.0	1.8
Ship & Boat Building	$377.6	$302.1	$679.8	1.8
Construction	$164.4	$164.4	$328.8	2.0
Living Resources	$165.9	$132.7	$298.7	1.8
Minerals	$67.1	$47.0	$114.1	1.7

Ocean Economy Contribution to Wages by Sector

California's Ocean Economy GSP by Sector 2000				
Sector	Direct Wages in Millions	Indirect and Induced Wages in Millions	Total Wages in Millions	Multiplier
Transportation	$5,121.4	$7,170.0	$12,291.4	2.4
Tourism & Recreation	$5,545.0	$4,436.0	$9,981.0	1.8
Ship & Boat Building	$377.6	$302.1	$679.8	1.8
Construction	$164.4	$164.4	$328.8	2.0
Living Resources	$165.9	$132.7	$298.7	1.8
Minerals	$67.1	$47.0	$114.1	1.7

Wage Comparison of Ocean Economy by Sector

- Overall, wages declined from $12.17 billion to $11.44 billion, or 6.0% over the decade.
- Coastal Tourism & Recreation was the only sector to increase in real wages from 1990 to 2000.

	Construction	Living Resources	Minerals	Ship & Boat Building	Tourism & Recreation	Transportation
1990	$219	$206	$83	$1,073	$3,601	$6,988
2000	$164	$166	$67	$378	$5,545	$5,121

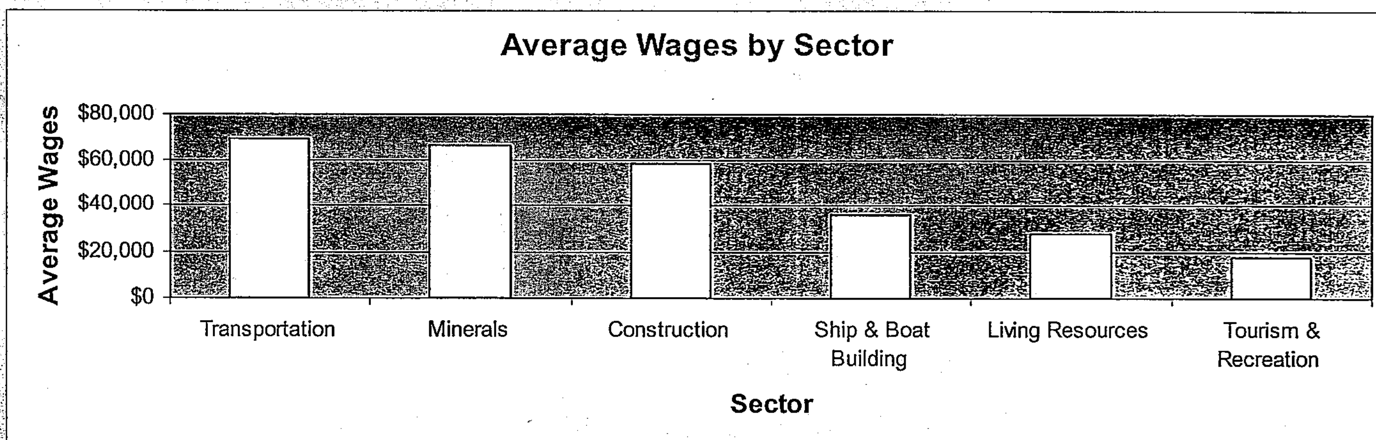
Sector Values in $Millions

A004009

Ranking of Average Wages by Sector for 2000

- The Transportation sector paid the highest average wages in 2000.
- Tourism & Recreation paid the lowest average wages in 2000.

Ranking	Sector	Wages	Employment	Average Wages
1	Transportation	$5,121,396,509	74,289	$68,939
2	Minerals	$67,091,107	1,014	$66,165
3	Construction	$164,413,562	2,833	$58,035
4	Ship & Boat Building	$377,642,817	10,557	$35,772
5	Living Resources	$165,933,760	6,015	$27,587
6	Tourism & Recreation	$5,544,976,307	313,417	$17,692



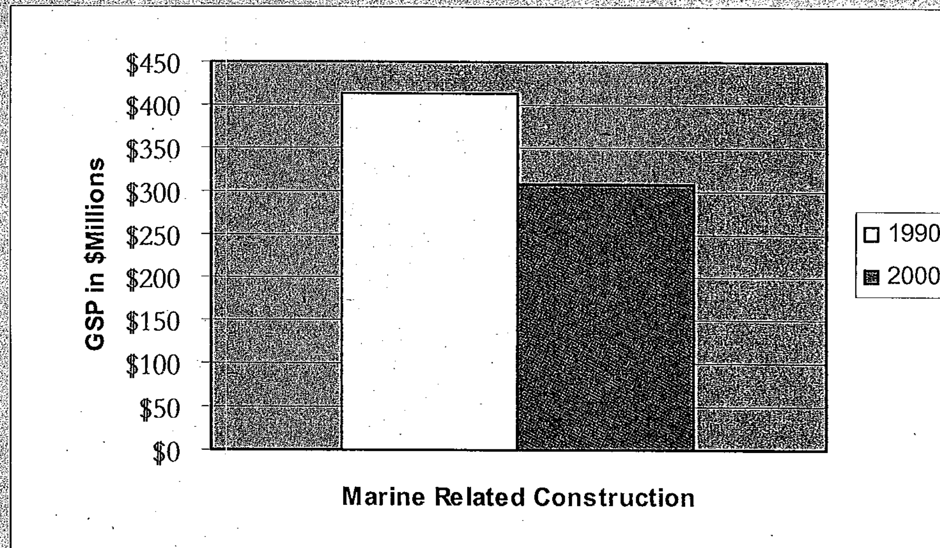
A004010

Construction GSP by Industry

- The Construction industry contributed 1.4% to California's total Ocean Economy GSP in 2000.

- Marine Construction GSP declined approximately $105,000,000, or over 25% between 1990 and 2000.

Industry	1990 GSP in $Millions	2000 GSP in $Millions	Change in GSP in $Millions	Percent Change
Marine Related Construction	$414.3	$309.1	-$105.2	-35.4%

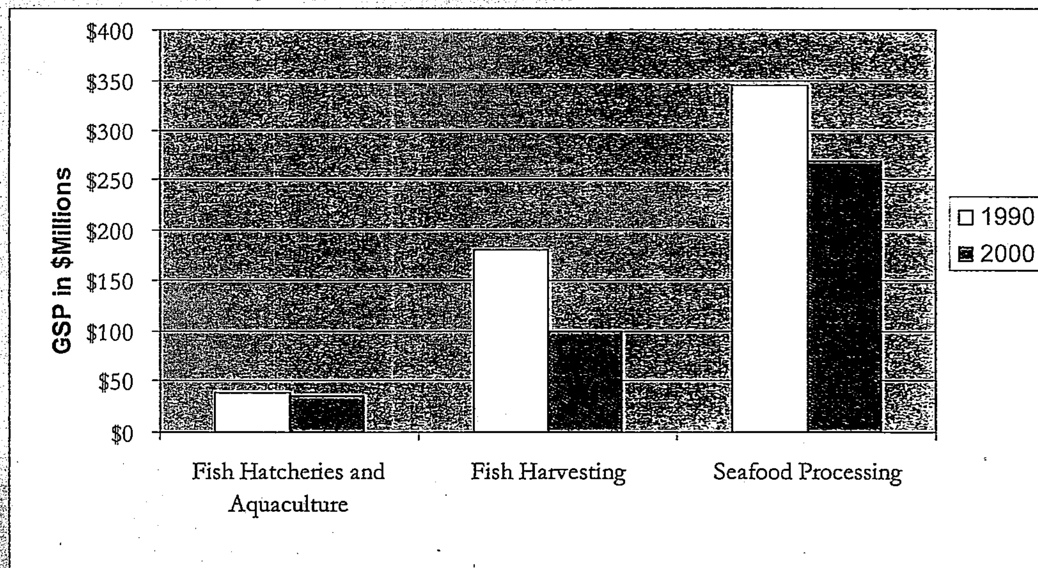


A004011

Living Resources GSP by Industry

- The Marine Living Resources sector contributed 1.9% to California's total Ocean Economy GSP or $403,284,093 in 2000.
- The sector's GSP decreased by 28.4%. Fish Hatcheries and Aquaculture decreased 8.1%. Fish harvesting decreased 45.2%. Seafood Processing decreased 22.0%.

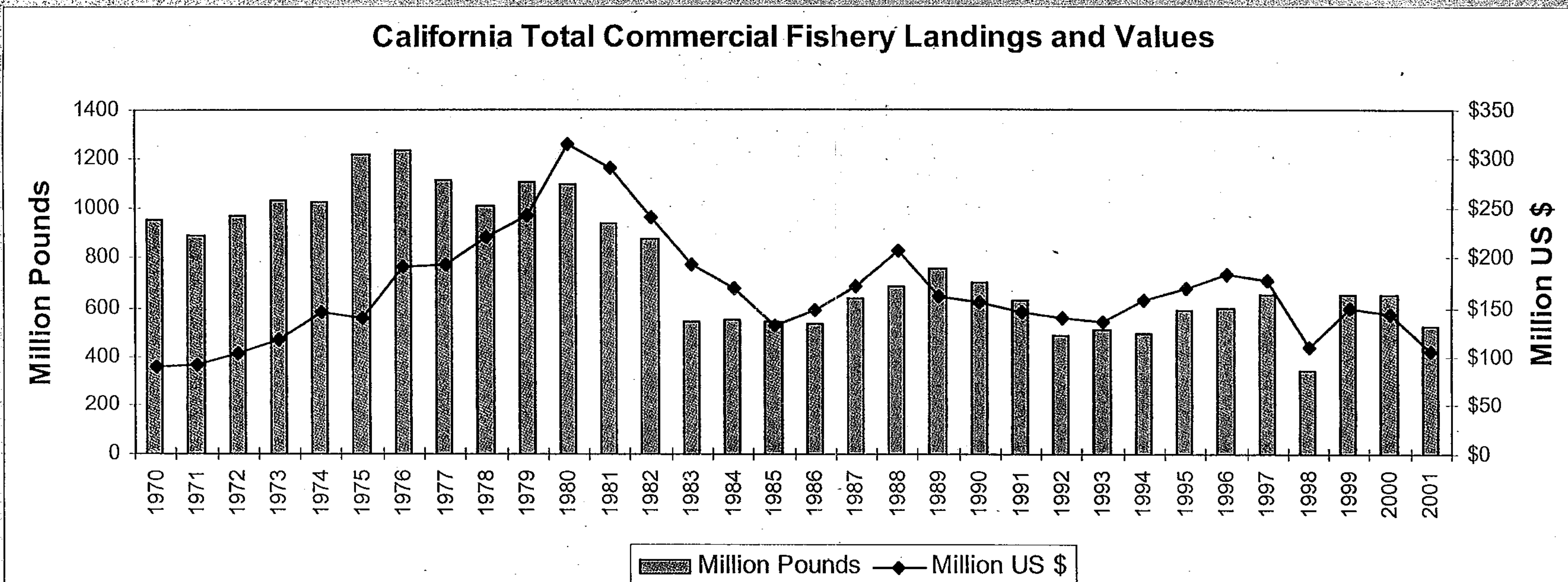
Industry	1990 GSP in $Millions	2000 GSP in $Millions	Change in GSP in $Millions	Percent Change
Fish Hatcheries & Aquaculture	$38.5	$35.4	-$3.1	-8.1%
Fish Harvesting	$179.8	$98.6	-$81.3	-45.2%
Seafood Processing	$345.3	$269.4	-$75.9	-22.0%



A004012

Commercial Fish Landings & Values

- Landings peaked in 1976 at nearly 1.3 billion pounds of seafood.
- Values peaked in 1980 at approximately $320,000,000.
- In 2000, landings were near 500 million pounds and valued at $100,000,000.



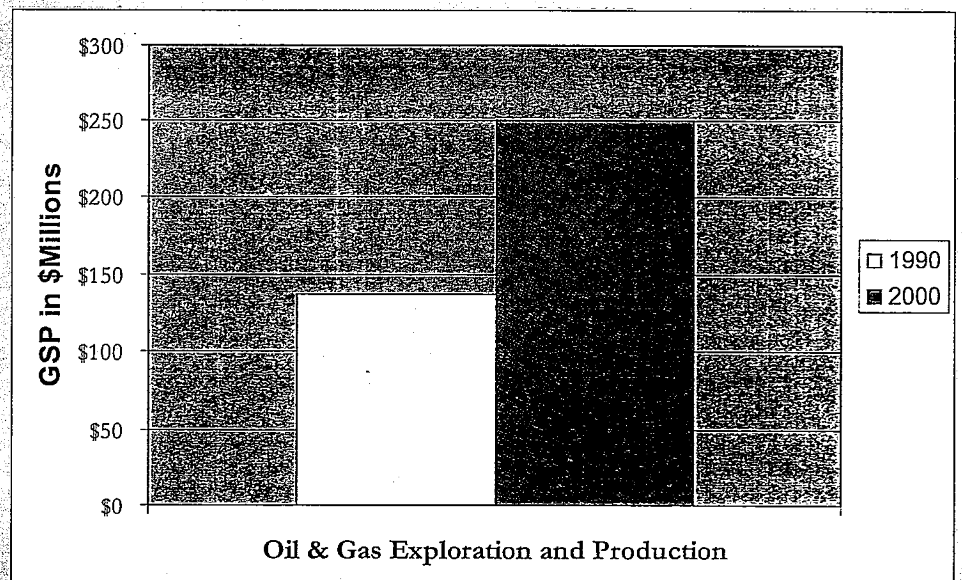
Source: NMFS

Minerals GSP by Industry

- The Minerals sector contributed 1.9% to the total GSP of all the Ocean Economy sectors in California.

- The Oil & Gas Exploration and Production industry GSP increased by 82.3%.

Industry	1990 GSP in $Millions	2000 GSP in $Millions	Change in GSP in $Millions	Percent Change
Oil & Gas Exploration and Production	$137.0	$249.8	$112.8	82.3%

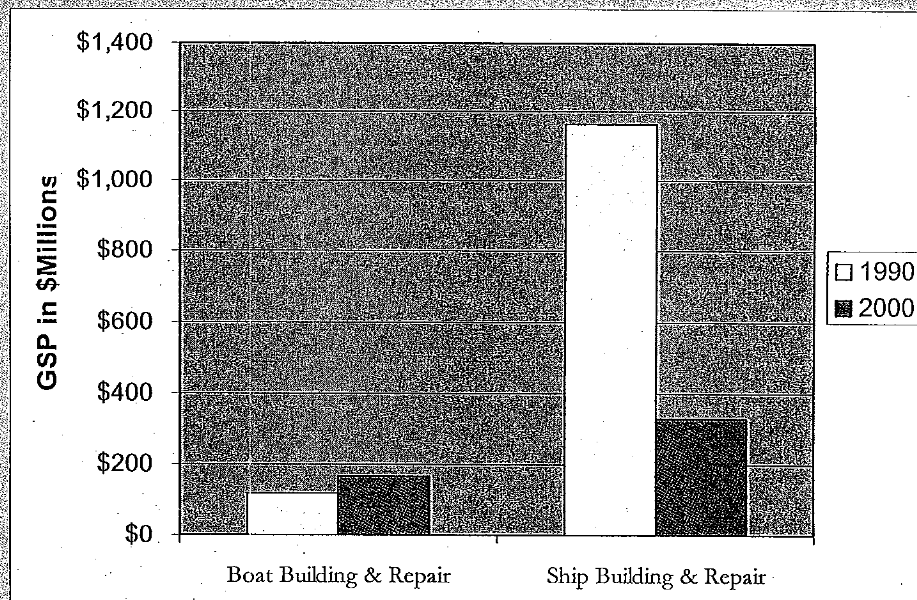


A004014

Ship & Boat Building GSP by Industry

- The Ship & Boat Building sector contributed 2.3% to California's total Ocean Economy GSP, or $493,135,966 in 2000.
- The sector's GSP decreased 59.2%. Boat Building & Repair GSP increased 41.4%. Ship Building & Repair GSP decreased 71.8%.

Industry	1990 GSP in $Millions	2000 GSP in $Millions	Change in GSP in $Millions	Percent Change
Boat Building & Repair	$116.7	$165.0	$48.4	41.4%
Ship Building & Repair	$1,165.3	$328.1	-$837.2	-71.8%



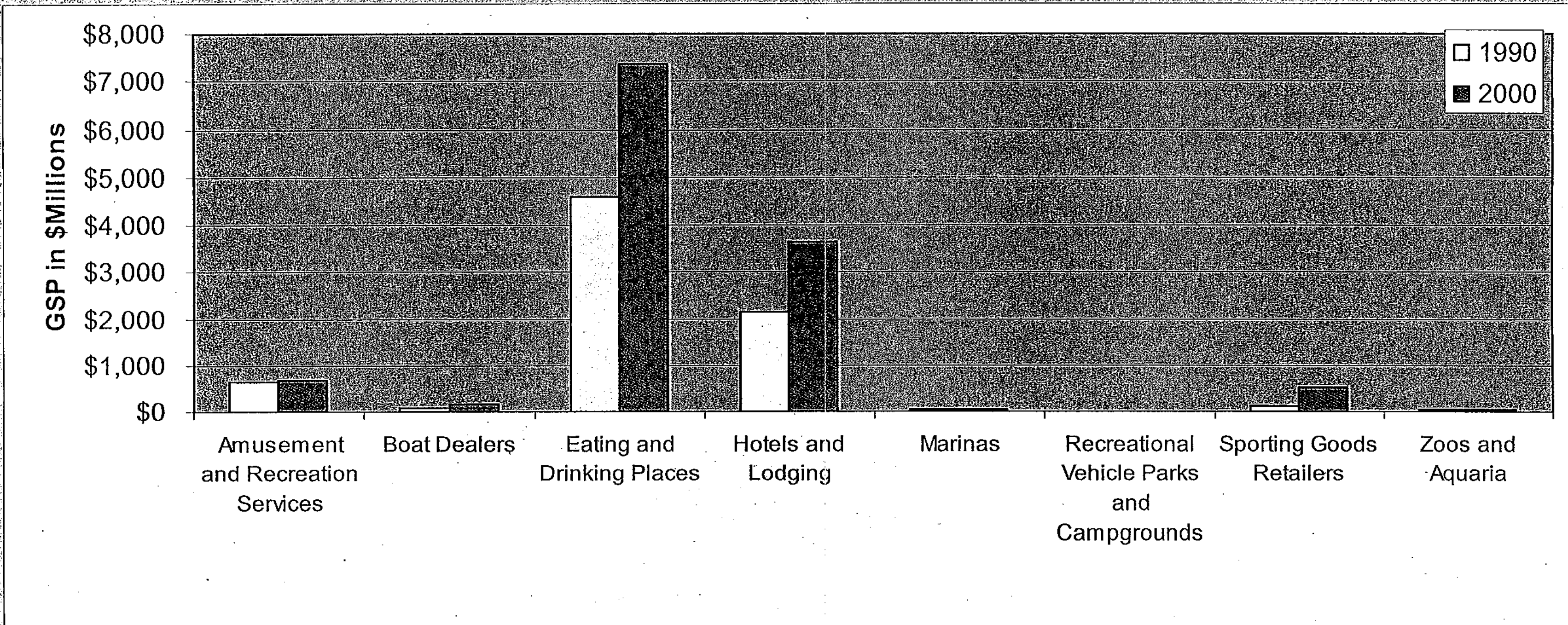
A004015

Tourism & Recreation GSP by Industry

Industry	1990 GSP in Millions	2000 GSP in Millions	Change in GSP in Millions	Percent Change
Amusement and Recreation Services	$648.7	$688.8	$40.1	6.2%
Amusement and Recreation Services NEC *	$17.4	$17.9	$0.5	3.0%
Boat Dealers	$92.0	$139.8	$47.8	52.0%
Eating and Drinking Places	$4,586.4	$7,350.3	$2,763.9	60.3%
Hotels and Lodging	$2,157.3	$3,657.9	$1,500.7	69.6%
Marinas	$32.8	$40.1	$7.3	22.4%
Sporting Goods Retailers	$129.0	$501.7	$372.7	288.9%
Zoos and Aquaria	$26.2	$30.1	$3.9	14.8%
Total	**$7,689.7**	**$12,426.6**	**$4,736.9**	**61.6%**

Data for Recreational Vehicle Parks & Campsites are not available
*NEC: Not elsewhere classified

Tourism & Recreation GSP by Industry



- The Tourism & Recreation sector contributed 58.0% to California's total Ocean Economy GSP, or close to $12.5 billion in 2000.
- Eating and Drinking Places and Hotels and Lodging are the largest grossing industries in the Coastal Tourism & Recreation sector.

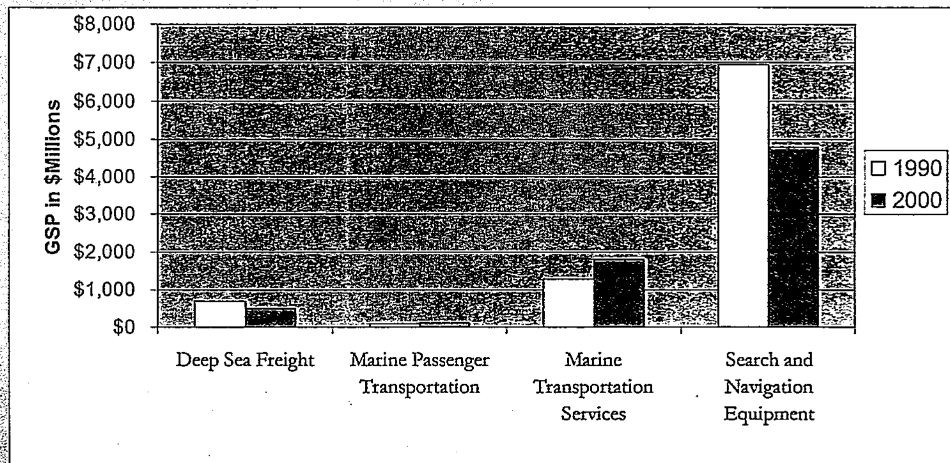
A004017

Transportation GSP by Industry

- The Transportation sector contributed 34.5% to California's total Ocean Economy GSP or $7,386,839,629 in 2000.
- The largest GSP growth was in Marine Passenger Transportation, which increased 62.4%.

Industry *	1990 GSP in $Millions	2000 GSP in $Millions	Change in GSP in $Millions	Percent Change
Deep Sea Freight	$686.7	$503.9	$10.8	26.6%
Marine Passenger Transportation	$69.9	$113.5	$320.9	62.4%
Marine Transportation Services	$1,258.2	$1,784.8	$123.3	41.9%
Search and Navigation Equipment	$6,969.7	$4,788.5	-$260.2	31.3%

* Data for Warehousing are not available due to data suppression.



Data Sources

- The data in this report, unless cited otherwise, are available on the website for the National Ocean Economics Program. A detailed description of the estimation methodology for the Ocean Economy also is available. www.OceanEconomics.org
- Employment and wage data are derived from the Quarterly Census of Employment and Wages, a cooperative program of state employment agencies and the Bureau of Labor Statistics. www.bls.gov
- GSP data are estimated based on information from the Bureau of Economic Analysis. http://www.bea.doc.gov/
- Population and housing data are from the Bureau of the Census. www.census.gov
- Estimating methods for all data sources are described in http://www.OceanEconomics.org/Download/NOEPMethod8.pdf

The data contained in this report are part of an ongoing research project, and are subject to future revision.

THE NATIONAL OCEAN ECONOMICS PROJECT:
THE CONTRIBUTION OF THE COAST AND COASTAL OCEAN TO THE U.S.ECONOMY

Research Strategy and Work Plan

Judith T. Kildow
Wrigley Institute, University of Southern California
Principal Investigator

Hauke Kite-Powell
Marine Policy Center, Woods Hole Oceanographic Institution
Associate Investigator

Charles S. Colgan
Muskie School of Public Service, University of Southern Maine
Associate Investigator

Elizabeth J. Bruce
Wrigley Institute, University of Southern California
Program Manager

APRIL 2000

National Board of Advisors

Michael Hanemann, University of California, Berkeley;
Marc Hershman, Director of the School of Marine Affairs, University of Washington;
Mary Hope Katsouros, The H. John Heinz III Center
Charles Kolstad, University of California, Santa Barbara;
Roger McManus, Center for Marine Conservation;
Giulio Pontecorvo, Columbia University;
Robert Solow, Massachusetts Institute of Technology Nobel laureate;
Lester Thurow, Massachusetts Institute of Technology;
Judith Weis, Rutgers University.

December Panel of Economic Experts:

Scott Farrow, Carnegie Melon University
Myrick Freeman, Bodoin College
Douglas Lipton, University of Maryland
Linwood Pendleton, University of Southern California
Karen Polenske, Massachusetts Institute of Technology
Rodney Weiher, NOAA, Department of Commerce

ACKNOWLEDGEMENTS

We wish to thank

Our National Board of Advisors for their time, valuable support and guidance.
The panel of economists for their time and advice.
The National Oceanic And Atmospheric Administration And The National Fish And Wildlife Foundation For Financial Support.
The USC Wrigley Institute for Environmental Studies for hosting the project and providing matching funds.
Linwood Pendleton for the hours of collegial time and effort he gave to this effort.
All the many others who contributed to this plan.

TABLE OF CONTENTS

INTRODUCTION

This project will provide the first major comprehensive and in-depth analysis of the size and composition of the coast and ocean economy in the United States. The end product will be an electronic set of accounts for the coast and coastal ocean easily accessible by interested publics. It will include the fundamental national data that reflects the contribution of the ocean to the U.S. Gross Domestic Product (GDP). It will also illustrate the value of the key ocean economic sectors, such as fisheries and tourism; regional accounts for coastal states, counties and other jurisdictional units; and satellite accounts for natural resource values and environmental amenities that will enhance the current system of accounts. Data from case studies, such as the Chesapeake Bay, will be compiled to link the ocean economy with the ocean environment. Time and resource limitations preclude the generation of new economic data in this project. Rather, this is a meta-study, a compilation of multiple public and private sources that will be carefully screened and documented for reliability and accuracy.

The outcome of this project will be an important element of the U.S. statistical system, and help provide useful data on ocean-related economic activities and resource trends to governments, businesses and individuals to assist with investment and management decisions as they attempt to balance growth with conservation in coastal areas. AT the Federal level, the ocean may represent a large engine for the U.S. economy, but we really don't know. We do know what the U,S. has spent on the coast and ocean during the past 30 years, and it is a relatively small portion of the U.S. budget. Without the knowledge that this data base will provide, it is difficult to know if U.S. expenditures are being effectively targeted or whether we may be missing some important opportunities. With the proposed database, it won't be difficult to see where investments have paid off, where they are lacking and where the potential targets of opportunity may be.

This project will compile information into a unique database allowing users to access the data they need to examine economic trends in ocean-related activities and to compare these trends across different sectors and regions of the U.S.

This document describes a research plan designed to ensure that the proposed work can be carried out with the highest intellectual and practical integrity. The following pages include the research strategy and work plan necessary to reach the goals of the project. This research plan explores the conceptual foundations of the study, defines an approach to estimating the economic values of the coast and ocean, and sets forth a work plan that elaborates the critical tasks that are integral to a useful product. It also identifies a number of theoretical and practical issues that must be confronted in the project.

BACKGROUND

The American economy began in the ocean. The earliest permanent settlements in North America were fishing settlements of the English and French who came seeking cod to take back to Europe (Innis, 1940). Today, despite the evolution of the "high tech" economy, the ocean still plays a vital role in the American economy. Whether as a source of energy food, transportation, or recreation, or as a place to live, Americans still rely on the ocean. Today 53% of the U.S. population lives in counties adjacent to the coast (NOAA,1999).

Yet, surprisingly little is known about how large the role of the ocean is in the American economy. This project will bring together data from a wide variety of sources to measure the ocean's contribution to the Gross Domestic Product, the broadest measure of economic activity. In doing so, it will provide detailed analysis of both key ocean industries and coastal regions. It will also extend the existing measurement of ocean-related economic activities with data that can be used a) to assess the health of the ocean as an economic resource and b) to relate changes in the ocean environment to changes in the ocean economy.

The essence of this work lies in defining what will be valued. Economic value is not a single concept measured by a single number, but a multi-dimensional concept with several different measures. Four broad types of value will be measured in the study:

- The market value of transactions involving the oceans. These are the flows of production and income which are generated over time. This data will be derived primarily from the National Income and Product Accounts and the source data sets for these accounts used to measure Gross Domestic Product. These will constitute an "oceans satellite account" in accordance with recent developments in national income accounting in the United States and elsewhere.

- The regional ocean related economic values that are both tied to specific locations in coastal regions, such as states, and that spread across regions through the myriad interactions of the economy.

- The value of the ocean as "capital". This is the "stock" value of the ocean, reflecting its ability to generate future flows of production and income . Some of these values will be imbedded in market prices; others will need to be imputed. This will allow assessment of the ability of the oceans to provide a sustainable flow of economic value into the future.

- The values that the ocean yields which are not measurable in market transactions but which are important nonetheless, such as the value of a day at the beach. This extension is needed because the national income accounting approach is an incomplete view of economic values. Greater understanding of the economic values of the coast and ocean, not set in market transactions, will be needed to approach a complete understanding of the ocean's value.

USE AND USERS OF THE DATA

The type of data collected in this project will be used for a variety of purposes at both the national and regional level. While some of these uses can be foreseen, it should also be recognized that the act of bringing this amount of information together and making it easily available will itself provide opportunities to better understand the ocean's relationship to the economy in ways which cannot be identified in advance.

At the national level, the data will be of primary interest to:

Resource Managers: Those responsible for managing coastal and ocean resources in the federal government have increasing access to information about the conditions of these resources, but often lack access to information about how these resources create economic value. Yet it is often the tension, sometimes real and sometimes perceived, between the management of coastal and ocean and resources and the economic values derived therefrom that lies at the heart of policy disputes. By providing comprehensive economic data, resource managers will be able to identify those relationships and build policies informed by both the conditions of the resource and a better sense of how society uses those resources.

Sectoral and Industrial Analysis: The project will provide new insights into the condition of key ocean-related industries. These will come in part from the National Income framework, which will permit specific industries to see themselves in the national context, and in part from the detailed sectoral studies which will provide comprehensive pictures of recent trends in each industry. Users will include federal government officials, industry and trade association analysts, and other private sector researchers in both the profit and nonprofit sectors.

Whether from a resource or a sectoral perspective, the data will most frequently be used for policy planning and analysis, impact assessments (including both environmental impact and regulatory impact assessments), and for program evaluation. Making the data easily available will assure that multiple perspectives are brought to the analysis of the data in policy debates and will expand research into the economic value of the ocean.

At the regional level, there is great demand for this information from those who perform similar roles in resource management and the policy development surrounding it. Examples include Texas and their recent policies on sea-level rise, and California's new initiative to purchase and preserve large tracts of coastal lands.

In addition, state and local governments undertake a wide variety of activities in economic development planning which would use this information to formulate strategies to aid coastal communities in economic development. For example, Maine has had a "Jobs from the Sea" initiative which focuses on increasing the ocean's role in the state's economy. In the initial phases of this project, little was known about the current role the ocean played in the state's economy. The proposal was delayed nearly a year while basic information was collected; this project would have provided much of that information and substantially accelerated the process.

The use of the information from this study will be greatly expanded because the products will have the following characteristics, which are unavailable from any other source:

Accessibility: The data will be available in an easy-to-access online format.

Comparability: Data collected in the core accounts will be comparable to the maximum extent possible with the national income accounts, permitting comparisons with other economic data not possible with current scattered data collection efforts.

Comprehensiveness: The information will be as comprehensive as possible from resource, geographic, industrial, and theoretical perspectives.

Documentation: The data will be fully documented as to sources, estimation methods, theoretical foundation, and limitations. Using the hypertext capabilities of the web, documentation will be fully accessible to all users for the data they are interested in.

PREVIOUS STUDIES

The concept of an "Ocean GDP" is not new. In 1974, the Bureau of Economic Analysis, the agency responsible for maintaining the National Income and Product Accounts, undertook a special study for the Assistant Secretary of Commerce for Policy to identify the contribution of the ocean to the Gross National Product[1] (Nathan Associates, 1974). In that study, BEA developed estimates for Gross Product Originating from the Ocean using the economic census data for 1972. Two follow-up studies used a similar approach to estimate the values for 1977 and 1987. (Pontecorvo et al.,1980; Pontecorvo, 1988). All of these studies focused on the most clearly identifiable industries and economic activities, those activities that either "utilized an ocean resource in a production process" or "produced a product or service that was demanded because of some quality attributable to the ocean". Sixty-six sectors from the national income accounts were selected for analysis based on these criteria.

Other studies have focused attention on the coast rather than the ocean. Following Pontecorvo, Luger (Luger, 1991-92; Colgan, 1990) developed a methodology for measuring coast-dependent, coast-linked, and coastal-service activities. This approach significantly expanded the types of economic activities brought into the measurement process. By focusing on the coastal zone, Luger also brought the Great Lakes into the analysis, since they are defined for federal management purposes as part of the coastal zone.

The last decade has seen increasing attention to the concept of extending the national income accounts to incorporate the kind of resource-related sources of economic value that were attempted earlier. This attention has stemmed in part from long-standing concerns that the national income accounts are a good, but imperfect, measure of economic well-being. Thus, there have been new attempts to include important aspects of economic welfare that were traditionally excluded from the systems of national accounts used by various nations (Eisner,1989).

Attention has also come from a growing concern about sustainable development that emerged in the 1980s. The idea of sustainable development provides a framework for integrating economic and environmental issues in the context of intergenerational equity. Developing systems to measure the twin goals of economic improvement and environmental integrity has become a priority. Led by the United Nations (UN, 1993), both the U.S. Government (BEA, 1994a) and non-governmental organizations (Repetto et al., 1989) began serious investigations of integrated economic and environmental accounting.

In 1992, the Bureau of Economic Analysis began work to extend the national income accounts to include assessment of natural resource values. However, in 1995, the United States Congress directed the Commerce Department to suspend further work and to obtain an external review of environmental accounting. The National Academy of Sciences, through a panel formed by the National Research Council, has recently reaffirmed both the desirability and possibility of integrating economic and environmental accounts (National Research Council, 1999).

Another group of studies on the economic value of the ocean has focused on the economy of various regions as influenced by the oceans. Some of these studies have been done at the state level (Moller and Fitz, 1994 and 97); Rubin, et.al, 1999), while others have been done at the multi-state and international level (Colgan and Plumstead, 1993) or at the sub-state regional level (Colgan 1990). These studies have tended to rely on employment in specific industries or estimates of output from regional econometric models, and have thus focused on the market-related activities that are the most easily measured.

More recently, economic impact analyses, mandated by Congressional legislation have been carried out to determine the impact of pending regulations on the potentially impacted elements of the U.S. fishing industry. These estimates of economic impact provide another set of economic values for a particular sector, and in particular regions. They do not give us a national estimate of the fishing industry, but they can offer us new data on one sector that can be compiled toward national estimates.

Studies undertaken thus far have identified the basic components of an ocean-GDP, but have largely approached the estimation of ocean-related GDP either through only one component, Gross Product Originating (GPO), or by indirect estimating techniques. Moreover, national studies have not been undertaken in ten years. Since the earliest efforts, in the 1970s, there has been a significant increase in interest in the measurement of the economic value of key resources, such as the ocean. This is due to at least two factors: a.) attention to the concept of sustainable development and b.) awareness at the regional level where regional policy makers are working to better manage both their environments and economies. Estimates of the ocean-related GDP have not been updated in a decade. The expanded interest in measuring the economic value of the ocean has extended beyond the measures inherent in the national income accounting framework. For these reasons, it is desirable now to build on previous studies to create updated economic accounts for the ocean and to significantly expand our understanding of the economic value the ocean brings to the U.S. economy.

THEORETICAL OVERVIEW

Economic value begins with the concept of opportunity cost: that which people are willing to give up (money, time, or other resources) in exchange for goods, services, or other benefits received. This concept of value is simple in principle, but complex in practice. When applied to a natural resource such as the ocean, the definition of "value" takes several forms. The most basic answer to the question "what is the economic value of the ocean" is "that portion of whatever people pay (in the sense of opportunity cost) for goods or services that is uniquely determined or influenced by the ocean". Economists refer to this idea as the "marginal" value of the ocean. It is the *additional* value of goods and services created by the ocean. This approach to the definition of value goes to the core of the idea of the "economic value of the ocean" – or more precisely, the contribution of the ocean to values generated in the economy.

Another way to think of value in this sense is to compare something that comes from the ocean with a similar, but non-marine good or service. If people will pay for the marginal difference of a marine related good or service, that is the added value of the ocean. Thus, the value of the ocean is the difference in what people pay between:

- a lobster and a freshwater crayfish;
- transporting grain by ship and by airplane
- a day at the beach and a day at the lake, and
- two identical houses in otherwise identical neighborhoods one of which is located on the coast and another located away from the coast

This "pure" value of the ocean is the most rigorous definition, but it has both conceptual and practical problems. The conceptual problem is that this approach to value implicitly requires that the value of the resource is what is generated by the presence of the resource in comparison with its absence. But the ocean is not going anywhere in any realistic sense, though it can be degraded in quality so that its ability to generate economic values is diminished. Thus the "marginal" value of the ocean may be meaningful in theory, but in the ocean case it has a certain logical flaw.

The practical issue is that this "pure" concept of value is not easily observable in the vast majority of cases, since economic data is not collected to measure this concept of value. Rather, economic data such as the output of industries or payments to labor measures the results of market transactions that contain the economic value of the ocean as well as other values.

This practical issue points to a distinction that helps identify other concepts of "value" that are applicable in a broader array of circumstances: the distinction between "ocean" and "coast". Many types of economic activities use the ocean, either directly or indirectly. While marine fishing is a direct use, a hotel located near the ocean is an indirect use. Many of the patrons of the hotel (consumers) may go to the beach or take walks along the shore; and the additional value to those patrons gained from these activities, as opposed to the next best non-marine alternative, could be considered the "value of the ocean". But there is also value created in the hotel (and associated industries) in the coastal region. This "value added" of businesses like the hotel transforms inputs, like the raw land or the food in the restaurant, into goods and services for which people spend money. This value added is a function of the coastal location, but the precise proportion of the value that can be traced to the ocean is difficult to measure given that people may engage in many different kinds of activities while at the hotel. Yet these values are important; indeed they form the basis for the measurement of this activity in the national income and product accounts, the basic measure of the size of the economy.

Thus there is no single "economic value" of the ocean. The concept of economic value includes the *marginal* or additional values of goods and services created by the ocean as well as the values of economic activities that take place in or near the oceans. Each perspective provides a different measure of the ocean's contribution to national wellbeing.

Any search for the economic value*(s)* of the ocean must therefore include both perspectives: the value of the ocean and the values associated with the ocean. It must start with the more conventional and measurable estimation of the levels and changes of economic activity *associated with* the ocean. In order to assure consistency of treatment, estimates of value should operate within an established measurement framework of economic activity such as the national income and product accounts. It must also go beyond the national income framework to seek those values that reflect the true marginal value of the ocean where this can be estimated. In many cases, this marginal value may be discerned from the analysis of conventional economic data, but it may also be found in the analysis of economic transactions that are meaningful but take place outside the standard marketplace of goods and services. Such estimations of the marginal market and non-market values will comprise extensions of the national income account measures of economic activity. In measuring values across the economy, it is critical to avoid double counting values. The inter-relationships among economic transactions, where the output of one firm is the input to another can easily lead to significant errors in measuring the actual net change in economic activities and values if appropriate adjustments are not made. The national income accounting framework has been developed to provide a consistent set of rules to avoid the problem of double counting, and thus provides the essential foundation upon which measures of the economic value of the ocean must rest.

Ocean Economic Values in a National Income Accounting Framework

The National Income and Product Accounts are the basic measure of the level of economic activity in the United States. These accounts have been developed according to certain rules, which may be summarized as follows (Seskin and Parker, 1998):

1. Use the values to ultimate consumers as the principal measure of value. This means distinguishing between final goods and services (those purchased by ultimate consumers) and intermediate goods and services. These latter are the inputs to the production process that creates final goods and services; their value is subsumed within the final market prices.

2. Measure exchanges on an annual basis, but provide more frequent estimates.

3. Measure the annual changes in the value of long-lived assets as additions to value (investments) and reductions in value (depreciation) as part of the annual exchanges of goods and services.

Gross Domestic Product

Using these rules, the total market value of goods and services can be measured each year as the Gross Domestic Product. This measure provides the sum of the value of goods and services measured at market prices to the final consumers. Three broad classes of final consumers are considered: households and businesses, government, and those in other countries. A fourth category, investment, counts the purchases of long-lived goods by households, businesses and government. GDP is thus defined as:

$$GDP = C + I + G + X$$

where:

GDP=Gross Domestic Product
C= Expenditures for personal consumption of goods and services
I= Net private investment
G= Government purchases of goods and services for both consumption and investment
X = Net Exports (Total Exports– Total Imports)

An adjustment for depreciation (the normal wear on these long-lived goods) is made to measure Net National Product.

The measurement of GDP is also based on the equivalence between production and consumption. GDP is a measure of production (what the economy produces) but is measured as consumption (what is bought) in order to avoid the problem of double counting. If each sale of goods or services in the economy were simply summed, many values would be counted twice. For example, the sale of cod from the fishing boat to the processor to the restaurant constitutes three separate sales, but only the final sale to the consumer at the restaurant includes all the previous sales. It is this value that is counted in the GDP as the value of the ocean's output of fish for food.

Gross Domestic Income

GDP is not the only value concept measured in the national income and product accounts. As the name suggests, income or the returns to labor, capital, and the owners of land, is also measured. Again there is a fundamental identity:

Production = Consumption = Income.

Thus there is an income concept equivalent to gross domestic product: Gross Domestic Income, defined as:

GDY = COMP+PROP+RENT+PROF+INT+BTP-CAPCON

where:
GDY=Gross Domestic Income
COMP= Compensation to Individuals
PROP= Proprietors Income
RENT= Rental Payments
PROF= Profits
INT= Interest Payments
BTP= Business Transfer Payments
CAPCON=Consumption of Fixed Capital

As illustration, these concepts can be seen as another view of the values created by the cod fishery. Those values include the income earned by employees of the fishing boat, processor and restaurant (compensation), the profits of each of these companies, as well as certain other adjustments defined within the income framework, thus providing another definition of economic value.

These two concepts -- GDP valued at market prices to the final consumer and GDY -- constitute the most common and basic measures of the economic value of goods and services. But even within the framework of market-determined values, these are not sufficient to capture the full range of values in which people may be interested. While counting only the final value to consumers is essential to providing a consistent nation-wide summary of production, the actual output of the various sectors may still be of interest. Thus, the contribution of the fishing boat, the processor, and the restaurant to GDP are each of interest in their own right.

Gross Product Originating

Thus another concept is needed to measure this type of value. This additional measure is Gross Product Originating (GPO), which measures output by sector of production. It is actually derived from the Gross Domestic Income data (Lum and Moyer, 1998), and is defined as:

$$GPO = \sum_{i}^{n} S_i - \left(\left| I_i + \sum_{i}^{n} I \right| \right)$$

Where:

S_i = sales by industry i
L_i = labor inputs purchased by industry i
I_i^n = intermediate inputs (goods and services) purchased from all other industries i to n.

As this definition indicates, GPO is the "value added" of each sector and thus is consistent with the GDP calculations.

From the NIPA perspective, therefore, "value" can be defined as:

1. the consumption of all goods and services produced within the country;
2. the income derived from production and distributed to individuals, businesses, and governments; and/or
3. the value added created in the production of all goods and services within the country.

Applying the NIPA Framework to the Fishing Industry

These different concepts can be summarized in an ocean context in Table 1. This table summarizes the way in which the value created by commercial fishing can be viewed using the various measures of the national income accounting framework. For purposes of simplification, there are three stages of production: the fishing boat, the processor, and a restaurant (a supermarket could be substituted for this last stage).

Table 1. The Value of the Fishing Industry in a NIPA Framework

	Price	Revenues		GDP	GDY	GPO
The Fishing Boat			Net Investment			
			Income to owner		•	
			Wages to crew		•	
			Supplies (Ice, fuel, etc)			
	Dockside price	Landed Value				
			Value Added (1)			•
The Processor			Net Investment			
			Wages to workers		•	
			Raw materials			
			Profits		•	
			Value Added (2)			•
	Wholesale Price	Sales at Wholesale				
The Restaurant			Net Investment			

			Wages to Cooks/Wait staff		•	
			Profits		•	
	Retail Price	Sales at Retail		•		
			Value Added (3)			•
Value Added (1) Total Landed Value less payments for supplies						
Value Added (2) Wholesale price less fish costs and other input materials						
Value Added (3) Retail price less costs of fish and other materials						

In Table 1, a "•" in a column indicates whether the concept is counted in Gross Domestic Product (GDP), Gross Domestic Income (GDY) or Gross Product Originating (GPO). Each provides a different measure of value, and each is equally valid and consistent with the other measures. Table 1 also points out that the sales of fish at the dockside (landed value) and at the wholesale (processed) level are not counted within the national income framework, even though these measures are obviously of interest to an understanding of the commercial fishing and fish processing industries. Though sales figures are not used, they may be measured and presented, along with employment data, to provide supplemental information of interest to policy makers.

Table 1 also points to some of the challenges inherent in constructing an ocean-related GDP. These were identified by BEA in their 1974 study of ocean-related national production, which used the GPO measure (BEA, 1974). BEA found that identifying ocean-related production from GDP[1] could not be done easily for many products. While the value of the cod might be directly attributable to the ocean, the value of other products, such as oil and gas from the sea, can not be separated from oil and gas produced on land, based solely on the data contained within the national income accounts. In addition, the data to separate the income components was not easily available for ocean-related economic activities in the time available for the BEA study.

Economic Values Omitted from the NIPA

The lines in Table 1 labeled "net investment" represent changes to the capital stock of each industry in a year. These include, for example, the purchase of a new fishing boat, the installation of a new filleting machine, or the opening of a new restaurant. It also represents normal wear and tear (depreciation). But missing from Table 1 is any measure of the fundamental asset of the fishing industry- the stock of fish itself. Nor is there any way to compare the asset value of the fishery stock in one year to that in any other year to assess whether the resource stock is improving or deteriorating.

The omission of the calculation of the capital values and the net changes in these values of natural resources from the NIPA has been the subject of a significant amount of controversy and

[1] Prior to 1994, BEA used Gross National Product, rather than Gross Domestic Product, as the principal measure of the economy, and thus the 1974 study used GNP.

research. The controversy arises because of concerns that the standard approaches to estimating values in the NIPA or other market estimates of value are likely to overstate economic values if they do not take into account the depletion of natural resource stocks. The omission of capital values and their net changes may ultimately lead to the further depletion of natural resources.

To illustrate this point another way, imagine that the commercial fishery at issue were on a privately owned lake. In this case, the national income accounts would measure the changing economic condition of the fishing boats, the processing plants, and the restaurants that sold the fish as above. But the national income account framework would not tell the owner of the lake whether this asset was improving or not, and thus appropriate economic signals about what should be done to maintain the resource would be absent.

Development of an ocean-related GDP raises another issue that is not present in other approaches to extending the GDP. Economic values derived from the ocean may originate from specific ocean resources, such as marine fisheries, or may originate from a geographic relationship between the economic activity and the ocean. In this latter category are a variety of economic activities that could take place anywhere (such as recreation), but only a portion of these activities is associated with the ocean. This creates two problems. First, the portion of economic activity that is directly geographically associated with the ocean (takes place on or near the coast) must be identified. Second, economic value that originates with the ocean may be extended quite a distance from the ocean. The restaurant in the above example may be in North Dakota. These aspects point to tasks that identify both the regional dimensions of ocean economic value and the indirect effects of ocean-related production.

Another omission from the national income accounts can be illustrated by considering recreational benefits. Many people regularly go to the beach or fish for recreation. Only their expenditures for food, fuel, fishing gear, or other recreational equipment show up in the national income accounts. But the value of their recreational experiences often far exceeds that which is measured as the simple expenditures on food, fuel, etc. Measurement of these non-market values has been the subject of intense methodological research in economics over the past four decades; and full consideration of the economic value of the ocean must include a way to incorporate these aspects.

To continue the fisheries example, the values of fish caught by commercial fishing vessels and sold to fish processors, supermarkets, or restaurants would be measured in the national income accounts. However, the value of fish caught for recreation would not be counted if the fish were returned to the sea or directly consumed by the person who caught it. The recreational fisherman's purchases of bait or fishing tackle or a boat would be measured in the sales of those industries. If only the national income accounts were used to measure economic value, the value of recreational fishing would equal only the expenditures on the boat, pole, and bait. The fish would have no value itself. But this is clearly a mistake; the fish must have some value or else no one would pursue them. This value for recreational fishing (and for similar uses of the ocean) must be measured and included along with the other values to get a complete picture of the ocean's economic value.[2]

A FRAMEWORK FOR MEASURING OCEAN ECONOMIC VALUE

Given the various definitions of economic value discussed above, it is possible to construct a framework of economic valuation for the coast and ocean. This approach begins with the national income accounts and then adds in the measurement of those values which are not included in those accounts.

The NIPA Framework

Starting from a NIPA framework for the measurement of flows requires three different perspectives: consumption, production, and income. Table 1 sets out a general framework for considering an ocean NIPA. As constructed, Table 1 assumes that values will be entered based on market transactions and would be fully reconcilable with the existing NIPA meeting the following conditions:

1. $E_o+E_{no}=GDP$
2. $P_o+P_{no}=GPO$
3. $Y_o+Y_{no}=GDY$

where the subscript *o* designates that component associated with the ocean and the subscript *no* designates non-ocean.

That is, the sum of expenditures on ocean derived products and non-ocean derived products should equal gross domestic product, the sum of ocean derived and non-ocean derived production should equal gross product originating, and the sum of income derived from ocean production and non-ocean production should equal gross domestic income.

Table 2 takes the basic framework from Table 1 and shows how the various major categories of ocean-related economic activity can be arranged within a framework that is consistent with the NIPA. This depicts what we call the *core account* of ocean economic value. Discussion of how

[2] More formally, the national income accounts measure value at the average price of all goods and services sold. These are the values *associated with the ocean.* The true economic value *of the ocean* is its marginal value contained within those average prices. That marginal value of the ocean exists only to the extent that the ocean imparts some particular value to a good or service that is separate from the value of that good or service produced in some non-ocean context. These marginal values are also contained within the consumer and producer surplus associated with goods and services coming from the ocean. Thus the value *of the ocean* is measured in both a gross sense as the marginal contributed by the ocean to the value of goods and services measured at their average prices plus the marginal value contributed to the social surplus associated with these goods and services. This study will estimate both the values associated with those measured at average prices and, where possible, the marginal values.

the various elements will be estimated and the theoretical and research issues involved will be presented below.

Several of the cells in Table 2 are shaded. These denote areas of inconsistency with the NIPA, and are of two types. First, the table identifies gross output (sales) in addition to value added. As noted, this is a policy-relevant variable that will be identified and presented separately. Second, the table defines research as an investment, although it has been the normal practice of BEA to treat research- related expenditures such as new lab equipment and supplies as either consumption or fixed capital investment, and then only when the government purchased the equipment directly. Purchases by private industry or the non-profit sector were treated as intermediate goods and not included. This approach was consistent with the overall rules of the NIPA system, but missed the critical role that the generation and application of new knowledge plays in the economy. For this reason, BEA has recently developed a satellite NIPA account for research and development (BEA et al., 1994b), which more fully captures the investment nature of these types of expenditures. It is our intention to identify a marine-related R&D component.

Within the conceptual framework underlying the national income accounts, these "ocean" accounts are a "satellite" account. Satellite accounts may be estimated using various methodologies but they must remain consistent with the measures of GDP, GDY, and GPO. By remaining within these concepts, it is possible to compare the ocean-related economy to other parts of the national economy both in terms of size and change over time. But there are limits to these measures, and so a full picture of ocean economic values requires an extension of the analysis.

Table 2. A Depiction of the Core Account of Ocean Economic Value Based on a NIPA Framework

Expenditure on "Ocean Derived" Goods and Services			Production of Goods and Services from the Ocean			Income Earned from Ocean Production		
Consumption	Goods	Oil	Gross Output	Net (Value Added) Output	Oil	Wages and Salaries	Profits‡	Oil
		Other Minerals			Other Minerals			Other Minerals
		Fisheries/Food			Fisheries/Food			Fisheries/Food
		Non-food living resources			Nonfood living resource			Nonfood living resource
	Services	Natural Gas*			Natural Gas			Natural Gas
		Recreation & Tourism			Recreation & Tourism			Recreation & Tourism
		Transportation			Transportation			Transportation
Investment		Structures			Construction			Construction
		Research purchased by non-government entities			Research			Research
Government	Goods & Services	Consumption items**						
	Investment	Structures						
		Research						
Net Exports	Goods	Exports of Consumption Items less Imports						
	Services	Exports of Consumption Items less Imports						

NOTES:
† Capital consumption adjustments are not shown in the table but would be included to reconcile to the NIPA accounts when needed.
* Standard NIPA accounting rules require that all commodities which can be held in inventory be counted as goods, while commodities which cannot be held in inventory are counted as services. Since natural gas is normally sold through pipelines that directly connect source to customer, it is not held in inventory and is thus counted on the services line in the consumption tables.
** These would include goods and services purchased by the government for its own use
‡ Profits includes rental income, proprietors income, and corporate profits

Beyond NIPA: The Extended Ocean Accounts

The discussion in the previous section suggests that there are three extensions to the basic NIPA framework that need to be considered to complete the picture of ocean economic value:

- the investment and asset value of the natural resource base,
- the regional and multiplier dimensions of economic value, and
- the non-market elements of economic value.

We refer to these elements as the *extended accounts* of ocean value.

Investment and Resource Asset Values

Table 3 presents an asset accounting framework for the natural resources of the ocean. Theoretically, this table shows an "opening stock" which is the value of the assets at some time 0, the changes in the value in some period, and the closing stock value after additions and subtractions. This framework allows the net change in asset (stock) values, which result from the transactions (flows) reported in Table 1, to be calculated, and thus shows the net change in "ocean derived" wealth. It shows the physical units and general source of unit prices. However, it is necessary to note that in reality, the dynamic nature or biological resources precludes precision in any of these measures. Neither a snapshot, nor a time series over partial biological cycles can give us a full accounting. It may be necessary to do longer time series for some resources to obtain reliable values.

Table 3 has no counterpart in the current U.S. system of national accounts, and so cannot be reconciled to a reference set of data. It is based on the work of Repetto et al. (1989) and represents one approach to the development of more fully integrated economic and natural resource/environmental accounts. It is also consistent, at least conceptually, with the recent work of BEA in developing a satellite minerals account for the United States (BEA, 1994c) and with the recommendations of the National Research Council (1999).

Table 3. An Asset Accounting Framework for the Natural Resources of the Ocean

		Oil		Gas		Other Minerals		Fisheries		Other Living		Amenities		Absorption Capacity	
		Bbls	Market Price	TCF	Market Price	Tons	Market Price	Tons	Market Prices	Tons	Market Prices	Use days	Mrkt/Nonmrkt Values	TBD	TBD
Opening Stock															
+ Additions	Discoveries														
	Net Revisions														
	Extensions														
	Growth														
	Reproduction														
- Reductions	Production														
	Degradation														
	Depletion														
= Net Change															
Closing Stock															

NOTES TO TABLE 3

Cell entries are the product of the physical units indicated and the unit rents derived from the sources indicated.
Opening Stock is the closing stock of the previous period.
"Additions to assets" include:

- Discoveries - New commercial discoveries of resources, such as new oil and gas deposits, new food items, or new products such as medicines that are discovered.
- Revisions (Net) - Changes in previous stock amounts resulting from new information.
- Extensions - Changes in previous stock amounts resulting from new technologies (e.g., enhanced oil recovery technologies)
- Growth - Changes in stock amounts resulting from addition of territory (e.g., extension of the EEZ) or from man-made additions to supply (e.g. aquaculture)
- Reproduction - Natural population increases for renewable marine resources

"Reductions in Assets" include:

- Production - The amount of resources removed from the ocean in a time period
- Degradation - Reductions in capacity of renewable resources to reproduce
- Depletion - Adjustments to value to reflect the future lost value from removal of nonrenewable resources.

Closing Stock is the difference between the value of the opening stock plus additions less reductions.

Regional and Multiplier Values

The regional dimensions are still another angle from which to view ocean values. The regional dimension brings into play both issues of geography and of the direct, indirect, and induced roles of ocean economic activity in the national economy. Table 4 provides a simple framework for describing this dimension.

Table 4. A Framework for the Regional and Multiplier Values

The Regional and Multiplier Dimensions		
	Proximate	**Not Proximate**
Ocean Dependent	•	
Fisheries		
Oil & Gas		
Shipping		
Ship/Boat Build		
Recreation/ Tourism		
Coastal construct.		
Real Estate Government		
Ocean Linked	•	•
Goods and Services Inputs to Above		
Ocean Supporting	•	•
Indirect and Induced Effects		

The categories in Table 4 are derived from Luger (1991-92), but are modified somewhat. The description is changed from "coastal" to "ocean" to reflect the terminology to be used in the current study. "Ocean dependent" activities are essentially the same as Luger's "coastal dependent" activities: they depend directly on either extraction of ocean resources or on physical proximity to the ocean. Ocean-linked activities supply goods and services directly to ocean-dependent activities. They may be located near the ocean or at some distance. Ocean supporting activities derive from the direct activities of both ocean dependent and ocean linked activities. Put another way, the ocean linked and ocean supporting activities constitute, in sum, the "multiplier effect" of the ocean dependent activities.

Measurement of the concepts indicated in Table 4 will require a somewhat different approach from measurement at the national level. While gross regional product (the analog to GDP) is estimated by BEA at the state level, it is not estimated at the county level, which is the both the smallest geographic entity at which much data is available and one which is in many cases still too large to be meaningfully "ocean related" (even when it is a coastal county). Personal income and employment are available at the county level, making it possible to estimate ocean-related GPO at the county level and, to some extent, GDY.

Non-market Values

The last element of the extended account is the inclusion of non-market values for recreation, environmental amenities, etc. There are a number of important aspects of ocean related values that are not measured or fully captured in market transactions, including:

- amenity values (such as scenic views),
- recreation values, and
- assimilative capacity for waste streams.

Estimates of these values have been made using a wide variety of techniques in an even wider array of locations. These methods for evaluating non-market values fall into two basic categories:

1. Revealed Preference Methods (using methods that draw on imbedded market values):
   - Hedonic models
   - Random utility models
   - Basic travel cost models

2. Contingent market models (using methods that draw on hypothetical value estimates):
   - contingent valuation
   - contingent ranking
   - stated preference
   - conjoint analysis

The Random Utility Model (RUM) is used to evaluate the data from both mode, revealed or hypothetical. Each of these methods has advantages and disadvantages and each is appropriately used for the valuation of certain types of resources. Some of these approaches, such as hedonic pricing models, attempt to isolate the component of market values attributable to specific resources such as ocean amenities. Others, such as travel cost, use market values as a proxy for the non-market values. Still others (contingent valuation) attempt to derive values from simulated markets. Contingent valuation is a technique which uses survey techniques to elicit individuals' valuation of goods or services not measured by market prices. It is a potentially powerful tool, capable of measuring values that no other technique can address. But it is also controversial because it often asks for responses to hypothetical situations. For this reason, reviews of the use of contingent valuation (Arrow, et al., 1993; National Research Council, 1999) have suggested that it be used for policy purposes such as damage claims or adding the value of the environment to the national income accounts only in limited circumstances. Other valuation techniques such as hedonic pr3icing and travel cost methods, which measure values in the traces of actual behavior, are suggested as preferable. RESEARCH STRATEGY

The framework for ocean economic values presented above identifies four distinct elements grouped into two broad "accounts":

The Core Account
- GDP_o
- GDY_o
- GPO_o

The Extended Accounts
- the values of the natural resources of the ocean, including their annual changes,
- the regional, indirect, and induced values of ocean economic activity, and
- the resource values not directly revealed or counted in market transactions.

Figure 1 provides a schematic map of these elements.

Construction of the Core Account

The sources of data for the core account begin with data from the NIPA database, which includes measures of both the relationships among industries (input-output) and changes in the flows of production and income . This data will be disaggregated to identify ocean-related activity, using the GDP, GPO, and GDY concepts to the maximum extent possible. However, as noted earlier, both the GDP and GDY elements of the standard national income accounts do not contain sufficient information to identify many key elements of ocean-related economic activity, either because the relevant activity comprises intermediate goods and services or because the level of industrial detail or geographic relation is insufficient.

The estimation of the core accounts will, therefore, require that very detailed additional studies be undertaken of each of the key industries. These industry studies will identify income and profit components and supplier relationships, and will separate ocean-related activities from non-ocean related activities. Two major types of data will be used:

- Economic Census data. The detailed studies of industries by the Bureau of the Census, conducted every five years (most recently for 1997), are the primary source data for the estimation of key components of the GDP and the national input output tables. These data are now available for limited public use at data centers in Massachusetts, Pennsylvania, and California. These data will be used to construct more detailed accounts of the relevant industries than has heretofore been possible.

- Government and industry sources. Estimation of many of the values will require compilation of data from government and industry sources. For example, data from the Minerals Management Service as well as from state agencies in Texas, Louisiana, California, and Alaska will be needed to separate ocean-derived oil and gas production from total oil and gas production of the United States. Data on waterborne commerce from the Army Corps of Engineers will provide needed detail to measure that sector. Data from the insurance industry will be used to identify the changing value of coastal real estate.

The compilation of data for the core account will proceed by analyzing the NIPA data and then conducting a series of industry studies that will both describe the industry in some detail (including time series measurements where possible) and provide the foundation for constructingthe relevant NIPA-related measures for inclusion within the core account.

In addition to the core national income accounting framework data, a parallel data set showing employment and gross output will also be created. Sectors to be examined include:

- living resources, including fishing (including aquaculture) and commercial fish processing
- minerals (oil and gas)
- tourism/recreation, including beach use and boating
- construction (including expenditures on restoration, maintenance, repair and rehabilitation of coastal lands)
- waterborne transportation
- ~~real estate~~
- ship and boat building
- government

While these sector studies are underway, regional studies will begin to identify those elements of ocean-dependent activity that are determined by geography rather than product or source. Examples include many tourist related businesses, such as hotels in major seaside resort destinations. This will be done using a variety of sources, including the Economic Census data, County Business Pattern data also from the Census Bureau and, in selected states, the ES-202 employment data.

In conducting this analysis, scrupulous attention must be paid to the laws governing the confidentiality, which will restrict the level of geographic detail that may be described. Data will be collected using the rule that the lowest level of geographic and industrial detail consistent with confidentiality rules will be selected. This will mean most data will be available at the state level, and some will be available at the county level, though this will vary by size of state. Multi-county regions defined by level of permissible disclosure may also be created.

Construction of the Extended Accounts

Construction of the Extended Accounts will each require a different approach.

Investment and Resource Asset Values

Work in this field has already begun in some key areas. The BEA minerals valuation study of 1994 provides a starting point from which to separate offshore oil and gas measurements. Other marine minerals (such as sand and gravel) may be assessed using similar approaches.

The valuation of fishery resources using an investment/depreciation framework is much less well developed. Repetto (1999) has shown, using an analysis of the Atlantic sea scallop fishery, that it is possible to utilize existing biological and economic data to prepare such an assessment. Extension and refinement of this type of analysis to other fish stocks will be a key task.

The assimilative capacity of the ocean is the third major resource asset that the study will attempt to value. Here the conceptual basis of the valuation must first be established. Economic theory and practice have yet to settle on the proper measurements. Appropriate data sources will then be explored to provide at least preliminary estimates.

In summary, the natural resources we plan to value include:

- oil and gas
- other minerals
- fisheries
- other living resources
- amenities
- assimilative capacity
- recreational

Regional and Multiplier Values

The examination of regional activity will already have begun in the core data analysis. The task in the extended analysis will be to provide more complete pictures of the regional economic effects of the ocean through the identification of the ocean-linked and ocean-supporting activity. As discussed above, these can be measured most easily in terms of employment and income. Gross Regional Product (GRP) estimates are also possible using estimating procedures such as that suggested by Luger (Luger, 1991-92)

The estimation of the "multiplier effects" may be done using any of several approaches, including application of the national I/O tables. It may also be done using regional multiplier analysis, probably at the state level only, using any of several techniques, such as the BEA Regional Industrial Multiplier System (RIMS), the Impact PLANning model originally developed by the U.S. Forest Service and now produced by the Minnesota IMPLAN Group, or the models developed by Regional Economic Models Inc. (REMI).

Non-market Values

Given the wide array of resources, regions, methods, and studies that have been undertaken to identify and measure the non-market values of resources, no single consistent set of accounts of non-market ocean values is likely to be possible without a major additional research initiative employing consistent methodologies and covering the entire country. As Freeman (1995) has shown, such estimates of the same resource (in this case clean water for recreation) can differ by orders of magnitude. The principal task here, therefore, will be to examine the existing literature on non-market values of ocean related resources, and to develop a range of possible estimates of values which can be accessed for use where appropriate.

This element of research must begin by recognizing that while the idea of integrating economic and environmental accounting has come a long way, the use of information about economic values not counted in market transactions linked to national income accounts remains both complex and controversial. In its review of the process of integrating environmental information into the national income accounts, the National Research Council (1999) noted this controversy and set forth some preliminary guidelines on how to integrate non-market values. However, these guidelines must be elaborated to provide a more explicit foundation to link non-market value information to the national income data.

The basic data for this phase will be the numerous studies that have been conducted over the years on the non-market values associated with the ocean and its resources. Primary attention will be given to studies of recreational activities and the value of the ocean as an amenity. These studies have been published in both the peer-reviewed and non peer-reviewed literature, and have used a wide variety of economic assessment frameworks. Some of these have constructed non-market values from observed market transactions (travel-cost methods) while others have used techniques to measure values using more indirect methods (contingent valuation).

Analysis of non-market values will likely focus on coastal recreational activities in three areas: marine recreational fishing, access to the coast and ocean for recreation, and the relationship between water quality and coastal recreation. The research will assemble as much of this analysis as possible from all sources, and describe the studies by region, resource, analytic method, results, strengths and weaknesses. This information will then be built into the data management system.

The analysis of non-market values also needs to include a "capital stock" component in order to develop an understanding of how these values change over time. Changes to the stock of recreation opportunities will be measured both by changes in the opportunity for such activities as beach going, boating, sea kayaking, wildlife viewing, etc., and changes in the values associated with these opportunities. These values will include the expenditure on market goods and services (buying a sea kayak) as well as the non-market values (the value of recreational time using the sea kayak). Changes (additions and reductions) in both the quantity of opportunities and the value of those opportunities will provide a complete economic picture of how the ocean's value as a recreational asset is changing. It can then be linked to the overall national income accounts and the ocean satellite account to show how these changes compare with other changes in the economy as a whole and of the ocean economy.

Because the information available to develop this "capital stock of recreation" for the entire nation may be limited, the focus in this project will be to develop and apply the concept in selected states. Because of their size and diversity, California, Texas, and Florida will likely be selected for this purpose. These are also states where major investigations of coastal recreational activities already have been conducted (See for example, Leeworthy & Bowker (1997) for a study of recreation in the Florida Keys; Whittington (1993) for a study of the Galveston Bay area in Texas, and Moller and Fitz, (1997) for the economic analysis of the seven industries in the California Ocean Resource Study. We shall use ongoing research in California as part of that case study.

Data Collection and Management Issues

Almost all of the data to be assembled in this project will come from extensive re-working of published and unpublished sources to produce a new dataset from the national income accounts combined with additional estimates from a variety of sources. It will be critically important to the project and to the use of the data that sources and estimation procedures are fully documented. An extensive meta data set will be developed and made available as part of the online database.

In addition, much of the data in the non-market portions of the study are likely to vary widely in quality and reliability. Simple division of the information into "peer-reviewed" and "non peer-reviewed" will provide only the most cursory guide to reliability. Therefore, another task will be to assemble a group of economists, policy researchers, and data users to develop a data quality assurance protocol. This protocol will allow users to differentiate between those studies and data that meet the highest standards of scientific quality and reliability and those that should be treated and used with increasing degrees of caution.

Boundaries

The nature of economic activity associated with the ocean inevitably raises questions about the boundaries that will be selected for distinguishing "ocean-related" from "non-ocean related". In fact, there is no single right geographic area that defines the ocean-related economy. The fishing industry example used above shows how those boundaries can extend well away from the ocean itself. Clearly greater physical proximity increases the likelihood of an "ocean component" to economic value or measuring economic activity. By this standard, we should look to the tightest possible definition of "coastal", focusing on the region immediately adjacent to the shore. But economic data is not available at this level of geographic detail. Almost all regional economic data is available only at the county level. This study, like its predecessors, will also look at county level data.

But this still raises the question of which counties are "coastal". "Coastal counties" for federal coastal zone management purposes are defined by each state, and often are defined by the boundaries of tidal influence. This definition can reach well inland (for example, Kennebec and Penobscot counties in Maine). Other definitions include coastal watersheds, which can reach even further inland. In order to avoid stretching an already elastic definition of "coastal", this study will use a definition of coastal counties as those with a significant portion of their border on salt water. This definition will include such major bays as the Chesapeake, San Francisco Bay, and Puget Sound. Figure 1 shows the coastal counties which have been selected for study. A list of these counties by state is found in Appendix 1.

In other contexts, "coastal" can also include the Great Lakes. In this study, the Great Lakes will be excluded initially, since this study focuses on the ocean. Future studies and additional funding should extend the methods and data developed here to the Great Lakes.

WORK PLAN

The following lays out the work tasks needed to accomplish the study. The timing of the tasks is not specified, since much will depend on levels of funding available to the study. However, the work on the core NIPA account analysis will be conducted in the early stages of the project, as will the development of the database management systems. This early work will include the development of employment data to match the output and income data, and will extend to the state level for those industries that can be broken out readily from the BEA NIPA and regional data bases. This work encompasses tasks 1-4 below. The sectoral and resource valuation studies will be done on a schedule that is determined by available funding and personnel resources.

Description of Tasks

Task 1: Identification of Coastal and Ocean industry/commodity groupings.

Those industries directly dependent on the ocean must be identified, along with those indirectly dependent or influenced. The typologies developed by Pontecorvo and Luger will provide a starting point for analysis, however these may be extended or reformulated. In addition, a cross-walk between the SIC and North American Industrial Classification System (NAICS) of industrial classification must be developed to account for the transition under-way between these two systems and to make it possible to use the 1997 Economic Census data that has been coded using the NAICS.

Task 2: Core Data Development

Working with BEA personnel, the detailed industrial and geographic breakdowns will be undertaken to develop the data on all industries identified in Task 1. A database of national and state-level data will be developed as the core data for further analysis. In addition, the I/O relationships will be identified for ocean-dependent sectors. The I/O table thus developed will be used to develop initial multiplier estimates at the national level for ocean dependent industries and, as additional detail becomes available, for indirectly dependent industries.

Two other elements of the core data will also be collected in this task. The first is employment, which will be collected from BEA, BLS, and Census sources as appropriate. The second is population, which will be collected from Census data at the tract, minor civil division, and county level by state.

Task 3: Database Design

One goal of the project is to make the economic data collected as easily accessible as possible. This will be accomplished by developing a database accessed through a query system over the world wide web. In addition, the database will be linkable to geographic information systems so that it can be merged at various levels of geographic specificity with other information developed by NOAA and other researchers. Since data will be entered into the database continuously throughout the project, the initial design of the database must be flexible and allow for refinements to the design, as new information becomes available and as early tests of the data systems reveal the need for additional work.

An Industry Council will be formed, along with periodic meetings with a select group of other data users to ensure that the information system contains the type, level of aggregation and format to meet their needs.

Task 4: Summarize NIPA Accounts and Develop Sector- and Resource-Specific Study Agenda

Once Task 2 is accomplished, it will be possible to identify the strengths and weaknesses of the existing BEA data for the purposes of the study. This will reveal the kinds of questions that must be addressed in the sector specific studies in order to separate the ocean from the non-ocean components of the data. In addition, this task will examine the kind of information available from other sources, such as the detailed information from the Economic Census reports and other published government statistics from agencies such as the Minerals Management Service and National Marine Fisheries Service. From this analysis, a research agenda will be developed for each sector to guide the researchers assigned to that sector.

In addition, similar agendas will be prepared for the assessment of resource values.

Task 5: Sector Studies

The Sector Study Agenda will be used to guide the researchers engaged to complete each of the studies identified. The level of effort and approach in each study will vary by the topic. A number of such industry studies will be conducted simultaneously.

Task 6:Resource Studies

As with the sector studies, the resource studies will be undertaken on an individual schedule flowing from the agendas developed in Task 4.

Task 7: State Studies

The data derived from Task 2 will permit a state-level summary of direct ocean-dependent economic activity. It is possible to extend the analysis for each state through the second and third levels of the study, depending on availability of support. This extension would provide:

- an assessment of indirect economic activity accounted for by direct ocean-dependent economic activity;

- more detailed analysis of certain types of economic activity, such as real estate, tourism and recreation, government; and what ever other economic activities are indigenous to the particular state, and

- locally-specific analysis of resource values where the data is available.

Task 8: Data Quality Assurance

Extensive documentation of all data used in this project will be assembled and made available as part of the on-line data system. To facilitate this, a working group of economists and data users will be assembled to develop a data quality protocol to assess the quality and reliability of data and provide users with a guide to the data and its uses.

Task 9: Data display and analysis system completion

This task completes the data management system development, including the integration with appropriate geographic information systems. If time and money allow, satellite photos and overflight photos will be integrated in time series to depict changes in coastal areas over time.

Task 10: Case Studies of Data Application

During the course of the study, it is anticipated that several occasions will arise when it will be possible and desirable to undertake specific case studies of regions, resources, or activities in order to demonstrate how the data can be used to support specific types of policy decisions. These case studies will most likely be undertaken as part of the state-level studies. Available funding and the specific desires of funders will heavily influence the choices of case studies.

Task 11: Reports and Publications

Throughout the project a set of reports and publications will be prepared. Some will be the results of sector-specific studies (or sub-components thereof) or of the resource valuation studies. Others may provide discussion of methodological issues raised during the course of the study. In addition, a final report will be prepared summarizing all data.

Task 12: Consultations

Throughout the project, numerous consultations will take place. These will include meetings of the project's National Advisory Board and Industry Council. There will also be a need for 1) meetings of economists who will provide technical guidance on some of the research issues identified; and 2) user groups who will provide input on type, format, and aggregate levels of data they need. It would also be desirable to have meetings of state officials who may be involved in the analysis of specific states. Finally, it is expected that project team members will meet with groups interested in the project at appropriate conference venues, such as Coastal Zone 99 and Coastal Zone 01, Industry Association meetings, and other similar meetings.

Products

The project will produce a series of technical reports and peer-reviewed journal articles covering the overall estimation of ocean economic values and more detailed studies of the various industries and key resources.

A major product will be a database that can be accessed over the world wide web by researchers and analysts. The database will contain output, income, employment and other relevant data for products, resources, and regions. Time series will be made available wherever possible, with a goal of having as much data as possible available from 1970 to the present. Regional data will be available at both the state and county level, and, for some data, at finer geographic levels. The data will also be made available through geographic information system formats, using internet mapping technologies or providing downloadable files.

Project Schedule

Depending on funding availability, the following is the expected schedule of tasks under the project:

1999 Identify coastal industries
Complete research plan design
Complete analysis of federal government ocean expenditures
Begin analysis of national income accounts data.
Begin database design

2000 Economic Census analysis
Regional data analysis
Complete 3-4 industry studies
Complete 1-2 resource value studies
Complete 1-2 state studies
Design and implement data base access programming
Develop data documentation system

2001 Complete 3-4 industry studies
Complete 1-2 resource value studies
Complete 1-2 state studies
Complete satellite account construction with all market data
Develop data quality assurance protocol

2002 Complete non-market valuation studies
Complete database construction
Issue final report(s)

REFERENCES

Arrow, K., R. Solow, P. Portney, E. Leamer, R. Radner, and H. Schuman. 1993. Report of the National Oceanic and Atmospheric Administration Panel on Contingent Valuation. *Federal Register* 58:4601-4614.

Bell, Frederick W. And Vernon R. Leeworthy 1986, "An Economic Analysis of the Importance of Saltwater Beaches in Florida." Report Number 82. Tallahassese, Fl. Florida Sea Grant college

Braden, John, and Charles D. Kolstad. 1991. Measuring the Demand for Environmental Quality (Amsterdam: North Holland).

Nathan Associates. 1974. *Gross Product Originating from Ocean-Related Activities*. Bureau of Economic Analysis Washington.

Bureau of Economic Analysis. 1994a. " Integrated Economic and Environmental Satellite Accounts" *Survey of Current Business*, April.

Bureau of Economic Analysis. 1994b. A Satellite Account for Research and Development. *Survey of Current Business*. November.

Bureau of Economic Analysis, 1994c. Accounting for Mineral Resources: Issues and BEA's Initial Estimates. *Survey of Current Business*. April.

Colgan, C.S. 1990. *Valuing Coastal Zone Management*. Newport, Oregon: National Coastal Resources Research and Development Institute. Publication NCRI-T-90-005. 1990

Colgan, C.S. and Plumstead, J. 1993. *Economic Prospects for the Gulf of Maine* Augusta, Maine: Gulf of Maine Council on the Marine Environment

Eisner, Robert. 1989. *The Total Incomes Systems of Accounts*. Chicago: University of Chicago Press.

Fang, B., et. al. 1998. U.S. Transportation Satellite Accounts for 1992. *Survey of Current Business*. April.

Freeman, A. M. 1995. The Benefits of Water Quality Improvements for Marine Recreation: A Review of the Empirical Evidence. *Marine Resource Economics*. 10: 384-406.

Freeman, A. Myrick III. 1993. The Measurement of Environmental and Resource Values: Theory and Methods (Washington, D.C.: Resources for the Future).

Godschalk, David R., Luger, Michael I., Coates, Dennis C., May 1990. Evaluation of the National Coastal Zone Management Program, Center for Urban and Regional Studies, University of North Carolina, Chapel Hill, N. C., National Coastal Resources Research and Development Institute.

Innis, Harold A. 1940. *The Cod Fisheries: The History of an International Economy*. New Haven, Conn. Yale University Press.

Leeworthy, V.R. and Bowker, I.M. 1997. *Nonmarket User Values of the Florida Keys/Key West* Washington: National Oceanic and Atmospheric Administration.

Luger, Michael I., 1991-92 "The Economic Value of the Coastal Zone," *in Journal Environmental Systems,* Vol21(4), pp. 279-301, 1991-92.

Lum, S.K.S. and Moyer B.C. 1998. Gross Product by Industry 1995-1997 *Survey of Current Business*. November.

Moller, Rosa and Joe Fitz,1997. The Resources Agency of California, California's Ocean Resources: An Agenda for the Future, Chapter 2: Economics of Ocean Dependent Industries, March 1997.

NOAA, 1999. U.S. Department of Commerce, NOA, Special Projects Office, "Trends in U.S. Coastal Regions. 1970-1998.

National Research Council. 1999. *Nature's Numbers: Expanding the National Economic Accounts to Include the Environment.* Washington: National Academy Press.

Okubo, S. and Planting M. U.S. travel and Tourism Satellite Accounts for 1992. *Survey of Current Business*. July.

Pontecorvo, G. et. al. 1980. Contribution of the Ocean Sector to the U.S. Economy. *Science*, 30. May.

Pontecorvo, G. 1988. Contribution of the Ocean Sector to the U.S. Economy: Estimated Values for 1987- A Technical Note. *Marine Technology Society Journal*: 23-2.

Seskin & Parker. 1998. A Guide to the NIPA's *Survey of Current Business*. March

Repetto, R., et. al. 1989. *Wasting Assets: Natural Resources in the National Income Accounts*. Washington. World Resources Institute.

Repetto, R. 1999. Creating Asset Accounts for a Commercial Fishery: A Case Study of the Atlantic Sea Scallop Fishery. Unpublished paper.

Rubin, J. et. al. 1999.. Estimating the Marine Sector in the Maine Economy. *Maine Policy Review*. Fall.

United Nations. 1993. *Integrated Environmental and Economic Accounting: Interim Version, Studies in Method.*

Whittington,Dale. 1993 "The Economic Value of Galveston Bay" in Colgan, Charles (editor) *Valuing Coastal Resources: Linking Economics and the Natural Sciences* Portland, Me. Edmund S. Muskie Institute of Public Affairs.

APPENDIX I: GLOSSARY

This glossary provides a guide to terms used in the research plan. The definitions are limited to the uses of the terms in the plan.

Amenity Value	That portion of the value of a good or service attributable to the quality of the surrounding environment.
Asset Value	The price which land, including natural resources would fetch if sold; alternatively the price estimated through indirect means such as contingent valuation
Average Value	The per unit value of goods and services sold in markets.
Benefits Transfer	The process of estimating the economic benefits of a resource in one location and using those estimates to value a resource in another location.
Capital	(1). A fixed asset used in the production of goods and services. (2) The funds used to purchase those assets.
Capital Stock	The total amount of capital available at any specified point in time.
Capital Value	The total value of the capital stock (average value multiplied by the quantity of capital).
Coastal Counties	Counties with a border on salt water, including those of principal bays.
Contingent Valuation	A technique for measuring non-market values using surveys to simulate purchasing decisions.
Core Accounts	Measures of economic activity associated with the ocean that are fully consistent with the U.S. national income and product accounts.
Economic Welfare	The basic measure of economic well-being as defined by individual views of the usefulness of goods and services.

Economic Value of the Ocean

(1) That portion of the value of a good or service which is uniquely contributed by the ocean. (2) The sum of the market value of goods and services whose production is derived from or associated with the ocean.

Environmental Accounting

The development of measures of changing environmental quality and their compilation into a systematic assessment process. Also can refer to the integration of the value of environmental and natural resources within a national income framework.

Extended Accounts — The addition of measurements of natural resource (ocean values) that are not included within a national income accounting framework but which are needed to provide a more complete measure of economic value.

Final Goods and Services (final demand)
The goods and services as consumed by the ultimate consumers (households, businesses, exports, etc.)

Gross Domestic Income (GDY)
The total value of income earned from the production of goods and services from economic activity conducted within the United States.

Gross Domestic Product (GDP)
(1) The total value, measured at the point of final demand, of goods and services produced in the United States. (2) The sum of the value added of the production of goods and services.

Gross National Product (GNP)
The total value, measured at the point of final demand, of goods and services produced by citizens of the U.S.

Gross Product Originating (GPO)
The total value of goods and services produced by each industry in the U.S.

Gross Regional Product (GRP)
The total value of goods and services, measured as final demand, of all goods and services produced within a specific region.

Hedonic Pricing — A statistical estimation technique for separating amenity values from other determinants of market value.

Input/output model — A model which depicts the economy in terms of a comprehensive accounting of purchases and sales among industries.

Intermediate Goods and Services
Goods and services used in the production of other goods or services.

Investment — The acquisition of capital for future production

Marginal Value — The value of one additional unit of a good or service consumed.

Market Value — Values of goods and services determined by prices at which they are sold in market transactions.

Multiplier (Economic Multiplier)

The ratio of the sum of the total value of economic transactions within the nation or a region resulting from a specified increase in investment or other economic activity increase.

National Income and Product Accounts (NIPA)
: The system for measuring GDP, GDY and GPO for the United States.

Net Investment
: The additional investment made each year, less that investment which replaces capital that has worn out (depreciated).

Net National Product
: Gross national product less the amount of investment needed to replace worn out capital (depreciation).

Non-market Goods and Services
: Goods and services which are not exchanged in normal market transactions, but which have economic value nonetheless.

Non-market Value
: The value of non-market goods and services. They are measured by means such as hedonic pricing and contingent valuation.

Ocean Derived
: The portion of the value of goods or services (whether that value is measured in market transactions or by other means) that is determined by the presence of the ocean.

Ocean Dependent
: Economic activity which requires resources extracted from the ocean or physical location on or near the ocean.

Ocean Linked
: Economic activity which depends indirectly on the ocean dependent activity.

Ocean Related
: The sum of ocean dependent and ocean linked activities.

Ocean Satellite Accounts
: The combination of core and extended ocean accounts.

Ocean Supporting
: Goods and services provided to ocean related activities. The "backward linkages" of ocean related activities.

Opportunity Cost
: The economic values foregone as a result of the choices to consume or produce any specified good or service.

Output
: The sales of an industry.

Random Utility Model
: A technique for comparing the economic values of similar resources.

Rent
: The returns to the owner of a resource in excess of that return just sufficient to continue ownership of the resource.

Recreation Value — The value of recreational activity to the recreationist in excess of expenditures on related purchases.

Resource Stock — The physical amount of a natural resource measured at a specified point in time.

Travel Cost Models — A technique for measuring the non-market values of resources (generally those associated with recreation) using expenditures on travel as a proxy for recreational value.

Appendix II: Coastal Counties

STATE NAME	COUNTYNAME
Alabama	Baldwin
	Mobile
Alaska	Aleutians East
	Aleutians West
	Anchorage
	Bethel
	Bristol Bay
	Dillingham
	Haines
	Juneau
	Kenai Peninsula
	Ketchikan Gateway
	Kodiak Island
	Lake and Peninsula
	Matanuska-Susitna
	Nome
	North Slope
	Northwest Arctic
	Prince of Wales-Outer
	Ketchikan
	Sitka
	Skagway-Yakutat-Angoon
	Valdez-Cordova
	Wade Hampton
	Wrangell-Petersburg
California	Alameda
	Contra Costa
	Del Norte
	Humboldt
	Los Angeles
	Marin
	Mendocino
	Monterey
	Napa
	Orange
	San Diego
	San Francisco
	San Luis Obispo
	San Mateo
	Santa Barbara
	Santa Clara
	Santa Cruz
	Solano
	Sonoma
	Ventura
Connecticut	Fairfield
	Middlesex
	New Haven
	New London
Delaware	Kent
	New Castle
	Sussex
Florida	Bay
	Brevard
	Broward
	Charlotte
	Citrus
	Collier
	Dade
	Dixie
	Duval
	Escambia
	Flagler
	Franklin
	Gulf
	Hernando
	Hillsborough
	Indian River
	Jefferson
	Lee
	Levy
	Manatee
	Martin
	Monroe
	Nassau
	Okaloosa
	Palm Beach
	Pasco
	Pinellas
	Santa Rosa

	Sarasota
	Seminole
	St. Johns
	St. Lucie
	Taylor
	Volusia
	Wakulla
	Walton
Georgia	Bryan
	Camden
	Chatham
	Glynn
	Liberty
	McIntosh
Hawaii	Hawaii
	Honolulu
	Kauai
	Maui
Louisiana	Cameron
	Iberia
	Jefferson
	LaFourche
	Livingston
	Orleans
	Plaquemines
	St. Bernard
	St. Charles
	St. John the Baptist
	St. Mary
	St. Tammany
	Tangipahoa
	Terrebonne
	Vermilion
Maine	Cumberland
	Hancock
	Knox
	Lincoln
	Sagadahoc
	Waldo
	Washington
	York
Maryland	Anne Arundel
	Baltimore
	Baltimore City
	Calvert
	Caroline
	Cecil
	Charles
	Dorchester
	Harford
	Kent
	Queen Annes
	Somerset
	St. Marys
	Talbot
	Wicomico
	Worcester
Massachusetts	Barnstable
	Bristol
	Dukes
	Essex
	Nantucket
	Norfolk
	Plymouth
	Suffolk
Mississippi	Hancock
	Harrison
	Jackson
New Hampshire	Rockingham
	Strafford
New Jersey	Atlantic
	Cape May
	Cumberland
	Essex
	Hudson
	Middlesex
	Monmouth
	Ocean
	Salem
	Union
New York	Bronx
	Kings
	Nassau
	New York
	Queens
	Richmond
	Suffolk

	Westchester		Chambers
North Carolina	Beaufort		Galveston
	Bertie		Jefferson
	Brunswick		Kenedy
	Camden		Kleberg
	Carteret		Matagorda
	Chowan		Nueces
	Craven		Refugio
	Currituck		San Patricio
	Dare		Willacy
	Hyde	Virginia	Accomack
	New Hanover		Charles City
	Onslow		Chesapeake
	Pamlico		Essex
	Pasquotank		Gloucester
	Pender		Hampton
	Perquimans		Isle of Wight
	Tyrrell		James City
	Washington		King George
Oregon	Clatsop		Lancaster
	Coos		Mathews
	Curry		Middlesex
	Douglas		Newport News
	Lane		Norfolk
	Lincoln		Northampton
	Tillamook		Northumberland
Rhode Island	Bristol		Poquoson City
	Kent		Portsmouth
	Newport		Prince George
	Providence		Prince William
	Washington		Richmond
South Carolina	Beaufort		Stafford
	Charleston		Suffolk
	Colleton		Surry
	Georgetown		Virginia Beach
	Horry		Westmoreland
	Jasper		York
		Washington	Clallam
Texas	Aransas		Grays Harbor
	Brazoria		Jefferson
	Calhoun		Pacific
	Cameron		Wahkiakum

Estimating the Economic Value of the Ocean in a National Income Accounting Framework

Preliminary Estimates of Gross Product Originating for 1997

National Ocean Economics Project
Wrigley Institute for Environmental Studies
University of Southern California

Working Paper 1
July, 2000

Charles S. Colgan
Edmund S. Muskie School of Public Service
University of Southern Maine

1. Introduction.

A key part of the effort to estimate the economic value of the ocean is to develop estimates of the appropriate values of the goods and services traded in the market economy. Such estimates should include the output of industries associated with the ocean, as well as other measures of economic activity, including income generated, employment, the number of firms, etc. Providing the information that permits seeing the economy of the ocean within the context of other economic activity requires preparing estimates that are consistent with the National Income and Product Accounts (NIPA). The key component is Gross Product Originating (GPO) of each industry that uses the ocean and its resources.[1] This paper discusses the issues involved in preparing such estimates and presents some preliminary findings based on 1997 figures. Future working papers will describe refinements of this data based on more detailed data, and the extension of these estimates to the regional level and the creation of a historical data series. When complete, comparisons will be possible over time and across industries and regions.

The estimation of GPO, or value added, is the most appropriate way for measuring the economic value of the ocean in a national income framework since it avoids double counting output. Total sales cannot be used, since the sales of many industries are the purchases of other industries. Value added is the difference between total sales and the costs of material inputs. It is comprised of wages, profits, net interest, and indirect taxes. GPO is the statistic that permits the most consistent way of measuring the output of industries, and so allows comparisons among industries based on their actual size.

2. Defining Ocean Industries.

Table 1 shows the key industries which have been identified as potentially influenced by the ocean. The list of industries is derived from three sources:

The Bureau of Economic Analysis (1972) and Pontecorvo et.al (1980 and 1987). These three previous studies focused on key industries using ocean resources based on whether the industry was related by Supply (inputs) or Demand (outputs).

Luger (1992). This study of the economic value of the coastal zone divided industries into coastal-dependent, coast-linked, and coastal service industries depending on how closely tied the industry is to direct use of ocean (coastal) resources.

The Economic Census of 1997. This Census (actually a series of surveys conducted by the Bureau of the Census and the Department of Agriculture) was used as the basis for the preliminary estimates presented here. The Economic Census provided data at significantly

---

[1] A more complete discussion of the national income accounts and their relationship to ocean economic values can be found in the *Research and Work Plan* of the National Ocean Economics Project available at www.oceaneconomics.org.

greater industrial detail than was available from the other sources, and those appropriate to the ocean were selected.

Table 1 shows the industry name and several different classification schemes. The one, two,

Table 1

Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Ag-For-Fish	0				11							Living Resources	S1	CD	IND
Commercial Fishing	0	09			11	1141			3.0002		3	Living Resources	S1	CD	IND
Commercial Fishing	0	09	091		11	1141						Living Resources	S1	CD	IND
Finfish Fishing	0	09	091	0912	11	1141	114111					Living Resources	S1	CD	IND
Shellfish Fishing	0	09	091	0913	11	1141	114112					Living Resources	S1	CD	IND
Other Fishing	0	09	091	0919	11	1141	114119					Living Resources	S1	CD	IND
Fish Hatcheries	0	09	091	0921	11	1125						Living Resources	S1	CD	IND
Finfish Farming	0	02	027	0273	11	1125	112511					Living Resources	S1	CD	IND
Other Aquaculture		02	027	0273	11	1125	112519					Living Resources	S1	CD	IND
Shellfish Farming	0	09	091		11	1125	112512					Living Resources	S1	CD	IND
Mining	1				24							Minerals			
Oil & Gas	1	13	131	1311	21	2111	211111		8.0001			Minerals	S1	CS	GEO
Oil Products						2111	211111					Minerals			GEO
Natural Gas						2111	211111					Minerals			GEO
Natural Gas Liquids	1	13	132	1321	21	2111	211112					Minerals	S1		GEO
Oil & Gas Drilling	1	13	138	1381	21	2111	213111		11.0601	12.0215		Minerals	S1	CS	GEO
Oil & Gas Explore Services	1	13	138	1382	21	2131	213112		11.0602			Minerals	S1	CS	GEO
Geophysical Surveys	1	13	138	1382	54	5413	54136					Minerals	S1	CS	GEO
Other Exploration Services	1	13	138	1382	21	2131	213112					Minerals	S1	CS	GEO
Oil & Gas Services NEC	1	13	138	1382	21	2131	213112					Minerals	S1	CS	GEO
Nonmetallic Minerals	1	14	138	1382	21	2123						Minerals	S1		GEO
Crushed Limestone	1	14	142	1422	21	2123	212312		9.0004			Minerals	S1	CS	GEO
Sand & Gravel	1	14	144	1442	21	2123	212321		9.0002			Minerals	S1	CS	GEO
Construction	1											Construct & Rehab			
Industrial Nonbuilding Structure	1	16	162	1629	23	2349	23493					Construct & Rehab	S2		GEO

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Dredging	1	16	162	1629	23	2349	234990	424				Construct & Rehab			GEO
Pile Driving Contractors	1	16	162	1629	23	2349	234990	429				Construct & Rehab			GEO
Ship Painting	1	16	162	1629	23	2349	234990	575				Construct & Rehab			IND
Harbor & Port Construction	1	16	162	1629	23	2349	234990	373				Construct & Rehab			IND
Marine Construction	1	16	162	1629	23	2349	234990	374				Construct & Rehab			IND
Oilfield Construction	1	16	162	1629	23	2349	234990	385				Construct & Rehab			IND
Pipeline Construction	1	16	162	1629	23	2349	234990	353				Construct & Rehab			GEO
Manufacturing	2														
Animal Feeds	2	20	204	2048	31	3111	311111					Indirect		CD	
Animal & Marine Fats & Oils	2	20	207	2077	31	3116	311613					Living Resources		CD	GEO
Canned & Cured Seafoods	2	20	209	2091	31	3117	311711		14.0700			Living Resources		CD	IND
Fresh or Frozen Packaged Fish	2	20	209	2092	31	3117	311712					Living Resources		CD	IND
Inorganic Chemicals (Nat Gas Liquids)	2	28	281	2819	21	2111	211112					Indirect		CD	
Medicinal Chemicals & Botanical Prods	2	28	283	2833	32	3254	325411					Indirect		CD	
Surface Active Agents	2	28	284	2843	32	3256	325613					Indirect		CD	
Chemicals NEC (Paint & Coating)	2	28	289	2899	32	3255	32551					Indirect		CD	
Woven products	2	22	221	2211	31	3132	31321					Indirect		CL	
Cordage & Twine	2	22	229	2298	31	3144	314491		17.0900			Indirect		CL	
Mens & Boys Clothing NEC	2	23	232	2329	31	3152	315228					Indirect		CL	
Women & Girls Outerwear NEC	2	23	233	2339	31	3152	315239					Indirect		CL	
Children's Outerwear NEC	2	23	236	2369	31	3152	315228					Indirect		CL	
							315229								
Canvas & related products	2	23	23	2394	31	3149	314912					Indirect		CL	
Furniture & Fixtures NEC	2	25	249	2599	33	3371	337127					Indirect		CL	
Newspaper Publishing	2	27	271	2711	51	5111	511111					Indirect		CS	
Paints, Varnishes, etc.	2	28	285	2851	32	3244	32551					Indirect		CL	

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Nonferrous Wire Drawing	3	33	335	3357	33							Indirect		CL	
Other Aluminum Rolling	3	33	335	3357	33	3313	331319					Indirect			
Copper Wire Drawing	3	33	335	3357	33	3314	331422					Indirect			
Other Nonferrous Wire Drawing	3	33	335	3357	33	3314	331491					Indirect			
Fiber Optic Cable Manufacturing	3	33	335	3357	33	3359	335921					Indirect			
Other Comm & Energy Manufacturing	3	33	335	3357	33	3359	335929					Indirect			
Copper Foundaries	3	33	336	3366	33	3315	331525					Indirect		CL	
Hardware, NEC	3	34	342	3429	33							Indirect		CL	
Other Misc. Fabricated Metals Products	3	34	342	3429	33	3329	332999					Indirect			
Other Metal Container Mfg	3	34	342	3429	33	3324	332439					Indirect			
Bolt, Nut, Screw, Rivets & Washers	3	34	342	3429	33	3327	332722					Indirect			
Other Motor Vehicle Parts Mfg	3	34	342	3429	33	3363	336399					Indirect			
Other Metal Valve & Pipe Parts	3	34	342	3429	33	3329	332919					Indirect			
Showcases, Partitions, Shelves, Lockers	3	34	342	3429	33	3372	337215					Indirect			
Other Hardware	3	34	342	3429	33	3372	33721					Indirect			
Fabricated Structural Sections	3	34	344	3441	33	3323	332312					Indirect		CL	
Fabricated Plate Work	3	34	344	3443	33							Indirect		CL	
Plate Work	3	34	344	3443	33	3323	332313					Indirect			
Heavy Gauge Metal Tanks	3	34	344	3443	33	3324	33241					Indirect			
Heating Equipment (part)	3	34	344	3443	33	3334	333414					Indirect			
Prefabricated Metal Buildings	3	34	344	3448	33	3323	332311					Indirect		CL	
Iron & Steel Forgings	3	34	346	3462	33	3321	332111					Indirect		CL	
Ammunition	3	34	348	3483	33	3329	332993					Indirect		CL	
Ordinance & Accessory NEC	3	34	348	3489	33	3329	332995					Indirect		CL	
Misc Fabricated Wire	3	34	349	3496	33							Indirect		CL	

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Industrial Truck, Tractor, etc. machinery	3	34	349	3496	33	3339	333924					Indirect			
Other Fabricated Wire Products	3	34	349	3496	33	3326	332618					Indirect			
Misc Fabricated Products	3	34	349	3499	33							Indirect		CL	
Showcases, Partitions, Shelves, Lockers	3	34	349	3499	33	3372	337215					Indirect			
Motor Vehicle Seating	3	34	349	3499	33	3363	33636					Indirect			
Powder Metallurgy	3	34	349	3499	33	3321	332117					Indirect			
Other Metal Container Mfg	3	34	349	3499	33	3324	332439					Indirect			
Hardwar Mfg	3	34	349	3499	33	3325	33251					Indirect			
Other Metal Valve & Pipe Parts	3	34	349	3499	33	3329	332919					Indirect			
Other Misc. Fabricated Metals Products	3	34	349	3499	33	3329	332999					Indirect			
Internal Combustion Engines NEC	3	35	351	3519	33							Indirect		CL	
Other Motor Vehicle Parts Mfg	3	35	351	3519	33	3363	336399					Indirect			
Other Engine Equipment	3	35	351	3519	33	3361	333618					Indirect			
Construction Machinery	3	35	353	3531	33							Indirect		CL	
Railroad Rolling Stock	3	35	353	3531	33	3365	33651					Indirect			
Overhead Travelling Hoists	3	35	353	3531	33	3339	333923					Indirect			
Construction Machinery	3	35	353	3531	33	3331	33312					Indirect			
Conveyors	3	35	353	3535	33	3339	333922					Indirect		CL	
Industrial Tractors	3	35	353	3537	33							Indirect		CL	
Industrial Truck, Tractor, etc. machinery	3	35	353	3537	33	3339	333924					Indirect			
Other Misc. Fabricated Metals Products	3	35	353	3537	33	3329	332999					Indirect			
Other Metal Container Mfg	3	35	353	3537	33	3324	332439					Indirect			
Food Product Machinery	3	35	355	3556	33	3332	333294					Indirect		CL	
Pumps	3	35	356	3561	33	3399	339911					Indirect		CL	
Industrial Controls	3	36	362	3625	33	3353	335314					Indirect		CL	
Vehicular Lighting	3	36	364	3647	33	3363	336321					Indirect		CL	

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Equipment															
Radio/TV Communication Equipment	3	36	366	3663	33	3342	33422					Indirect		CL	
Ship Building & Repair	3	37	373	3731	33	3366	336611					Transportation		CL	IND
Boat Building & Repair	3	37	373	3732	33	3366	336612					Tourism & Recreation			GEO
Search and Navigation Equipment	3	38	381	3812	33	3345	334511					Transportation			IND
Sporting Goods	3	39	394	3949	33	3399	33992					Tourism & Recreation		CL	IND
Transporation	4											Transportation			
Local & Interurban Passenger Transit	4	41										Transportation		CS	
Public Warehousing	4	42										Transportation	D1	CS	
Refrigerated Warehousing	4	42	422	4222	49	4931	49312					Transportation		CS	
General Warehousing	4	42	422	4225	49	4931	49311					Transportation		CS	
Water Transportation	4	44							65.0400			Transportation	S2		GEO
Deep Sea Foreign Freight	4	44	441	4412	48	4831	483111					Transportation	S2		IND
Deep Sea Domestic Freight	4	44	442	4424	48	4831						Transportation	S2	CD	IND
Coastal & Great Lakes Freight	4	44			48	4832	483211					Transportation	S2		IND
Water Transportation Services	4	44	446									Transportation	S2	CD	GEO
Deep Sea Passenger	4	44	448	4481	48	4831	483112					Transportation	S2	CD	GEO
Coastal & Gt Lakes Passengers	4	44	448	4481	48	4831	483114					Transportation	S2	CD	GEO
Coastal & Gt Lakes Ferries	4	44	448	4482	48	4831	483114					Transportation	S2	CD	GEO
Water Passengers NEC	4	44	448	4489	48	4831						Transportation	S2	CD	GEO
Scenic & Sightseeing	4	44	448		48	4872	48721					Transportation	S2	CD	GEO
Water Taxis	4	44	448		48	4832	483212					Transportation	S2	CD	GEO
Marine Cargo Handling	4	44	449		48							Transportation	S2	CD	IND
Dock & Pier Operations	4	44	449	4491	48	4883	48831					Transportation	S2	CD	GEO
Other Cargo Handling	4	44	449	4491	48	4883	48832					Transportation	S2	CD	GEO
Tow & Tugboat Services	4	44	449	4492	48	4888	48883					Transportation	S2	CD	IND
Marinas	4	44	449	4493	71	7139	71393					Transportation	S2	CD	GEO
Water & Transport Services NEC	4	44	449	4499								Transportation	S2	CD	GEO

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Air, Rail, and Boat Rentals	4	44	449		53		532411					Transportation	S2	CD	GEO
Port & Harbor Operations	4	44	449		48	4883	48831					Transportation	S2	CD	GEO
Navigational Services to Shipping	4	44	449		48	4833	48333					Transportation	S2	CD	IND
Other Services to Water Transport	4	44	449		48	4833	48339		65.0600			Transportation	S2	CD	GEO
Crude Petroleum Pipelines	4	46	461	4612	48	4861	48611					Transportation			GEO
Transportation Services	4	47										Transportation		CS	GEO
Natural Gas Pipelines	4	49	492	4922	48	4832	48321					Transportation			GEO
Communication	4	48										Indirect		CS	
Communication Services NEC	4	48	489	4899								Indirect	S2		
Ship to Shore Communications	4	48	489	4899	51	5133	51339					Indirect	S2		
Electric, Gas, Sanitary Services	4	49										Indirect		CS	
Trade	5											Indirect			
Wholesale-Durables	5	50										Indirect		CS	
Wholesale-Nondurables	5	51										Indirect		CS	
Building Materials Stores	5	52	521	5211	44	4441						Indirect	D2	CS	
Home Centers	5	52	521	5211	44	4441	44111					Indirect			
Other Building Materials	5	52	521	5211	44	4441	44119					Indirect			
Department Stores	5	53	531	5311	45	452	455211					Indirect	D2	CS	
Other Gen. Merchandise Stores							45299					Indirect			
Food Stores	5	54			44							Indirect	D2	CS	
Meat & Fish Markets	5	54	542	5421	44							Indirect	D2		
Seafood Markets	5	54			44	4452	44522					Living Resources	D2		IND
Auto Dealers	5	55			44							Indirect	D2	CS	
Boat Dealers	5	55	555	5551	44	4412	441222					Tourism & Recreation	D2		GEO
Apparel and Accessory Stores	5	56			44	4481						Indirect	D2	CS	
Furniture Stores	5	57			44	4422	44221					Indirect	D2	CS	
Eating & Drinking Places	5	58	581	5812	72	722						Tourism &	D2	CS	GEO

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
												Recreation			
Misc Retail	5	59			45							Indirect	D2	CS	
FIRE												Indirect			
Depository Institutions	6	60			52	5221						Indirect		CS	
Nondepository Instititions	6	61			52	5222						Indirect			
Security & Commodity Brokers	6	62			52	5231						Indirect		CS	
Fire, Marine & Casualty Insurance	6	63	633	6331	52	5241	524126					Indirect	D2	CS	
Insurance Agents	6	64			52	524						Indirect		CS	
Real Estate	6	65			53	531						Indirect	D2	CS	
Services	7														
Hotels & Lodging Places	7	70	701	7011	72	7211			72.0101			Tourism & Recreation	D2	CS	GEO
Receational Vehicle Parks & Campsites	7	70	703	7033	72	7212						Tourism & Recreation	D2	CS	GEO
Personal Services	7	72										Indirect		CS	
Business Services	7	73										Indirect		CS	
Automotive Repair	7	75										Indirect		CS	
Motion Picture Theaters	7	78	783									Indirect	D2	CS	
Misc Amusement & Recreation Services	7	79	799									Indirect	D2	CD	
Recreation Goods Rental					53	5322	532292					Tourism & Recreation	D2		GEO
Health Services	8	80										Indirect		CS	
Legal Services	8	81										Indirect		CS	
Colleges & Universities	8	82	822		61	6113	61131					Research	S2		IND
Social Services	8	83										Indirect		CS	
Membership Organizations	8	86	862				81392					Indirect	D1	CS	
Civic, Social & Fraternal Organizations	8	86	864				81341					Indirect	D1	CS	
Museums, Zoos, etc	8	84										Tourism & Recreation	D1	CS	GEO
Zoos, Aquaria	8	84	842	8422	71	7121						Tourism & Recreation	D1	CS	GEO
Architecture & Engineering Services	8	89	891									Indirect	D1		

Table 1

Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Noncommercial Educ, Scien, Institutions	8	89	892									Research	D1		IND
Govt & Govt Enterprises	9											Government			IND
Federal Government												Government			IND
State Governments												Government			IND
Local Governments												Government			IND

three and four digit Standard Industrial Classification (SIC)[2] codes are shown. This taxonomy of industries is being replaced by the North American Industrial Classification System (NAICS), a complete revision of the industrial classification which was necessitated both by a number of changes in the economy and the need to develop a common classification system for the United States, Canada and Mexico in order to implement the North American Free Trade Agreement. NAICS codes are six-digit codes. Many are consistent with the SIC, but many SIC classes have been subdivided in the NAICS.

Thus many entries in Table 1 have both SIC and NAICS codes, while others are coded in only one system or the other. These cases are generally those in which the NAICS provides additional detail over the SIC; in these cases, the NAICS coded industries may still be summed to equal SIC coded industry at the three-digit level or lower. In addition to the SIC and NAICS codes, the classification codes from the Bureau of Economic Analysis Benchmark Input/Output Tables are shown. These codes show the appropriate industry and/or product codes for each case.

Five other classifications are shown for use in this project:

! EC 97. The Economic Census uses an additional level of industrial detail for certain industries, particularly the construction sector. These codes designate the type of construction projects within the industries.

! The NOEP code shows the industry group developed for the National Ocean Economics Project.

! The BEA Code shows whether the industry was specifically included in the 1972 BEA study, and whether the industry was connected to the ocean by Supply (S) or Demand (D). Supply-related industries were subdivided into those which rely on extracting ocean resources (S1) or which depend on physical contact with the ocean (S2). Demand-related industries were those divided into those which were complements of the ocean (D1) or which were related by geographic proximity (D2).

! The Coastal Economy codes derived from Luger show whether an industry is coastal dependent (CD), coast-linked (CL), or coastal service (CS).

! The Estimation Type indicates whether the principal estimation of the values can be done using industry data alone (IND) or whether the industry data must be disaggregated by geography in order to identify those components associated with the ocean (GEO). These categories are discussed further in the next section.

3. Approaches to Estimating Gross Product Originating.

---

[2] The 1987 version of the SIC was used.

Estimation of GPO with respect to the ocean requires a shift in perspective from the normal way in which economic activity is measured. Rather than organizing the data by what is produced, as the SIC and NAICS do, this project requires organizing the data according to one input. In some cases, that input is directly tied to the output (e.g. commercial fisheries). In these cases, the ocean sector is coincident with the industry sector. In other cases, the ocean is a more indirect input and a sector's ties to the ocean is purely a function of geography. Examples include tourism and oil and gas production. These different approaches to estimation are indicated in the EST TYPE column in table 1.

The ability to estimate GPO for an ocean-defined sector depends on the level of detail in the definition of the industry. In a few cases this can be done at a relatively aggregate level (fisheries) In some other cases, this requires data at the four digit (SIC) or six digit (NAICS) level. (.e.g. dredging contractors). In many cases, even this level of classification is insufficient. (canvas products includes both marine and nonmarine products).

For a geography-defined sector, the problem is to get to the level of geography nearest the ocean. Ideally, this is done by using data at the municipal level or even below the municipal level. Two barriers prevent the use of such data in many cases. One is that most economic data series are not available below the county or Metropolitan Statistical Area level. The other is that strict rules regarding the disclosure of data that could identify a single firm prohibit publishing data at a level of industrial and geographic detail sufficient to meaningfully identify the ocean sectors in many cases.

A third level of problems exists for many industries. Ocean-related economic activity may be only a portion of the sales of a given firm or industry. For example, hotels, particularly in metropolitan areas like Los Angeles, may provide services to tourists who go to the beach, to museums, the Dodgers, or to Disneyland.. Thus the ocean component of the output of the hotel industry cannot be determined by either industry or geographic characteristics alone, but must be examined through the characteristics of the customers. A similar problem exists for the construction industry, since many firms that specialize in heavy construction may do both ocean and non ocean-related work.

In such cases, it is possible to distinguish between a *coastal* component and an *ocean* component to economic activity. Thus, through geographic disaggregation, it is possible to identify a coastal component to the industry which is related solely to the geographic location of the industry. However, additional detail is needed to identify the *ocean* component of economic activity. Again using hotels as an example, if the patterns of tourist behavior are known, for example through visitor surveys, then it may be possible to separate the proportion of time spent at the beach v. going to Disneyland and thus more realistically reflect the actual ocean-related economic activity of the hotel industry.

These three different issues give rise to what may be termed three types of estimates based on the type of data used.

Type 1 estimates are those which can be made using publicly available data only. Such estimates are generally confined to those sectors whose connection to the ocean is clear enough that the industry definition alone is sufficient.

Type 2 estimates are those which can be made using public data sets, but which require use of those data sets at a level of detail that is not normally available to the public. Data such as the individual firm records contained in the Economic Census need to be examined in order to get to the level of industrial or geographic detail sufficient to identify the ocean (or coastal) components.

Type 3 estimates are those which require information outside of the usual public economic data series in order to prepare meaningful estimates.

In addition to the *data* type, there is also the issue of the *estimation technique*. Three different approaches to estimation can be identified at this point:

First order estimates of economic activity are those that come directly from the public data sets. In the estimations of GPO contained in this paper, some data such as that for fisheries, are directly published in the Census of Agriculture and are included here. Employment data for most industries can be directly measured from the data sources associated with the type of data used.

Second order estimates are those which must be estimated from data at a high level of detail (for example four digit (SIC) or six digit (NAICS) using data from a lower level of detail (two or four digit industrial data). Most of the estimates below use this approach, which estimates the GPO in a given detailed sector as a function of the national GPO estimates for the two-digit SIC code industry. See below for more detail.

Third order estimates use original primary source data to build from the "bottom up" rather than the "top down". For those industries which use Type 2 data (public data, not publicly available) it is possible to construct estimates of value added (gross product originating) by using the wage and salary data reported in the original source records and then adding in the components (taxes, interest, profits) in the same manner as the Census Bureau and BEA do for the more aggregate publicly available data.

The combination of data types and estimation orders can be summarized in Table 2:

Table 2					
Data Type	Estimation Order				
		First	Second	Third	
	Type 1				

A004075

	Type 2			
	Type 3			

The estimates in this paper all use Type 1 data and are first or second order estimates. As will be seen, in order to fully measure the economic value of the ocean in a NIPA framework, it will be necessary to use all three types of data and all three approaches to estimation.

4. Preliminary Estimates of Gross Product Originating for 1997

Table 3 presents estimates of GPO for several industries based on the 1997 Economic Census and on estimates of GPO released by two-digit industries for the U.S. by the BEA for the period 1969-1998 by BEA. These estimates are derived using several different approaches:

Estimates for the domestic harvest of fisheries and for the retail value of fisheries are first order estimates, taken directly from the Census of Agriculture.

Two approaches to estimating GPO are used for other sectors. Estimate 1 (see Equation 1) uses the ratio of payroll to GPO at the two digit SIC level from the BEA data to estimate GPO from the payroll data reported in the Economic Census. Estimate 2 (see Equation 2) disaggregates the GPO reported by BEA to the ocean sector by the proportion of total payroll in that sector.

$$GPO_i = \left(\frac{GPO_s}{PAY_s}\right) PAY_i \quad \textbf{(1)}$$

$$GPO_i = GPO_s\left(\frac{PAY_i}{PAY_s}\right) \quad \textbf{(2)}$$

Where:

GPO_i = Gross Product Originating from Industry i as defined in Table 3 from the Economic Census.

GPO_s = Gross Product Originating from the broader sector as defined by BEA.[3].

PAY_i =Wages and Salaries in industry i. from the Economic Census.

[3] Note that the terminology used here is somewhat arbitrary. The "industry" in this case is the ocean-related industry, which is defined at a rather high level of detail. The "sector" is actually the two-digit industry for which BEA reports the GPO data. Since the BEA data is for a broader group of industries, the term "sector" is used to avoid confusion.

PAY_s=Wages and Salaries in industry i. from BEA.

These are all second order estimates using Type 1 data.

Certain other adjustments are also required. The "ocean share" for most industries is assumed to be 100%, but in some cases an ocean share must be estimated. For those industries whose ocean share is dependent on geography, the Economic Census data geographic series was used to extract the data for the coastal counties.[4]. These are designated as CC in table 3. For the oil and gas sector, the ocean share was estimated by using production statistics for the offshore from the Minerals Management Service and total production statistics for the U.S. from the Energy Information Administration to compute an ocean share. Note that this method excludes production outside of the federal waters and so is somewhat low. This share of production was also applied to the oil and gas service industries for preliminary estimation purposes. However, oil and gas service activity in any given year is probably not directly proportional to production activities.

Two broad sectors defined for the National Ocean Economics Project are excluded from Table 3. One is the government sector. A separate paper covering government expenditures on the ocean are under development. The scientific research sector is also excluded because the Economic Census data does provide sufficient detail to distinguish the marine research sector from other types of research institutions.

[4] See the NOEP Research Plan for a definition of the coastal counties used in the study.

Table 3

Preliminary Estimates of Ocean Gross Product Originating: 1997

Billions of dollars

NOEP Sector	NAICS	SIC 87	INDUSTRY	GPO EST1	GPO EST 2	Ocean %	PAY EC97	PAY/GPO 97	SHARE PAY
Constr	234120	16	Bridge & Tunnels-marine	$2.46	$2.46	100%	$1,629.194	1.51	0.717%
Constr	234990	16	All other heavy constr-marine	$0.60	$0.60	100%	$397.125	1.51	0.175%
Constr	234990	16	Dredging	$0.45	$0.45	100%	$300.020	1.51	0.132%
TOTAL CONSTRUCTION				**$3.51**	**$3.51**				
Living Res	311711	20	Canned & Cured Seafood	$0.23	$0.23	100%	$121.835	1.88	0.192%
Living Res	311712	20	Fresh & Frozen Seafood	$1.47	$1.46	100%	$780.770	1.88	1.228%
Living Res	1141	09	Domestic Harvest*	$1.94		100%			
Living Res			Retail Trade- Fisheries*	$17.27		100%			
TOTAL LIVING RESOURCES				**$20.91**					
Minerals	211111	13	Oil & gas production	$4.29	$4.29	20%	4968.722	4.31	4.6%
Minerals	211112	13	Natural Gas Liquids	$0.47	$0.47	20%	541.593	4.31	0.5%
Minerals	213111	13	Oil & Gas Drilling	$1.65	$1.65	20%	1918.086	4.31	1.8%
Minerals	213112	13	Other Exploration Services	$3.13	$3.13	20%	3628.416	4.31	3.4%
TOTAL MINERALS				**$9.54**	**$9.54**				
Tourism & Rec	7211	70	Accomod (exc Casinos) Coastal	$21.51	$21.54	CC	$12,291.063	1.75	30.51%
Tourism & Rec	7121	86	Zoos and Nature Parks-Coastal	$0.78	$0.78	CC	$478.508	1.62	1.20%
Tourism & Rec	336612	37	Boat Building	$1.17	$1.17	100%	$1,025.531	1.14	2.096%
Tourism & Rec	811490	37	Boat Repair-Coastal	$0.04	$0.04	CC	$33.351	1.14	0.068%
Tourism	441222	55	Boat Dealers	$0.56	$0.56	CC	321.276	1.75	0.08%

Table 3
Preliminary Estimates of Ocean Gross Product Originating: 1997

Billions of dollars

NOEP Sector	NAICS	SIC 87	INDUSTRY	GPO EST1	GPO EST 2	Ocean %	PAY EC97	PAY/GPO 97	SHARE PAY
& Rec									
TOTAL TOURISM & RECREATION				**$24.05**	**$24.08**				
Transp	235210	16	Ship Painting	$0.09	$0.09	100%	$61.573	1.51	0.027%
Transp	483112	44	Passenger	$0.60	$0.60	100%	$380.310	1.59	4.550%
Transp	483111	44	Freight	$1.34	$1.34	100%	$841.598	1.59	10.069%
Transp	334511	38	Search & Navigation Equip	$10.36	$10.34	100%	$9,422.203	1.10	19.120%
Transp	336611	37	Ship Building	$3.81	$3.79	100%	$3,338.358	1.14	6.823%
Transp	4861	48	Pipeline Transport of Crude Oil	$0.16	$0.16	20%	479.51	1.67	2.97%
Transp	4862	48	Pipeline Transport of Nat. Gas	$0.67	$0.67	21.5%	1870.95	1.67	11.59%
Tra nsp	4872	48	Water Scenic Trips	$0.47	$0.47	100%	282.848	1.67	1.75%
Transp	48831	48	Port & Harbor Operations	$0.40	$0.40	100%	237.681	1.67	1.47%
Transp	48832	48	Marine Cargo Handling	$3.23	$3.23	100%	1941.364	1.67	12.03%
Transp	48833	48	Navigational Services	$0.63	$0.63	100%	376.739	1.67	2.33%
Transp	48839	48	Other Support Activities	$0.35	$0.35	100%	207.487	1.67	1.29%
TOTAL TRANSPORTATION				**$22.11**	**$22.07**				
TOTAL				**$80.13**	**$80.12**				

* Estimates derived directly from the Census of Agriculture

There are a number of observations which may be made from the data in Table 3, most of which point to the directions for future research which will permit further refinement of the estimates.

1. There is little difference between Estimation technique 1 and technique 2. The major difference is in ship building, and this needs to be further examined. Since U.S. ship building is done primarily for the Navy, there is a need to compare estimates based on GPO with procurement data from the federal budget.

2. The largest single industry estimate is for accommodation (except casinos). This was a purely coastal (geographic) estimate and so includes a large proportion of non-ocean related uses. This is the classic example where Type 3 data is needed to prepare appropriate recommendations. The tourism and recreation sector excludes eating and drinking places. Since these serve both local and tourist populations, it was determined that it would be best to await additional data rather than relying only on geographic data.

4. The largest single industry in the data is search and navigation equipment. This sector has a very large payroll because of the skilled workers needed to produce the electronic equipment and software used in this sector. Wages and salaries are also the principal input to production of these goods.

5. The minerals estimates exclude the value of offshore production in the state waters of Texas, Louisiana, and Alaska. The oil and gas service industry estimates must be matched to actual levels of activity. The implication of the state waters exclusion is that the estimates for production are too low. The implication of the other adjustment is unknown.

6. Both the passenger and freight transportation data is comprised of both ocean and Great Lakes data. The Great Lakes data needs to be extracted to estimate the ocean data.

5. Future Research

The NOEP is currently attempting to develop more refined estimates for the recreational boating sector in Maine, and will soon begin to examine the minerals sector nationwide and in the principal offshore oil and gas producing states. Proposals to estimate the value of the transportation sector nationwide and in Rhode Island are currently under consideration, along with a proposal to examine the tourism and recreation sector in California. Pending additional funding, the Project will develop further refinements for all relevant sectors and industries. Much of the effort in these studies will be devoted to developing the data sets needed for type 3 data. These include tourism and recreation estimates by visitor days, oil and gas industry data, and transportation data.

There are three additional steps needed to complete the estimation of the national income account for the ocean. These will be the subject of future NOEP Working Papers.

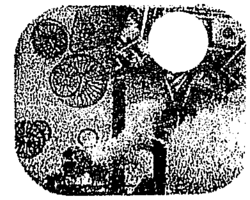
1. Estimation of regional-data. This will be done at the state level for all coastal states and

at the county level where disclosure rules permit.

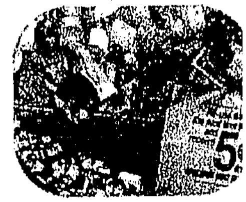
2. Historical estimates. The GPO series for 1997 shown here can be extended back to 1972 using the recently released GPO data. This will probably be done only for the Economic Census years in order to take advantage of the detailed data available in these years.

3. Development of Type 2 data from the Economic Census and BEA to refine the estimates presented here.

EPA-240-R-01-001
January 2001

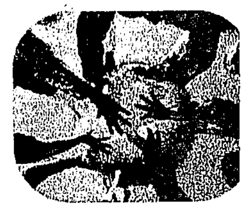


Pollution Charges, Fees, Taxes

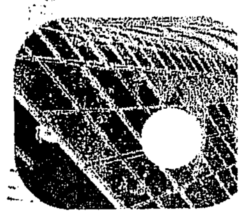


Deposit-Refund Systems

The United States Experience with Economic Incentives for Protecting the Environment



Trading Programs



Subsidies for Pollution Contr

Liability Approaches

Information Disclosure

Voluntary ns

NCEE
NATIONAL CENTER FOR ENVIRONMENTAL ECONOMICS

Office of Policy, Economics, and Innovation
Office of the Administrator
U.S. Environmental Protection Agency
Washington, DC 20460

United States
Environmental Protection
Agency

Office of the
Administrator

EPA-240-R-01-001
January 2001

EPA

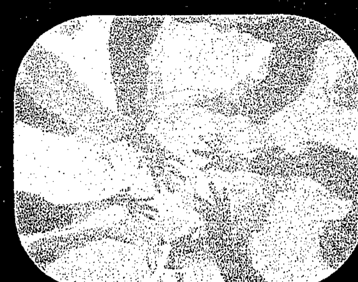
The United States Experience with Economic Incentives for Protecting the Environment

Pollution Charges, Fees, Taxes

Voluntary Programs

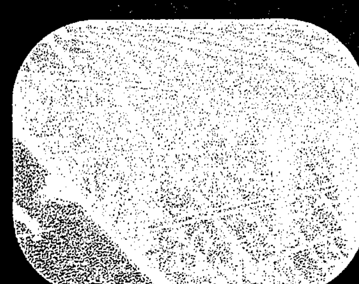
Deposit-Refund Systems

Information Disclosure



Trading Systems

Liability Approaches



Subsidies for Pollution Control

This page intentionally left blank

EXECUTIVE SUMMARY

I. Purpose of This Report

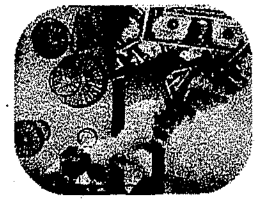
Over its 30-year history the predominant tool used by the U.S. Environmental Protection Agency (EPA) to help achieve the nation's environmental goals has been uniform, nationally applicable regulations derived from environmental law. Those regulations, e.g., source-specific emissions limits, product specifications, and pollution-control guidelines, have been responsible for much of the improvement in air and water quality that is evident in the country today.

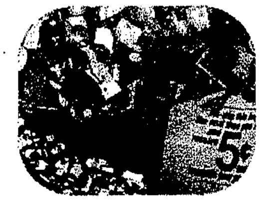
But over the past 20 years, and during the past decade in particular, EPA has begun to use a much broader array of tools to manage environmental quality. Among these relatively new tools, several kinds of economic incentives are being applied more and more widely. Once considered an academic abstraction or a revenue-raising adjunct to traditional regulatory mechanisms, market-based economic incentives are being used now as the principal instrument for controlling a growing number of environmental problems. To varying degrees, federal, state, and local governments are promoting the use of economic incentives as an environmental management tool because of the perceived advantages and effectiveness of these incentives.

Because of the wide—and growing—use of economic incentives at all levels of government in the United States, it is important to understand them more clearly. For example, what kinds of economic incentives are being used today to address what kinds of problems? Are particular incentives better suited for use at specific levels of government? Even more important are questions regarding relative effectiveness. How well have economic incentives performed in terms of improving environmental quality? How economically efficient and cost-effective have they been? To what extent have they stimulated technological change and innovation? How can past experience with economic incentives help improve their use today and in the future?

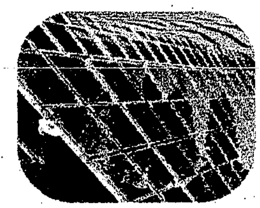
This report attempts to answer those questions by providing a broad overview and analysis of the current use of economic incentives as an environmental management tool in the United States. To that end, it makes use of, and builds on, related reports, surveys, and research. This report expands and updates the information contained in an earlier EPA report (1992) and a report to EPA in 1997 that documented the growing use of economic incentives in the United States and foreign countries. It also notes related research by the National Academy of Public Administration (NAPA).

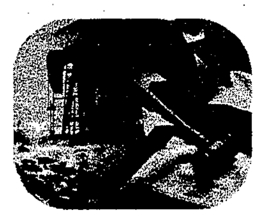
At the same time, this report is not exhaustive. It does attempt to identify most of the incentives currently in use at the federal level for environmental pollution control. However, it limits its discussion of incentives at other levels of government to a representative sample of programs. A complete survey and assessment of the large number of incentives currently in use at the state and local levels would require a much broader study than this report. Likewise, the report only briefly summarizes a voluminous theoretical and applied literature on economic incentives.


Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

II. Definition of Economic Incentives

For the purposes of this report, economic incentives are defined broadly as instruments that use financial means to motivate polluters to reduce the health and environmental risks posed by their facilities, processes, or products. These incentives provide monetary and near-monetary rewards for polluting less and impose costs of various types for polluting more, thus supplying the necessary motivation to polluters. This approach provides an opportunity to address sources of pollution that are not easily controlled with traditional forms of regulation as well as providing a reason for polluters to improve upon existing regulatory requirements. Under traditional regulatory approaches, polluters have little or no incentive to cut emissions further or to make their products less harmful once they have satisfied the regulatory requirements.

The definition of economic incentives used here is quite broad. As such, a great many instruments and programs could be included in this review. By necessity the report focuses on the most significant federal programs and a representative sampling of activities at the state and local level.

III. Value of Economic Incentives

Economic incentives have a singular advantage over traditional forms of regulation: they harness the force of the marketplace to reduce environmental and health risks. While this feature does not make economic incentives applicable to every source of pollution, market forces often can operate where traditional regulations would be ineffective. Sources of pollution include point sources such as discharge pipes and stacks; area sources such as factories and storage areas; and non-point sources such as streets, farms, and forests. In a traditional regulatory system, owners of many of these sources have an incentive to comply—i.e., avoidance of enforcement actions—but *releasing* pollution has no economic cost to the owner. Consequently, owners of these sources of pollution (hereafter referred to as "sources") normally have no incentive to do more than the regulations require, whether it is a limit on emissions or on the use of a specific technology.

With market incentives, sources of pollution can see an economic value in reducing pollution because doing so saves them money. Consequently, the difference between a traditional regulatory system and economic incentives can lead to several public health, environmental, and economic benefits.

First, economic incentives in some circumstances can be structured to achieve larger reductions in pollution than would result from traditional regulations. For example, a program that allows trading of pollution reduction obligations among sources may be able to require greater reductions in pollution than a similar program that does not use trading. Pollution charges or voluntary pollution prevention programs could encourage sources to reduce emissions below permitted amounts.

Second, economic incentives often can control pollution at lower costs than can traditional regulations. By setting standardized emissions, product, or technology requirements, traditional regulations do not usually take into consideration the different costs of compliance faced by different sources. But in an incentive system, the marginal costs of controlling pollution play an essential role. When emission allowances or credits can be bought and sold by the sources, the sources that have relatively low costs of pollution control will reduce more pollution than sources that have relatively high costs of pollution control. Thus, when economic incentives are used, goals of reducing pollution—whether applied over a facility, an industry, or the nation as a whole—will be achieved at the lowest cost as determined by market forces. One study done for the EPA (Anderson. 1999) estimated that the potential savings from widespread use of economic incentives at the federal, state, and local level could be almost one-fourth of the approximately $200 billion per year currently spent on environment pollution control in the United States.

Third, the use of economic incentives, in contrast to that of traditional regulations, can control the pollution that is caused by a multitude of small and dispersed sources. A traditional regulatory system, which relies on reporting, inspections, and fines for noncompliance, becomes very cumbersome and expensive to administer when applied to thousands, or even millions, of sources. For many serious environmental concerns today, such as surface water quality and global warming, the sources of the problem can indeed number in the millions. Deposits on lead-acid batteries and variable charges for solid waste disposal are two good examples of how economic incentives can more effectively manage the quantity of pollution that is released from large numbers of small and dispersed sources.

Fourth, economic incentives can stimulate technological improvements and innovations in pollution control in situations where traditional regulatory mechanisms may not. In some cases, traditional regulatory mechanisms can stimulate technological change. For example, challenging numerical performance standards have prompted the development of cleaner technologies (e.g., catalytic converters). Also, when regulations require the use of the best available control technology (BACT), manufacturers of pollution control equipment have an incentive to improve the performance of the products they offer for sale. But traditional regulations that specify the approved pollution control technologies discourage sources from developing better pollution control technologies. Not only is there uncertainty that an improved pollution control technology would be approved, but greater pollution control normally is costly. What source would want to engage in greater control of pollution than is required by existing regulations? Economic incentives, on the other hand, attach a value to controlling pollution. In some cases the value is an explicit monetary amount, while in other cases the financial impact is indirect. Therefore, sources have an incentive to develop technologies that are more effective or less costly, particularly when pollution reduction obligations can be traded among sources like any other commodity in the marketplace.

Clearly, economic incentives have several advantages that make them attractive environmental management tools. When properly designed and used in appropriate circumstances, they can achieve environmental results beyond those of traditional regulations, they can achieve those results at lower costs, they often can do a better job of controlling large numbers of small sources, and they provide a valuable spur to technological innovation.

However, just as economic incentives have advantages, they also have limitations. One of the most significant disadvantages is that they are often inappropriate for dealing with environmental issues that revolve around equity concerns. Many types of environmental standards are designed to protect individuals around the site of a polluting facility; in some cases the specific purpose is to protect individuals exposed to the highest pollutant concentrations. In general, people are not willing to accept higher risks to their health because it is "more economical" to reduce risks to others. There are many such environmental and health standards, including toxicity standards for air, waste management standards, and cleanup standards. For example, risks cannot be traded between Superfund sites. To do so would mean that some people would live near an unsafe site that doesn't meet federal standards because other people would live near another site that is twice as safe as required by federal standards.

IV. Types of Economic Incentives

This report examines several types of economic incentives that are currently in use in the United States at all levels of government, and it assesses their advantages and disadvantages. Although all these incentives give sources of pollution an impetus to minimize their emissions, the incentives take widely differing forms. In fact, the variety of economic incentives in use today is one of the most remarkable developments in environmental management over the past decade.

1. Fees, Charges, and Taxes

From the perspective of sources that are subject to environmental fees, charges, and taxes, these three terms are largely interchangeable in terms of their effects. They all require that the generator of a designated type of pollution pay a fee (or charge or tax) for each unit of pollution. These fees make attractive tools for managing the environment because they attach an explicit cost to polluting activities and because sources can easily quantify their savings if they reduce the amount of pollution they emit. One disadvantage is that fees do not guarantee the amount by which a source would reduce pollution.

Pollution-related fees, charges, and taxes are widely collected at all levels of government, and they are one of the most prevalent economic incentives in use today. For example, fees linked to air emissions are imposed in California, Texas, and several other states, while permit fees for water effluent discharge are based on the volume and toxicity of the discharge in Washington, New Jersey, and Wisconsin, among others. Per-bag fees on households that dispose of solid waste are in effect in more than 3,000 communities across the country. Fees that are tied to resources such as the use of grazing lands, water, and sewage systems are widely levied in the United States.

Similarly, environmental taxes are usually imposed on landfill operations and the disposal of hazardous wastes. Product charges are sometimes levied on products—e.g., chlorofluorocarbons, low-efficiency automobiles, fertilizer, motor oil, and packaging—that are believed to have harmful effects on the environment. Other fees are being charged on activities that are potentially damaging to the environment, for example, wetlands development and storm water runoff.

Although fees can generate substantial revenues for the government agency that imposes them, they tend to be set at rates too low to have a significant impact on pollution. Generally speaking, if pollution fees or taxes were set at rates equal to the incremental damage being caused by the pollution, or at a level that would force changes in business or personal behavior, they would be controversial. Concerns about the competitiveness of U.S. businesses would be raised if foreign companies were not subject to similar fees. Consequently, the rates of most of these environmental fees and taxes are not set high enough to achieve U.S. environmental goals, although in some specific cases fees and taxes are working well as a mechanism for controlling pollution.

2. Deposit-Refund Systems

Deposit-refund systems require a monetary deposit at the time of sale of a product. The deposit is returned when the item is returned at the end of its useful life. In the United States, deposit-refund systems have been applied most widely to help control the disposal of lead-acid batteries, but they also are being applied in some states to products such as aluminum and glass cans, pesticide containers, and tires. When used products are valuable, as is currently the case for lead-acid batteries, the private sector often creates and manages a disposal system. Regardless of who manages the disposal of such products, the fees charged by this system help subsidize the return of recyclable products.

Deposit-refund systems appear to be most appropriate for discrete, solid commodities such as beverage containers, batteries, and car bodies that would cause environmental harm through their improper disposal. Government-mandated deposit systems for less discrete substances, like air and water pollutants, have not been attempted. One factor that limits the widespread use of deposit-refund systems is their high transaction cost. Collecting and refunding deposits on the sale of individual products such as beverage containers tends to be expensive, and additional costs are involved in collecting and returning used products for disposal.

3. Marketable Permits

There are two distinct types of trading systems: cap-and-trade systems and credit systems. Cap-and-trade systems seek a specific environmental result; trading allowances to release pollution is simply an option to minimize the cost of achieving the emission reductions specified in the regulatory cap on emissions. In the cap-and-trade approach, allowances for future emissions are sold or granted to existing sources. Uncapped credit systems, on the other hand, do not establish any fixed ceiling on total emissions. Total emissions can increase if new sources of pollution enter the market and as existing sources increase production. In uncapped systems, credits are earned for controlling pollution beyond a baseline specified in one's permit. Distinctions between cap-and-trade and credit systems are discussed in much more detail in chapter 6.Two well-known examples of cap-and-trade systems are EPA's Acid Rain Trading Program and Southern California's RECLAIM. A wide variety of other federal, state and local programs feature some form of emission or effluent trading. For example, some of the high-mountain communities in Colorado require permits to use wood-burning appliances. Existing homeowners are given permits reflecting historic use but those who wish to install a new wood stove in a home are required to retire two existing permits, a rule that helps reduce air pollution. Certain classes of heavy-duty engines are subject to emissions averaging to meet an average performance standard, which is just the trading of pollution control obligations within a company, as well as emissions trading between companies. The rights to burn dry grass are subject to trading in Spokane County, Washington, and land development rights are traded in a few jurisdictions in Maryland, New Jersey, and Florida. In some areas, wetland mitigation credits can be created, banked, and sold to offset the adverse effects of development.

Trading programs have certain features that have made them increasingly popular in the United States. In a trading program, capital moves between companies involved in trades, and innovative, entrepreneurial companies can profit from low-cost reductions in emissions. In addition, cap-and-trade programs can provide great certainty about the magnitude of environmental improvement that will be achieved.

At the same time, trading programs may have several drawbacks, including the potential for high transaction costs and inactive markets, especially in credit or open-market systems. High costs can be attributed to the need to verify each reduction before authorizing the credit. Clearly, trading programs should not be applied to all environmental problems. The long-term effects of trading programs on technical innovation vary from program to program. Some have spurred considerable innovation, such as the acid rain program, while others have not due to high transaction costs.

4. Subsidies

Subsidies to support reductions in pollution take many forms. Among the many subsidies that are used at all levels of government to help manage environmental pollution are grants, low-interest loans, favorable tax treatment, and preferential procurement policies for products believed to pose relatively low environmental risks. Subsidies are used to support private-sector pollution prevention and control activities, the cleanup of contaminated industrial sites, farming and land preservation, consumer product waste management, alternative automobile fuels, clean-running cars, and municipal wastewater treatment.

Subsidies for environmental management are sometimes criticized because the government entity providing the subsidy—and the taxpayer, ultimately—is helping to bear the costs that should be the responsibility of the polluter. Other environmentally related subsidies, such as federal support for timber harvesting in the national forests, are also criticized because they in fact have proven harmful to the environment. Nonetheless, subsidies have become a fairly common tool to manage the environment at every level of government.

5. Liability

Being held legally responsible for health or environmental damages is a potent incentive for sources to reduce or avoid pollution, since if found liable they can face extraordinarily large and unpredictable damage claims. The Clean Water Act, for example, requires the cleanup of oil and petroleum products spilled into the nation's waters, while the Superfund Act and the Oil Pollution Act impose liability for environmental damages caused by the release of hazardous substances and oil, respectively. Since 1990, awards and settlements for damages to natural resources under these and related state statutes total more than $700 million, with a number of cases that involve large sums still in varying stages of litigation. Liabilities associated with the cost of cleanup at Superfund sites total billions of dollars.

With potential costs of this magnitude, sources have a powerful incentive to minimize their legal exposure. Consequently, expensive technologies that control pollution or aggressive environmental management systems can seem very reasonable to sources. While liability has prodded sources to take significant actions to reduce pollution, such as managing hazardous wastes on site, it is sometimes difficult to quantify the environmental results of those actions or to establish a causal link between concerns over liability and reductions in pollution.

6. Information Disclosure

The collection and public availability of information on environmental performance has proven to be a strong incentive for sources to reduce their emissions of pollution. The incentive derives from a number of factors. For example, when companies collect emissions information, they learn about the nature and magnitude of their emissions. When such information is made easily accessible to the public, workers and local communities have a much better idea of the environmental risks they face, so they are more prone to support or demand actions to reduce emissions. When a source's emissions are shown to decline over time, the source often reaps the benefits of better relationships with its employees and with the local community. Finally, in some cases a proven, long-term record of environmental stewardship makes a company's products more desirable to consumers.

The disclosure of environmental performance information is much more common today than a decade ago. Although some information is disclosed voluntarily, other information must be released to the public as required by statute. The two best-known laws mandating the public disclosure of environmental information are the Toxics Release Inventory provisions of the federal Community Right-to-Know Act and California's Proposition 65. Other forms of information reporting include environmental impact assessments, product labeling, environmental performance awards, Securities and Exchange Commission (SEC) environmental reporting requirements, and disclosure requirements for lead paint and radon when homes are sold.

Information disclosure has been a powerful tool for reducing pollution. Over the past decade, the Toxics Release Inventory, for example, shows that sources have substantially reduced the amount of substances listed in the inventory that they release into the environment. Because the TRI requires only the reporting of information, actions taken by sources to reduce pollution are voluntary and in all likelihood relatively low cost.

7. Voluntary Actions

Although government programs that encourage sources to reduce pollution on a voluntary basis were virtually unheard of 20 years ago, they have become one of the fastest growing environmental management tools in the country. At present, EPA and state governments have a variety of programs in place that encourage sources like private companies, schools, hospitals, and universities to reduce specific kinds of pollution. A 1999 EPA survey identified 54 such federal partnership programs, up from 28 just three years earlier. More than 7,000 organizations now participate in EPA's voluntary programs, and in 1998 those participants conserved 1.8 billion gallons of clean water, 7.8 million tons of solid waste, and prevented the release of air pollution in an amount equivalent to taking 13 million cars off the road. At t the same time, EPA estimates these organizations saved roughly $3.3 billion. Literally hundreds of similar programs are in operation at the state and local levels.

There are a number of reasons why voluntary reductions in pollution are proving more and more popular with sources, and they are related to the incentives associated with information disclosure. When sources voluntarily reduce pollution and their employees, neighboring communities, and customers learn about it, sources gain several benefits. Voluntary actions taken by sources often reduce employees' exposure to harmful pollutants, thus lessening sources' liability and improving their relationship with labor. Sources enjoy better relations with neighboring communities, and a reputation for good environmental stewardship may attract more customers for their products. In some cases, sources also save money by taking these actions. Moreover, sources that join voluntary partnership programs can be eligible for various kinds of technical assistance from sponsoring government agencies. For example, they can receive free information on the cost and availability of energy-efficient technologies.

V. Conclusions

1. Diversity of Economic Incentives at EPA

EPA is well known for its use of emissions trading as a key feature of its program to control acid rain. However, acid rain emissions trading is only one of the economic incentive programs managed by EPA.

Emissions trading, averaging, and banking are helping control major air pollution problems such as stratospheric ozone depletion and ozone-forming nitrogen oxide emissions. They are helping this country to achieve national goals for cleaner fuels, and they are built into virtually all EPA rules for motor vehicles and engines. New efforts to implement a Total Maximum Daily Load (TMDL) program in areas with impaired water quality are expected to substantially increase the use of water effluent trading in the years ahead.

EPA subsidies are helping to revitalize brownfields across the country. In addition, the Agency is rapidly expanding the kinds and extent of environmental information that it makes available to the public and that it requires sources of pollution to disclose to the public. The Toxic Release Inventory required by Superfund may be the public's most well known and most widely used EPA database, but over the past several years it has been augmented by many others. For example, beginning in 1998 drinking water suppliers have been required to provide households with information on the quality of their drinking water. Moreover, in 2000 EPA began publicizing the emission characteristics of motor vehicles to help consumers in their purchasing decision and to encourage vehicle manufacturers to further reduce emissions.

Voluntary programs have also become a major environmental management tool at EPA over the past decade. The Agency now manages dozens of such programs, many of which have led to measurable reductions in pollutant emissions. In some cases EPA's voluntary programs have given U.S. companies an incentive to develop less polluting products, like computers and household appliances, the sale of which reduces pollution in every part of the country.

EPA has incorporated nearly every type of economic incentive currently in use in the United States into its programs. And the growth of those incentives over the past decade suggests that the Agency is likely to increase its use of them in the decade ahead.

2. Wide Application at Other Levels of Government

The survey undertaken in this report demonstrates the extent to which economic incentives have been adopted as an environmental management tool at state and local levels in the United States. The report discusses dozens of such applications in detail, but there are hundreds more that are known but not included for analysis here.

Not only are the number of state and local economic incentives growing, but their diversity is remarkable. In fact, one of the most interesting aspects of economic incentives that are being tested in different states and communities in the 1990s is their rich variety. Several examples follow. Communities in California, Washington, Michigan, Wisconsin, Minnesota and many other states are charging fees to households for collecting and disposing of their solid waste based on the amount of waste generated. More and more states are imposing taxes on the generation of hazardous wastes. North Carolina imposed a disposal fee on "white goods" such as refrigerators and freezers in 1995, the same year that Minnesota levied a tax on the "contamination value" of property. As an outgrowth of EPA's proposed Open Market Trading Rule, states like Illinois, Michigan, New Jersey, Texas, and Pennsylvania have developed trading programs for air emissions. In addition to EPA's subsidies for developing brownfields, states like New Jersey, Pennsylvania, Delaware, Minnesota, Ohio, Arizona, and Tennessee are offering similar subsidies. In addition, trading programs for water effluent are in various stages of development in Long Island Sound, the Boise River, Chesapeake Bay and many other locations.

The sheer numbers and variety of these programs make them a difficult topic for analysis within a single limited study. However, they do suggest that state and local governments will continue to be a major developer and user of economic incentives well into the future.

3. Unique Contributions to Environmental Management

In some instances it is difficult to quantify the reductions in pollutants or the improvements in human health and environmental quality that result from the use of specific economic incentives. However, there is little doubt that such incentives are providing a new and unique element to environmental management in the United States. In many cases, incentives are generating health and environmental benefits beyond what is possible with traditional regulations, and sometimes they can be applied in situations where regulations might not be possible at all. It is difficult to imagine, for example, the public supporting a regulatory system that mandated reductions in household waste, but household wastes are declining significantly in communities that charge for waste collection based on the amount generated.

The contributions to environmental management made by economic incentives are as varied as the incentives themselves. Deposit-refund systems are helping change the environmental behavior of individual consumers in ways that traditional regulations could not. Deposit-refund systems and taxes on products and outputs are reducing the pollution caused by a multitude of small and geographically dispersed sources that typically are difficult to control through traditional regulations.

Many economic incentives give an impetus to technological change and innovative pollution control because sources can generate profits by finding better, cheaper ways of reducing emissions. EPA's voluntary programs are a particularly good example of economic incentives acting as an incubator for technological improvements. When businesses take initiative on their own or work collaboratively with government to find ways to reduce pollution, instead of merely reacting to government regulations, they tend to apply the same inventiveness and cost-cutting skills used in other parts of the business. In this sense, voluntary programs, as well as other kinds of economic incentives, unleash the qualities of American entrepreneurs that make U.S. businesses such strong competitors in the marketplace and encourage these sources to use those skills to protect the environment.

4. Cost Savings

Economists have long understood that economic incentives have the potential to reduce pollution at a cost below that imposed by traditional regulations. The national experience of using economic incentives over the past decade reinforces this point of view. In some cases, it is difficult to quantify the costs imposed by a particular incentive. In other cases, the hoped-for cost reductions do not materialize to the extent expected. However, in general, it is clear that economic incentives do provide the opportunity to achieve any given level of pollution control with substantial cost savings.

Evidence supporting the lower costs of economic incentives is both theoretical (derived from models) and empirical (based on the results of operating programs). At least 40 studies based on computer modeling of different scenarios for controlling pollution show that economic incentives should be more cost-effective than traditional regulations. One study (ICF, 1989) estimated that allowance trading in EPA's acid rain program could result in savings to affected utilities of $700 to $800 million per year over the long term. The actual cost savings now are believed to be at least twice this amount. Other areas also offer potentially large savings. For example, effluent trading has the potential to save sources as much as $7.5 billion annually. Even if the cost savings from using market incentives are less than predicted as a result of regulatory, institutional, transactional, or legal restraints, or some combination of these factors, the actual savings undoubtedly are still significant.

5. Applicability to Specific Environmental Problems

The nation's recent—and growing—experience with economic incentives has helped improve our collective understanding of their relative usefulness and applicability to specific environmental problems. Experience to date suggests that, even though a wide variety of incentives are available, any particular one may be effective in managing only a fairly narrow range of problems (see Table ES-1).

Product taxes, for example, have been imposed on such diverse goods as fertilizer, tires, and chlorofluorocarbons. It is most useful to apply these taxes to products that have many consumers because administering these taxes is relatively simple and inexpensive. Product taxes have the added advantage of raising revenue for the taxing authority. For other environmental problems, however, raising revenue may be a less important, or even inconsequential, consideration.

Subsidies often are politically popular. In contrast to taxes, they transfer funds to specific targets within the private sector where incentives for conservation, recycling or pollution control currently are lacking. Consequently, subsidies may be most useful in situations in which targeted assistance is essential and other policy approaches would be politically unacceptable or ineffective.

Deposit-refund systems, like input or output taxes, appear to be most useful when applied to numerous, decentralized sources of pollution. However, these systems tend to have high administrative costs compared to alternative instruments such as taxes and fees. Clearly, the relative ability to administer the incentive would be a primary consideration when choosing among these alternatives.

In short, any government agency interested in using economic incentives has a range of options from which to choose. The environmental success of the incentive selected depends to a great extent on the characteristics of the specific environmental problem at hand.

Table ES-1. Uses of Economic Incentives

Incentive	Examples	Pros & Cons
Pollution Charges & Taxes	Emission charges Effluent charges Solid waste charges Sewage charges	Pros: stimulates new technology; useful when damage per unit of pollution varies little with the quantity of pollution Cons: potentially large distributional effects; uncertain environmental effects; generally requires monitoring data
Input or Output Taxes & Charges	Leaded gasoline tax Carbon tax Fertilizer tax Pesticide tax Virgin material tax Water user charges CFC taxes	Pros: administratively simple; does not require monitoring data; raises revenue; effective when sources are numerous and damage per unit of pollution varies little with the quantity of pollution Cons: often weak link to pollution; uncertain environmental effects
Subsidies	Municipal sewage plants Land use by farmers Industrial pollution	Pros: politically popular, targets specific activities Cons: financial impact on government budgets; may stimulate too much activity; uncertain effects
Deposit-Refund Systems	Lead-acid batteries Beverage containers Automobile bodies	Pros: deters littering; stimulates recycling Cons: potentially high transaction costs; product must be reusable or recyclable
Marketable Permits	Emissions Effluents Fisheries access	Pros: provides limits to pollution; effective when damage per unit of pollution varies with the amount of pollution; provides stimulus to technological change Cons: potentially high transaction costs; requires variation in marginal control costs
Reporting Requirements	Proposition 65 SARA Title III	Pros: flexible, low cost Cons: impacts may be hard to predict; applicable only when damage per unit of pollution does not depend on the quantity of pollution
Liability	Natural resource damage assessment Nuisance, trespass	Pros: provides strong incentive Cons: assessment and litigation costs can be high; burden of proof large; few applications
Voluntary Programs	Project XL 33/50 Energy Star	Pros: low cost; flexible; many possible applications; way to test new approaches Cons: uncertain participation

This page intentionally left blank

Table of Contents

A004098

A004100

List of Figures

List of Tables

List of Acronyms

ADF	Advance Disposal Fee
AEL	Acceptable Exposure Level
AF	Alternative Fuel
AFV	Alternative Fuel Vehicle
API	American Petroleum Institute
AQMP	Air Quality Management Plan
ATU	Allotment Trading Units
AUM	Animal Unit Months
BAAQMD	Bay Area Air Quality Management District
BAT	Best Available Technology Economically Achievable
BCRP	Beverage Container Recycling Program
BLM	Bureau of Land Management
BOD	Biochemical Oxygen Demand
BPT	Best Practicable Control Technology Currently Available
Btu	British Thermal Unit
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CalCAP	California Capital Access Program
CARB	California Air Resources Board
CBEP	Community-Based Environmental Protection
CCAP	Climate Change Action Plan
CCTI	Climate Change Technology Initiative
CDM	Clean Development Mechanism
CEM	Continuous Emission Monitoring
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFC	Chlorofluorocarbon
CH_4	Methane
CLEAN	California Loans for Environmental Assistance Now
CLI	Consumer Labeling Initiative
CMA	Chemical Manufacturers Association
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
CPCFA	California Pollution Control Financing Authority
CPTC	California Private Transportation Company
CRP	Conservation Reserve Program
CRS	Congressional Research Service
CSI	Common Sense Initiative
CWA	Clean Water Act
DACS	Department of Agriculture and Community Services (Florida)
DEM	Division of Environmental Management
DfE	Design for the Environment
DOE	Department of Energy
DOT	Department of Transportation
EAP	Environmental Accounting Project
EBI	Environmental Benefits Index
EER	Energy Efficiency Rating
EHS	Environmental Health and Safety
EIP	Economic Incentive Program

ELP	Environmental Leadership Program
EO	Executive Order
EPA	Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
EPCRA	Emergency Planning and Community Right-to-Know Act
EQIP	Environmental Quality Incentive Program
ERC	Emission (or Effluent) Reduction Credits
ERMS	Emission Reduction Market System
EU	European Union
FGD	Flue Gas Desulfurization
FTC	Federal Trade Commission
FWPCA	Federal Water Pollution Control Act
FY	Fiscal Year
GEF	Global Environment Facility
GHG	Greenhouse Gas
GNP	Gross National Product
gpm	Grams Per Mile
HAP	Hazardous Air Pollutant
HEL	Highly Erodible Land
HFC	Hydrofluorocarbon
HON	Hazardous Organic Chemical NESHAP
IET	International Emissions Trading
IPTEP	Industrial Property Tax Exemption Program
IRR	Internal Rate of Return
ISO	International Organization for Standardization
JI	Joint Implementation
kWh	Kilowatt Hour
LAER	Lowest Achievable Emission Rate
MACT	Maximum Available Control Technology
MMBtu	Million Btus
MMTCE	Million Metric Tons of Carbon-Equivalent
MOU	Memorandum of Understanding
mpg	Miles Per Gallon
MSDS	Material Safety Data Sheet
N_2O	Nitrogen Oxide
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFRC	National Fenestration Rating Council
NGO	Nongovernmental Organization
NLEV	National Low Emission Vehicle
NMOG	Non-Methane Organic Gas
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen Oxide
NPDES	National Pollution Discharge Elimination System
NRDC	Natural Resources Defense Council
NSR	New Source Review
ODC	Ozone-Depleting Chemical
OMB	Office of Management and Budget
OPA	Oil Pollution Act
OSHA	Occupational Safety and Health Administration
OTC	Ozone Transport Commission
P2	Pollution Prevention

P3	Public-Private Partnership
PAH	Poly-Nuclear Aromatic Hydrocarbons
PDR	Purchase of Development Rights
PET	Polyethylene Terephthalate
PFC	Perfluorocarbon
POTW	Publicly Owned Treatment Work
ppm	Parts Per Million
PRIA	Public Rangelands Improvement Act
PSD	Prevention of Significant Deterioration
RACT	Reasonably Available Control Technology
RCRA	Resource Conservation and Recovery Act
RECLAIM	Regional Clean Air Incentives Market
RIA	Regulatory Impact Analysis
RFF	Resources for the Future
ROG	Reactive Organic Gases
RTC	RECLAIM Trading Credits
RVP	Reid Vapor Pressure
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SCS	Scientific Certification Systems
SEC	Securities and Exchange Commission
SEP	Supplemental Environmental Project
SF_6	Sulfur Hexafluoride
SFI	Sustainable Forestry Initiative
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act
SOCMI	Synthetic Organic Chemical Manufacturing Industry
SO_2	Sulfur Dioxide
SRF	State Revolving Fund (Clean Water)
STEP	Strategies for Today's Environmental Partnership (API)
TSCA	Toxic Substances Control Act
TDR	Transferable Development Rights
TMDL	Total Maximum Daily Load
TNRCC	Texas Natural Resource Conservation Commission
TRI	Toxics Release Inventory
TSP	Total Suspended Particulates
UNFCCC	United Nations Framework Convention on Climate Change
URVs	Unit Risk Values
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USIJI	United States Initiative on Joint Implementation
VMT	Vehicle Miles Traveled
VOCs	Volatile Organic Compounds
VOM	Volatile Organic Matter
WAVE	Water Alliance for Voluntary Efficiency
WRAP	Waste Reduction Awards Program
WRP	Wetlands Reserve Program
WRI	World Resources Institute

1. Introduction

In recent years, economic instruments have achieved a prominent place among the tools used by governments to manage the environment. Once mainly an academic proposition, or a revenue-raising adjunct to traditional regulatory mechanisms, market-based economic incentives are now being used as the principal instrument of control on a number of environmental issues. Nowhere is this fact more evident than in the 1990 Clean Air Act Amendments, which created many programs that are underpinned by market-based mechanisms. The Clean Water Act Amendments of 1992, the Safe Drinking Water Act, and a host of state and local initiatives also contain important new incentive-based initiatives.

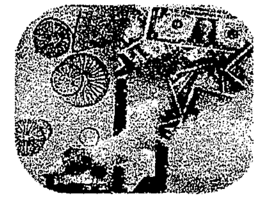
1.1 Purpose of the Report

This report expands upon and updates two earlier EPA surveys on the use of economic instruments for managing the environment. A 1992 EPA report documented the growing use of economic instruments to manage the environment in the United States and also characterized the experiences of many other countries.[1] A 1997 report to EPA reviewed many additional programs in the United States and in other nations.[2] Since these reports were issued, many new instruments have been implemented and existing instruments have been subjected to evaluation by academics and government agencies. Thus, an update is not only timely but also a good opportunity for offering new insights and perspectives. This is not the first such update. Particularly noteworthy are survey articles by Stavins and Hahn and recent research by the National Academy of Public Administration.[3] While the basic conclusions of the earlier EPA reports are still valid, the number of instruments that have been reviewed for their efficacy has grown substantially. A number of subtle and not so subtle differences in perspective also may be evident to the reader.

This report attempts to go well beyond simply enumerating existing market-based mechanisms for managing the environment by examining key issues. How well have these instruments performed? How economically efficient or cost-effective are these mechanisms in achieving the goals of environmental management? What are their effects upon the environment? Why are potential gains from economic instruments seldom observed in practice, and what can be done to improve this record? What can be learned in these cases that will assist in the formulation of new mechanisms?

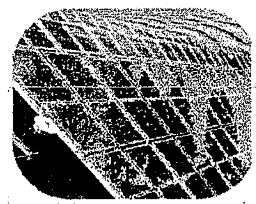
1.2 Scope of the Report

For the purposes of this report, the term "economic incentives" will be defined broadly as instruments that provide continuous inducements, financial or otherwise, to sources of pollution, to reduce their releases of pollutants or make their products less polluting. In essence, with incentives, sources view each unit of pollution as having a cost, whereas under more traditional regulatory approaches pollution may be free or nearly so once regulations have been satisfied.


Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

To achieve maximum cost effectiveness, each source should control pollution to the point where the last units of pollution cost the same amount to control at each source. To achieve effici , the situation that maximizes the difference between benefits and costs, pollution should be controlled until the per-unit costs of controlling pollution that are faced by each source are equal to the incremental value of damage to health and the environment caused by that pollution. This latter objective is much more difficult to achieve, so much so that it is of interest primarily as an academic or theoretical exercise; it does not have great regulatory significance.

The definition of economic incentives used here excludes mechanisms that use explicit or implicit price signals to control activities that have pollution as a by-product. While sometimes known as "environmental incentives," programs that provide ride sharing, bike paths, high-occupancy vehicle lanes, parking surcharges, and the like are beyond the scope of this report. However, there is a brief discussion of congestion pricing that addresses a problem not unlike (and quite likely linked directly to) pollution. While of interest because these mechanisms may lead to a reduction in pollution, they provide neither an explicit nor an implicit price on units of pollution. Excluding these mechanisms carries no particular implication regarding EPA's perspective regarding their present or future applications.

Payments per unit of pollution are perhaps the clearest example of an incentive, as the term is used in this report. Credits and allowances to reduce pollution also provide direct price signals. As such, sources receive rights that can be sold and used by another source. Subsidies for pollution control and deposit-refund systems also create continuous financial incentives. Finally, indirect financial incentives are created through reporting requirements, liability rules, and voluntary programs. All of these mechanisms provide financial incentives for sources to reduce their emissions and to make their products more environmentally friendly.

The principal contrast between incentive mechanisms and traditional regulatory approaches is that the latter do not provide incentives to reduce releases below permitted levels, or to make their products less harmful to the environment once regulatory requirements are satisfied. Under traditional regulatory approaches, sources are tempted to view releases within permitted amounts as having no cost and products that release less pollution than allowed by requirements s as having no incremental value. Sources operating within the limits of existing regulations have little reason to act until new regulations are issued.

In fact, if firms reduce pollution below permitted amounts or produce products with superior environmental performance, they may trigger actions by regulators to impose tougher requirements based on a source's past performance. Thus, under traditional forms of regulation there may be perverse incentives *not* to innovate and *not* to improve the technology to control pollution. Nonetheless, some incentives to exceed regulatory requirements do exist. Releasing less than permitted amounts of pollution provides a margin of safety to sources in the event of equipment malfunctioning; it often leads to fewer inspections; and it may trigger a tightening of regulations that would adversely affect competitors. Vendors of equipment that controls pollution also may have an incentive to design equipment and processes that exceed regulatory requirements. If they design technologies that exceed these requirements, EPA might adopt stricter pollution control requirements, thus creating a market for the vendors' products. Although this report attempts to make a careful distinction between traditional and market-based approaches, these distinctions are often blurred in practice. A range of pollution control measures does exist. They span the spectrum from such highly prescriptive traditional regulatory measures as technology requirements to such purely market-oriented measures as deposit-refund systems or pay-per-bag methods for municipal waste disposal. Between these extremes exists a broad range of instruments, with no clear dividing line between traditional regulatory approaches and methods based on economic incentives. Many approaches to environmental management embody some features of incentive mechanisms along with a heavy dose of direct regulatory action. Most of the best known examples of economic incentive approaches, such as the acid rain trading program and the gasoline lead credit trading program, also have some features that are found in traditional regulatory approaches such as enforcement for noncompliance.

While many incentive programs are reviewed herein, including all that could be identified at the federal level, this report makes no pretense of being exhaustive. The literature on economic incentives is immense. Many levels of government have adopted such programs or are considering their use. Rather than being comprehensive, an attempt has been made to identify those mechanisms that are most likely to have significance in the long term. In doing so, many important initiatives have undoubtedly been omitted because of a lack of information or the need to create limits on the scope of this report. For example, economic mechanisms for allocating water are noted only briefly, despite the potential effect of this mechanism on the environment, because pollution control is not the primary objective of water allocation. Likewise, the brief discussion on highway pricing and congestion charges merely serves to introduce these incentives, since the effects of these fees on the environment—although they may be potentially significant—have yet to be documented.

1.3 Organization of the Report

This report is organized into eight additional chapters that are briefly summarized below.

Chapter 2 examines current and past U.S. government policies that incorporate incentive mechanisms, with an emphasis on policies initiated by the Clinton administration.

Chapter 3 provides an overview of the various types of incentive mechanisms in terms of their cost effectiveness and environmental effects, both in theory and in practice.

Chapter 4 discusses pollution-based fee, charge, and tax systems in place in the United States, and fees imposed on the quantity and quality of emissions, or both, that are released into the environment.

Chapter 5 considers deposit-refund systems to encourage recycling or the proper disposal of the product.

Chapter 6 covers trading systems, including credits for pollution reductions that have been achieved (open market programs) as well as emissions cap-and-trade (allowance) programs.

Chapter 7 discusses subsidy systems, including grants, low-interest loans, favorable tax treatment, and preferential procurement policies for products believed to be environmentally friendly. The chapter also considers the potential benefits that could be achieved by eliminating subsidies that harm the environment. Chapter 8 addresses the use of liability as a mechanism for compensating victims when sources release pollution that causes harm to human health and the environment and also as a mechanism for encouraging sources to comply with existing environmental regulations.

Chapter 9 discusses in some detail the potential effects that economic incentives may have on the information reporting requirements of two laws. They are the Emergency Planning and

Community Right-To-Know Act (EPCRA), which established the Toxics Release Inventory (TRI) reporting requirements, and California's Safe Drinking Water and Toxic Enforcement Act, commonly referred to as Proposition 65. Other forms of information reporting are also reviewed in this chapter, including environmental impact assessment reporting, product labeling, environmental performance awards, Securities and Exchange environmental reporting requirements, and lead paint and radon disclosure requirements.

Chapter 10 looks at programs under which EPA and the states ask companies to voluntarily participate in activities to reduce pollution and protect the environment.

2. Government Policy on Economic Incentives

From the early days of the EPA, policy makers have recognized that economic instruments held the potential to improve the cost effectiveness of environmental management. The Nixon administration proposed to use emission fees to limit sulfur dioxide, however this initiative failed in Congress. Gradually, as allowed by its governing statutes, EPA began to experiment with the use of economic incentives, introducing emissions trading in the early 1980s. The Clean Air Act Amendments of 1990, a product of the Bush administration, greatly increased the use of economic incentives in environmental management. The Clinton administration has continued strong support for the use of economic incentives in environmental management. This chapter highlights some of the key reports, executive orders, environmental management innovations, and legislation that demonstrate the growing commitment to expanding the use of innovative, cost-effective approaches to environmental management.

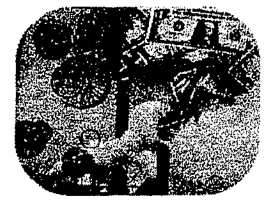
2.1 Reports and Strategies

2.1.1 Project 88 Report

Sponsored by Senators Heinz and Wirth, a group of public policy scholars prepared the Project 88 Report in 1988.[4] It identified 36 proposals for "innovative solutions to major environmental and natural resource problems." Among the economic incentives included in these proposals were

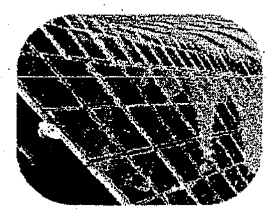
- a national market for CO_2 offsets;
- internationally marketable permits for greenhouse gases;
- marketable permits for potential ozone-depleting substances, SO_2, NO_x, and point and non-point sources of water pollution;
- a deposit-refund system for hazardous wastes that can be placed in containers;
- taxes on fuel-inefficient vehicles with rebates for fuel-efficient vehicles;
- taxes on certain pesticides; and
- air emissions charges for mobile sources.

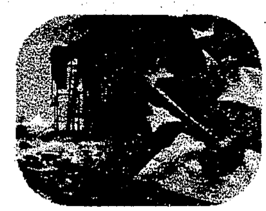
Round II of the *Project 88 Report* evaluates in detail implementation issues regarding three areas where incentives might be applied: global climate change, solid and hazardous waste management, and natural resource management. Many of the initiatives proposed in the *Project 88 Report* subsequently were enacted: solid waste management unit pricing, the Gas-Guzzler tax on fuel-inefficient vehicles, and marketable permits for SO_2, NO_x, and water effluents. The proposal for an international market in greenhouse gases that was contained within the Kyoto Protocol also flows directly from this report.

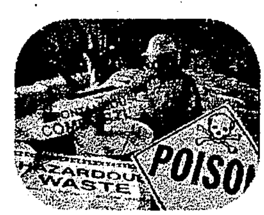

Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

2.1.2 Report of the EPA Economic Incentives Task Force

The 1991 report by the EPA Economic Incentives Task Force, entitled *Economic Incentives: Options for Environmental Protection* studied existing and potential incentive mechanisms for the purpose of stimulating discussion on the role of such mechanisms in environmental policy.[5] The report focused on four areas where incentives might be applied: municipal solid waste management, global climate change, water resource management, and multi-media concerns. In the preface to the report, the EPA Administrator stated, "To maintain progress toward our environmental goals, we must move beyond a prescriptive approach by adding innovative policy instruments such as economic incentives. Properly employed, economic incentives can be a powerful force for environmental improvement."

2.1.3 President's Council on Sustainable Development

Created in May 1993, the Council on Sustainable Development includes of representatives from the Cabinet, industry, and environmental groups. The Council has the task of developing a strategy to achieve long-term economic growth without harming natural resources.

In its March 1996 final report, the Council recommended the use of performance targets in lieu of technology standards, commending Project XL for allowing companies to develop innovative methods to control pollution. It also recommended the adoption of incentives and the elimination of disincentives for environmental protection in a number of areas, as well as more cooperation between industry and government in controlling pollution. One example of cooperation that was endorsed by the report was the Common-Sense Initiative, under which industry and environmental groups worked with EPA to study ways to improve environmental regulations affecting six specified industries.

2.1.4 Economic Report of the President

Under the terms of the Employment Act of 1946, the President's Council of Economic Advisors prepares an *Economic Report of the President* every year. Among the topics discussed in the 1996 report was regulatory reform and its application to environmental policy.

The report offers several ideas for "reinventing regulation," which it defines as "taking a new look at regulation and the regulatory process to ensure that regulations meet legitimate social needs, and where necessary changing both content and process to improve efficiency and effectiveness." Efforts to reinvent regulations take several forms, including the "better targeting of regulatory efforts to where the need is greatest," "a shift in emphasis from prescribing methods of compliance to specifying desired outcomes," and "harnessing economic incentives through market-based regulatory mechanisms."

A significant portion of the report is devoted to reinventing regulation of the environment and natural resources. "The Administration is improving the way we protect the environment," states the report, "making government a partner rather than an overseer." The report cites "cooperation with States and localities, partnerships with the private sector that engender creative solutions as well as set standards, and careful assessment of the advantages and disadvantages of alternative government action" as a means by which "environmental protection can be achieved at an affordable cost."

Stating that environmental rules should impose the least possible burden and that their benefits should justify their costs, the report discusses a number of incentive approaches that have been could be used to protect natural resources. The section entitled "Creating Cost-Effective Policies: Economic Incentives for Environmental Protection" includes liability for environmental damages, fees and charges, trading systems, conservation easements, and the provision of information. Trading systems for water pollution, air pollution, and fishing quotas are discussed at length. On the subject of water pollution, the report contains Administration estimates that several hundred million dollars to several billion dollars a year could be saved if effluent trading programs were expanded.

2.2 Executive Orders and Initiatives

2.2.1 Executive Order 12291

President Reagan's E.O. 12291 of February 17, 1981, required a Regulatory Impact Analysis (RIA) for proposed "major rules." The definition of "major rule" was similar to that of "significant regulatory action" in E.O. 12866, which replaced E.O. 12291. E.O. 12291 required that no regulatory action be taken "unless the potential benefits to society for the regulation outweigh the potential costs to society." Each RIA was required to contain a "description of alternative approaches that could substantially achieve the same regulatory goal at lower cost, together with an analysis of this potential benefit and costs and a brief explanation of the legal reasons why such alternatives, if proposed, could not be adopted."

After E.O. 12291 was adopted, EPA developed guidelines for conducting RIAs, according to which "each RIA should calculate the benefits and costs of a proposed regulation's full range of effects and should compare them with those of other regulatory and non-regulatory approaches." In the section entitled "Considering Alternative Approaches," the guidelines called for the consideration of "market-oriented regulatory alternatives (whether or not they are explicitly authorized in the Agency's legislative mandate)." Such alternatives "include using information or labeling to enable consumers or workers to evaluate hazards themselves and using economic incentives, such as fees or charges, marketable permits or offsets, changes in insurance provisions, or changes in property rights." EPA was required to submit all RIAs and proposed regulations to OMB for review. EPA's RIA guidelines were intended to increase the use of incentive mechanisms in environmental regulation.

E.O. 12291 built on a number of earlier Executive Orders and regulations dating back to President Nixon's "Quality of Life" reviews that required an assessment of alternatives and cost comparisons for proposed regulations. President Ford's E.O. 11821 of 1974 and E.O. 11949 of 1976 required inflation impact statements for major regulations. President Carter's E.O. 12044 of 1978 required Regulatory Analyses of the economic consequences of proposed regulations and alternatives under consideration, and the Executive Order instructed agencies to select the least burdensome alternative.

2.2.2 Executive Order 12866

A central idea of President Clinton's Executive Order (E.O.) 12866 of September 30, 1993 is that regulations should be adopted only after a reasoned determination concludes that quantified and nonquantified benefits justify the costs of the regulation. Further, E.O. 12866 states that, "in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach." This order replaced President Reagan's E.O. 12291. Under E.O. 12866 agencies are required to assess the benefits and costs of any "significant regulatory action."

Actions deemed "significant" include those that "have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments, or communities" or that meet certain other criteria.

E.O. 12866 also requires that agencies consider the possibility of using incentive-based approaches for any significant regulatory action. Two specific "Principles of Regulation" in E.O. 12866 refer to incentive-based approaches:

> 1b3: "Each agency shall identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public."
>
> 1b8: "Each agency shall identify and assess alternative forms of regulation and shall, to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt."

In January 1996, an interagency group convened by the Office of Management and Budget (OMB) issued a document entitled *Economic Analysis of Federal Regulations* that provided guidelines for performing economic analysis of proposed federal regulations under E.O. 12866.[6] Among the topics discussed in these guidelines were the importance of performance-based standards, alternative compliance methods, information approaches, and economic incentives.

On the first of these topics, the guidelines state, "Performance standards are generally to be preferred to engineering or design standards because performance standards provide the regulated parties the flexibility to achieve the regulatory objective in a more cost-effective way." "Performance standards," the guidelines continue, "should be applied with a scope appropriate to the problem the regulation seeks to address. For example, to create the greatest opportunities for the regulated parties to achieve cost savings while meeting the regulatory objective, compliance with air emission standards can be allowed on a plant-wide, firm-wide, or region-wide basis rather than vent by vent, provided this does not produce unacceptable air quality outcomes (such as 'hot spots' from local pollution concentration)."

On the subject of ensuring compliance, the guidelines state, "When alternative monitoring and reporting methods vary in their costs and benefits, promising alternatives should be considered in identifying the regulatory alternative that maximizes net benefits."

The guidelines mention various "informational measures," including "government establishment of a standardized testing and rating system (the use of which could be made mandatory or left voluntary), mandatory disclosure requirements (e.g., by advertising, labeling, or enclosures), and government provision of information (e.g., by government publications, telephone hotlines, or public interest broadcast announcements)."

The guidelines also call for consideration of economic incentives: "In general, alternatives that provide for more market-oriented approaches, with the use of economic incentives replacing traditional regulatory requirements, are more cost effective and should be explored." Incentives "that may be considered include fees, subsidies, penalties, marketable permits or offsets, changes in liabilities or property rights (including policies that alter the incentive of insurers and insured parties), and required bonds, insurance or warranties."

In March 2000, OMB issued new *Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements.*[7] OMB explains the relationship between this document and the *Best Practices Manual* as follows:

> *These Guidelines draw from the "Best Practices" document developed in 1994 and 1995 by an interagency group co-chaired by the Department of Transportation and the Council of Economic Advisers. That "Best Practices" document in turn revised the "Regulatory Impact Analysis Guidance" published by OMB in 1990 after a two-year notice and comment period. You should use this document in estimating and presenting the benefits and costs of regulations. While it does not represent OMB guidance, you may use the "Best Practices" (Q: shouldn't the document title here be surrounded with quotes as shown in other instances in this paragraph?) document as supplementary material to illustrate further specific issues or techniques. (page 2)*

2.2.3 Climate Change Initiative

The Climate Change Action Plan relies largely on voluntary incentives to achieve reductions in greenhouse gas emissions. Among its initiatives are Green Lights and Energy Star, Climate Wise, and at least four voluntary programs to promote methane recovery (Natural Gas Star, AgStar, Coalbed Methane Outreach, and Landfill Methane Outreach). Several of these programs are described in more detail in Chapter 10.

The more recent Climate Change Technology Initiative (CCTI) supplements these purely voluntary programs with targeted subsidies to improve technologies, so fewer greenhouse gases are produced. Shortly after the Kyoto agreement to reduce greenhouse gas emissions of December 1997, the Clinton administration proposed the CCTI and asked for congressional approval of \$3.6 billion in tax credits as incentives and \$2.7 billion for research and development.[8] Congress authorized \$1.021 billion in R&D and \$85 million in tax credits for FY 1999 and \$1.095 in R&D for FY 2000. The 2001 budget proposed spending over \$1.4 billion for R&D in FY 2001 and \$4 billion in tax credits for the CCTI over the next five years.

2.2.4 Greening the Government

Executive Order 13148, issued by President Clinton on April 22, 2000, instructs the head of each federal agency to ensure that actions are taken to integrate environmental accountability into routine agency decision making and long-term planning. Many of the directives of the order could be classified as economic incentives because they help to provide information, take full costs into account in decision making, and reduce the use of toxic chemicals where cost-effective. Among other things, the order calls for federal agencies to develop and implement environmental management systems and to ensure compliance with environmental regulations by implementing audit programs and policies on environmental compliance that emphasize pollution prevention. The order also directs agency heads to keep the communities in which federal facilities are located informed as to possible sources of pollution, to make efforts to reduce the use of toxic chemicals by 10% per year, to engage in pollution prevention efforts, and to conduct life cycle cost analysis. The order is the latest of several issued by the Administration on "greening the government," including E.O. 13101 of September 14, 1998, E.O. 13123 'une 3, 1999, and E.O. 13134 of August 12, 1999.

2.2.5 National Performance Review

Vice President Gore's National Performance Review released a report in 1993 entitled *Creating a Government That Works Better & Costs Less.*[9] Focused on reinventing government, the report included a number of recommendations for improving environmental protection, some of which advocated the use of economic incentives. The document's authors suggested that EPA work with Congress to encourage the use of incentives to reduce water pollution, including wastewater discharge fees. It also recommended that the conditions for accessing federal resources for activities such as grazing and mining be modified. The purpose of this suggestion was twofold: first, to ensure that the government obtains a fair return on its land, and, second, to provide incentives for improving federal land management.

2.2.6 Reinventing Environmental Regulations

On March 16, 1995, the President announced the first government-wide regulatory reforms designed to improve environmental regulation, so the nation achieves a better environment at lower cost. The President emphasized economic incentives in these reforms. For example, the document entitled *Reinventing Environmental Regulation* provides 10 principles for reinventing environmental protection. One of these principles is that environmental regulations must be "performance based" and must allow flexibility while requiring accountability in attaining goals. Another principle is that "market incentives should be used to achieve environmental goals, whenever appropriate." The document also includes "25 High Priority Actions," a sec' in which open-market air emissions, effluent trading in watersheds, and other topic are discussed.[10] (Subsequent initiatives by EPA to implement these recommendations are described in Chapter 6.)

In addition, the document describes actions that can improve compliance, accountability, and enforcement. EPA now coordinates these activities through its Environmental Leadership Program, a voluntary program that focuses on the role of compliance management systems in enforcement. It also provides incentives for auditing, disclosure, and correction. (This program is described in Chapter 10.) The document characterizes Project XL (another voluntary program discussed in Chapter 10) as one of the "Building Blocks for a New System" of environmental regulation.

2.2.7 National Environmental Technology Strategy

On March 18, 1995, the Vice President announced a National Environmental Technology Strategy to "create high-wage jobs and exports and stimulate overall economic growth; reduce the cost of cleaning up past pollution; and help prevent future damage to the environment." The strategies advocated the use of economic instruments to promote innovations in pollution control technologies that enhance the effectiveness of pollution control efforts or reduce cost, or both.

2.3 Recent Environmental Management Initiatives

2.3.1 Performance Track Approach at EPA

How to obtain more environmental protection more efficiently is the focus of recent EPA innovations in environmental management.[11] Noteworthy among the new innovative approaches are rewards for superior environmental performance. The current system of environmental regulation offers little incentive for firms to go beyond compliance. EPA now views this approach as a missed opportunity to encourage top environmental performers. Through a new "Performance Track" approach, firms would receive a standard package of incentives such as public recognition for meeting environmental criteria. Firms that routinely do much more than meet established requirements would be placed on a smaller second track and receive a higher level of recognition and incentives more closely tailored to their individual needs. EPA views this two-tiered reward structure as a significant step toward a more performance-based system that stimulates superior environmental achievement.

2.3.2 EPA Air and Water Policy Initiatives

Among the many initiatives within EPA that concern economic instruments, one on air quality and one on water quality are particularly noteworthy. Beginning in the late 1970s, EPA explored the ways in which flexibility could be integrated into air quality regulation, so cost effectiveness would be enhanced. These activities, which are described in Chapter 6, culminated in the Emission Trading Policy Statement and laid the groundwork for the broader use of economic incentive approaches in the Clean Air Act Amendments of 1990. Since then, EPA has provided trading opportunities in many air programs and rules to combat a variety of air pollution problems. In addition, the EPA Office of Water has actively promoted effluent trading as a means of improving the cost effectiveness of attaining its goals on water quality.

2.3.3 EPA Research Activities

Through the years, the Office of Research and Development (ORD), the EPA policy office, and several program offices have supported research on economic incentives for environmental management. Much of that research is available on the Economy and Environment home page at www.epa.gov/economics. At present, ORD is supporting a program in Market Mechanisms and Incentives Research.[12]

2.3.4 Promotion of Economic Instruments Abroad

On April 9, 1999, Vice President Gore and Premier Zhu Rongji announced a cooperative agreement designed to increase markets for U.S. environmental technology in China. The agreement will increase opportunities for U.S. investment in the Chinese energy-producing sector and promote the reduction of greenhouse gas emissions in China through a program to trade sulfur dioxide (SO_2) emissions. "In an agreement that will move China closer to a system of emissions trading, the EPA and China's State Environmental Protection Administration signed a Statement of Intent on development of a Sulfur Dioxide Emissions Trading Feasibility Study. The agreement calls for developing a study to test the effectiveness of emissions trading in China as a market-based approach to reducing greenhouse gas emissions."[13]

2.4 Legislation: Clean Air Act Amendments of 1990

While other environmental legislation also creates programs based on economic incentives, the Clean Air Act Amendments of 1990, enacted during the Bush administration, are particularly noteworthy. With the passage of these amendments, the legislative branch of government showed strong support for economic incentives and expanded the regulatory toolbox beyond traditional regulatory requirements, which had dominated air pollution control policy in previous years. Among the incentive mechanisms authorized in these amendments are the Acid Rain Trading Program, provisions for offsets and other trading programs in ozone non-attainment areas, early reduction credits for hazardous pollutants, fees based on pollutant emissions, the possibility of marketable credits for certain fuel constituents, marketable production allowances for ozone-depleting substances, and labeling of ozone-depleting substances.

3. The Cost Effectiveness and Environmental Effects of Incentive Systems

3.1 Introduction

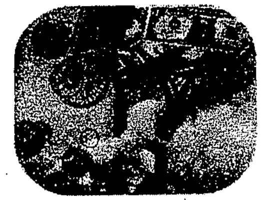
This chapter reviews several of the attributes of incentive-based strategies for managing the environment. From the perspective of economics, pollution is an output that occurs outside of normal market transactions. Termed an "externality," it has little or no cost to the source but may impose significant costs on other economic actors. How best to get sources to control their pollution is an issue that has been studied closely by economists and policy analysts.

One means of control is to rely on private negotiations between those who bear the costs of pollution and the sources of pollution. If several conditions are satisfied, such negotiations can lead to an optimal level of pollution control in which the full costs of pollution are taken into account in the decision process of the source.[14] One condition is that the sources and victims do not engage in strategic behavior. Another condition is that individuals who are harmed by pollution and sources can negotiate without any transaction costs (such as personal time or the need for third-party involvement). The final condition is that sources and victims are fully informed as to risks and harms that may occur. Although the assumption of no strategic behavior may be reasonable in many cases, costless transactions may never be a realistic assumption. The more parties who are harmed and the more geographically dispersed these parties are, the higher the transaction costs are likely to be. Likewise, it is unrealistic to assume that victims of pollution are as fully informed about risks as are the sources.

The existence of environmental legislation reflects the fact that negotiations between victims and sources of pollution cannot be relied upon as a means of control for most pollution problems. EPA's governing legislation uses various approaches to set environmental goals. Under some of the laws, the goal is to adequately protect public health and the environment without explicitly considering costs. In other cases, the governing statutes instruct EPA to take costs into account in protecting public health and the environment or to set goals that balance cost, health and environmental considerations.

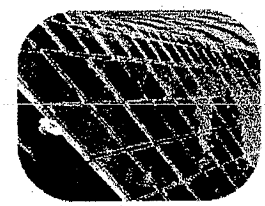
The governing environmental statutes have varying opportunities and limitations with respect to the mechanisms that are available for achieving environmental goals. In the traditional regulatory approach, EPA often specifies requirements for different types of sources (factories, vehicles, fuels, etc). The regulations may impose limitations on the amount of discharge, the technology used to control pollution, the inputs that may be used, or characteristics of the outputs that are produced.

Market-based or incentive approaches, by contrast, provide rewards for reducing pollution (and, conversely, assign penalties for releasing pollution). The rewards may or may not be financial. In contrast to the traditional regulatory approach, an incentive-based regulatory strategy gives sources great flexibility in selecting both the type and

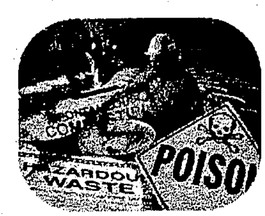

Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches



Information Disclosure


Voluntary Programs

magnitude of their response and gives them incentives to develop new and cheaper strategies and technologies to control pollution.

Depending upon the characteristics of the sources of pollution and the damages (see Table 3-1), some tools of environmental management are likely to be more cost-effective than are others. Cost-effective tools achieve environmental goals for the least cost. Other criteria such as fairness, political acceptability, stimulus for innovation and technological improvement, and enforceability also could be used in place of, or in conjunction with, cost effectiveness.

Table 3-1. Considerations for Selecting Regulatory Instruments

CHARACTERISTICS OF THE SOURCES OF POLLUTION

- Are the costs of control known with certainty? If not, how great is the uncertainty?
- Is the technology of pollution control static, or is it likely to change over time?
- Can the quantity of pollution from each source be measured (or approximated) easily?
- How many sources are there for each pollutant?
- Are incremental control costs similar for different sources, or is there considerable variation?

CHARACTERISTICS OF THE DAMAGE CAUSED BY POLLUTION

- Does a unit of pollution from each source have the same impact on health and the environment, regardless of where it is released?
- Are the impacts on health and the environment known with certainty? If not, how great is the uncertainty?
- What are the major sources of uncertainty? What is known regarding the effect of pollution on environmental quality, exposures, physical effects, or the economic valuation of effects?
- How many parties are experiencing damage from pollution?
- Is it critical to control pollution within narrow limits to achieve environmental goals, or is the damage caused by pollution such that there is a continuum of effects from less serious to more serious, with no obvious unacceptable level and no obvious safe level of pollution?

The following sections describe alternative means for managing the environment and the circumstances under which one mechanism is likely to perform better than another tool.

3.2 Traditional Regulatory Approaches

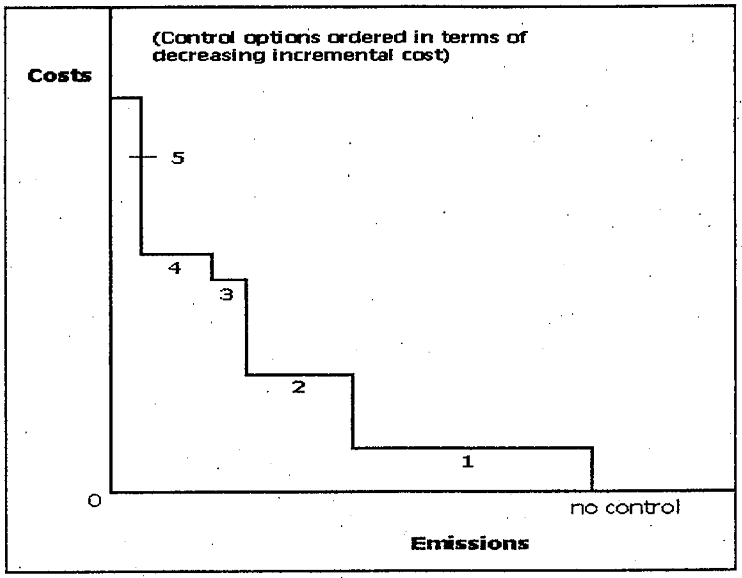
Traditional regulatory approaches normally operate through one of three means: source-specific emission limits, output specifications, or technology requirements. A brief description of each alternative illustrates both the strengths and weaknesses of traditional forms of regulation.

The first alternative applies emission (or effluent) limits to specific sources as a means of achieving health standards or environment-based ambient standards. The total amount of pollutants that are released could be limited by setting emissions standards for individual sources, such that total emissions just equaled the sum of the individual contributions from each source. Other pollution allocation formulas that do not treat new sources more harshly than existing sources could also be used. One such formula, for example, determines a set weight of pollution that can be released per unit of output.

Unless the authority responsible for controlling pollution is able to identify which sources have the lowest incremental costs for controlling pollution and insist that those sources implement their pollution controls first, this source-specific approach to emissions will not be cost-effective. As Figure 3-1 depicts, each source will usually have a number of options for controlling emissions. The least cost option (#1 in the figure) will control some emissions. Other successively more expensive measures may be implemented until all emissions are controlled.

It is very difficult in practice to identify the least cost strategy for controlling emissions from multiple sources. If all control measures and their costs are known, linear programming or other modeling techniques could be used to find the least cost strategy for every level of emission control for the sources taken as a whole. However, in most cases all potentially available control measures are not known, and, even if they were, pollution control laws typically do not allow an agency to impose strict controls at one source and relatively lenient control burdens on another, even if their control costs are quite different. Generally, similar sources must be treated the same. Furthermore, incremental control costs include more than simply the costs that sources must bear in order to comply with regulations, as noted earlier. It is likely to be difficult to predict in advance how emission limits would affect production technology, energy and other input use, and other cost elements. Economic instruments avoid the problems that a pollution control agency would have in identifying the least cost methods of meeting a pollution control objective by harnessing market forces to identify cost-effective solutions.

Figure 3-1. Control Options for a Source



The second alternative specifies certain characteristics of outputs that are destined for the product market. Some examples include fuel efficiency requirements for automobiles, product specifications for gasoline, and regulations regarding the ability of products to be recycled and the recycled material content of consumer products. The regulatory strategy of imposing limitations on the polluting characteristics of products is affected by the same issues noted above that make it difficult to regulate emissions in a cost-effective manner. For example, the cost to individual refineries of meeting a sulfur limit in gasoline is likely to vary significantly. It would be more efficient to allow trading among sources to meet pollution reduction obligations than to apply uniform standards to each source.

The third alternative imposes technology requirements that specify the techniques or equipment that sources must use to control pollution. EPA prefers to use performance-based numerical limits rather than technology requirements whenever feasible, and, in fact, the Agency's programs rely heavily on numerical limits. Some standards that are performance-based demand a level of emission control that can be met only with one existing technology. Unless pollution control technologies improve, such performance standards have the same effect as technology standards. (For example, new source performance standards for SO_2 emissions at coal-fired electric power plants require a 90% reduction in these emissions from their uncontrolled state, a degree of control that can be met only by scrubbing.)

Technology standards (or more accurately de facto technology standards) are likely to be les- cost-effective than emission or effluent standards, since the latter give sources the freedom choose the least costly method of compliance. Further, technology standards tend to lock firms into one accepted method of compliance, which discourages technical change and innovation. However, when emissions cannot be measured or concerns exist about the feasibility of enforcing tax or trading systems or both, technology standards provide a practical way to reduce pollution.

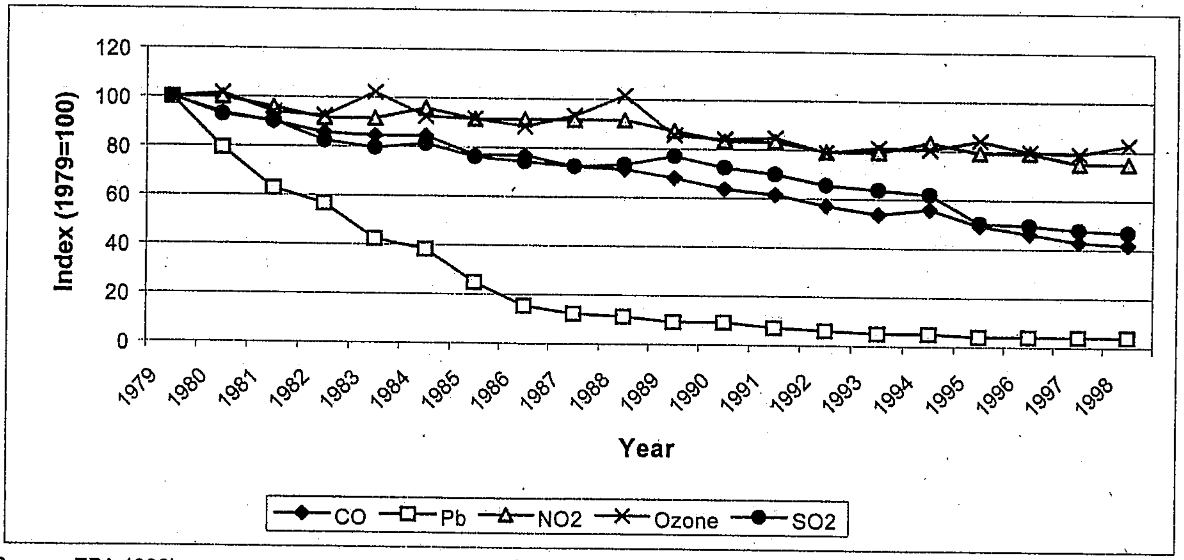
From a dynamic perspective, identifying the strategies that should be implemented to control pollution at the least cost is more problematic. Technology is not static. Over time, the number of possible options increases. Most of the options offer improvements over earlier technologies, in terms of cost, environmental performance or both. A traditional regulatory strategy to identify and mandate least cost controls can lock firms into technologies that become progressively less effective, and thus less attractive, over time.

These issues aside, traditional regulatory policies have achieved much in the United States. For the most part, traditional regulatory policies have resulted in ambient air and water quality that is demonstrably better now than it was 30 years ago when the EPA was established. The most recent *Emissions Trends Report* (EPA, 1998b) reveals that emissions of all criteria pollutants have declined since 1979: In the case of sulfur dioxide and carbon monoxide, emissions have been reduced by more than 50% and lead emissions by more than 95%. (See Figure 3-2.) Water quality is also improving. This achievement is significant given the economic growth and increasing populations that has occurred over the same period of time.

3.3 Incentive-Based Mechanisms

While incentive-based systems have existed in some form for decades as tools of environmental

Figure 3-2. National Long-Term Air Quality Trends, 1979-1998



Source: EPA 1998b

management, the federal government has aggressively sought their implementation for only the past 10 to 15 years. Economic incentives to protect the environment rely on decentralize

A004122

decision making by economic agents, all acting in their own self interest. In contrast, traditional regulatory approaches to environmental management are based on the regulations established by federal, state, or tribal governments that have been given the authority to make pollution control decisions. Actual compliance is the responsibility of the sources of pollution that are subject to the regulations. However, the flexibility that sources have to choose technology, as well as the extent of pollution control, tends to be quite limited under a traditional regulatory approach. Economic incentive methods generally allow sources to select how much they reduce pollution and the technology that helps them in this endeavor.

3.3.1 Pollution Charges, Fees, and Taxes

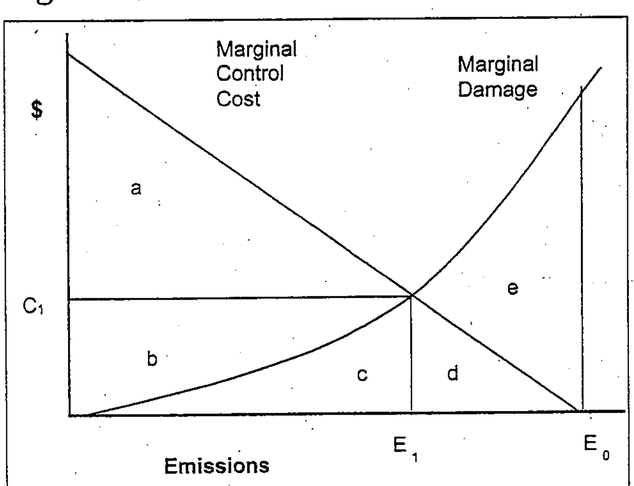
Pollution charges, fees, and taxes are payments required of sources for emitting pollution. (The three terms are used interchangeably here.) Ideally, sources would pay for each unit of pollution they emit. A source that is concerned with minimizing costs and is also faced with such a tax will control those emissions for which control costs are less than the tax and release the remainder. The source will then pay the tax on each of those units of pollution released into the environment.

A simplified analysis of charges, fees, and taxes from an economic perspective is illustrated in Figure 3-3. Prior to regulation, total uncontrolled emissions are equal in magnitude to E_0. Damage to the environment is equal to the area (c+d+e) and the source spends nothing on pollution control. If an emission fee of magnitude C_1 were imposed, cost-minimizing polluters would reduce total emissions to E_1. The total costs of pollution, which is equal to the sum of pollution control costs and environmental damage (c+d), are minimized with the fee at level C_1.

Emission fees set at C_1 per unit of emissions cause cost-minimizing polluters to pay for all emissions up to E_1, an amount equal to the area (b+c) in Figure 3-3. Polluters subject to the fee spend an amount equal to area (d) to control emissions beyond E_1 and reduce environmental damage by an amount equal to the area (d+e) relative to uncontrolled emissions.

Emission fees that are high enough to change behavior significantly, like the one shown in this example, would typically result in large revenue transfers to the government. That is, payments the government, equal to area (b+c) in Figure 3-3, tend to be large, especially relative to the environmental damage that is mitigated, area (d). For this reason, polluters usually oppose pollution charges, taxes, and fees that would be high enough to act as an incentive for them to reduce pollution. They would prefer that their environmental expenditures be used to control pollution, not sent to the government.

Figure 3-3. Tax Per Unit of Emissions



From an economic perspective, charges, taxes and fees are basically interchangeable, although from a legislative and legal perspective some differences exist. The House Ways and Means Committee must review proposed taxes, since tax revenues are a part of general federal revenues. Fees and

A004123

charges, in contrast, are designed to recover some or all of EPA's administrative costs an' ~ed only be reviewed by environment committees and subcommittees. Fees and charges are in. ,ed in two ways. First, an environmental statute may specify the activities that are subject to fees and charges. Second, EPA has additional general authority to collect and assess fees and charges under the Independent Offices Appropriations Act (31 U.S.C. §9701). Fees and charges assessed and collected under this Act must be deposited into the General Fund of the Treasury and cannot be retained by EPA.

Legislation authorizing pollution fees, taxes, and charges typically limits their magnitude to what is necessary to recover the costs of administering the program in question or related programs. Worldwide, the vast majority of emission tax, fee, and charge systems collect revenues that amount to only a few percent of pollution control costs.

Two exceptions are noted. The first is the tax on U.S. chlorofluorocarbon (CFC) production. This tax was designed to remove windfall profits that would otherwise accrue to CFC producers from increases in CFC prices due to reductions in the quantities of CFCs allowed in commerce. This tax is discussed in more detail later in this report. The second exception is the Swedish charge on NO_x emissions, which is set at a high level with the objective of changing behavior. Power plants pay the NO_x charge on emissions of NO_x and receive rebates in proportion to their energy output. The result is a mechanism that raises no revenue for the government yet produces significant incentives.[15] Relatively clean facilities receive rebates in excess of payments while relatively dirty facilities pay more in charges than they receive in rebates.

Designing pollution taxes that minimize the total costs of pollution (damage costs plus control costs) is difficult for a variety of reasons, including the lack of data on pollution damages the inability to precisely measure emissions, and political opposition to large revenue transfe m pollution sources (companies) to the authority imposing the tax (government). The relationship between the quantity of emissions and the cost of the damages caused by those emissions (often called the "pollution damage function") depicted in Figure 3-3 is highly simplified and glosses over a number of difficult measurement issues. In many situations, the function is not well known, so the ability of an agency to set charges to equate marginal control costs with marginal damages is questionable. Moreover, the damage function may differ from one localized area to another depending upon the population at risk, prevailing winds, sunshine, temperature, and other factors. If marginal control costs or marginal damages differ from one region to another, a single charge level may be inappropriate. Charges that differ by region may be required in order to achieve the efficient amount of pollution control. In addition, an emission tax provides the pollution control agency with limited control over the physical quantity of emissions dispersed into the environment because sources have the choice of controlling emissions or releasing emissions and paying the tax. If the magnitude of emissions is very important, as could be the case with toxic emissions that threaten public health, an emission tax may be viewed as an inadequate control over the actual quantity of emissions.

The implementation of emission fees, taxes, and charges also depends on the ability to measure emissions. The precision with which a pollution tax can be levied depends on the precision with which emissions can be measured. Political concerns may also be an issue in implementing emission taxes. Environmentalists sometimes oppose emissions fees because they seem to sanction the release of pollution.

3.3.2 Deposit-Refund Systems

A deposit-refund system operates like a tax on the purchase of a product with a subsidy for returning the used item to a designated collection site. The purpose of the subsidy or refund is to encourage individuals and firms to dispose of these items in an environmentally acceptable manner. The tax or deposit is made on the original purchase and yields sufficient revenue to pay future refunds. Some or all of the unclaimed deposits may be used to subsidize collection facilities. While the magnitudes of the deposit and the refund often are the same, there is no reason that this has to be the case.

Although most deposit-refund systems are created by legislation, deposit-refund systems sometimes are developed by the private sector when the used product has economic value. Thus, private-sector deposit-refund systems for beverage containers were widespread in the early part of the twentieth century before cheaper, non-returnable containers appeared. Mandatory deposit legislation for lead-acid automotive batteries has been enacted in about a dozen states, while the private sector has created deposit systems for lead-acid batteries in the remainder of the states, largely because of the economic value of used batteries. Ten states have enacted beverage container deposit-refund systems. Deposit systems exist for car bodies in four European nations, and for a wide variety of containers throughout most European nations. In a few nations of Europe, deposit systems help assure the recycling of used motor oil.

Administrative costs are an important consideration when determining whether to create deposit systems. Ackerman et al. (1995) estimate that administrative costs average about 2.3 cents per container—more than $300 per ton for steel containers and $1,300 per ton for aluminum cans—in states with traditional legislation on beverage container deposit systems. A full accounting of the desirability of deposit-refund systems would compare administrative costs and the costs imposed on consumers with the benefits of reduced disposal costs, energy savings, reduced litter, and other environmental benefits. Deposit-refund systems appear best suited for products whose disposal is difficult to monitor and potentially harmful to the environment. When the used product has economic value, the private sector may initiate the program.

3.3.3 Marketable Permit Systems

Two main forms of trading systems are observed: emission (or effluent) reduction credits (ERCs), and tradable allowances for future pollution. ERCs are earned by sources when they release less pollution than is authorized in their environmental permits. With either form of trading system, sources with high marginal control costs will try to buy credits or allowances from sources with low marginal control costs. Trading ERCs or allowances in such a situation is mutually beneficial.

For trading systems to function well, several requirements must be satisfied. First, there should be several potential participants (i.e., sellers and buyers of allowances or ERCs) so that a functioning market can develop. Exactly how small a universe of potential participants is sufficient for a functioning market is difficult to say, but simulation experiments suggest that 8 to 10 participants is a reasonable estimate.[16] Second, if sources are dispersed geographically, trading ratios other than one-to-one might have to be imposed to assure no degradation in environmental quality in particular locations.

Third, pollution control agencies must have the ability to monitor emissions (or measure a surrogate) reasonably well. The commodity to be traded needs to have constant or near-constant impacts across the geographic area where trading is allowed. Fourth, the commodity to be tra' must be quantifiable. The process of establishing emission baselines so that credits or allowan can be quantified is likely to require good historic data on emissions, input use, processes, etc.

Trading systems tend to be more popular with pollution sources than pollution charges because in many cases sources do not have to pay for emissions that are below permitted amounts. In fact, the right to emit pollutants up to permitted amounts and not pay for those emissions may have a considerable value once a trading system is created.

The literature that is cited later in this chapter predicts large, potential savings from trading systems. Available evidence on actual achievements, however, points to relatively modest savings from many of the programs. In searching for the reasons why such a wide gap exists between the potential savings and the actual savings, Stavins (2000) identifies transaction costs as the primary culprit. For example, the need to ensure that the credits claimed under the trading system represent real emissions reductions is one source of transaction costs.

With high transaction costs, the prices that sellers receive for pollution rights is depressed and the prices that buyers must pay for these rights remains high, which makes transactions less attractive for both buyers and sellers. With transaction costs acting as a barrier to trading, sources find it difficult to identify potential trading partners and to conclude trades. Transaction costs were especially high for some of the early emissions and effluent trading programs. Only a tiny fraction of the potentially beneficial trades actually took place.[17] Transaction costs were lower for programs such as lead credit trading and resulted in a far higher proportion of available credits actually being traded.

Price versus Quantity Instruments

The economics literature makes an important distinction between price and quantity instruments when a regulatory authority is uncertain regarding control costs and damage functions (Weitzman, 1974). Quantity instruments, such as cap and trade systems, provide the pollution control authority strict control over the quantity of emissions. Price instruments, such as pollution taxes and fees, provide strict limits on how much a firm must spend to control pollution but do not limit the release of emissions.

With uncertainty, the regulatory authority would not be able to predict costs well if it implements a quantity-based pollution control mechanism, or the environmental consequences if it implements a price-based approach. Which type of uncertainty is likely to be more serious? If important environmental threshold effects exist, a quantity approach would be preferred. But few pollutants have that characteristic; most exhibit relatively stable dose-response relationships. Because of difficulties in forecasting control technologies, it may be more important to limit the maximum amount that sources incur to control pollution. Thus, uncertainty may offer a reason to prefer price to quantity instruments for many types of pollution.

Transaction costs also feature prominently in the choice between making trades between sources within a firm (internal trades) and between firms (external trades). For all of the trading programs that have been studied, firms exhibit a strong preference for internal trading when it is feasible, often even when larger cost savings can be achieved by external trading.[18]

3.3.4 Subsidies for Reducing Pollution or Improving the Environment

Subsidies are the mirror image of emission taxes. Rather than taxing emissions to encourage firms to reduce their emissions, the subsidy approach offers cash payments to firms for reducing emissions. Polluters who release emissions forgo the cash payment. Under a subsidy system, polluters have an incentive to control all units of pollution whose marginal control cost is less than the subsidy. Subsidy systems for pollution control are especially popular in two sectors: farming and municipal government.

Economists point out a major drawback of subsidy systems. Existing firms, farmers, and other entities that receive pollution control subsidies would have an incentive to reduce their pollution. However, the subsidies could attract new firms to enter the industry. In some extreme cases, pollution control subsidies could have the perverse effect of increasing total pollution.

Both federal and state governments have numerous subsidies already written into the tax code, a number of which are perceived as having harmful environmental consequences. Reducing environmentally harmful subsidies is another mechanism for improving the environment.

3.3.5 Liability for Harm Caused by Pollution

Another approach for resolving environmental issues is to make polluters liable for the damage their pollution causes. The purpose is twofold: First, to get polluters to make more careful decisions about the release of pollution; and second, to compensate victims of pollution. Liability rules control pollution through the decentralized decisions of polluters to act in their own best interest.

If polluters are liable (and must pay) for the damage they cause, they will control pollution to the point where the marginal pollution damage equals the marginal costs of control. At this point, their total payments for controlling pollution and compensating victims are minimized.

Liability can take two forms: civil law and common law. Civil liability is expressly written into law. Many environmental statutes worldwide have liability provisions. In the United States, the most important statutes are the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which holds responsible parties liable for cleanup costs, and the Oil Pollution Act (OPA), which holds responsible parties liable for damage to natural resources caused by releases of hazardous substances and petroleum. Liability under CERCLA applies to historic as well as contemporary releases of pollutants. The form of liability is strict, joint, and several, meaning that a single contributor can be held responsible for all of the damage, even though many contributors caused the damage. Furthermore, liability is retroactive. Therefore, an individual or company can be held liable for actions that were perfectly legal at the time they occurred.

In an attempt to improve the incentive effects for cleaning up hazardous waste sites, EPA and the states have developed numerous so-called "Brownfields" initiatives, which are described in this report. The initiatives provide limited relief from strict and retroactive liability in exchange for promises to clean hazardous waste sites and turn them into productive assets. EPA recognized the need to address some of the concerns raised in the past regarding the fairness of enforcement in Superfund. As a result, EPA has taken significant steps to reduce litigation, to promote faster settlements, and to emphasize fairness in the application of Superfund's liability scheme. By streamlining the process by which claims are resolved at Superfund sites, EPA is accelerating the cleanups themselves and increasing the pace at which contaminated properties can be moved back into viable economic use, which is the critical first step in expediting many brownfields development projects.

Polluters respond to federal and state pollution liability statutes by taking precautionary actions that reduce the severity and frequency of spills. Alberini and Austin found this effect with respect to the imposition of strict liability laws by states.[19] The petroleum industry created the

Marine Spill Response Corporation, an emergency spill response effort, following the Exxon Valdez spill and the 1990 Oil Pollution Act.[20]

Common law, such as nuisance, trespass, and negligence, can be used to address harm to individuals and to private property that is caused by pollution. The effectiveness of these approaches in dealing with pollution is an open question. In selected applications, liability can be a strong deterrent, but a number of considerations limit the effectiveness of this approach as a general solution to pollution-related problems. One factor that restricts its widespread use is the time limit for filing claims, otherwise known as the "statute of limitations." In most jurisdictions, a case must be filed within two or three years of discovering a harm. In a few jurisdictions, a case must be filed within a two- or three-year period of when the harm occurred. This distinction is very important for individuals who develop cancer and other diseases of long latency possibly as a result of exposure to toxic substances, since observable effects may arise many years or even decades following the exposure.

A second limiting factor is the burden of proof required by law. The burden of proof required for a judgment against the defendant is usually the standard of "more likely than not," which usually is interpreted as having a probability greater than 50%. Epidemiological studies may suggest that exposure to a particular toxic substance is but one of many factors that could have caused a disease. Satisfying the more-likely-than-not standard can be difficult. Even if a substance is implicated, it may be difficult to determine which polluter is responsible for the harm. For example, doctors may determine that an auto mechanic's lung cancer likely was caused by inhaling dust from brake linings, but assigning responsibility to a particular manufacturer may be impossible. A few jurisdictions allow the assignment of proportional responsibility for both the harm-causing substance and for the determination of who is responsible.

A final limiting factor for liability systems are the transaction costs of pursuing a claim. These costs include the legal costs of obtaining evidence, reaching agreement among plaintiffs on how to pursue a case, presenting the case, and following up if the case is appealed. Liability works best when there is one party on each side of the case and an easily demonstrated harm. When the harm is large in magnitude, liability systems may perform reasonably well when transaction costs are small in proportion to the amounts awarded and if there are few defendants and clear causation, even if the number of plaintiffs is large.

3.3.6 Information Disclosure

By information disclosure programs, this report refers to mandatory disclosure requirements, such as those associated with California's Proposition 65 and the Emergency Planning and Community Right-to-Know Act (EPCRA), which also is referred to as Title III of the Superfund Amendments and Reauthorization Act of 1986. At the time these statutes were enacted, there was little evidence as to how companies would respond to information disclosure rules, other than that they strenuously objected to such requirements.

A number of retrospective studies found that EPCRA requirements gave a strong incentive for firms to identify and act upon opportunities for reducing accidental and routine releases of hazardous substances.[21] Information reporting requirements caused firms to behave as if all emissions were costly. Emissions that could be controlled relatively cheaply were reduced.

3.3.7 Voluntary Pollution Reduction Programs

At both the state and federal level, an enormous number of voluntary programs attempt to motivate firms and individuals to reduce pollution, promote conservation, and increase recycling. There are many reasons why voluntary programs are increasing in popularity. First, although the statutory authorities for creating programs and regulating sources through traditional regulatory mechanisms may be fully implemented, many less serious pollution and resource conservation problems remain. Second, voluntary programs are perceived to have low costs because firms and individuals undertake the measures on a purely voluntary basis. Unlike traditional regulatory measures, voluntary programs do not carry the threat of enforcement actions and penalties for noncompliance. Third, voluntary programs are sometimes used to experiment with new approaches to pollution control, approaches that may be adopted by law or regulation at a later date.

What incentive do firms and individuals have to participate in voluntary programs? In some cases, the reward is limited to the satisfaction of doing a good deed. Many recycling programs would be characterized as such. Participants in some voluntary programs receive free technical assistance regarding pollution control options. The permit approval process may be accelerated for firms that participate in some voluntary programs. Finally, many voluntary programs publicly acknowledge the participants that have successfully met program criteria. Being publicly recognized as an environmentally responsible firm could bring benefits such as increased product sales, improved access to talented workers, and a lower cost of capital to the firm.

3.4 Relative Cost Effectiveness

Economic analysis indicates that incentive mechanisms can often increase the cost effectiveness of pollution control relative to traditional regulatory approaches. Several reasons exist for this conclusion. First, some incentive-based mechanisms explicitly allow the trading of pollution allowances or pollution reduction credits. By trading credits or allowances, sources with high incremental costs of pollution control can have their obligations satisfied by sources with low incremental costs of pollution control. Other incentive-based mechanisms levy a charge or tax on each unit of pollution. Under such an approach sources would control pollution only to the point at which the incremental cost of control equaled the charge or tax. In an ideal world that did not have transaction costs and competitive markets, both permit/credit trading and pollution fee, charge and tax approaches should result in the same marginal cost of controlling pollution at each source. In such an idealized world of economic incentives, control costs should be lower than (or, at most, the same as) the costs associated with a traditional regulatory approach.

Being cost-effective, though, does not necessarily guarantee that the net benefits of pollution control are higher when an incentive-based approach is used. For example, the location of individual sources can matter. One source may be located upwind of a large population center while another is downwind. Equating marginal control costs per ton or equating the trading of allowances or pollution reduction credits among sources may well not maximize net benefits to society. Imagine the consequences if allowance trading resulted in greater emissions at a source upwind of a population center and lower emissions at a downwind source.

A number of other incentive-based mechanisms, such as information reporting requirements, liability rules, and voluntary programs, rely on implicit charges for pollution. The cost effectiveness of such mechanisms is more difficult to predict because sources are reducing pollution for reasons that have only an indirect financial consequence. In some cases, a financial link to incentive-based approaches is very tenuous. The motive for participating in voluntary programs is largely one of improving corporate image to customers, to employees, and to regulators, although management's concern for the environment certainly could be a factor. With corporate image as the principal goal, the benefit to a firm of reducing emissions is difficult to express in financial terms. Perhaps the best that could be done is to examine what firms actually spend to participate in such programs to determine their willingness to pay for pollution reduction. One might find that firms respond in a systematic fashion to the various indirect incentives. Across a sample of firms, liability, for example, might generate a higher willingness to pay for a unit of pollution reduction than an information-reporting requirement, which in turn might exceed the willingness to pay for strictly voluntary activities.

An emerging literature has examined the impacts of existing taxes on the cost effectiveness of different approaches to environmental management (the so-called "tax-interaction" effect). If true, the tax interaction effect would raise the social cost of all environmental programs that control pollution. It appears that economic instruments fare better under these calculations than do traditional regulatory approaches. Goulder et al. (1998) used a general equilibrium model to demonstrate that preexisting taxes would make pollution control about 35% more costly than what was calculated with conventional methods. Relative to conventional calculations of cost, the general equilibrium method shows all forms of regulation as being more costly, however economic instruments maintain their cost advantages. Another observation is that the relative performance of economic instruments can be enhanced through careful design. For example, auctioning marketable permits can result in important efficiency gains relative to simply giving these permits to existing sources (so called "grandfathering").

Parry and Bento (1999) extended the results calculated by Goulder et al. with a simple numerical model that evaluated the effects of tax-favored consumption (e.g., employer- provided health insurance and the mortgage interest deduction). In this model, some economic instruments perform much better than traditional regulatory alternatives. In particular, the welfare gain from using revenue-neutral environmental taxes or the auctioning of emission permits can be greater than previously thought. Under certain conditions, the welfare costs of an environmental tax can be negative.

In a reexamination of the Goulder tax-interaction effect, Jaeger (2000) finds evidence of a double-dividend effect but not the alleged tax-interaction effect.[22] With the double-dividend effect, not only is pollution controlled with a tax or trading program, but revenues are also raised for other worthwhile programs.

Several studies that compare the theoretical cost effectiveness of incentive mechanisms to traditional regulatory approaches to managing the environment are summarized in Table 3-2 (air pollution); Table 3-3 (water pollution); Table 3-4 (solid waste); and Table 3-5 (other pollution-related issues). Many of these studies did not specify the precise nature of the market-based mechanism that would be used. Rather, the assumption was made that either pollution taxes or marketable permits would yield the least cost outcome that was identified through linear programming. One observes in every case that the ratio of costs comparing the traditional regulatory approach with the market-based approach exceeds 1, and sometimes it far exceeds 1.

Table 3-2. Potential Savings from Using Economic Incentives to Control Air Pollution

Pollutant Controlled	Study Year, Source	Geographic Area	Traditional Regulatory Approach	Ratio of Costs: Traditional Approach vs. Incentive Approach
Hydrocarbons	Maloney & Yandle (1984) T	DuPont facilities in United States	Uniform percent reduction	4.15
Nitrogen dioxide	Seskin et al. (1983) T	Chicago	Proposed Reasonably Available Control Technology (RACT) regulations	14.4
Nitrogen dioxide	Krupnick (1986) O	Baltimore	Proposed RACT regulations	5.9
Total Suspended Particulates (TSP).	Atkinson & Lewis (1974) T	St. Louis	State Implementation Plan (SIP) regulation	6.0
Particulates (TSP)	McGartland (1984) T	Baltimore	SIP regulations	4.18
Particulates (TSP)	Spofford (1984) T	Lower Delaware Valley	Uniform percent reduction	22.0
Particulates (TSP)	Oates et al. (1989) O	Baltimore	Equal proportional treatment	4.0 at 90 ug/m3
Reactive organic gases and NO_2	SCAQMD (1992) O	Southern California	Best Available Control Technology	1.5 in 1994 1.3 in 1997
Sulfur dioxide	Roach et al. (1981) T	Four Corners Area	SIP regulation	4.25
Sulfur dioxide	Atkinson (1983) A	Cleveland		
Sulfur dioxide	Spofford (1984) T	Lower Delaware Valley	Uniform percent reduction	1.78
Sulfur dioxide	ICF Resources (1989) O	United States	Uniform emission limit	5.0
Sulfates	Hahn and Noll (1982) T	Los Angeles	California emission standards	1.07
Six air pollutants	Kohn (1978) A	St. Louis		
Benzene	Nichols et al. (1983) A	United States		
Chlorofluorocarbons	Palmer et al. (1980); Shapiro and Warhit (1983) T	United States	Proposed emission standards	1.96
All regulated air pollutants	Bates et al. (1994) O	Poland	European Community and German standards	1.1 to 1.2
Sulfur dioxide	Haklos (1994) O	Europe	Uniform percent reduction	1.42
Ozone	Hahn (1995) O	United States	Vehicle mandate in CA and Northeastern United States	1.3 (NE only) 2.0 (CA + NE)
NO_x	Krupnick at al. (2000) O	Eastern United States	EPA SIP call provisions	1.83 (utilities) 2.0 (all sources)[23]

Note: T refers to original citation in Tietenberg (1990), A to original citation in Anderson et al. (1990), and O to original publication of paper.

Table 3-3. Potential Savings from Using Economic Incentives to Control Water Pollution

Substance Controlled	Source Year, Source	Geographic Area	Traditional Regulatory Approach	Ratio of Costs: Traditional Approach vs. Incentive Approach
Biochemical Oxygen Demand (BOD)	Johnson (1967) T	Delaware Estuary	Equal proportional treatment	3.13 at 2 mg/l 1.62 at 3 mg/l 1.43 at 4 mg/l
BOD	O'Neil (1980) T	Lower Fox River, WI	Equal proportional treatment	2.29 at 2 mg/l 1.71 at 4 mg/l 1.45 at 6.2 mg/l
BOD	Eheart et al. (1983) T	Willamette River, OR	Equal proportional treatment	1.12 at 4.8 mg/l 1.19 at 7.5 mg/l
BOD	Eheart, et al. (1983) T	Delaware Estuary	Equal proportional treatment	3.00 at 3 mg/l 2.92 at 3.6 mg/l
BOD	Eheart et al. (1983) T	Upper Hudson River, NY	Equal proportional treatment	1.54 at 5.1 mg/l 1.62 at 5.9 mg/l
BOD	Eheart et al. (1983) T	Mohawk River, NY	Equal proportional treatment	1.22 at 6.8 mg/l
Heavy metals	Opaluch & Kashmanian (1985) O	Rhode Island jewelry industry	Technology-based standards	1.8
Selenium	EDF (1994) O	Central Valley, CA	Best management practices	1.2
Nitrogen	Moore (2000) O	Long Island Sound	Equal treatment	1.46 at 3.5 mg/l
Nitrogen	Shabman and Stephenson (1998) O	Long Island Sound	Equal treatment	1.56 at 3.5 mg/l
Phosphorus	Faeth (2000) O	Minnesota River Valley	Equal treatment	2.7 at 1ppm/l
Phosphorus	Faeth (2000) O	Rock River, WI	Equal treatment	1.74 at 1 mg/l
Phosphorus	Faeth (2000) O	Saginaw Bay, MI	Equal treatment	5.9 at 1 mg/l

Note: T refers to original citation in Tietenberg (1990), A to original citation in Anderson, et al. (1990), and O to original publication of paper.

Table 3-4. Potential Savings from Using Economic Incentives to Control Solid Waste

Substance Controlled	Study Year, Source	Geographic Area	Traditional Regulatory Approach	Ratio of Costs: Traditional Approach vs. Incentive Approach
Municipal solid waste	Palmer, et al. (1995)	United States	Uniform percent reduction of 10%	2.0

Of course, these ratios are merely theoretical calculations of potential savings. Actual savings could be much less if sources face high transaction costs with trading regimes, a scenario that severs as the basis for comparison in most of the studies. A recent report to EPA (Anderson, 1999) used these studies and other inputs to calculate the potential savings from the widespread use of economic instruments in environmental management. The estimate is large—on the order of $45 billion a year, or almost one-fourth of current environmental expenditures of $200 billion a year at the federal, state, and local levels.

Table 3-5. Potential Savings from Using Economic Incentives for Other Pollution-Related Issues

Substance Controlled	Study Year, Source	Geographic Area	Traditional Regulatory Approach	Ratio of Costs: Traditional Approach vs. Incentive Approach
Fuel efficiency	Charles River Associates (1991)	United States	Corporate Average Fuel Economy standards	4.5
Agricultural chemicals	Rendleman et al. (1995)	United States	Uniform percent reduction	1.1
Traffic congestion	Hau (1990)	Hong Kong	Car ownership restraint	2.5

Examining the performance of trading systems in particular, one finds that existing applications fail to achieve anywhere near their theoretical potential cost savings.[24] Trades have been fewer and cost savings smaller, according to this analysis, than indicated by economic modeling. A number of explanations have been offered for why the predicted savings are not realized.[25] Regulatory and legal requirements of the actual programs may limit the trading opportunities to a greater extent than portrayed in the models, especially where the incentive programs operate in conjunction with traditional regulatory programs. Various models have not fully reflected all the aspects of real regulatory programs, including the transaction costs, restrictive trading rules, monitoring and reporting requirements, and the administrative burden placed on both emission sources and regulatory agencies.

In addition to the limitations imposed by the regulatory structure, potential participants in trading systems may be reluctant to trade emissions credits or allowances, preferring instead the greater certainty of installing pollution control equipment at their facilities. Moreover, pollution credits have a limited life whereas engineering controls, in principle, last for the life of a facility. In most trading systems, the vast majority of trades that take place occur within firms, not between firms. Furthermore, markets for permits that are available for sale tend to be thin, and it may be difficult to locate potential sellers.[26]

For tax, charge, and fee systems in the United States, the principal limitation to achieving the theoretical gains in cost effectiveness has been the generally low level of charges relative to the levels that would be required to have a significant impact on pollution. Typically, charges are set to recover the administrative costs of a program, not to affect pollution.

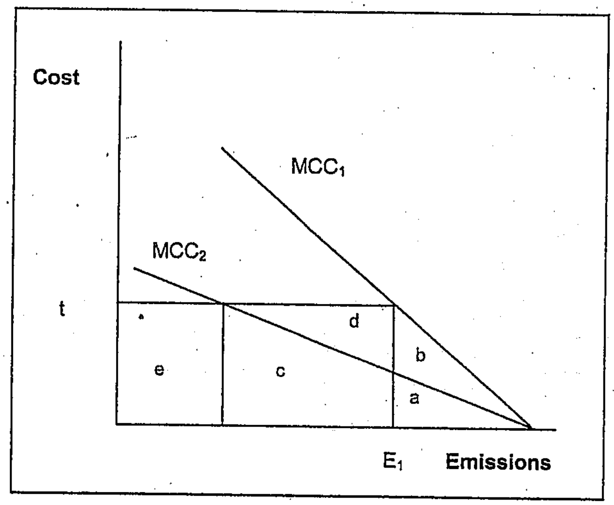
Even if the cost savings of trading systems are less than predicted, the actual savings are still impressive. In the appropriate circumstances, the wider use of incentive programs that are feasible in an actual policy setting will result in substantial cost savings while achieving equivalent environmental goals. In other circumstances, the cost differences between an incentive program and a well-designed traditional regulatory program will be less, although the incentive program will provide a stronger stimulus for innovation and technical change.[27]

3.5 Economic Instruments and Technological Change

Market-based instruments should have significant advantages over traditional regulatory mechanisms in terms of stimulating technical change and innovation in pollution control. The reason is that each and every unit of pollution is costly to the source. In contrast, under a traditional regulatory approach, once a source has satisfied the emission limits, all pollution within those limits has no cost. Why spend valuable resources instituting further controls when there is no offsetting cost savings? In fact, there generally is no incentive for a facility to reduce pollution much below permitted amounts because such an action would invite regulators to reduce the facility's permit limits. In many parts of the nation, pollution control agencies are constantly struggling to find ways of meeting ambient environmental quality goals. Facilities that demonstrate the possibility of making emission reductions below permitted amounts offer an easy target for obtaining some of the necessary emission reductions. These same innovative firms may be the catalysts for developing regulations that require other firms in the same industry to reduce their emissions to the amount shown to be feasible.

Figure 3-4 graphically depicts the difference in incentives produced by an emissions tax and by a traditional regulatory policy. A firm with marginal control costs (MCC) of MCC_1, facing an emission standard set at E_1 will control emissions to that level and incur costs equal to areas (a+b) for controlling all emissions beyond E_1. With an emissions tax set at t, the firm also would control emissions to E_1, but the firm would not only incur control costs of (a+b) but also would have to pay the tax on E_1 of emissions equal to (c+d+e).

Figure 3-4. Comparison of Emission Tax and Emission Limit



The incentive for sources to find improved methods of pollution control are much stronger under the emissions tax, since total pollution control costs are much higher. If the source finds a new, cheaper pollution control technology (represented by the shift in marginal control costs to MCC_2 in Figure 3-4), total abatement costs under the emissions standard approach would fall by an amount equal to area (b). Under the emissions tax approach, total pollution control outlays would equal (a+c+e), a decrease of (b+d).

It should not be surprising that the theoretical and empirical literature concludes that emission taxes provide the greatest stimulus for technical change and innovation, with marketable permits offering a lesser stimulus and traditional regulatory approaches the least. Among traditional regulatory approaches, it is safe to say that performance-based standards should provide a greater incentive to innovate than would pure technology requirements.

Long-run changes in behavior and technology are among the most difficult economic effects to document. For that reason, relatively little is known of the effects that take place as a consequence of different pollution control policies. Yet these effects are thought to be very important.

Outlays for research and development (R&D) in pollution control are between 2% and 3% of total pollution control expenditures. This percentage is about the same as the average R&D expenditure in all of U.S. manufacturing. Pollution control that is based more heavily on economic instruments would be expected to stimulate greater R&D and, in turn, reduce the costs of improving the environment over the long run.

There is historical evidence that Clean Air Act requirements (some market-based, some not) have helped to provide impetus and market opportunities for technology innovation and performance improvements. Innovative companies have responded by producing breakthroughs such as alternatives to ozone-depleting chemicals and new super-performing catalysts for automobile emissions. There are many examples of technologies that were not commercially available a dozen years ago, but that are now important elements of pollution control programs. These examples include the following:

- Selective Catalytic Reduction (SCR) for NO_x emissions from power plants
- Advanced gas reburning technology for NO_x
- Scrubbers that achieve 95% SO_2 control on utility boilers
- Sophisticated new valve seals and detection equipment to control leaks
- Water-based and powder-based coatings to replace petroleum-based formulations
- Reformulated gasoline
- LEVs (Low-Emitting Vehicles) that are far cleaner than those believed possible in the late 1980s (an additional 95% reduction over the 1975 controls)
- Reformulated lower VOC paints and consumer products
- Safer, cleaner burning wood stoves
- Dry cleaning equipment that recycles perchlorethylene
- CFC-free air conditioners, refrigerators, and solvents

This pattern of technological progress is continuing today. In the regulatory impact statement for the 1997 ozone and PM National Ambient Air Quality Standards (NAAQS), EPA identified a number of emerging technologies—ranging from fuel cells to ozone-destroying catalysts to new coating technologies—that may hold promise for achieving further air pollution reductions. EPA can help foster additional demand for clean technologies by promoting strategies that create a market for the most efficient, best performing technologies.

3.6 Impacts on Environmental Quality

A full understanding of the desirability of incentive programs requires information on the actual environmental benefits that are achieved relative to command and control alternatives. The literature focuses almost exclusively on the cost side of the equation as opposed to the environmental effects because most studies assume that the same environmental goals are being sought in both approaches to environmental management. When comparing incentive-based policies with traditional regulatory approaches, or when comparing one incentive-based policy with another incentive-based policy, there may be impacts on environmental quality that would be of interest to regulators and other parties.

In general, incentive mechanisms based on trading are designed to produce environmental effects that closely approximate what would be achieved through a traditional regulatory approach. Some distinctions exist. For example, a cap-and-trade policy provides control over total emissions, while an open-market trading approach does not limit overall emissions. In an open-market approach, credits are generated at the sources' discretion. Open-market trading could reduce total emissions, however, if trading ratios of greater than 1:1 were applied. Some trading programs described in this report have that feature (e.g., fireplace permit trading), but others do not.

In most cases, emission tax systems have not been designed to produce a specific environmental impact. Rather, the primary goal has been to raise modest revenues. (See, for example, Arnold 1995, chapter 11.) However, in the few examples for which emission fees have been set at a level intended to have environmental impacts, the benefits were greater than forecast (e.g., Swedish NO_x and SO_2 charges, and U.S. chlorofluorocarbon taxes).

Deposit systems appear to have achieved environmental results greater than could be achieved with a traditional regulatory approach. However, the refund must be large enough to induce consumers to bring back the used product. For example, deposits/refunds on automobile bodies (required in some European countries) function well in assuring the proper disposal of car hulks when set at a high enough level. A traditional regulatory approach works less well for car hulks. Thousands of abandoned cars are removed at city expense in New York each year, despite regulations prohibiting that type of disposal.

Variations in environmental effects can be important in evaluating the overall desirability of different approaches. Oates et al. provide an example in a comparison of regulatory approaches for of particulate matter control in the Baltimore, Maryland, region. The traditional regulatory approach of applying uniform emission limits to sources results in control of particulate matter to an extent greater than necessary to meet ambient air quality standards in some parts of the city. In contrast, an incentive-based approach achieves the air quality standard with more uniform ambient concentrations of particulate matter in all parts of the city. The extra reductions of particulate matter in some areas under the traditional regulatory approach yield a benefit that partially offsets the higher costs of the traditional approach.[28]

3.7 Finding the Right Instrument for the Problem

This chapter has described a wide range of instruments from the perspectives of cost effectiveness, distributional consequences, environmental effects, and incentives to develop new technologies to deal with pollution. An ideal tool would maximize the net benefits that accrue to society (all environmental and other benefits, less compliance costs, administrative costs, monitoring and enforcement costs) without creating major imbalances in the distribution of costs or benefits. The evidence accumulated from literally hundreds of applications of economic instruments that is reviewed in the following chapters suggests that the set of instruments that can deal effectively with individual classes of environmental problems is fairly narrow. Table 3-6 identifies the types of incentive-based instruments that have been applied to a variety of environmental problems. The relative effectiveness of the different mechanisms is also characterized. The interested reader is referred to Dower (1995) for other perspectives on selecting the best economic instrument for specific environmental problems.

Table 3-6. Uses of Economic Instruments

Instrument	Examples	Pros & Cons
Pollution Charges & Taxes	Emission charges Effluent charges Solid waste charges Sewage charges	Pros: stimulates new technology; useful when damage per unit of pollution varies little with the quantity of pollution Cons: potentially large distributional effects; uncertain environmental effects; generally requires monitoring data
Input or Output Taxes & Charges	Leaded gasoline tax Carbon tax Fertilizer tax Pesticide tax Virgin material tax Water user charges CFC taxes	Pros: administratively simple; does not require monitoring data; raises revenue; effective when sources are numerous and damage per unit of pollution varies little with the quantity of pollution Cons: often weak link to pollution; uncertain environmental effects
Subsidies	Municipal sewage plants Land use by farmers Industrial pollution	Pros: politically popular Cons: high budgetary cost; may stimulate too much of the activity; uncertain effects
Deposit-Refund Systems	Lead-acid batteries Beverage containers Automobile bodies	Pros: deters littering; stimulates recycling Cons: potentially high transaction costs; product must be reusable or recyclable
Marketable Permits	Emissions Effluents Fisheries access	Pros: provides limits to pollution; effective when damage per unit of pollution varies with the amount of pollution; provides stimulus to technological change Cons: potentially high transaction costs; requires variation in marginal control costs
Reporting Requirements	Proposition 65 SARA Title III	Pros: flexible, low cost Cons: impacts may be hard to predict; applicable only when damage per unit of pollution does not depend on the quantity of pollution
Liability	Natural resource damage assessment Nuisance, trespass	Pros: strong incentive effect Cons: assessment and litigation costs can be high; burden of proof large; few applications
Voluntary Programs	Project XL 33/50 Energy Star	Pros: low cost; flexible; many possible applications; way to test new approaches Cons: uncertain effectiveness

This page intentionally left blank

4. Pollution Charges, Fees, and Taxes

4.1 Introduction

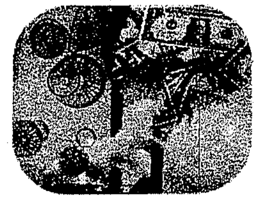
A *pollution charge* is a fee based on the quantity of pollutants that are discharged into the environment. A *user charge* is a fee paid in exchange for the use of natural resources or for the collection or disposal of pollutants. A *product charge* is a fee imposed on products that are believed to have environmentally harmful effects. Although the terms "fee," "charge," and "tax" are used interchangeably in this chapter, there are subtle differences. Under federal law, a tax is a purely revenue-raising instrument, whereas charges or fees are intended to offset costs to the government. Thus, tax receipts would be part of general revenues. While many charges and fees that are collected must be placed in the Treasury General Fund, some are allowed to be retained and could supplement agency budgets. The different types of fees, charges, and taxes discussed in this chapter can be classified in various ways. They are summarized in Table 4-1.

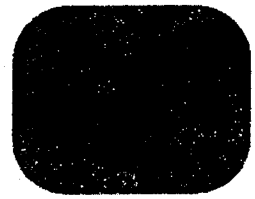
Table 4-1. Fees, Charges, and Taxes in Environmental Policy

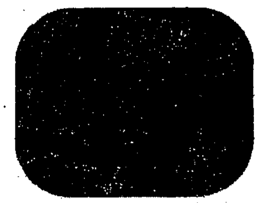
Instrument	Description	Examples
Pollution fee	Charge based on the quantity of pollutants released into the environment	Air emissions permit fees in California, Maine, other states Effluent permit fees in Louisiana, California, Wisconsin, other states Solid waste disposal fees
User fee	Fee for the use of resources	Water use fees Congestion or time-based highway tolls Grazing fees
Product charge	Charge on a product believed to have environmentally harmful effects	Gas guzzler tax CFC tax State taxes on fertilizers State advance disposal fees on tires, motor oil, packaging, other goods
Other fees on environmentally damaging activities	Various mechanisms	Wetland development fees Stormwater runoff fees

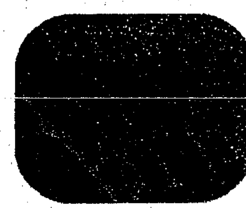
Most environmental taxes are designed primarily to raise revenue, often to fund environmental protection activities. The economic rationale behind such taxes is that those who cause pollution should bear the costs. Such costs include both damages to the environment and the administrative costs incurred by the authorities that regulate polluters. To be economically efficient, environmental taxes should reflect both of these costs.

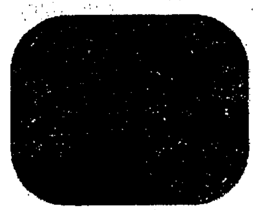
Although some charges, especially product charges, have been imposed at the federal level, the majority of them have been introduced at the state or local level. In the case of air and water pollution, the federal government has provided policy guidance on charges, but the states have developed and implemented a wide variety of charges as they have seen fit.











Given the multiplicity of environmental taxes—especially at the state and local levels—and the frequency with which they are adopted or modified, this chapter does not attempt to provide a comprehensive description of all the environmental taxes in place in the United States. Rather, its purpose is to describe some of the more important environmental taxes.

4.2 Water Fees

Water fees take various forms, including user fees (e.g., for groundwater, surface water, or drinking water supplied by waterworks) and fees for direct or indirect water discharges. Indirect discharges are sent to treatment works. The rationale for water user fees is that water is not a free resource but rather a scarce commodity that should be priced to avoid inefficient use and related environmental problems. The rationale for discharge fees follows from the polluter-pays principle described in the previous section. Most water fees are intended primarily to raise revenue to recover the costs of providing service rather than to allocate a scarce resource among competing interests.

4.2.1 Indirect Discharge and User Fees

Fees are imposed on households and businesses for discharges of wastewater into Publicly Owned Treatment Works (POTWs). Frequently, the water and wastewater utilities that service a household or business are one and the same. When a single invoice includes both services, users may be able to distinguish discharge fees from water user fees only by careful attention to line items. Wastewater discharges are not directly metered in most cases; rather they are assumed to be equal in volume to water consumption, which is measured. Some discharge fees for larger businesses are based not only on water use but also on discharge toxicity, which provides them with a separate incentive to reduce the toxicity of their discharges. Sims found that toxicity-based charges provided an incentive for large industrial facilities to reduce the volume of their discharge.[29]

With respect to water user fees, EPA's 1995 Community Water System Survey estimated that 95% of residential water customers and 98% of nonresidential water customers are metered. They pay water charges based directly on their usage.[30]

Whether a water user fee has a greater effect in terms of raising revenue or reducing a potentially polluting activity depends largely on the elasticity of the demand for water, that is whether demand is responsive to changes in price. If the demand is inelastic, an increase in user fees will raise revenue. User fees will not, however, affect consumption behavior in a significant way. If demand is elastic, however, consumption behavior is likely to be changed by a water fee, but the revenue-raising prospects are limited. Although water demand is often assumed to be inelastic, studies that separate water demand by season have found that household water demand is inelastic in winter but elastic in summer. Others have found that water demand by industrial and agricultural users is sensitive to price changes.[31]

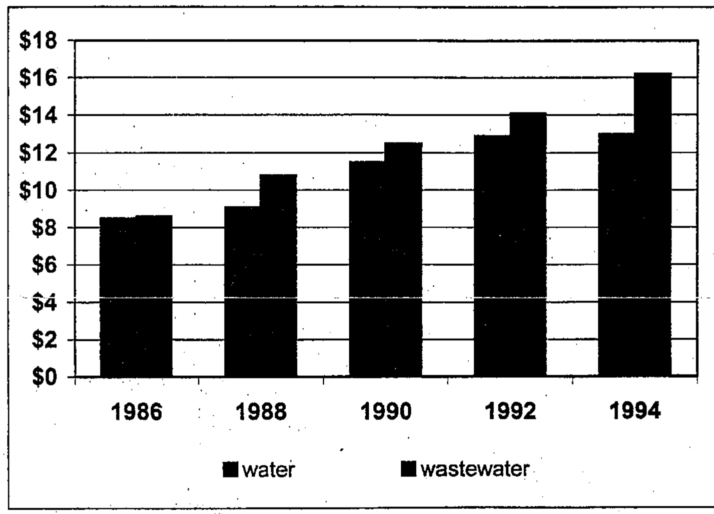
To promote water conservation, many have suggested the use of rate schedules that impose higher rates per 1,000 cubic feet as use increases. Two periodic surveys give an indication as to the type of rates that water utilities use. The Ernst & Young survey focuses on only the largest urban utilities, while the EPA Community Water System Survey is a more comprehensive, random-sample survey that includes smaller utilities. The Ernst & Young survey of residential rates for about 130 utilities reported that 38% use decreasing rates, 37% use uniform rates, and

22% use increasing rates. It also shows two trends over time: a greater use of increasing rates and a lesser use of decreasing rates. EPA's Community Water System Survey obtained residential rates from more than 1,000 systems: 49% use uniform rates, 16% use decreasing rates, and 11% use increasing rates. Since utilities could report more than one type of rate per class of customer, the total for all rate types is more than 100%. Taken together, these two surveys suggest that smaller utilities in general are less likely to use increasing or decreasing rates than larger utilities.

As shown in Figure 4-1, periodic surveys of selected water utilities indicate that water and wastewater fees have risen significantly since 1986. These price increases have exceeded the rate of inflation. In addition, EPA's Community Water System Survey notes the tendency for large utilities to raise rates more frequently than small utilities. Smaller utilities raise rates by a greater amount when they do raise rates, but the differences are less dramatic when reported in annualized terms.

In addition to water and wastewater charges, stormwater charges have been imposed in a number of areas. Ernst & Young found that the number of utilities with such charges increased significantly from 1992 to 1994. Their use varies significantly across regions: They are used by over half of all utilities surveyed in the West but by none surveyed in the Northeast. In some areas, reduced storm-water fees are assessed in return for measures that promote stormwater management.

Figure 4-1. Water and Wastewater Charges (monthly average)



Source: Ernst & Young. 1994. p. 3

Finally, in some states, water user fees generate revenues for drinking water programs. New Jersey, for example, raises $2.8 million annually (out of a total drinking water program budget of $5 million) from a water use tax of $0.01 per 1,000 gallons.[32]

4.2.2 Direct Discharge Fees

The Federal Water Pollution Control Act of 1972 provides for the regulation of point- source discharges through a system of national effluent standards that are promulgated by EPA. All point sources must obtain National Pollution Discharge Elimination System (NPDES) permits in order to discharge effluent.[33] By August 2000, EPA had authorized 43 states to issue NPDES permits.[34] In two states, EPA regional offices issue the permits. As of July 1995, about 59,000 municipal and industrial facilities in the United States had received NPDES permits.[35]

A 1993 survey revealed that 39 states assessed NPDES permit fees as of December 1993. In 10 of the states, fees varied according to discharge volume and toxicity, while in 18 other states fees varied according to discharge volume alone (see Table 4-2). Other criteria sometimes used in setting fees include the purpose of the water use, the characteristics of the receiving water, and the type of facility releasing the discharge. Some states use point or class systems with various criteria to determine the fee levels for different dischargers. Fees for Publicly Owned Treatment Works (POTWs) are sometimes based on the size of the population that is presumed to be connected to the local sewage system.

Table 4-2. State Effluent Permit Fee Structures

Fee Structure	States
Flat or varies only according to industry or size of permit holders.	Alabama, Alaska, Delaware, Hawaii, Kentucky, Maine, Massachusetts, Pennsylvania, Rhode Island, Utah, Virginia
Varies according to discharge volume	Arizona, Arkansas, Colorado, Connecticut, Florida, Kansas, Minnesota, Missouri, Nevada, New York, North Carolina, Ohio, Oregon, South Carolina, South Dakota, Tennessee, Vermont, Washington
Varies according to discharge volume and toxicity	California, Indiana, Louisiana, Maryland, Montana, New Jersey, Oklahoma, Texas, West Virginia, Wisconsin

Source: Duhl. 1993, p. 10.

The primary purpose of NPDES permit fees is to raise revenue, especially for the permitting program. This rationale explains why fees are often based on the complexity of the permit, a reflection of the administrative effort required to get the permit in place. In a number of states, fees are set to attain revenue targets.

A secondary purpose is to discourage water pollution. Although the incentive effect of water effluent fees in the United States has not been studied in a comprehensive way, several factors limit the likelihood of a strong impact. In some cases, fees are based not on measured discharge characteristics but rather on more easily measured parameters that are related to discharge characteristics. Moreover, some fee structures have broad classes for characterizing discharge volume, toxicity levels, or both. These structures impose the same fee within a given volume or toxicity class In such cases, polluters have no incentive to limit discharges unless they can move from one fee class to another. Finally, the charges are often modest relative to control costs. New Jersey has the highest effluent fees. In 1993, two facilities in New Jersey paid $702,812. In most states, however, the highest fees are less than $100,000. As a point of comparison, effluent control costs typically exceed $5 million each year at a large industrial facility.

4.2.3 Some State Effluent Permitting Fees

Although it is beyond the scope of this report to describe water effluent fees for all 50 states, examples from Louisiana, California, and Wisconsin should illustrate typical characteristics of these fees. Each of these states has NPDES permit fees (i.e., effluent fees) that vary with both the volume and toxicity of the discharge.

Louisiana uses water permit fees to fund not only the state permit program but also the activities of the Office of Water Resources of the Department of Environmental Quality. (The legislature no longer provides general revenues to the Office.) The annual permit fee is determined by a worksheet that assigns points on the basis of several factors: (1) facility complexity; (2) flow volume and type; (3) pollutants released; (4) heat load; (5) potential public health threat; and (6) the designation of a facility as major or minor, depending upon how many people it employs. The points are multiplied by a rate factor of $97.50 per point for municipal facilities and $170.63 per point for industrial facilities to determine total annual fees. The minimum annual fee is $227.50, and the maximum annual fee is $90,000. In addition to annual fees, Louisiana imposes application fees for new, modified, or reissued permits. In most cases, these fees are 20% of the annual fee.[36]

In California, NPDES annual fees are based on the threat to water quality and the complexity of the permit. There are three categories for each characteristic: Categories I, II, and III for the level of threat to water quality; and Categories a, b, and c for the complexity of the permit. Permit holders with a I-a rating (the greatest threat to water quality and the most complex permits) pay the highest fees, $10,000 a year. III-c permit holders pay the lowest fees, $400 a year. These fees fund State Water Board programs.

In addition to the NPDES permit fees, California charges Bay Protection and Toxic Cleanup fees. This fee structure is similar to that of the NPDES permits except that it is also applied to other sources of pollution such as storm drains, boat construction and repair facilities, marinas, dredging operations, and beach replenishment activities. Another difference is that its revenues fund the Bay Protection and Toxic Cleanup Program, which is designed to identify hot spots, develop a water quality database, and help coordinate water policy. The Bay Protection Fee schedule ranges from $300 for III-c permittees (who pose the least threat to water quality and have the least complex permits) to $11,000 for I-a permittees. Dredging operations are charged an annual fee of up to $15,000.

The Wisconsin effluent fee system is believed to have potential incentive effects. The fee rate per pound of individual pollutants is inversely related to the permit limit in pounds for the pollutant. Thus, the most harmful pollutants are taxed at the highest rate per pound. Pollutant loadings are calculated on the basis of flow and concentration information contained in wastewater monitoring reports. Polluters are thereby encouraged to reduce both the quantity and the toxicity of pollutant releases.

4.2.4 Stormwater Runoff Fees

It is common practice for counties to impose fees on real estate developments based on surface area runoff (paved areas and areas under roof). Fee revenues are used for storm-water management in stream valleys. These fees differ from the utility stormwater fees described in Section 4.2.1 in that they apply to runoff into surface water.

4.3 Air Emission Fees

As is the case with water pollution, there are no national air emissions fees. However, the Clean Air Act Amendments of 1990 require that states impose fees for issuing emission permits. The Amendments also impose fees on VOC emissions that will come into force in 2005 and 2010 in areas that fall far short of attaining national ambient air quality standards for ozone. States have been more active in the use of emission fees as an air quality management tool.

4.3.1 Permit Fees

The 1990 Clean Air Act Amendments require that states impose permit fees to recover the administrative costs of their EPA-approved operating permit programs. The Amendments set the minimum presumptive level for such fees at $25 per ton of emissions of air toxics and criteria air pollutants (excluding carbon monoxide). They also specified that this amount should be adjusted for inflation. Each state is required to set fees that completely cover operating permit program costs. If the fees are greater than or equal to $25 per ton, adjusted for inflation—at present, about

\$35 per ton—EPA assumes that the fees are adequately high. States with lower fees must present detailed evidence that fee revenues are sufficient to cover their operating permit program costs. Several state permit programs have been denied full EPA approval because they have submitted insufficient information on the adequacy of their fees. These states have received interim approval, pending their submission of evidence of fee adequacy.

Although states can meet the revenue-raising requirement through flat fees or other types of fees, most have chosen incremental per-ton fees. Some states base their fees on the pollutant's potential harm to the environment. New Mexico, for example, levies fees of \$150 per ton for air toxics but only \$10 per ton for criteria pollutants. Fee structures in Maine and California are discussed here for illustrative purposes.

4.3.1.1 Air Emission Permit Fees in Maine

In November 1993, Maine raised its air emission permit fees. Charges were raised from \$2 per ton to \$5 per ton for emissions up to 1,000 tons; from \$4 per ton to \$10 per ton for emissions between 1,001 and 4,000 tons; and from \$8 per ton to \$15 per ton for emissions in excess of 4,000 tons. The minimum charge rose from \$100 to \$250, and the maximum charge rose from \$100,000 to \$150,000. The fees apply to emissions of sulfur oxides (SO_x), NO_x, VOCs, and particulate matter. Having since been adjusted for inflation, their fee levels (as of 1997) are shown in Table 4-3. The fees applied to all permit holders.

Table 4-3. Air Emissions Permit Fees in Maine

Amount Emitted	Fee (\$/ton)
Up to 1,000 tons	5.28
1,000-4,000 tons	10.57
More than 4,000 tons	15.85

Source: Limouze, Maine Air Quality Bureau.

Maine has also imposed an air quality surcharge based on the toxicity of emissions. The magnitude of the surcharge is determined on the basis of several criteria. Approximately 85 facilities are subject to the tax, which is capped at \$50,000. Before the surcharge was adopted, the Director of Maine's Air Quality Bureau said that the state would give polluters an incentive to identify how they would reduce their emissions of the most toxic substances.[37] The same Air Quality Bureau official indicated that surcharge revenues have fallen and that the surcharge has had a slight incentive effect. The official also suggested that the impact on the environment is difficult to isolate from other potential factors, such as the Toxics Release Inventory. Permit fees produce approximately \$1.8 million in revenues each year, and toxicity surcharges net \$0.6 million in annual revenues. Revenues are used for the air permit program and other air quality activities.

4.3.1.2 Emission Permit Fees for South Coast Air Quality Management District

The South Coast Air Quality Management District (SCAQMD), located in Southern California) levies the highest fees per unit of air emissions in the United States. The fees shown in Tables 4-4 and 4-5 are adjusted for inflation and budgetary needs of the SCAQMD every May.

Facilities that temporarily exceed their allowable emissions levels must pay excess emissions fees. For most pollutants, the excess emissions fees are about the same as the regular fees. For carbon monoxide, however, they are approximately twice as high. In addition, SCAQMD imposes fees for visible emissions and various administrative procedures.[38]

Table 4-4. Emission Fees in SCAQMD

FY 99–00, $ per ton

Annual Emissions	Organic Gases	Nitrogen Oxides	Carbon Monoxide	Sulfur Oxides	Particulate Matter
4–25 tons	$292.80	$171.30		$203.10	$223.90
25–75 tons	475.40	272.10		328.30	362.80
>75 tons	711.60	409.80		492.90	543.20
>100 tons			$3.50		

Source: SCAQMD Rule 301.

Fees for some air toxics have escalated rapidly, far faster than the fees for criteria air pollutants. Between 1996 and 2000, emission fees for asbestos; cadmium; hexavalent chromium; chlorinated dioxins; 1,3 butadiene; and lead rose by 50% to more than 100%.

Table 4-5. Air Toxics and Ozone-Depleting Chemicals Emission Fees in SCAQMD

Pollutant	$ Per Pound		
	FY96–97	FY98–99	FY99–00
Asbestos, cadmium	2.17	3.00	3.40
Benzene, carbon tetrachloride, ethylene di-bromide, ethylene dichloride, ethylene oxide	0.90	1.00	1.13
Methylene chloride	0.05	0.05	0.06
Hexavalent chromium	2.67	4.00	4.53
Chlorinated dioxins and dibenzofurans	3.17	5.00	5.66
Nickel	1.67	2.00	2.26
1,3-Butadiene, inorganic arsenic, beryllium, poly-nuclear aromatic hydrocarbons (PAH)	1.50	3.00	3.40
Lead, vinyl chloride	0.50	1.00	1.13
1,4-Dioxane	0.11	0.21	0.23
Formaldehyde, perchloroethylene	0.21	0.21	0.23
Chlorofluorocarbons	0.18	0.18	0.20
1,1,1-trichloroethane	0.038	0.04	0.04

Source: SCAQMD Rule 301

Given the presence of traditional forms of regulation and other factors that might influence air pollutant emissions, the incentive effect of the SCAQMD emissions fees is difficult to determine. In most cases, these fees are lower than the marginal costs for pollution abatement. The main purpose of these fees is to recover the administrative costs of SCAQMD's activities.

4.3.1.3 California "Hot Spots" Fees

The California Air Toxics "Hot Spots" Information and Assessment Act (AB 2588) requires facilities to report the type and quantity of certain substances they release into the air. The California Air Resources Board (CARB) administers the program. The law also requires CARB to develop and adopt fees to cover the administrative costs of the program that are incurred by CARB and local air districts. Districts can either set their own fees or request that CARB set fees for them. Each district is responsible for billing and collecting the fees and remitting the district's share of state costs to CARB. The information component of this law is discussed in Chapter 9. The fees are discussed in this chapter.

CARB's Hot Spots fee structure, which is used in 12 of California's 34 air pollution control districts, is no longer based on tonnage of emissions. However, at least two of the 22 districts that set their own fees base them on the amounts and toxicity of pollutants. One district bases its fees on amount but not toxicity. The toxicity-based fee structure of the Bay Area Air Quality Management District (BAAQMD) is described here as an example.

BAAQMD bases fees on Unit Risk Values (URVs) for carcinogen emissions and Acceptable Exposure Levels (AELs) for other emissions. Fee amounts depend on the quantities of weighted emissions. For carcinogens, weighted emissions are determined by multiplying the amount of each substance by 100,000 times its URV. For other toxics, weighted emissions are determined by multiplying the amount of each substance by the reciprocal of its AEL (in m^3/micro-gram). The sum of the weighted emissions of all toxics is multiplied by a coefficient to calculate the fees charged to each source. The coefficient varies from year to year depending on the costs incurred by CARB and BAAQMD to manage the Hot Spots program.

Facilities with fewer than 50 weighted pounds pay nothing, while facilities with weighted emissions between 50 and 1,000 pounds pay a flat fee of $125. For gasoline dispensing facilities, the fee is simply $5 for each dispensing nozzle. For small businesses, which are defined as having no more than 50 employees and $5 million in annual receipts, fees are capped at $5,000. Government facilities are also subject to the fees. Although there is no maximum fee for larger businesses, no source has paid more than $60,000 in annual fees. In 1992, about 1,200 facilities paid $1.16 million in fees.

A total of 81 toxics are subject to the fees. In most cases, emissions are not measured but rather estimated on the basis of two factors: data on the use of toxics and emissions factors that depend on the abatement equipment. Although fee amounts appear relatively small for larger businesses, BAAQMD officials believe that the fees have contributed to a decrease in toxic emissions. Facilities have lowered emissions in various ways, including process changes and reductions in the use of toxics. When toxicity-based fees were adopted in 1992, for example, hospitals and metal plating facilities emitted relatively large amounts of ethylene oxide and hexavalent chromium. Since these substances have high URVs, emitting facilities faced high fees. Most of these facilities installed Best Available Control Technology soon after the BAAQMD fee structure was adopted.[39]

However, it is difficult to isolate the effects of these fees from other factors that could influence toxic emissions, including the information and reductions planning components of the Hot Spots program and federal Toxic Release Inventory requirements. In addition, refineries have made large investments to comply with the reformulated fuel and fugitive emissions standards.

4.3.2 Ozone Non-attainment Area Fees

The 1990 Clean Air Act Amendments impose fees on "excess" VOC emissions in ozone non-attainment areas designated as "Severe" or "Extreme." The fees are set at $5,000 per ton (adjusted for inflation since 1990) for each ton emitted in excess of 80% of a baseline quantity. The fees come into effect on the applicable attainment date for the area: 2005 for areas with the designation Severe and 2010 for areas designated as Extreme. (In 1990, California's South Coast

Air Quality Management District was the only non-attainment area rated as Extreme. At present, there are no areas that have that classification.)

4.4 Solid Waste Disposal Fees

This section briefly discusses variable rate programs (a relatively new trend in household waste collection), landfill taxes, and hazardous waste disposal taxes. The purpose of such disposal taxes is to discourage waste generation and encourage recycling. Unfortunately, they also create incentives to dispose of waste illegally or to transport waste to other locations where disposal is cheaper.

4.4.1 Variable Pricing Programs

Communities throughout the United States have traditionally levied fixed collection fees for household waste, or they have included collection and disposal costs in property taxes. Such pricing practices are inefficient in that the marginal price of solid waste disposal faced by the household is zero, whereas the marginal collection and disposal cost is positive.

However, a growing number of communities are now charging for solid waste collection based on the volume generated by the household. Such variable rate (or "pay-as-you-throw") programs have been implemented in more than 4,100 communities in 42 states, reaching an estimated 10% of the U.S. population. Four states have mandated the use of variable rate programs in some or all of their municipalities. Washington's law applies mostly to private collectors that operate in unincorporated areas of the state, but virtually all municipalities in the state use variable rates. Iowa and Wisconsin require variable rates only in communities that fail to attain a 25% waste recycling/diversion goal by certain deadlines. In Minnesota, variable rates are required in all communities.[40] EPA is also encouraging variable rates, and the Agency has held a series of workshops to explain their advantages and disadvantages and to provide information on how to implement them.

Variable rate programs can take several forms. Prepaid garbage bags or stickers that affix to bags can be required for collection, or collection fees can be based on the number of cans, the size of cans, or both of these characteristics. A small number of communities have weight-based systems. More common are mixed programs that combine a fixed rate—which in some programs entitles households to collect a pre-specified amount of waste—and incremental rates for amounts in excess of the maximum covered by the flat rate. Such mixed programs are growing in popularity, perhaps because they are relatively easy and inexpensive to implement, they provide a stable source of revenue for collection services, they have the potential to reduce illegal dumping, and they offer a pre-specified level of service at a fixed cost to many customers.[41] However, according to one source, collection systems that require periodic billing of customers are likely to be more expensive to administer than bag or sticker systems.[42] On the other hand, one disadvantage of using bags is that they can tear, especially if handled improperly or opened by animals. Table 4-6 describes variable rate structures in a number of U.S. communities studied by Miranda and Aldy and Bauer and Miranda.

Waste collection systems can be open systems or exclusive franchises. In open systems, the city may provide optional waste collection (e.g., Grand Rapids, Lansing), or it may leave collection completely in the hands of private firms (e.g., Colorado Springs). In exclusive franchises, collection can be done either by the city (e.g., Spokane, Tacoma) or by one or more contracted

Table 4-6. Variable Rate Structures

Community	Fee Structure
Glendale, CA	65-gallon cart: $6.45/month, 2¢/gallon 100-gallon cart: 10.10/month, 2¢/gallon
Pasadena, CA	60-gallon cart: $10.41/month, 4¢/gallon 100-gallon cart: 16.23/month, 4¢/gallon 2 60-gallon carts: 19.01/month, 4¢/gallon 60-gallon & 100-gallon carts: 22.40/month, 4¢/gallon 2 100-gallon carts: 28.62/month, 3¢/gallon
San Jose, CA	32-gallon cart: $13.95/month, 10¢/gallon 64-gallon cart: 24.95/month, 10¢/gallon 96-gallon cart: 37.50/month, 10¢/gallon 128-gallon cart: 55.80/month, 10¢/gallon
Santa Monica, CA	40-gallon cart: $14.85/month, 9¢/gallon 68-gallon cart: 17.76/month, 7¢/gallon 95-gallon cart: 21.07/month, 6¢/gallon 68-gallon & 95-gallon carts 37.28/month, 5¢/gallon
Oakland, CA	20-gallon can: $10.08/month, 13¢/gallon 1st 32-gallon can: 13.74/month, 11¢/gallon Each extra 32-gallon can: 16.49/month, 13¢/g
Portland, OR	20-gallon can: $14.60/month, 18¢/gallon 32-gallon can: 17.60/month, 14¢/gallon 35-gallon cart: 19.30/month, 14¢/gallon 60-gallon cart: 24.05/month, 10¢/gallon 90-gallon cart: 27.10/month, 8¢/gallon
Tacoma, WA	60-gallon can: $17/month, 7¢/gallon 90-gallon can: 25.50/month, 7¢/gallon
Spokane, WA	20-gallon can: $8.56/month, 11¢/gallon 1st 30-gallon can: 11.07/month, 9¢/gallon Each extra 30-gallon can: 6.01/month, 5¢/gallon
Colorado Springs, CO	1 34-gallon can + 1 30-gallon bag: $9.50/month, 4¢/g 2 cans and 2 bags: 11/month, 2¢/gallon 3 cans and 3 bags: 13/month, 2¢/gallon
Downers Grove, IL	30-gallon bag: $1.50, 5¢/gallon
Hoffman Estates, IL	30-gallon bag: $1.45, 5¢/gallon
Woodstock, IL	30-gallon bag: $1.56, 5¢/gallon
Grand Rapids, MI	30-gallon bag: $0.85, 3¢/gallon 30-gallon can: 44.20/year, 3¢/gallon
Grand Rapids, MI	64-gallon cart: $15/month, 6¢/gallon 104-gallon cart: 17/month, 4¢/gallon
Grand Rapids, MI	90-gallon cart: $17.35/month, 5¢/gallon
Lansing, MI	30-gallon bag: $1.50, 5¢/gallon
Lansing, MI	63-gallon cart: $12/month, 5¢/gallon 104-gallon cart: 15/month, 4¢/gallon
Lansing, MI	60-gallon cart: $11/month, 5¢/gallon 90-gallon cart + 3 30g bags: 13.40/month, 2¢/g

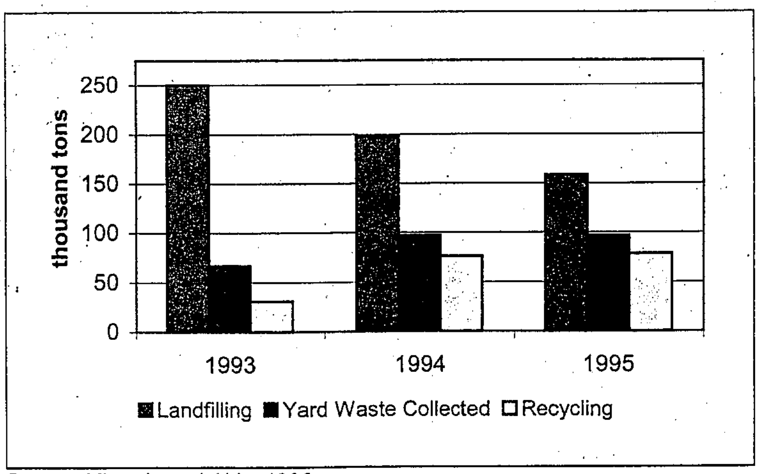
Sources: Miranda and Aldy. 1996; Bauer and Miranda. 1996.

haulers (e.g., Oakland). In both open and franchise systems, communities can set rules regarding collection fees. In St. Paul, Minnesota, for example, the city operates no collection program but requires that collectors charge variable rates, and Portland's open system has no city program but sets the collection fees that private haulers charge their customers.

Many communities with variable rates implement public education, curbside recycling, yard waste, white goods (e.g., refrigerators), and holiday greenery collection programs as well. Education has been found to be an important element in the success of variable rate programs. The collection frequency, fees, materials collected, and participation requirements for these programs, with the exception of public education, vary across communities. These complementary activities can have an important impact on the success of variable rate programs.

San Jose, California, began its variable rate program in 1993. The city contracts its waste collection and curbside recycling services to two different firms. One company serves the approximately 80,000 single-family households in the northern half of the city as well as all multi-family housing. The other business serves about 105,000 single-family households in the southern half of the city. A combination cart/sticker system is used to price household waste collection. Residents subscribe to specific cart sizes and pay the fees shown in Table 4-6 for weekly collection of the waste in these carts. When these households have too much garbage for their cart sizes, they can put the excess garbage in 32-gallon plastic bags, provided the bags each bear a sticker sold for $3.50 at local libraries, supermarkets, and convenience stores. Multi-family dwellings pay flat fees. One potential advantage of the stickers is that they give households the flexibility to exceed planned waste generation on occasion. San Jose also offers free curbside collection of recyclables and yard waste and collects white goods for a separate fee of $18 for up to three items. Figure 4-2 suggests that the variable rate program has significantly reduced the amount of waste sent to landfills and increased the amount of recycled waste. The amount of yard waste set aside for collection and subsequent composting also increased.

Figure 4-2. Solid Waste Flows in San Jose



Source: Miranda and Aldy. 1996

The variable rate systems described thus far base prices on waste volumes. Another, less common price basis is weight. Communities that have implemented weight-based pricing include Seattle, Milwaukee, Minneapolis, Durham (NC), Columbia (SC), and Farmington (MN). Such systems could have a stronger incentive effect by charging for every additional unit of weight and thereby eliminating the incentive given by volume-based systems to compact trash into containers. Seattle's weight-based scheme lowered the weight of garbage collected by 15%. One disadvantage of weight-based systems is that they tend to be technologically much more complicated, requiring that collection trucks carry specialized equipment and increasing the time haulers take to collect waste.

A004149

Seattle, for example, found that collection times were extended by 10% under the city's weight-based system. If the weight of garbage decreases enough, however, there is the potential to offset the increased implementation costs.[43]

In most areas where variable rate programs have been introduced, the amounts of waste collected have decreased significantly, a result of either increased recycling or decreased waste generation.

- A 1998 study of 114 variable rate cities and 845 traditional fixed rate communities estimated a 43.8% reduction in waste disposal after those cities and communities began to charge $1 for every 32-gallon bag.[44]
- A 1992 survey of 14 cities with variable rate programs found that the amount of waste destined for disposal decreased by an average of 44% during the first year following program initiation.[45]
- A study in Maine found that municipalities with variable rate systems disposed of less than half as much waste per capita as municipalities without such systems.[46]
- Surveys in Tompkins County, New York, and Dover, New Hampshire, found that variable rates led consumers to think of ways to reduce waste generation, including altering their purchasing habits.
- A 1996 study of four communities in California and five in the Midwest found that they achieved reductions in waste disposal of 6% to 50% after introducing variable rate systems. The higher the unit prices, the greater the reductions. Moreover, reductions were greater in those communities with relatively small minimum container sizes. If the minimum container size is too large, consumers often have little incentive to alter their behavior.[47]
- As shown in Table 4-7, another study found reductions in the tons of waste sent to landfill, reductions that ranged from 17% to 74% following the adoption of variable rates in 21 northern cities. The study reached two conclusions. First, the magnitude of the unit prices was positively correlated with the change in the amount of waste recycled. (That is, the higher the price per unit of waste, the more waste was recycled). Second, unit prices were negatively (not the right term) correlated with the change in the amount of waste landfilled. That is the higher the price per unit of waste, the less waste that was sent to landfills and the more waste that was recycled.

  The recycling increases shown in Table 4-7 were achieved in geographic areas that did not simultaneously implement recycling programs. In places where the adoption of variable rate programs has coincided with new public recycling activities, however, it is difficult to determine how much of the decline in waste disposal is due to the variable rates and how much is due to the new recycling alternatives. The Dover survey found that curbside recycling programs alone encouraged recycling but that variable rates provided additional incentive.[48] Another study estimates that a variable rate program will increase the amount of waste that is recovered under existing recycling programs by 4% to 13%.[49]
- Nestor and Podolsky (1998) reported on the results of an experiment in the city of Marietta, Georgia. In January 1994, the City of Marietta simultaneously introduced a bag/sticker program and a subscription can program in different parts of the city. After adjusting for seasonal effects, Nestor and Podolsky estimate that households participating

in the bag program reduced their garbage disposal by approximately 23% while households participating in the subscription can program decreased waste disposal by only about 8%. The explanation for this difference is that the bag/sticker program offers households more flexibility on a week-to-week basis regarding the amount of waste they are required to pay for. Households who are able to set out smaller-than-usual amounts of waste immediately benefit from it. The bag/sticker program gives households greater incentive to reduce waste because they are not committed to a specified number of containers each week.

Table 4-7. Responses to Variable Rate Pricing

Municipality	% Reduction in Tons of Waste Landfilled	% Increase in Tons of Waste Recycled
Antigo, WI	50	145
Charlemont, MA	37	N/A
Downers Grove, IL	52	N/A
Grundy Center, IA	32	N/A
Hancock, VT	33	N/A
Hartford, VT	17	29
Harvard, IL	33	113
High Bridge, NJ	18	N/A
Huntingburg, IN	74	N/A
Illion, NY	51	141
Ithaca, NY	31	63
Lisle, IL	53	N/A
Mt. Pleasant, IA	49	N/A
Mt. Pleasant, MI	44	141
Perkasie, PA	54	157
Plains, PA	49	88
Quincy, IL	41	45
River Forest, IL	19	N/A
St. Charles, IL	41	456
Weathersfield, VT	36	150
Woodstock, IL	31	N/A

Source: Miranda, as reprinted in Arner and Davis.

Despite the evidence cited in Figure 4-7, variable rate programs have some unresolved problems. Data on decreases in collection can be misleading if the programs result in significant illegal disposal of waste or the diversion of waste to cheaper disposal services. Illegal dumping includes direct discharge to the environment as well as placing waste in someone else's container or donating irreparable items to charitable organizations. Direct discharge to the environment is likely to be of more concern than other types of illegal disposal. The Maine study found that an increase in backyard burning and a slight increase in roadside dumping and illegal disposal in commercial containers coincided with variable rate systems. Of the 14 cities surveyed in Skumatz (1993), "six cities reported no problem with dumping, four reported minor problems, and four reported notable problems." Among the measures cited to limit illegal disposal are creation of viable recycling alternatives, public education, locking commercial dumpsters, high dumping fines, and flat collection fees that entitle households to a minimum level of service.[50]

Other problems need to be addressed in designing and managing variable rate programs. They can be difficult to implement in multi-family housing such as apartments, and they can have a regressive effect on large families. Variable rates are likely to be regressive because the amount of waste produced per thousand dollars of income is likely to be higher for a poor household than for a more affluent household. In addition, variable rate programs can lead to significant decreases in revenue for municipal waste collectors because households reduce the amount of solid waste that they generate.

Variable rate programs may not be appropriate for all communities. Analysts assert that variable rate pricing is unlikely to be successful in communities having the following characteristics: (1) those with affordable and environmentally acceptable landfills; (2) those with few or no nearby recycling facilities; (3) those with open spaces located nearby, which makes that land vulnerable to illegal dumping; and (4) those with consumers who oppose paying variable rates.[51] In some areas, however, variable rate programs appear to be beneficial. According to a World Resources Institute (WRI) study, "Where landfill costs are high, disposal charges would generate net economic savings of $0.17 for every dollar of revenue collected, even after the gross costs of curbside recycling programs were paid."[52]

4.4.2 Landfill Taxes

According to the National Recycling Coalition, surcharges on waste delivered to landfills have been imposed in over 20 states.[53] If operators are capable of passing on such taxes to their customers in their disposal fees, landfill taxes could have effects similar to variable rate programs.

New Jersey levies three different landfill taxes: a Solid Waste Services Tax of $1.05 per ton, a Landfill Closure and Contingency Tax of $0.50 per ton, and a Solid Waste Recycling Tax of $1.50 per ton. For waste in liquid form, rates for the Solid Waste Services Tax and the Landfill Closure and Contingency Tax are 0.002 cents per gallon, and rates for the Solid Waste Recycling Tax are 0.00225 cents per gallon.

In Pennsylvania, counties are required to create trust funds to finance the costs associated with closing landfills and to finance these trust funds with disposal fees. The per ton disposal fee is calculated by dividing the estimated cost of closing the landfill by the estimated weight of the garbage that will be sent to the landfill before it is closed.

Texas levies a fee of $1.50 per ton on the disposal of all municipal solid waste. In part, fee revenues are used to fund the state's efforts to control solid waste. They are also used to provide grants to local governments and other organizations for recovering resources, minimizing the amount of waste, and developing programs that help enhance the efficiency of solid waste management facilities.[54]

It is unclear whether these landfill taxes have produced a significant incentive effect. Moreover, as is the case with variable rate programs, increasing the price of waste disposal creates incentives to use alternative disposal options. The District of Columbia's experiences with its nearby Lorton, Virginia, landfill is a case in point. Of the $64.39 per ton tipping fee at Lorton, $28.39 per ton was reserved for the District's residential recycling program. Private trash haulers have reportedly trucked waste to landfills located elsewhere in Virginia and southern Pennsylvania, where tipping fees are lower. The resulting loss in revenue from tipping fees led the District to suspend its recycling program in 1995. It subsequently reestablished the program but with reduced service. Because of the instability of these tipping fee revenues, the District now relies on general revenues to fund its recycling program.

4.4.3 Hazardous Waste Taxes

A 1998 survey identified 30 states that impose taxes on the generation or management of hazardous wastes.[55] Some of these states have higher tax rates for landfilling than for incineration, and several states impose no tax on incineration. In some states, taxes vary according to the type of waste or whether the waste was generated outside the state, or both of these factors. In addition, on-site disposal of hazardous waste is exempt from taxes in some states. Vermont and California each levied taxes of more than $100 per ton for land disposal of hazardous waste, and six other states levied taxes of more than $50 per ton. The mean tax level for all states, including those with no tax, was $21 per ton. To put these taxes into perspective, in the late 1980s a middle-of-the-range estimate of the costs associated with the disposal of hazardous waste was $132 per ton.

California levies fees on both the generation and disposal of hazardous waste. As shown in Table 4-8, California imposes taxes on hazardous waste disposal that range up to $220 per ton. Generation fees vary by quantity generated, with rates fixed within a given range of tons per year. (See Table 4-9.)

Table 4-8. Hazardous Waste Landfill Fees in California

Waste Category	Rate ($/ton)
Non-RCRA cleanup wastes	$7.50
Other non-RCRA wastes	17.94
Ores and minerals	14.30
Extremely hazardous waste	220.00
Restricted hazardous waste	220.00
Hazardous waste (RCRA)	44.44

Source: California Department of Toxic Substances Control.

Table 4-9. California Hazardous Waste Generation Fees

Weight of Waste Generated (tons/year)	Fee ($)	Middle Range of Rates Charged ($/ton)
Less than 5	$0	$0
5 to 25	169	11.3
25 to 50	1,348	35.9
50 to 250	3,371	22.5
250 to 500	16,855	44.9
500 to 1,000	33,710	44.9
1,000 to 2,000	50,565	33.7
More than 2,000	67,240	<33.7

Source: California Department of Toxic Substances Control.

According to the California Department of Toxic Substances Control, the two fees are intended to raise revenue and to encourage waste minimization. The tonnage of hazardous waste sent to landfills has declined in the last 10 years. It is difficult, however, to determine to what extent this decline is due to the fees, as many other factors could influence generation and disposal practices.

Hazardous waste is also subject to numerous other administrative fees in California. Efforts are currently being made to simplify the existing fee structure, which is widely viewed as too complicated.[56]

The findings of several studies suggest that taxes on hazardous waste have had an impact on disposal. Two engineering studies, one by the Congressional Budget Office (1985) and the other by EPA (1984), concluded that such taxes significantly reduced the disposal of hazardous waste in landfills. By 1987, 10 states had taxes exceeding the level at which EPA predicted a 60% reduction in landfill disposal. Another study examined empirical evidence on the effects of a twofold rise in hazardous waste taxes in New York in 1985. It found that the quantity of hazardous waste disposed of in the state decreased significantly. Because taxes on incineration remained constant in this case, the amount of waste incinerated rose, but it did not increase as much as the amount of waste sent to landfills declined.[57]

Sigman (1996) studied the impact of landfill and incineration taxes on the generation of four types of chlorinated solvent wastes from metal cleaning. Using data from the 1987–1990 Toxics Release Inventories, the study included a cross-section analysis of generation across states and used a number of independent variables, including disposal taxes in the state of generation and in neighboring states. It also studied the impact of disposal taxes and other factors on the choice of disposal method. The study reached two conclusions. First, elasticities of waste generation with respect to these taxes on disposal were in the range of -7 to -22, meaning that the quantity of hazardous waste sent to landfills or incinerators was very sensitive to the tax. Second, the taxes encouraged generators to choose incineration or other treatment options as their waste management method, instead of landfilling. However, the estimated impact of these taxes was minor because the fees were low in comparison to the total costs of waste management.

Although "[s]tates' experience suggests that taxes may provide an alternative to the standard-based policies now used for most hazardous waste regulation," Sigman found, the design and implementation of such taxes pose several potential problems, including the determination of tax levels. To maximize the efficiency of these taxes, they should reflect the social cost of hazardous waste generation. This cost, however, depends on the type of waste, the method of disposal, the geographic location, and various other factors that are difficult to assess and incorporate into tax structures. If, on the other hand, taxes are too high, they could encourage illegal dumping, of which even a small amount could cause enough environmental damage to offset the increased efficiency achieved by taxes. "In the presence of illegal dumping," the study states, "a deposit/refund program may be substantially less costly than a waste-end tax."

Because current federal regulations impose high costs on generators of hazardous waste, there may already exist sufficient incentives to reduce the generation of hazardous waste. If existing regulatory incentives are sufficient, taxes could raise the costs of waste disposal to a level that is higher than what is socially desirable.

4.5 Product Charges

Product charges are imposed on either a product or some characteristic of that product. Economic theory suggests that products whose disposal causes environmental pollution should be taxed to reflect the added social costs they impose. To date, the theoretically ideal product charge has not been imposed. Although some product charges may be large enough to have a significant effect on behavior, most of them are intended primarily to raise revenue. Product charges typically take the form of advance disposal fees (ADFs) or of taxes on a product designed to fund its proper disposal after use.

A traditional regulatory mechanism that competes with the product charge is termed "extended producer responsibility;" it relies on take-back requirements placed on the manufacturers of certain products. Producers bear the responsibility for ensuring the proper disposal of post-consumer waste. Although some states have implemented extended producer responsibility for selected products, the federal government has never endorsed such an approach.[58] Several European nations have also enacted rules regarding extended producer responsibility.

4.5.1 Federal Product Charges

A number of federal product charges have been imposed, including charges on fuels, transportation, transport equipment, and chemicals. Most of these taxes are intended to raise revenue. Consequently, they have minimal effect on incentives. For a list of federal environmental excise taxes, see Barthold (1994). The following subsections in this chapter discuss the Superfund taxes, taxes on fuel-inefficient automobiles, and taxes on chlorofluorocarbons (CFCs).

4.5.1.1 Superfund Taxes

Until the end of 1995, the federal government imposed taxes on oil, chemicals, and business profits to fund the cleanup of inactive hazardous wastes designated under Superfund. This activity was financed by taxes on crude oil (9.7 cents per barrel), chemicals ($0.22-$4.87 per ton), and gross business profits (0.12% of amounts over $2 million).[59] Congress did not extend the tax after its scheduled expiration. The oil and chemical taxes could be regarded as product charges or raw material input taxes. Their primary purpose, however, was to raise revenue, rather than to prevent pollution.

4.5.1.2 Taxes on Gas Guzzlers

Introduced in 1978, the gas-guzzler tax is imposed on the sale of new automobiles with a fuel efficiency of less than 22.5 miles per gallon. Sports utility vehicles (SUVs), minivans, and trucks are not subject to the tax. The magnitude of the tax ranges from $1,000 to $7,700 per automobile, depending on fuel efficiency. Revenues, which amounted to $144.2 million in 1992, contribute to the Highway Trust Fund.[60] Most gas-guzzler tax payments have been made by buyers of foreign luxury cars.

Two measures that could have effects similar to gas-guzzler taxes are fines for the failure to meet corporate average fuel efficiency (CAFE) standards and taxes on luxury cars. CAFE fines, which could be regarded as non-compliance fees, are based on the extent to which an auto manufacturer violates CAFE standards. These fees could provide an incentive for manufacturers to invest in the design of fuel-efficient cars. Luxury taxes are set at 10% of the sales price of a car in excess of a base level, which was originally set at $30,000 but has since increased. Since many luxury cars are relatively fuel-inefficient, luxury car taxes could encourage the use of more fuel-efficient vehicles.

4.5.1.3 Ozone-Depleting Chemicals

In accordance with the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer and subsequent amendments, the production of ozone-depleting chemicals (ODCs) such as chlorofluorocarbons (CFCs) for most uses in the United States was phased out by January 1, 1996. To facilitate the phaseout, the United States imposed a tax on selected ODCs on January 1, 1990; the government expanded that tax to other ODCs the following year. The magnitude of the tax was determined by multiplying a base rate per pound of ozone-depleting chemicals produced or imported by an ozone depletion factor that varied according to the type of chemical. Initially set at $1.37 per pound, the base tax amount increased to $3.35 in 1993, $4.35 per pound in 1994, and $5.35 in 1995. Since 1996, the annual increase in the base tax amount has been $0.45 per pound per year. The ozone depletion factors, which are intended to indicate each chemical's damage to the ozone layer, were set by the Montreal Protocol.[61] For example, methyl chloroform had a factor of 0.1, whereas Halon-1301 had a factor of 10.0, which meant that methyl chloroform was taxed at $0.53 per pound in 1995 while Halon-1301 was taxed at $53.50 per pound that year. The tax was imposed on producers and importers of these chemicals as well as on the importers of products that contained these chemicals or that used them in their production processes.

Unlike most product charges, this tax is widely credited with a significant incentive impact. ODC consumption (expressed in CFC-11 equivalents using the above-mentioned ozone depletion factors) fell from 318,000 metric tons in 1989 to 200,000 metric tons in 1990, the year the tax was introduced.[62] A Congressional Research Service (CRS) study concluded, "the CFC tax has clearly accelerated the rate at which CFC uses are being substituted for and the rate at which CFCs are being recovered for reuse." CRS adds that the tax was also intended to raise revenue for the federal government and to capture a portion of the windfall revenues experienced by ODC producers as a result of the tightened supply of ODCs.[63]

According to the World Resources Institute (WRI), the tax raised $2.9 billion in its first five years. WRI adds that the phaseout cost less than EPA's original projection.[64] In 1988, EPA predicted that the average cost of reducing the use of CFCs by 50% would be $3.50 per kg. In 1992, EPA revised its cost estimate to only $2.45 per kilogram.

The tax is believed to have contributed significantly to the reduction in ODC use. Several other factors, however, also had an impact, including the establishment of an ODC trading system (described in Chapter 6); the well-publicized intentions of the federal government to phaseout ODC use; and EPA's work with the private sector on ODC recycling and the use of substitutes. As a result of the multiplicity of these policy measures, it is difficult to isolate the effects of the CFC tax.

4.5.2 State Product Charges

States have imposed charges on a number of products, including beverage containers, fertilizers, furniture, motor oil, pesticides, refrigerators, solvents, and tires. Some of these have taken the form of advance disposal fees (ADFs). Hoerner (1998) identified approximately 400 environmental taxes that are imposed at the state level. Some taxes, such as those on the sale of tires, are found in well over one-half of the states. Litter taxes, which are imposed on the sale of products that commonly are found in litter, are found in a handful of states. Many states impose severance taxes on the removal of minerals from the ground. This section highlights a few of the charges that states impose on different products.

4.5.2.1 Tire Charges

Fees are imposed on automobile tires in at least 34 states. The fees generally range from $0.25 to $2.00, but Texas has a fee of $3.50 on truck tires. Some of the fees are assessed as a percentage of the price of the tires. Given the low magnitude of the charge levels relative to the price of tires and the lack of substitutes for tires, the incentive effect of state tire charges on the buyers of tires is likely to be minimal; however, the system does encourage the proper disposal of tires. Most fees were instituted as part of a scrap tire program, which included restrictions or bans on the disposal of used tires in landfills.[65] States use their tire fee revenues to subsidize the development of markets for end uses of used tires, such as rubberized surfaces, noise barriers, blasting mats, and rubberized asphalt pavement. Fee revenue also may be used to pay for the cleanup of tire disposal sites and for the enforcement of laws designed to prevent illegal disposal. The effect is that tire buyers pay for the proper disposal of used tires through these tax/subsidy schemes.

As shown in Table 4-10, the federal government also imposes product charges on tires, charges that range from $0.15 to $0.50 per pound. Revenues from these charges are allocated to the Highway Trust Fund.[66]

Table 4-10. Federal and State Tire Charges

Taxing Authority	Fee Structure	Uses of Revenues
Federal Government	Tires 40–70 lbs: $0.15/lb x weight exceeding 40 lbs Tires 70–90 lbs: $4.50 + $0.30 x weight exceeding 70 lbs >90 lbs: $10.50 + $0.50 x weight exceeding 90 lbs	Highway Trust Fund
State Governments (34)	$0.25 to $2.00 for passenger car tires	Tire recycling, tire disposal site cleanup, other similar activities

Source: Fullerton. 1995, p. A7; *Scrap Tire News Legislative Report*, pp. 18–19.

4.5.2.2 Fertilizer Charges

At least 46 states impose charges on the sale of fertilizers. Nebraska's fee of $4 per ton is one of the highest; most are below $1 per ton. Assuming fertilizer prices of $150–$200 per ton, the charges are too low to significantly influence the use of fertilizer. The most common use of these charge revenues is the inspection of fertilizers and fertilizer storage by state agencies.

4.5.2.3 Rhode Island Hard-to-Dispose Material Tax

Rhode Island imposes charges on "hard-to-dispose material," such as lubricating oil, antifreeze, organic solvents, and tires. The fees are 5 cents per quart of lubricating oil, 10 cents per gallon of antifreeze, 0.25 cents per gallon of organic solvents, and 50 cents per tire. Although the incentive effects are assumed to be minimal, the charge incorporates at least some of the disposal costs of these various materials into their prices. Charge revenues are deposited in a "hard-to-dispose material account" that funds educational and technical assistance programs, grants, research, and collection centers for hard-to-dispose material.

4.5.2.4 Florida Advance Disposal Fee (ADF)

In a two-year experiment with ADFs, on October 1, 1993, Florida instituted a fee of one cent on a variety of containers. Exempted from the tax were containers made of plastic, plastic-coated paper, and glass that had average recycling rates of at least 50%; glass containers having 35% recycled content; and plastic containers having 25% recycled content. Paper and plastic packaging were also subject to the ADF, with exemption possibilities similar to those for glass and plastic containers. Since the Florida Department of Environmental Protection determined that aluminum and steel cans had already fulfilled the 50% recycled content requirement, they were exempt from the tax.[67] To further encourage recycling, the tax was doubled the second year it was in effect.

Despite the low-fee level, manufacturers reportedly went to considerable trouble to obtain exemptions. Their efforts appear to have been due more to the public relations value of being exempted than to the ADF itself.[68]

One interesting aspect of this ADF is the wide range of options that it gave manufacturers to obtain exemptions. These options included working with other firms in the same sector to raise recycling rates, increasing the recycled content of packaging, averaging the amount of recycled content over various containers, and recycling equivalent amounts of previously discarded waste into other products. In theory, the variety of options should have allowed each firm to select a relatively cost-effective way to promote recycling. Most firms sought exemption based on use of recycled content. However, at least two companies, Piper Plastics and Anheuser-Busch, have built, or plan to build, recycling facilities. Both companies cited the ADF as the decisive factor in their decisions to build these facilities in Florida.[69]

One disadvantage of including various exemption possibilities in the ADF was the potential administrative burden of assessing requests for exemptions. At least one industry group criticized the ADF as deceptive, burdensome, and administratively costly.[70] The ADF expired in October 1995.

4.5.2.5 North Carolina ADF

North Carolina imposes a fee on "white goods," such as refrigerators and freezers. Beginning in 1995, the ADF was $10 for products containing CFCs and $5 for those without CFCs. Effective July 1998, the tax was reduced to a flat $3 per item and extended to July 2001.[71]

Although the ADF probably does not have a significant incentive effect, it generates revenues to manage the disposal of white goods. With the introduction of the ADF, county landfills were required to accept old white goods for disposal, free of charge. Counties received 75% of the ADF revenue on a per capita basis to fund the removal of CFCs and programs that recycle white goods and metal products. Additional ADF revenues were available for those counties whose disposal costs exceeded their per capita allocations of ADF funds from the state. In July 2001, local governments will be authorized to impose disposal fees for white goods.

4.5.2.6 Texas Clean Fuel Incentive Surcharge

In 1989, Texas introduced a 20-cent-per MMBtu-surcharge on boiler fuel oil. The surcharge applies only to industrial and utility boilers that are capable of using natural gas, that are in use between April 15 and October 15 of each year, and that are located in ozone non-attainment areas having populations of 350,000 or more. As part of a larger state effort to encourage the use of natural gas, the surcharge specifically addresses ozone problems that occur in the summer months and that caused by NOx emissions. Used oil and fuels derived from hazardous waste are exempt from this fee. Surcharge receipts are deposited in the State General Revenue Fund.[72] According to one official on the Texas Natural Resource Conservation Commission (TNRCC), the surcharge has had little if any incentive effect because few facilities used fuel oil before the surcharge was introduced.

4.6 Road User Fees

Tolls are the most common type of road user fee for financing road construction in the United States. Because these fees are purely revenue-raising mechanisms that are unrelated to environmental protection, they are not discussed in this report. However, another type of road user fee, congesting pricing—the tolls that vary by time of day or how heavily the road is being used—is intended to reflect some of the social costs of traffic congestion. One of these costs is increased emissions per mile traveled. One study estimated that if the current level of vehicular traffic in southern California flowed smoothly, emissions from motor vehicles would decrease by approximately 13%.[73] For this reason, congestion pricing is of considerable interest as an environmental management tool. Moreover, economic analysis indicates that the economic gains from congestion pricing can be large, much greater than any other traffic management tool.[74] Congestion pricing makes users aware of the impact their use of a highway has in terms of increasing the travel time of others. By making users pay the full social cost of travel and not just their private cost, highway use declines and traffic flows more smoothly.

In December 1995 in southern California, a congestion-based 4-lane toll road opened in the median of the existing eight-lane Riverside Freeway (SR-91). The road was built by private funds from the California Private Transportation Company (CPTC), and the same firm operates the toll system. CPTC is free to determine toll levels, but it is subject to a cap on the rate of return on its investment. Five different toll levels range from $0.25 to $2.50 per 10-mile trip, depending on the time of day. Toll prices are announced in advance, so motorists can plan their trips accordingly. Windshield-mounted transponders allow motorists to pay for toll-lane use without stopping at toll booths. High-occupancy vehicles (HOV) having three occupants, public transit vehicles, zero-emission vehicles, and vehicles with a disabled-person license plate are exempt from paying the tolls.

By March 1996, over 30,000 transponders were in use, a level the project had not expected to reach until late June. In interviews with the *Los Angeles Times,* express lane users have reported time savings of more than 30 minutes. CPTC adds that the toll lanes have not only reduced travel times for their users but also diminished congestion on the adjacent freeway.[75]

As part of its Value Pricing Pilot Program, the Federal Highway Administration is studying the experiences of SR-91 and is funding several other projects. Some of the pilot projects are highlighted below.[76]

- In March 1998, San Diego began a pilot project that charged for the use of lanes in the I-15 freeway based on the time of day and the level of congestion. In the first four months of the project, almost 4,000 transponders had been distributed.
- Houston began a pilot project in January 1998 that allowed a limited number of users of HOV-2 carpools into HOV-3 carpool lanes for a fee of $2 during peak travel periods.
- Beginning in August 1998, variable pricing is being used to manage traffic flows on two bridges in Ft. Myers, Florida. The program offers drivers a 50% reduction in the usual toll if they travel on either side of peak travel periods.

4.7 Wetland Compensation Fees

Wetland compensation fee systems are programs in which a regulatory agency collects fees in lieu of requiring a developer to compensate for wetland losses through their on-site mitigation or through their acquiring of credits generated by a mitigation bank. (This system is discussed in greater detail in Chapter 6.) The fees are used for mitigation projects undertaken by an agency or non-profit organization. Wetland compensation fees offer the flexibility to mitigate wetland loss in a cost-effective manner. Instead of doing mitigation at the project site, a developer pays a fee to another organization to perform mitigation activities in more suitable locations.

Fee-based mitigation mechanisms have been used in Arkansas, Florida, Illinois, Louisiana, Maryland, Mississippi, Texas, and Virginia. The magnitude of the fees is usually set to cover costs such as mitigation, land acquisition, project planning, and site management.

Initiated in 1986, Florida's Mitigation Park Program is the oldest fee-based wetland mitigation system in the United States. Fees paid by wetlands developers in lieu of on-site mitigation are deposited in the Florida Game and Fresh Water Fish Commission's Fish and Wildlife Habitat Trust Fund. These charges finance the purchase and subsequent management of large, biologically defensible Mitigation Parks. These parks, which range in size from 400 to 1,500 acres, are publicly owned but may be managed by either government entities or non-profit organizations.

To participate in the program, developers need approval from the regulatory agency with which they are working. Fees depend on the amount of wetlands developed, the type of habitat impacted, and the species present at the site of the development. The developer pays one fee to finance land acquisition; a second fee (15% of the first fee) to fund site management; and a third fee (7% of the sum of the first two charges) to their state's tax department. Interest accrued on the second fee is used to fund site management. As of 1999, the Mitigation Park Program had received more than $17 million in deposits and had purchased in excess of 7,000 acres.[77]

In Maryland, the mitigation fees paid by developers into the Nontidal Wetlands Compensation Fund depend on the number of acres and type of wetlands impacted and the costs of wetland restoration and construction. The mitigation ratio (the number of acres that must be enhanced, restored, or created for every acre impacted) is 1:1, 2:1, or 3:1, depending on the type of wetland impacted. The 3:1 ratio applies to wetlands of special concern to the state. Land acquisition costs are assessed on the basis of the prevailing market prices for agriculturally zoned or low-density land that has little potential for development. Restoration and construction costs are assessed at $10,000 per acre in low-cost counties and $50,000 per acre in high-cost counties. Counties with a relatively large amount of farmed hydric soils, which indicates the former presence of wetlands, are placed in the low-cost category. Losses of less than 5,000 square feet of wetlands do not require mitigation.

In Louisiana, companies are required to offset their damage to coastal wetlands by performing a mitigation project on their own property or by contributing mitigation fees to the Louisiana Wetlands Conservation and Restoration Fund. Mitigation fees range from $1,500 to $12,000 per acre, depending on the environmental quality of the wetland that is lost to development.

The costs, benefits, and incentive effects of wetlands compensation fees have not been comprehensively studied, and it would be difficult to determine those effects given the varied functions that wetlands perform. Some evidence suggests, however, that such fees have been beneficial. Clustering individual mitigation activities into selected areas increases the viability of the wetlands. Moreover, the fact that developers have participated in fee-based schemes suggests that paying fees is more economical for them than conducting on-site mitigation activities on their own.

4.8 Grazing Fees

Federal and state governments charge fees for animal grazing on public lands. Federal fees date back to 1906 and are currently charged for grazing on about 167 million acres of Bureau of Land Management (BLM) land and 94 million acres of Forest Service land. About 10% of the livestock producers in the 16 Western states participate in the program. Grazing on BLM land accounts for approximately 2% of total beef-cattle feed in the 48 contiguous states. Fees are charged based on a formula that was established by the 1978 Public Rangelands Improvement Act (PRIA).[78] The PRIA formula is based on private grazing rates, beef cattle prices, and the cost of livestock production. The fee is expressed in animal unit months (AUM), where one AUM is the amount of forage required to sustain one cow and her calf, one horse, or five sheep or goats for a month. The fee in 2000 is a minimum of $1.35 per AUM, the same minimum fee imposed by President Reagan in 1986.[79]

The theory behind such fees is that animal owners should pay fair market value for the use of the land and that they should bear the costs of the damage inflicted by their animals on that land. However, current fee levels are widely believed to be lower than what would be charged if the grazing rights were being sold by a private owner. That belief is supported by the fact that properties with attached federal grazing rates command higher market prices than properties without such grazing rights. Moreover, the fees may not adequately compensate the federal government for the environmental destruction caused by the movement of privately owned animals on public lands. To the extent that the fees are too low, they amount to a form of subsidization. Therefore, they are included in the discussion of environmentally harmful subsidies in Chapter 7.

4.9 Minnesota Contamination Tax

The Minnesota Contaminated Property Tax, which entered into effect in fiscal year 1995, is levied on the "contamination value" of property, i.e., the difference in the value of the property before and after contamination. Owners of contaminated property who do not have approved cleanup plans pay this fee at the full property tax rate. The contamination tax is halved for owners who have filed an approved cleanup plan. Owners who purchase contaminated land without being notified by the seller of the contamination pay 25% of the full property tax rate until they file a cleanup plan, after which the tax rate decreases to 12.5%. According to a local tax official, the tax gives property owners "a strong impetus to clean up."[80]

This page intentionally left blank

5. Deposit-Refund Systems

5.1 Introduction

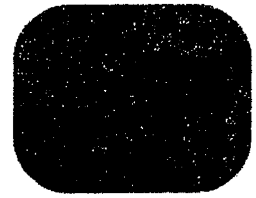
Deposit-refund systems (hereafter referred to as "deposit systems") are a combination of a product charge (the deposit) and a subsidy for recycling or proper disposal (the refund). Manufacturers or vendors of products that are subject to deposits incur additional costs in handling returned products, but these costs are often partially offset by the interest earned on deposits, unclaimed deposits, and sales of collected, used products.

One of the objectives of a deposit system is to discourage illegal or improper disposal. Waste products that are discarded improperly have higher social costs than those disposed of properly, since such discards can become an eyesore or even an environmental or health threat. Improperly discarded waste is also quite expensive to redirect to the legal waste stream. Deposit systems are commonly applied to beverage containers, in part because these containers make up a large proportion of roadside litter. Another important objective of a deposit system is to divert recyclable items from the waste stream.

In addition to being used for beverage containers, deposit systems have also been used for other products such as pesticide containers, lead-acid batteries, and tires. Some of these systems are voluntarily implemented by industry, whereas others are implemented by state or local authorities. While federal legislation on deposits has been considered, none of these proposals has been enacted.

Several studies have concluded that deposit systems are more cost-effective than other methods of reducing waste disposal, such as traditional forms of regulations, recycling subsidies, or advance disposal fees (ADF) alone. A recent study by Palmer et al. (1995) concluded that a 10% reduction in waste disposal would cost $45 per ton of waste reduced under a deposit system, compared to $85 per ton under advance disposal fees and $98 per ton under recycling subsidies. However, the study noted that the relatively high administrative costs of a deposit system could outweigh these cost savings.

Administrative costs are an important consideration when determining whether to create deposit systems. Ackerman et al. (1995) estimate that administrative costs average about 2.3¢ per container—more than $300 per ton for steel containers and $1,300 per ton for aluminum cans—in states with traditional legislation on beverage container deposit systems. A full accounting of the desirability of deposit-refund systems would compare administrative costs and the costs imposed on consumers with the benefits of reduced disposal costs, energy savings, reduced litter, and other environmental benefits. Deposit-refund systems appear best suited for products whose disposal is difficult to monitor and potentially harmful to the environment. When the used product has economic value, the private sector may initiate the program.


Pollution Charges, Fees, Taxes

Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

Fullerton and Kinnaman (1995) conclude that fees for waste collection should be priced as if disposal and recycling are the only two disposal options. If illicit burning or dumping is also an option, the optimal policy is "a tax on output plus a rebate on proper disposal," in other words, a deposit system. While variable pricing programs for waste collection have the potential to give waste generators an incentive to improperly dispose of waste, deposit schemes give them an incentive to return waste for proper disposal or for recycling. For example, with beverage containers, roadside litter is an important issue, so a deposit system is a good policy choice.

As noted in this chapter, studies have found that deposit systems result in higher recovery rates of used products and less contamination of recyclables than curbside recycling programs. However, deposit schemes are also believed to cost more to administer than curbside programs.

5.2 Beverage Containers

Beverage containers have been subject to both voluntary and mandatory deposit schemes. In the past, the beverage industry made extensive use of voluntary schemes to recover refillable bottles. However, this practice nearly disappeared following the introduction of cheaper "disposable" containers.

As shown in Table 5-1, 10 states have passed "bottle bills" that mandate beverage container deposits ranging from 2.5¢ to 15¢ per container, the most common amount being 5¢ per container. Beer and soft drink containers are subject to deposits in all 10 states; mineral water containers in six states; malt containers in four states; and wine coolers, liquor, and carbonated mineral water containers in three states. Michigan includes containers of canned cocktails, New York includes containers of soda water, and Maine includes containers of juices and tea. In most states, deposit requirements apply to the full range of container types, including glass, plastic, aluminum, and steel. The State of Delaware, however, has exempted aluminum from its requirement.

Most states require retailers to take back containers that are in their product line, even if the container was purchased elsewhere. In Maine, however, retailers located within a certain distance of a certified redemption center are not obligated to take back containers. In addition to retail outlets, "redemption centers" accept containers in most states. Any organization may operate such centers, although certification of the center may be required. Some redemption centers and retailers could earn profits from mandatory handling fees of 1.5¢ to 3¢ per container, fees that are paid by distributors. As shown in Table 5-1, distributors usually keep unclaimed deposits.

Not included in this table is a deposit system that has been in effect in Columbia, Missouri, since 1982. Under this system, consumers pay deposits of 5¢ on containers of beer, soft drinks, malt, and carbonated mineral water. Although retail stores are required to take back containers, no handling fees are mandated. The overall rate of redemption is estimated to be 85% to 95%.

Although it is beyond the scope of this report to describe in detail every deposit system that is listed in Table 5-1, systems in Maine and California are discussed below as illustrative examples.

Table 5-1. State Beverage Container Deposit-Refund Systems

State	Since	Containers Covered	Deposit, Refund Amounts	% Returned	Redemption Sites	Unclaimed Deposits	Handling Fees
California	1987	Beer, soft drinks, wine coolers, mineral water	<24 oz, 2.5¢ >24 oz, 5¢	Aluminum 88% Glass 76% PET 50% Overall 84%	State-certified centers	Program administration grants	Per container processing fee
Connecticut	1980	Beer, malt, soft drinks, mineral water	Minimum 5¢	Cans 88% Bottles 94% Plastic 70-90%	Retail stores and redemption centers	Kept by distributor or bottler	Beer, 1.5¢; Soft drinks, 2¢
Delaware	1982	Non-aluminum beer, malt, soft drink, mineral water <2qt	5¢	Insufficient data	Retail stores and redemption centers	Kept by distributor or bottler	20% of deposit
Iowa	1979	Beer, soft drinks, wine, liquor	5¢	Aluminum 95% Glass 85% Plastic 70-90%	Retail stores and redemption centers	Kept by distributor or bottler	1¢
Maine	1978	Beer, soft drinks, wine, wine coolers, liquor, juice, water, tea	Beer, soft drinks, juice: 5¢. Wine, liquor: 15¢	Beer, soft drink 92% Spirits 80% Wine 80% Juices, non-carbonated 75%	Retail stores and redemption centers	Kept by distributor or bottler	3¢
Mass.	1983	Beer, soft drinks, carbonated water	5¢	Overall 85%	Retail stores and redemption centers	State	2.25¢
Michigan	1978	Beer, soft drinks, canned cocktails, carbonated and mineral water	Refillables: 5¢; Nonrefillables : 10¢	Overall 93%	Retail stores	75% environmental programs, 25% handling fees	25% of unclaimed deposits
New York	1983	Beer, soft drinks, wine coolers, carbonated mineral water, soda water	5¢	Wine cooler 63% Soft drink 72% Beer 81%	Retail stores and redemption centers	Kept by distributor or bottler	1.5¢
Oregon	1972	Beer, malt, soft drinks, carbonated mineral water	Standard refillables: 3¢; Others: 5¢	Overall 85%	Retail stores	Kept by distributor or bottler	None
Vermont	1973	Soft drinks, beer, malt, mineral water, liquor	Soft drinks, beer: 5¢ Liquor: 15¢	Overall 85%	Certified redemption centers and retail stores	Kept by distributor or bottler	3¢

5.2.1 Maine Bottle Deposit System

Maine introduced a deposit system for beer and soft drink containers on January 1, 1978.[81] In distributing beer and soft drinks to retailers, distributors (or manufacturers) levy a 5¢ deposit. Retailers in turn include this amount in their sales prices. The customer can obtain a 5¢ refund by returning the container to any retailer that sells the product or to a redemption center.

Distributors (or manufacturers) return the 5¢ deposit to retailers for every returned container. In addition, retailers are reimbursed a 3¢ handling fee, which provides a strong incentive for retailers to promote the return of containers. At times, demand by retailers for used containers is so high that customers can obtain refunds 10% to 20% higher than the deposit amount. In some places, reverse vending machines also offer refunds for returned containers.

Distributors typically pick up used containers while distributing new products. Distributors (or manufacturers) have at least three sources of revenue to offset the costs of handling containers. First, they can sell the collected containers to processors and keep unclaimed refunds and handling fees. Second, in the past distributors had to share one-half of their unclaimed refunds

with the state government. Distributors then complained about their costs. As a result of their efforts, distributors were allowed to retain all unclaimed refunds, effective January 1, 1996.[82] Third, distributors earn revenue by the interest earned on deposits and handling fees before redemption.

The deposit system was expanded to include liquor and wine containers on September 1, 1990, and bottled water, iced tea, and juice on December 31, 1990. This action resulted in new (and perhaps less cost-effective) types of deposit-refund arrangements. Unlike soft drinks and beer, several companies in the same geographic area often distribute juice. Consequently, each one often has difficulty determining which containers it is responsible for collecting. As a result, some distributors may pay more in refunds than they receive in deposits, while for others, deposits may exceed refunds. Because distributors fear that they will lose money in collecting deposits and paying refunds, manufacturers have had to collect deposits themselves and contract independent collectors to redeem containers. This method may be less cost-effective than collection by distributors who already travel to collection sites when they distribute new products.

Two redemption problems have been identified. One, the in-state distribution of containers can take place without deposit fees being imposed. Second, the in-state redemption of containers that were originally purchased outside the state also occurs. These errors have resulted in redemption rates in excess of 100% for certain products. For example, Coca-Cola reported redemption rates for Minute Maid Juices® and Hi-C® of 142% in 1993, 281% in 1994, and 126% in 1995. The same type of bottle deposit fraud is estimated to cost the state of Michigan more than $16 million per year.[83] Nearly one-third of the cans returned for recycling in southeast Michigan were purchased outside the state.

Retailers have complained that the deposit system (especially the expanded one) requires more storage space and more time for recordkeeping, receiving bottles and sorting bottles. In addition, traces of beverages in containers have attracted pests. The administrative burden probably became more severe following the expansion of the system because significant variations in the types of juice containers make them more difficult to sort and store.

The deposit system in Maine is reported to have significantly reduced litter. A 1979 study by the Maine Department of Transportation found that total litter declined by 10% and that container litter declined by 56%.[84] Since completion of the study, the redemption rate rose. Thus, it is likely that container litter has decreased further. In addition to reducing the incidence of litter, the deposit system also gave incentives to scavenge bottle and can litter to obtain refunds. The deposit also may have increased recycling capacity by creating a reliable supply of recyclable materials. Three container-processing facilities were established in Maine as a result of the deposit system. These facilities can, in turn, stimulate demand for recyclables that are collected outside the deposit system.

Criner et al. (1991) estimate that the costs of Maine's deposit system exceed those of curbside collection programs, but the system also results in higher collection rates. They surveyed retailers, redemption centers, distributors, and manufacturers to develop cost estimates for the deposit system. Using a computerized waste management model, Criner et al. estimated that retailers incurred costs of 2.4¢ to 3.1¢ per container under the original deposit system and virtually the same costs under the expanded system. The high end of this range applies to smaller retailers. Based on these estimates, the handling fee of 3¢ per container appears to be set at a level that covers retailers' costs. The handling fee was originally one cent, but it rose to 2¢ in 1980 and to 3¢ in 1990.

Criner et al. estimated the costs incurred by distributors at 5.7¢ per container for beer and soda and 7.5¢ for juice products. (These estimates do not include the costs incurred by consumers in returning containers for refunds.) Collection costs, storage facilities, and labor can be more expensive for containers of juice than for other beverage containers. Two reasons for this difference are suggested: (1) significant Variations in the types of juice containers make them more expensive than other containers to sort and store; and (2) manufacturers hire companies specifically to collect used juice containers, which raises costs.

Table 5-2 presents cost estimates for collecting recyclables under curbside programs and deposit systems for a hypothetical Maine community of 25,000 inhabitants. The estimates are based on the assumption that curbside collection is present. They suggest that the costs of deposit systems are not only significantly higher than curbside programs but that they also raise the costs of curbside collection when the two activities are implemented at the same time. This latter effect is probably caused by the diversion of recyclable containers away from curbside programs, which reduces the economies of scale that were present in these programs.

Table 5-2. Beverage Containers: Estimated Tons Recycled and Costs of Collection in Maine

Collection Method	No Deposit System	Original Deposit System	Expanded Deposit System
Curbside Programs: tons recycled (cost per ton)	2,538 ($41)	1,917 ($80)	1,378 ($100)
Deposit Schemes: tons recycled (cost per ton)	0	1,138 (567)	2,037 (402)
Total: Tons Recycled (weighted average cost per ton)	2,538 (41)	3,055 (261)	3,413 (280)

Source: Criner et al. 1991, p. 50.

A significant portion of the costs of Maine's deposit system appears to be passed on to consumers. Criner et al. compared beverage prices in Maine with those of neighboring New Hampshire, Rhode Island, and Massachusetts. Prices were very similar for juices, which were not subject to deposits at the time, but they were higher in Maine for soda and beer. As noted in Table 5-1, Massachusetts has a 5-cent deposit, as does Maine. Criner et al. speculate that the deposit system in Massachusetts has not resulted in beverage prices that are higher than those of New Hampshire and Rhode Island. Two reasons may explain this theory. First, distributors in Massachusetts face more competition than they do in Maine. Second, the state's population density limits the cost of handling and transporting used containers.

Criner et al. also found that the prices of most juices sold at two Maine supermarkets increased during the fall of 1990 to late February 1991. During the same period, the prices of orange juice in large plastic containers (64–96 oz.)—which was subject to deposit requirements—fell significantly. These findings suggest that expanding the deposit system to include juice containers an impact on the prices of these beverages. However, the price increases at the two stores were not compared with price changes elsewhere.

5.2.2 California Beverage Container Recycling Program

The 1986 California Beverage Container Recycling and Litter Reduction Act (AB2020) led to the creation of the Beverage Container Recycling Program (BCRP) in 1987. The program was originally intended to achieve an overall beverage container-recycling rate of 80%.

California's deposit system removes some of the constraints on vendors associated with other deposit systems. It introduces flexibility through simplification and leaves intact the incentive to consumers to return containers for proper disposal or recycling. California's system differs significantly from that of other states in two ways. First, retailers in the state are not responsible, for the most part, for collecting deposits and offering refunds to consumers. Second, used containers are not returned to their original distributors. Instead, manufacturers of most beverage containers pay a fee of 2¢ per container to a state recycling fund. When containers are returned, the fund pays 2.5¢ per container to the individual or organization that collected it. The beauty of this system is that anyone can be a collector: businesses or consumers. For containers of more than 24 ounces, the fee is 4¢, and the payment is 5¢. The payment may be passed on to consumers to entice them to return containers.

This system resembles an advance disposal fee, with fee revenues used to provide collection incentives. It is the result of compromise between various interests, including grocers (who did not want to manage used containers in their stores) and environmentalists (who wanted incentives to stimulate recycling).

Retailers with annual revenues of less than $2 million are not required to accept used containers, and larger retailers can be exempted if there is a recycling center located within a half-mile radius of their store. In areas where there are no centers, retailers usually hire a recycling business to establish a collection site or to install a reverse vending machine.

The state also assesses handling fees each year for each type of container. Manufacturers are required to either pay these fees or to guarantee a price for recyclable containers that is equal to the cost of collection. These requirements have increased the prices of recyclable containers in the state to the point at which incentives are provided to import these containers from other states. The law bans redemption for such imports.

In 1994 and 1995 the BCRP received about $333 million in revenues. However, this figure fell in the next few years because reductions in processing fees were required by 1995 legislation and container redemption increased. Unclaimed deposits and fees finance grants for private, non-profit programs and public-sector activities that help reduce litter and promote recycling.

Like all other states with deposit systems, California has specific labeling requirements for its beverage containers. All containers must bear the label "CA Redemption Value" or "California Redemption Value." To increase the public's awareness of the deposit system, the redemption value must be posted separately on store shelves, in advertising, and on retailer invoices.

The BCRP required that a government structure be created to manage the program. Initially, the program generated relatively low return rates. By the early 1990s, however, after the initial one-cent container fee had been more than doubled, the program had achieved return rates comparable to those of other states with deposit systems. As shown in Table 5-1, the overall recycling rate for beverage containers has risen to 84%.

Ackerman et al. (1995) observe that California's redemption system results in lower costs per redeemed container than systems in which redemption is managed through vendors. Containers are not sorted by brand and returned to their distributors as in other states. As a result, administrative costs are estimated at 0.2¢ per container in California and 2.3¢ in other states with deposit-refund laws.

5.2.3 Summary of Beverage Deposit/Refund Systems

Although data are incomplete, anecdotal evidence suggests that beverage container deposit laws have significantly reduced litter in several states, as would be expected. Maine reported decreases in litter following the introduction of its deposit scheme. Oregon reported a 75% to 85% decrease in roadside litter just two years after enacting deposit legislation.

Another probable impact has been an increase in the percentage of containers recycled, although this is difficult to confirm due to a lack of historical data on recycling. Wellman, Inc. (1994) estimate that the percentage of PET containers recycled in 1993 was about 80% in states with deposit systems (excluding California), 70% in California, but only 53% nationally. A 1990 GAO study found that almost two-thirds of the glass recycled in the United States. came from the deposit states, excluding California, even though these states made up only 18% of the U.S. population. If California is included, the 10 states accounted for more than 80% of this country's recycled glass. All deposit states also report return rates on aluminum cans that exceed the national average.

A related phenomenon is the relatively high market share for refillable containers in states with deposit schemes. In the case of beer containers, for example, all nine deposit states (excluding California) exceed the national average for market share of refillables. McCarthey (1993) calculated that the unweighted average for these nine states was 15% in 1990, which was three times the national average.

A comparison of deposit systems and curbside recycling programs by McCarthey (1993) found that deposits generally resulted in higher percentages of materials returned and less contamination of collected materials. Among states with large curbside programs but no deposit systems, the study found that none had attained a recovery rate equal to that of states with deposit schemes. Moreover, glass collected through curbside programs is much more likely to break before it can be sorted by color. Such breakage makes it difficult to recycle not only glass bottles but also other recyclables that may be contaminated with glass. The largest user of recycled polyethylene terephthalate reported that more than 90% of the PET it purchased came from states with deposit schemes because of its concerns over contamination.

The costs of deposit systems may be substantial for manufacturers, distributors, vendors, consumers, and regulatory authorities. One study found California's system to be more cost-effective than those in which retailers accept redeemed containers. Deposit systems could also divert revenues from, and lower the cost effectiveness of, curbside recycling programs. However, McCarthey (1993) found evidence suggesting that "local governments would achieve a greater diversion of solid waste from disposal at a lower cost per ton if both a bottle bill and a curbside collection program were in place." One difference between the two approaches is that the costs of deposits are borne by manufacturers and distributors, who in turn pass on some costs to consumers, whereas the curbside programs are often funded by general revenues or waste tipping fees. Lack of information on the costs and benefits of litter reduction and recycling and on the costs incurred by consumers in returning containers makes it difficult to thoroughly evaluate beverage container deposit systems.

5.3 Lead-Acid Batteries

Lead-acid batteries are subject to mandatory deposit systems in several states and voluntary deposit systems in most other areas. The lead in used batteries has positive economic value for battery makers. Deposit amounts are typically $5 to $10 per battery. Consumers can obtain refunds by returning a used battery and proof of the deposit to the same retailer, typically within 7 to 30 days after the purchase of a new battery.

Despite the presence of numerous voluntary schemes, 11 states have required deposit systems. As shown in Table 5-3, state laws have addressed such questions as the refund period and what portion of unclaimed refunds should go to different parties.

Table 5-3. States with Mandatory Lead-Acid Battery Deposit Systems

State	Deposit/Refund ($)	Unclaimed Refunds	Refund Period (days)
Arizona	$5	Retailer	30
Arkansas	10	Retailer	30
Connecticut	5	Retailer	30
Idaho	5	Retailer	30
Maine	10	Retailer	30
Minnesota	5	Retailer	30
New York	5	Retailer	30
Rhode Island	5	State: 80%, Retailer: 20%	7
South Carolina	5	Retailer	30
Washington•	Minimum of 5	Retailer	30

Source: Weinberg, Bergeson & Neuman. 1996.

As with beverage containers, deposit systems for lead-acid batteries appear likely to have a significant incentive effect because they offer motorists money in return for a used product. As shown in Figure 5-1, the percentage of battery lead that has been recycled nationwide has exceeded 90% since 1988. Lead prices appear to affect the recycling rate to a minor extent; the dip in the recovery rate in 1992–1993 coincided with a period of low prices for primary and secondary lead. (Scrap lead prices can be found at several sites on the Internet.[85])

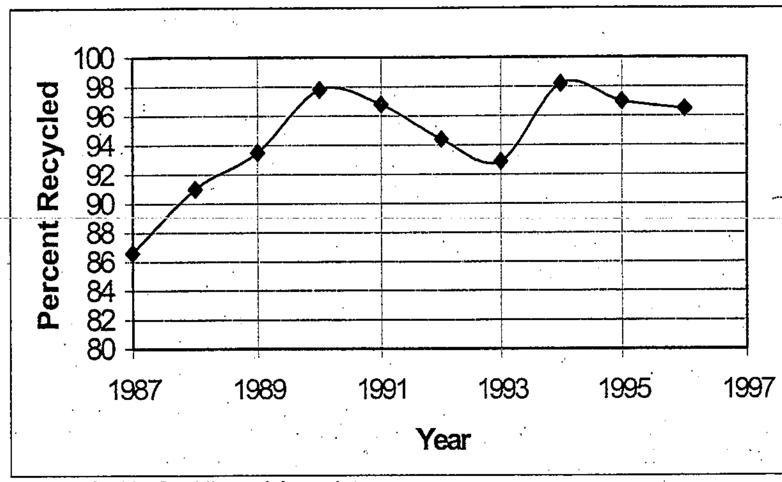
5.4 Maine Pesticide Container Deposit System

The discovery of more than 400 illegal disposal sites in Maine led state authorities to initiate a deposit system for pesticide containers in 1985. The rule applies to all limited-use and restricted-use pesticides sold in glass, metal, or plastic containers, a category that consists mainly of conventional agricultural and forestry applications. Deposit amounts are $5 for containers with less than a 30-gallon capacity and $10 for larger containers.

Farmers must rinse containers three times before returning them for refunds. Containers found to have significant traces of pesticides are not accepted for refunds. Collections are made at designated points once a year according to publicized schedules. Pesticide dealers arrange to have container-shredding equipment at the collection sites. According to the Maine Board of Pesticides Control, the deposit system has played a significant role in reducing the incidence of improper container disposal.[86]

In 1985, the first year that the deposit system operated in Maine, Board of Pesticides Control staff inspected all 7,055 containers that were turned in. Had these containers simply been drained rather than properly rinsed, 429 pounds of active ingredient would have been deposited into landfills. Since the containers were triple-rinsed and therefore were 99.998% clean, only 0.05 pounds of active ingredient was sent to landfills that year.[87] Published reports on the Maine pesticide container deposit system do not discuss the consequences of transferring pesticide residues to wastewater systems. It is possible that pesticide residues are managed in a more environmentally sound manner when they move through wastewater management systems than when they are sent to landfills.

Figure 5-1. Lead Recovery from Lead Acid Batteries



Source: Smith, Bucklin and Associates.

One problem with the deposit system is that it does not apply to general-use pesticide containers, which are far more numerous than containers for restricted-use and limited- use pesticides. One reason why general-use products are not included in the system is that inspecting them would require significantly more resources than are available at present. For a similar reason, a few larger states have considered a program similar to Maine's, but they have concluded that they would not be able to inspect a large number of containers.

5.5 Other Products

Since 1988, Rhode Island has required $5 deposits on all types of replacement vehicle tires. Customers can recover their deposits by returning old tires within 10 to 14 days after they purchase new tires. Their refund payments are limited to one tire for every tire purchased, and the refunds can be obtained only at the point-of-sale of the new tire. In addition to the deposit, Rhode Island—along with most other states—imposes product charges on tires to finance the cleanup of piles of old tires.

Outside the United States, deposit systems have been applied to car hulks, light bulbs, lubricating oil, and other products. An earlier EPA report by Anderson and Lohof (1997) describes several of these systems.

A004171

5.6 Voluntary Deposit Systems

In addition to lead-acid batteries, a few other products are subject to deposit schemes that are voluntarily operated by industry. Among such products are large paper drums, beer kegs, propane gas containers, and, in some areas, beer bottles and pesticide containers.

5.7 Performance Bonds

Performance bonds are fees levied upon companies that extract certain natural resources, such as timber, coal, oil, and gas. Amounts deposited with the performance bond can be refunded when the payer fulfills certain obligations. In that sense, a performance bond acts like a deposit-refund system.

An example of an environmental issue that has been addressed with the use of performance bonds follows. The Surface Mining Control and Reclamation Act (SMCRA) of 1977 requires the purchase of performance bonds before surface coal mining and reclamation permits can be obtained.[88] The amounts are determined by the regulatory authority, which can be either the state authority or the U.S. Department of the Interior. The fee amount depends on the reclamation requirements that are specified in the permit; the anticipated difficulty of reclamation due to factors such as topography, geology, hydrology; and the revegetation potential of the site. SMCRA requires that the amount charged be sufficient to finance reclamation by the regulatory authority in case the company forfeits its deposit. The minimum amount is $10,000 per permit area. Deposit amounts are adjusted as mined areas increase or decrease and as estimates of reclamation costs change.

Although such performance bonds give companies an economic incentive to reclaim mining sites, they are backed up by a regulatory requirement that is specified in a permit. The reclamation requirement may have more of an incentive effect than the deposit, since a firm's ability to obtain leases in the future is dependent in part on satisfying today's regulatory requirements.

Federal and state governments also use performance bonds to influence environmental management by the timber industry and oil and gas operators.

6. Trading Programs

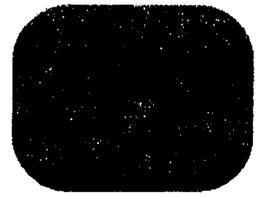
Crocker and Dales generally are credited with first proposing that marketable emission permits be used as an incentive mechanism for achieving environmental goals.[89] The basic approach outlined by Crocker and Dales and later refined by Dewees and Harrison is that the environmental authority can issue a fixed number of marketable permits to release emissions.[90] Through trading, low-cost sources will sell some of their permits and abate more than they would under a traditional regulatory approach, while high-cost sources will buy permits and abate less. The end result, according to the academic design, is the same amount of pollution reduction that would be achieved through traditional regulatory approaches, but it is achieved at lower cost.

EPA first applied the concept of marketable emission permits in the mid-1970s as a means for new sources of emissions to locate in non-attainment areas without causing air quality to worsen. New sources and existing sources that wanted to expand their facilities were required to offset their emissions by acquiring emission reduction credits from existing sources. This important but modest beginning was based on an interpretation of the Clean Air Act, rather than on a specific statutory authority. EPA's Offset Policy was included in the 1977 amendments to the Clean Air Act statute. In 1980, then-Administrator Hawkins signed a memo that allowed emission averaging between can-coating lines.[91]

On August 7, 1980, EPA promulgated New Source Review (NSR) and Prevention of Significant Deterioration (PSD) rules that allowed netting, a means for sources to avoid PSD and NSR requirements for emission increases due to facility expansion, if emissions were decreased contemporaneously elsewhere at the facility.[92] Under the PSD mandate, this rule included facilities within a plant as a source of emissions as well as an entire plant as a source of emissions, in what was termed a "dual-source definition." Chevron and others challenged this rule, claiming it made modernization too difficult. Eventually the U.S. Supreme Court agreed that states did not need to include the dual-source definition in their non-attainment rules. This opened the door to many of the emission trading programs that exist today.

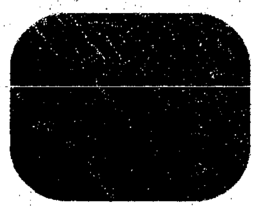
The 1990 Clean Air Act Amendments authorized a variety of emission trading systems. While similar statutory authority to establish effluent permit trading systems does not exist, EPA believes that the Clean Water Act allows effluent trading. Programs of this sort have been operational for several years without legal controversy. Pollution permit trading systems now come in a wide variety of forms, and they apply to a large and growing number of sources of pollution that affect the quality of air, water, and land.

Insofar as trading between economic entities is concerned, two main forms of trading systems are observed: (1) uncapped emission (or effluent) reductions credit (ERC) systems, and (2) capped allowance systems (also referred to as cap-and-trade systems). In the case of uncapped systems, pollution limits are rate-based (e.g., grams per mile for motor vehicles), and sources earn credits by releasing less pollution than their legal limit or other defined baseline. Under these systems,

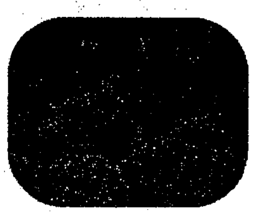

Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

emissions can increase with economic growth. By contrast, with capped systems, total emissions are limited by an overall ceiling that is designed to achieve health or environmental goals, and allowances are allocated to sources in quantities consistent with this ceiling. The formula for making such allocations will vary from one situation to the next.

A number of the programs described in this chapter involve the right to average emission characteristics of a slate of similar products that are manufactured by one economic entity. Emission averaging is an important mechanism for improving the cost effectiveness of environmental regulation. It can be characterized as intra-firm trading across the product lines where it is allowed.

Trading systems, properly designed and applied in appropriate circumstances, can cut compliance costs, encourage technological development, and create incentives for achieving environmental benefits beyond minimum requirements. For trading systems to function well, a number of requirements must be satisfied. There should be several potential participants in trades if a functioning market is to be created. Exactly how small a universe of potential participants there can be and still have a functioning market is difficult to say, but simulation experiments suggest that 8–10 participants is a reasonable estimate.[93] If sources are dispersed geographically, trading ratios other than one-to-one might have to be imposed to account for wind direction or the distance between sources to ensure no degradation in environmental quality.

Some pollutants are seasonal in their impact, implying that trades might be allowed only during a portion of the year. Trading might be limited because of a desire to avoid "hot spots" where pollution concentrations increase. Trading requires that pollution control agencies have the ability to monitor emissions (or measure a surrogate to those emissions) reasonably well. The need to ensure accountability of trades must not pose unacceptably high transaction costs. The commodity to be traded needs to be defined. In general, a well-defined commodity requires a baseline from which to calculate the emission reduction credits (or allowances) that may be traded. Establishing baselines is likely to require good historic data on emissions, input use, etc. In the case of allowance systems, the political will must exist to achieve an allocation of allowances among competing interests.

Cap-and-trade systems to date have allocated most or all of the allowable emissions under the cap to existing sources, providing allowance set-asides for new sources or using auctions as a safeguard to ensure access to allowances. Initially, environmentalists opposed marketable permit trading because the existence of trading was evidence that sources could make greater reductions in pollution than were being achieved. In addition, there has been a lingering concern that trading could result in localized "hot spots" that had undesirably high levels of pollution. With the success of the Regional Clean Air Incentives Market (RECLAIM) and the Acid Rain Program described later in this chapter, marketable permit trading has become more accepted as a cost-effective means of achieving many environmental goals.

On the other hand, attempts to establish new trading programs often encounter controversy. For example, some citizen groups have opposed trading programs for ozone-forming volatile organic compounds (VOCs). They based their opposition on two basic concerns: (1) the possibility of localized toxic pollution "hot spots," or (2) the ability of the source (or EPA for that matter) to reliably measure emissions to ensure that participants would be held accountable. EPA, in consultation with environmental justice groups and other stakeholders, is working on guidance for addressing these environmental justice concerns with trading.

The scope of trading systems is considerable. An emission trading proposal is a centerpiece of the Kyoto Protocol for controlling greenhouse gas emissions. Certain Colorado communities have created programs to trade the right to own and operate a wood burning stove or fireplace. For a number of years, there was an active program under which refiners could trade lead that was used as an additive in gasoline. Heavy-duty truck manufacturers can meet engine emission standards by averaging together the emissions performance of all the engines they produce. Programs to trade effluents are operating in selected locations. These particular programs are likely to be expanded significantly in coming years as a result of a new EPA initiative to improve water quality in polluted rivers and lakes. Developers whose activities would cause the loss of wetlands can satisfy mitigation requirements in some areas by purchasing credits from a wetland mitigation bank.

These and other trading systems for air, water, and land are described in this chapter. The discussion begins with a review of trading programs in air emissions, followed by sections on water effluent trading, land development, and, finally, international trading programs in which the United States is involved.

A few basic parameters may be used to characterize trading systems:

1. *Scope.* Is trading restricted to averaging within a single facility, allowed among facilities owned by the same firm, or allowed among firms or facilities under different ownership?
2. *Cap.* Is there a limit on total emissions or on effluents?
3. *Commodity Being Traded.* How will the commodity be defined: As allowances for future pollution, as credits for quantifiable reductions in pollution, as emission characteristics of products, as rights to own and operate products themselves, or as some other definition?
4. *Distribution of Tradable Permits.* Are the tradable certificates auctioned to the highest bidder, or are they grandfathered to existing sources?
5. *Trading Ratio.* Is the required trading ratio 1:1 or some greater ratio? Does the trading ratio depend on the respective location of the sources, season of the year, or other factors?
6. *Banking.* Can tradable certificates be banked or otherwise reserved for future use?
7. *Monitoring.* How is credit generation and trading monitored?
8. *Environmental Benefit.* Is a "set-aside" for the benefit of the environment built into the trading system? For example, each trade could be debited by 10% to yield an environmental benefit.

6.1 Trading in Clean Air Act Programs: An Overview

Since 1990, EPA has significantly expanded the use of trading in Clean Air Act programs. Today, emissions trading is a standard tool of EPA's air quality program. Although not a panacea for every situation, trading is being used by EPA and states to help solve a variety of air pollution problems. A broad overview of these programs follows. (Some of these programs are discussed in detail later in this chapter.)

Acid Rain: Perhaps the best-known example of trading is the Acid Rain Program's system of marketable pollution allowances for sulfur dioxide emissions for electric utilities. Enacted as part of the Clean Air Act Amendments of 1990, this cap-and-trade program has been highly successful at achieving cost-effective emissions reductions. The first phase of the program, which took effect in 1995, reduced annual emissions by 4 million tons. Since then measurements have shown that rainfall in the eastern United States is as much as 25% less acidic, some ecosystems in New England are showing signs of recovery, and ambient sulfate concentrations have been reduced, thus benefiting public health. The second phase of the program, beginning in 2000, will more than double the annual emissions reductions achieved by the first phase over time. The annual cost of the program, once it is fully implemented, is expected now to be approximately $2 billion, which is about one-half the cost that EPA had originally estimated.

Smog and Other Common Pollutants: EPA is working with states to promote trading and other market-based approaches to help achieve national air quality standards for smog, particulates, and other common pollutants that are regulated through national air quality standards. In addition, EPA has provided trading opportunities in virtually all federal rules that are aimed at cutting emissions from motor vehicles and fuels. These federal measures are essential to helping states meet federal air quality goals.

Under the Clean Air Act, states have primary responsibility for devising pollution control strategies for local areas, so states can meet national air quality standards. EPA has issued guidance to assist states in designing trading and other economic incentive programs, including economic incentives rules and guidance in 1994 (which, at present, are being revised); general guidance on State Implementation Plans (SIPs) in 1992; and the 1986 emissions trading policy statement. EPA also has assisted states in setting up trading programs, such as California's RECLAIM cap-and-trade program for sulfur dioxide and nitrogen oxides and the Ozone Transport Commission's (OTC) program for controlling nitrogen oxide emissions among states in the Northeast. Through a unique partnership, EPA and the OTC states are jointly implementing this NO_x budget system for the Northeast, which draws on the experience of the acid rain program.

In 1998, EPA issued a rule that established NO_x budgets for many states (the "NO_x SIP call") to combat the problem of transported ozone pollution in the eastern United States on a broader scale. To encourage an efficient market-based approach to reducing NO_x on a regional basis, EPA simultaneously provided states with a model cap-and-trade rule for utilities and large industrial sources. The experiences of the acid rain program and the OTC effort show that this approach holds the potential to achieve regional NO_x reductions in an efficient and highly cost-effective manner.

In the 1990 Clean Air Act Amendments, Congress called for EPA to help states meet their air quality goals by issuing federal standards to cut emissions from cars, trucks, buses, many types of non-road engines, and fuels. These rules cut toxic air pollution as well as reduced the amount of air pollutants, which were regulated through air quality standards.

EPA has provided trading opportunities in virtually all of these new standards, building on the early success of trading in the phased reduction of lead in leaded gasoline during the 1980s. These standards include rules for cleaner burning reformulated gasoline, which now accounts for approximately 30% of the nation's gasoline, and the national low-emission vehicle standards for cars and light-duty trucks that will be met nationwide by 2001. Opportunities for averaging, trading, and banking also are provided by new national emissions standards for heavy-duty trucks and buses, locomotives, heavy-duty off-road engines such as bulldozers, and small gasoline engines (e.g., those used in lawn and garden equipment).

Another recent example is the landmark Tier II/gasoline sulfur rule that President Clinton announced in December 1999. This rule would provide compliance flexibility to both vehicle manufacturers and fuel refiners by allowing them to use averaging, banking, and trading. to In the case of automakers, EPA created different "bins" of emissions levels, rather than require a single NO_x emissions standard for each vehicle model. EPA required automakers to achieve a fleet average emissions rate of 0.07 grams of NO_x per mile (gpm). Automakers whose fleet average is below 0.07 gpm could generate credits that they could either use in a later model year or sell to another auto manufacturer. This rule does allow the production of certain higher polluting vehicles that consumers desire. However, it also provides a strong incentive for the industry to develop technology well beyond the 0.07 gpm standard, since any higher polluting vehicle will have to be offset by a lower polluting one.

Industrial Air Toxics: The 1990 Clean Air Act Amendments called on EPA to establish national emissions standards to control major industrial sources of toxic air pollution. EPA has used emissions averaging as one of several ways to provide compliance flexibility in these industry-by-industry standards. For example, emissions averaging is permitted by national air toxics emissions standards for petroleum refining, synthetic organic chemical manufacturing, polymers and resins manufacturing, aluminum production, wood furniture manufacturing, printing and publishing, and a number of other sectors. To avoid shifting risks from one area to another, toxics averaging is allowed only within individual facilities. With appropriate safeguards, EPA also has used other methods, including multiple compliance options, to help provide flexibility in complying with air toxics rules.

Ozone Layer Depletion: In gradually phasing out the production of chemicals that harm the stratospheric ozone layer, EPA is giving producers and importers the flexibility to trade allowances. Under the Montreal Protocol, the United States and other developed countries agreed to stop producing and importing CFCs (chlorofluorocarbons) and other chemicals that are destructive to the ozone layer. By 1996, production of the most harmful ozone-depleting chemicals, including CFCs, virtually ceased in the United States and other developed countries. Additional chemicals are to be phased out in the future. Provided the United States and the world community maintain their commitment to planned protection efforts, the stratospheric ozone layer is projected to recover by the middle of the 21st century.

The phase-out of these chemicals is being achieved by using trading rules developed by EPA, rules that have served as a model for programs in other countries. In part because of the flexible market-based approach, the phase-out of CFCs was much less expensive than predicted. In 1988, EPA estimated that a 50% reduction of CFCs by 1998 would cost $3.55 per kilogram. In 1993, the cost for a 100% phase-out by 1996 was reduced to $2.45 per kilogram.

6.2 Foundations of Air Emissions Trading

The first trading of permitted rights to release any type of pollutant in the United States began in the 1970s as a mechanism to allow economic development in areas that failed to meet ambient air quality standards. EPA gradually broadened the offset policy to include emission bubbles, banking, and netting. These programs are described in the following paragraphs. While many of the achievements are modest, EPA's early efforts in emissions trading are important because they provided a foundation and valuable practical experience for the development of more effective and cost-effective trading programs such as the Acid Rain Program.

6.2.1 Offset Program

In the mid-1970s, the EPA proposed the "offset" policy that permitted growth in non-attainment areas, provided that new sources install air pollution control equipment which met Lowest Achievable Emission Rate (LAER) standards. These sources also had to offset any excess emissions by acquiring greater emission reductions from other sources in the area. Through this process, growth could be accommodated while maintaining progress toward attaining national ambient air quality standards.

Of more than 10,000 offset trades (a few of which are described later in this section), over 90% have been in California. Nationwide, about 10% of offset trades are between firms; the remainder are between sources owned by the same firm. Most offset credits are created as a result of all or part of a facility being closed.

The offset policy, which was included in the 1977 amendments to the Clean Air Act, spawned three related programs: bubbles, banking, and netting. The common element in these programs is the Emission Reduction Credit (ERC), which is generated when sources reduce actual emissions below their permitted emissions and apply to the state for certification of the reduction. To be certified as an ERC, the state must determine that the reduction meets the following criteria: (1) that the reduction is surplus in the sense of not being required by current regulations in the State Implementation Plan (SIP); (2) that it is enforceable; (3) that it is permanent; and (4) that it is quantifiable. ERCs are normally denominated in terms of the quantity of pollutant in tons released over 1 year. By far the most common method of generating ERCs is closing the source or reducing its production. However, ERCs also can be earned by modifying production processes and installing pollution control equipment. Trades of ERCs most often involve stationary sources, although trades involving mobile sources are permitted. States have approved a variety of activities that sources may use to generate offset credits. The South Coast Air Quality Management District (SCAQMD) in California, for example, accepts the scrapping of older vehicles and lawn mowers as a means of generating credits. It then applies a formula to determine the magnitude of air pollution credits for each old car that is scrapped.[94]

The offset, banking, and netting programs and bubble policy were subject to numerous revisions before being incorporated into EPA's Final Emission Trading Policy Statement, which was issued in 1986.[95] The Policy Statement addresses trading of ERCs for criteria pollutants such as sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide, and volatile organic compounds (VOCs) that contribute to the formation of ground-level ozone. The final policy statement responded to public comments that pollutant trading could cause environmental damage unless accompanied by safeguards, such as trading ratios greater than 1:1and the use of air quality modeling in some cases).

6.2.2 Bubble Policy

The bubble policy, established in 1979, allows sources to meet emission limits by treating multiple emission points within a facility as if they face a single aggregate emission limit. The term *bubble* was used to connote an imaginary bubble over a source such as a refinery or a steel mill that had several emission points, each with its own emission limit. Within the "bubble," a source could propose to meet all of its emission control requirements for a criteria pollutant with a mix of controls that is different from those mandated by regulations—as long as total emissions within the bubble met the limit for all sources within the bubble. A bubble can include more than one facility owned by one firm, or it can include facilities owned by different firms. However, all of the emission points must be within the same attainment or non-attainment area.

Bubbles must be approved as a revision to an applicable State Implementation Plan (SIP), a factor that has discouraged their use. Prior to the 1986 final policy, EPA approved or proposed to approve approximately 50 source-specific bubbles. EPA approved 34 additional bubbles under EPA-authorized generic bubble rules. The EPA-approved, pre-1986 bubbles were estimated to save $300 million over conventional control approaches. State-approved, pre-1986 bubbles saved an estimated $135 million.[96] No estimates are reported for the number of, or savings from, post-1986 bubbles. By design, bubbles are neutral in terms of environmental impact.

6.2.3 Banking

EPA's initial offset policy did not allow the banking of emission reduction credits for future use or sale. EPA contended that banking would be inconsistent with the basic policy of the Clean Air Act. But without a provision for storing or banking ERCs, the policy encouraged sources to continue operating dirty facilities until they needed credits for internal use. New and expanding firms without internal sources of ERCs had to engage in lengthy searches for other firms that were willing to create and supply credits.

The offset policy in the 1977 amendments to the Clean Air Act included provisions for the banking of emission reduction credits for future use or sale. Although the EPA approved several banks, there was limited use of the provision, most likely because of the uncertain nature of the banked ERC. In 1980, EPA determined that an ERC is not an absolute property right and that communities must have the option of modifying the use of ERCs, including the debiting of part or all of the banked ERCs.[97] A 1994 report identified 24 emission banks; some limited ERCs to a life of as little as 5 years.[98] Since that date, the number of banks has remained stable. Most of the banks provided a registry to help buyers of ERCs find potential sellers. Some states debit a percentage of each ERC deposit for use by the state to attract new industry or to meet anticipated SIP requirements.

6.2.4 Netting

Netting, the final component of EPA's 1986 emission trading policy statement, dates from 1980. Netting allows sources undergoing modification to avoid new source review if they can demonstrate that plant-wide emissions do not increase significantly. Netting is the most widely used of these early emission trading programs. Hahn and Hester (1989) estimate that between 5,000 and 12,000 sources have used netting.

In each application, netting is designed to have no significant impacts on environmental quality. However, with a large number of netting transactions, a modest adverse impact might ensue. The total savings in control costs from netting are difficult to estimate because the number of transactions is not known precisely, and the cost savings from individual transactions can be highly variable.

Cost savings can arise in three ways. First, netting may allow a firm to avoid being classified as a major source, under which it would be subject to more stringent emission limits. Reductions in control costs in such a case would depend upon the control costs and emission limits that the firm must satisfy after netting. One source estimated that netting typically results in savings between $100,000 and $1 million per application (indicating aggregate savings of $500 million to as much as $12 billion).[99] Second, the aggregate cost savings from avoiding the cost of going through the major source permitting process could range from $25 million to $300 million. Third, additional savings could arise from avoiding construction delays that are caused by the permitting process.

On April 3, 1996, EPA's Office of Air and Radiation announced a series of proposed revisions to new source regulations. These revisions were expected to reduce the number of permitting actions that new sources and sources undergoing changes must take by more than one-half. Because the proposal shares many of the features of netting, it is described here. The proposed regulations would allow sources to use plant-wide limits. They would also provide exemptions for pollution prevention activities and so-called "clean" emission sources in a facility.

Under the proposal, sources making changes could avoid new source review requirements by establishing a plant-wide cap on emissions. (In general, this cap would be the source's maximum potential emissions.) Process changes could be made as long as the changes did not result in an increase in emissions beyond the cap.

6.2.5 Evaluation of Early Emission Trading Activities

With data from offset transactions in the Los Angeles area, Foster and Hahn (1995) provide the most comprehensive evaluation of the original emissions trading program. The South Coast Air Quality Management District (SCAQMD) provided data on trading activity, some of which are reproduced in Table 6-1. The large increase in offset transactions in 1991 and 1992 reflects activity at two special funds created by the SCAQMD in 1991: the Community Bank, which serves small sources producing less than 2 tons per year; and the Priority Reserve, which secures credits for essential public services.

Table 6-1. Emission Trading Activity in the Los Angeles Area

YEAR	OFFSETS	NETTING	TOTAL
pre-1977	...	5	5
1977	...	30	30
1978	...	34	34
1979	...	72	72
1980	...	129	129
1981	...	238	238
1982	...	210	210
1983	...	258	258
1984	...	256	256
1985	7	235	242
1986	27	432	459
1987	24	329	353
1988	55	358	413
1989	30	352	382
1990	53	394	447
1991	2,208	155	2,363
1992	3,678	77	3,755

Note: Trading activity is based on the number of trades reported to SCAQMD.
Source: Foster and Hahn (1995).

During the period 1985–1992, over 10,000 tons of pollutants were traded in the offset program, with total expenditure on ERCs estimated to be on the order of $2 billion. (This figure indicates an average price for traded pollutants of about $200 per ton.) Nearly three-quarters of the trades involved reactive organic gases (SCAQMD terminology for a subset of volatile organic compounds), but there also were trades in CO, NO_x, PM, and SO_2.

AER*X, a broker in the Los Angeles offset market, supplied data for prices for over 40 of the trades from 1985 to 1992. The minimum price per ton in trades of reactive organic gases (ROG) fluctuated in the $40-per-ton range over this period, while the minimum value for NO_x trades was about $120 per ton. High prices for ROG increased steadily over the period, from $135 per ton to $711 per ton; and high NO_x prices increased from about $320 per ton to $655 per ton over the same period.

For a variety of reasons, one would not expect all tons of ROG or NO_x to be valued identically. First, the markets are imperfect, and information on historic trades is not widely disseminated. Second, credits that have been banked involve additional costs to the selling party. Third, offset ratios vary with the distance and location of parties to the transaction. The low end of prices could be determined largely by transaction costs to the seller (thought to be a minimum of $10,000 per transaction). In a few cases, transaction costs apparently exceeded the market value of the credits that were exchanged. Although the highest and average prices increased over the period, most of the change in 1991 can be attributed to a change in SCAQMD rules in the prior year. None of the observed prices remotely approach the typical incremental control costs for ROG and NO_x in the Los Angeles area over that period: on the order of $5,000 per ton for ROG and $8,000 per ton for NO_x.

ERC emission trading has not lived up to expectations; trades have been fewer and offset prices lower than many had expected. Several factors seem to have limited the appeal of the emissions trading policy. In order to assure that air quality did not deteriorate, state environmental administrators often required expensive air quality modeling prior to accepting proposed trades between geographically separated parties. Deposits to emission banks typically were "taxed" by the air quality management authority to meet state SIP requirements or to generate a surplus that the area could offer to attract new firms. Offset ratios greater than unity further depressed the value of ERCs. In many areas, it appears that ERCs had an economic value less than the transaction costs of completing a sale to another party.

In other respects, the emission trading program revealed the myriad possibilities for emission trading and many of the features that would be necessary to make trading viable. It served as the foundation for the enormously successful lead credit trading program and for many of the emission trading features of the 1990 Clean Air Act Amendments. States also have learned from the experience.

A number of states have redesigned their offset programs as trading programs without emission caps. (Examples include Delaware, Massachusetts, Michigan, New Jersey, Texas, and Wisconsin.) The Los Angeles area has developed a much more significant trading initiative known as "RECLAIM," with an emissions cap and phased reductions in the allowable emissions of SO_2 and NO_x. (The RECLAIM initiative is described in more detail later in this chapter.) Illinois recently developed a similar program with an emissions cap.

6.3 Acid Rain Allowance Trading[100]

An early solution to mitigate local air pollution that was caused by sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions from power plants was to build tall stacks to disperse pollutants away from populated areas. This strategy led to large increases in regional pollution concentrations and concerns about potential ecological damage. Coal-burning electric generating units built after 1970 were limited to 1.2 pounds of SO_2 per million Btu (British Thermal Units). By 1977, new plants were forced to meet a percent-reduction requirement in addition to the 1.2-pound limit. However, older coal-burning units continued to emit pollutants at much higher rates—up to 7 pounds of SO_2 per million Btus—and to operate far beyond their original design lives because of the high cost of building new units.

By the 1980s, studies began to demonstrate probable harm to lakes and forests, agricultural crops, materials, and visibility from the long-range transport of sulfates and nitrates formed from SO_2 and nitrogen oxide emissions. Studies also revealed that the acidification of soils and waters could release heavy metals and aluminum that were previously bound in soils. Further, increased atmospheric levels of sulfate and nitrate pose a risk to human health.

In Title IV of the Clean Air Act Amendments of 1990, Congress created the Acid Rain Program to address both wet and dry acidic deposition by cutting national SO_2 emissions from power plants by approximately 50%. Costs of compliance were estimated in the range of $5 billion per year. At that time, quantifiable economic benefits were believed to be lower—in the range of $1 billion per year.[101] Actual costs have been far less and associated benefits have been far greater, as further explained in this last paragraph of this subsection.

Title IV also sets allowable limits on NO_x emissions from utility boilers by placing limits on emission rates. An owner of two or more power plants may comply with the NO_x requirement by averaging emissions across all its power plants, a rudimentary form of emissions trading.

The Acid Rain Program set a cap of 8.95 million tons of SO_2 per year, to be achieved in two phases. During Phase I, which ran from 1995 through 1999, the 110 highest emitting coal-fired power plants (with a total of 263 coal-burning units) were required to reduce emissions to satisfy a tonnage cap. These so-called "Table 1" units were targeted for the first phase because their emissions exceeded 2.5 pounds of SO_2 per million Btu, and their capacity exceeded 100 megawatts. Between 125 and 182 additional units each year joined Phase I as substitution or compensating units. Although not required to participate until Phase II, these units elected to participate early to help fulfill the compliance obligations of a Table 1 unit. Furthermore, several units not required to participate in the Acid Rain Program opted to join the program during these years. In the second phase, which began in 2000, all power plants producing more than 25 megawatts and all new facilities must meet a lower emission cap. Phase II reductions will total an additional 5 million tons and will reach the overall 8.95 million-ton cap.

A major innovation of the program is the acceptance of emissions trading as a means of achieving compliance. Prior to the drafting of Title IV of the Clean Air Act, a number of studies had identified potential cost savings of as much as $1 billion per year through emissions trading due to significant differences among utility sources in the marginal cost of abatement.[102] Actual experiences with emission trading have exceeded expectations. A recent study estimates that emissions trading reduces the cost of complying with Title IV by 50%, or $2.5 billion annually.[103]

6.3.1 Allowances

Emission caps are enforced through a system of tradable emission allowances. Title IV specifies fixed numbers of allowances, each of which represents a limited authorization to emit one ton of SO_2, to be given each year to each of the affected units. Political considerations dictated that allowances be given rather than auctioned. SO_2 allowances issued in any particular year do not expire, meaning allowances issued in 1 year may be "banked" for use in subsequent years. The banking provision has been widely utilized in the Acid Rain Program. Emissions each year have been well below allocated levels, resulting in an increasing amount of banked allowances that can be used for compliance in later years. For example, 1999 emissions were almost 30% below the level allowed. Sources benefit from the flexibility that allows them to conserve allowances for use in later years.

The basic formula for computing Phase I allowances is 2.5 pounds of SO_2 per million Btu, multiplied by each unit's average 1985–1987 Btu consumption. For Phase II, 1.2 pounds of SO_2 per million Btu are multiplied by each unit's 1985–1987 Btu consumption. There are a number of departures from the basic formula, particularly in Phase II. Sources that fail to hold sufficient allowances to cover their emissions following a compliance period are subject to a penalty for each ton of excess emissions. Initially set at $2,000 per ton, the penalty is indexed for inflation and is currently more than $2,600 per ton. The Acid Rain Program has reported 100% compliance for its first 5 years, primarily because noncompliance carries such a high price.

As in Table 6-2, Table 1 units received 6.9 million allowances in 1999. Several other provisions of Title IV also create allowances, and the number of allowances created under these other provisions can vary from year to year. These other provisions varied from year to year during

Table 6-2. Origin of 1999 Allowable Emissions

TYPE OF ALLOWANCE	NUMBER OF ALLOWANCES	EXPLANATION OF ALLOCATION
Initial allocation	5,550,820	Granted to units based on baseline Btu output and emission rates, as specified in the Clean Air Act Amendments of 1990
Phase I extension	171,710	Given to Phase I units that reduce emissions by 90% or reassign obligations to units that reduce emissions by 90% (i.e., scrubbers)
Substitution allocation	909,455	These are the initial allocations of Phase II units that enter Phase I as substitution units
Auctions	150,000	Provided in the Clean Air Act Amendments in a Special Allowance Reserve when initial allocations were made
Compensation allocation	85,138	These are the initial allocations of Phase II units that enter Phase I as compensating units
Opt-in allowances	97,392	Provided to units that enter the program voluntarily
Small diesel allowances	25,617	Allocated to small diesel refineries that produced desulfurized diesel fuel in the previous year
Total (1997)	**6,990,132**	

Source: Exhibit 2 at http://www.epa.gov/airmarkets/cmprpt/arp99/index.html#so2compliance

Phase I. Owners of "extension" units that propose to reduce emissions with flue gas desulfurization (FGD)/scrubbing receive allowances, as do owners of "substitution" and "compensation" units. The substitution provision allows owners of units to substitute cheaper reductions from other units for the reductions required of Table 1 units. The compensation provision lets a utility reduce electricity generation of a Table 1 unit below its baseline level, provided the source of any compensating generation is designated. If the compensating unit emits SO_2, EPA provides an allocation of allowances to that unit, so the compensating unit in essence becomes part of Table 1. Phase I initially included 263 units. An additional 125–182 combustion units joined Phase I as compensation or substitution units (the totals varied by year). Several opt-in sources joined as well, raising the total of Phase I units to between 398 and 445 units.

Beginning January 1, 1995, EPA could allocate up to 300,000 bonus allowances from its Conservation and Renewable Energy Reserve to utilities that undertake energy efficiency and renewable energy measures. The full accounting of provisions for allocating 1999 allowances are identified in Table 6-2 to illustrate the many sources of allowances.

In order to maintain the emissions cap, new sources receive no allowances. Instead, they must buy them from existing allowance holders or in EPA auctions. New sources are also required to satisfy New Source Performance Standards.

In March 1995, EPA expanded the Acid Rain Program to include industrial facilities that burn fossil fuels.[104] The rule establishes an "opt-in" program that allows industrial sources and other sources to participate in the existing SO_2 program, which previously included only utilities. Industrial sources that participate in the program will have an allocation of allowances that they can use for compliance or for selling or trading to other sources. These provisions allowing industrial sources to opt-in have been little used, partially due to high transaction costs and lower-than-expected allowance prices.[105] Ten units had joined the program as opt-in units by 1999.

6.3.2 Monitoring and Compliance

Utilities whose units are included in Phase I and Phase II must install continuous emission monitoring (CEM) systems to verify compliance with emission limits, and they must file quarterly reports of their hourly emissions data with EPA. Initially, sources mailed these data to EPA on computer disks, but most sources now transmit the information over the Internet. Continuous emission monitoring systems—the accepted industry standard for measuring SO_2, NO_x, and CO_2—provide an accurate accounting of emissions, assuring those buying and selling allowances that the commodity they are trading is real and assuring EPA that emission limits have been met.

CEMs for coal-fired electric power plants have an initial capital cost of just over $700,000, and annual operating costs of just under $50,000. On an annualized basis that spreads the capital costs over a capital recovery period, the cost of operating a CEM is approximately $125,000 each year. This amount is equivalent to about $0.16 per kilowatt of installed capacity.[106]

The cost of monitoring with CEMS represents approximately 7% of the observed cost of compliance. More than 2,100 units are now required to have CEMS for Phase II of the program. This requirement helps ensure low transaction costs and confidence that each allowance represents one ton of SO_2 emissions, regardless of where or when it is generated. That confidence is an important underpinning of trading.

At the end of each quarter, EPA receives more than 1,700 reports containing hourly emissions data and heat input for affected units. More than 90% of this data is received electronically.

Using these data and the allowance record for each unit, EPA tracks compliance. CEMS provide some of the most accurate and complete data ever collected by EPA. In 1999, SO_2 monitors on sources in the Acid Rain Program achieved a median relative accuracy of 3% and a median availability of 99.5%.

Under the authority of Title IV, EPA developed an allowance tracking system that serves as the official record of ownership and transfers. The system currently requires a paper form with the signature of the seller, but it will allow transactions to be completed on the Internet by the end of this year. With just two staff members, EPA processes most allowance transactions within one day of receipt.

6.3.3 Allowance Auction

In addition to private transactions in allowances, Title IV directed EPA to offer allowances at an annual auction, beginning in 1993. This auction offers the equivalent of roughly 2.8% of total allowances. Private parties may also offer allowances at the auction. Each offer includes the quantity for sale and a minimum acceptable price. The auctions helped to provide a price signal to the allowance market in the early stages of the program and currently provide an additional source of allowances for utilities. The auctions have only involved allowances that can be used in the current year and 6 and 7 years into the future. From now on, each auction will involve current-year and 7-year allowances.

Before discussing the specifics of the auction, it is worth noting that it has largely served its purpose now that (1) the market under the Acid Rain Program is flourishing and (2) the auction activity is dwarfed by the allowance exchanges occurring every day all over the country. Economists have criticized the mechanics of the auction, suggesting that it may also contribute to lower prices than otherwise would occur.[107] The Act requires a discriminating price auction, which ranks bids from highest to lowest. EPA has interpreted this statement as requiring that each seller receive the bid price of a specific buyer. The auction first awards allowances offered by the seller with the lowest asking price to the bidder with the highest bid price. Incrementally, the allocation mechanism moves up the supply list and moves down the bid list until no bidder is willing to offer what the remaining sellers are asking. The idea of having a discriminating price auction came from staff members of the U.S. House of Representatives, who were convinced that such an auction maximized revenue to sellers.[108]

This unusual auction mechanism may cause sellers to misrepresent and under-reveal their true costs of emission control.[109] By lowering the reservation price, a seller increases the probability of sale and the expected price, if buyers are offering different prices. Therefore, sellers would set lower reservation prices in such a discriminating price auction than in a single-price auction. Joskow (1998) concludes that EPA auctions became a sideshow to the much larger private market, after just the first two auctions. (These two auctions provided useful indications early in the process that allowance prices would be lower than first anticipated.)–The evidence from a detailed analysis of the auction records is that private sellers in the EPA auction have tended to set prices above market-clearing levels rather than too low, as initially hypothesized by Cason and others.

6.3.4 Transaction Costs

Many observers of the Acid Rain Program have noted the low transaction costs of the allowance market. The allowance market operates on a very narrow bid—to-ask spread. Recently, this spread has been less than $2 per ton, or about 1% of allowance prices. Most allowance transfers are processed within 24 hours of receipt, as program requirements eliminate the need for review of submissions beyond electronic verification that the allowances being transferred are indeed in the seller's account. In addition, program design eliminates the need for source-specific emission limits or reviews of compliance strategies, causing the costs of oversight to drop dramatically.

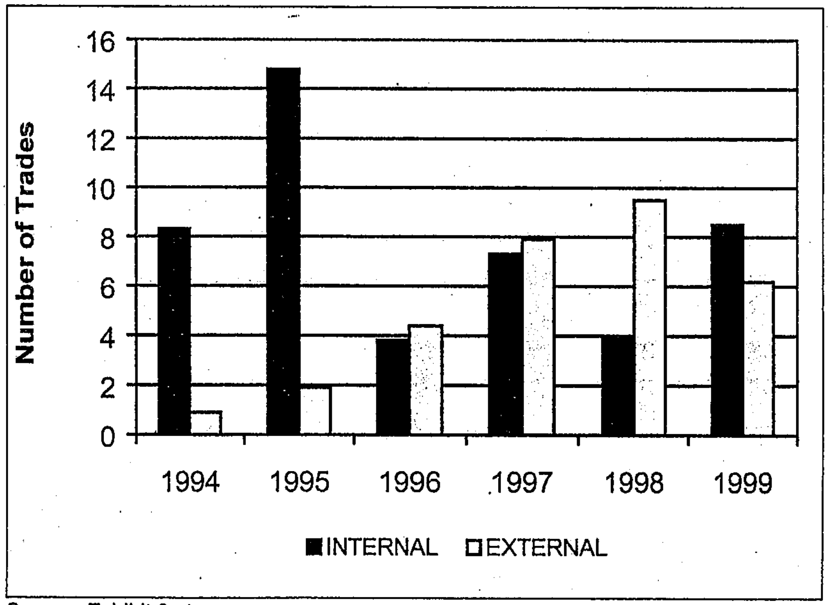
During the 5 years following the Clean Air Act Amendments, EPA spent $44 million to implement the Acid Rain Program and allocated an additional $18.9 million to state and local governments to implement the program. These costs may be compared with the $1.09 billion that EPA spent to implement the Clean Air Act in the same period and the $833 million EPA distributed to state and local governments for this purpose.[110]

6.3.5 Results

From 1995 through 1999, the Acid Rain Program has exceeded expectations, with firms exceeding the reduction target at less than one-half the forecast cost. These results follow from the very flexible structure of the program, one key component of which was the trading provision.[111]

While there was considerable trading activity from the start, little of that activity initially was between economically distinct entities. (See Figure 6-1.) In searching for explanations for the relatively low level of trading between economically distinct entities (labeled "external" in Figure 6-1), analysts have cited relatively high transaction costs at first, the behavior of public utility commissions, and legislation in some states that promoted the use of locally produced coal.

Figure 6-1. Internal and External Trading



Source: Exhibit 6 at http://www.epa.gov/airmarkets/cmprpt/arp99/index.html#so2compliance

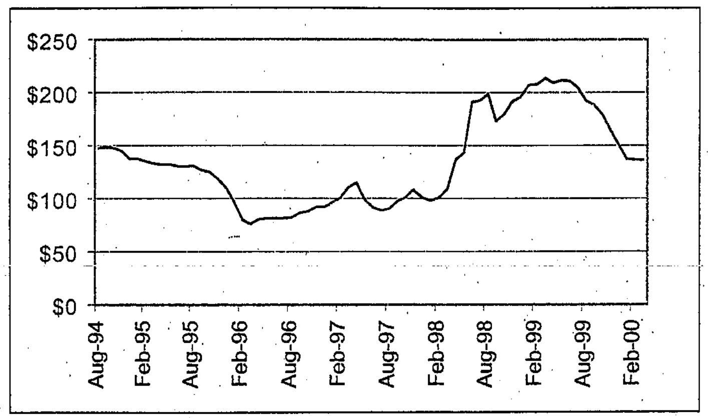
Emissions data compiled by EPA show at least 9,300 transfers involving 81.5 million allowances through the end of 1999. About 62% of the allowances or 50.4 million tons were transferred within organizations, and 38% or 31 million tons were transferred between organizations. Another 40 million tons reflect movements of allowances from EPA to the market through auctions, Phase I extension allowances, substitution allowances, and other mechanisms. SO_2 emissions control is ahead of schedule. The excess emissions reductions—unused allowances—in Phase I are being banked by utilities for use during Phase II, when the performance standard tightens significantly.

A004186

The price of allowances has been far below initial forecasts, an issue that has attracted considerable attention. Prior to passage of the Clean Air Act Amendments of 1990, industry estimates of abatement costs were $1,000 per ton, and EPA forecast allowance prices were in the $750-per-ton range. As an ultimate backstop for compliance, Congress authorized direct allowance sales by EPA at a price of $1,500 per ton. The direct sale provisions were eliminated several years ago when it became clear that allowance prices were far lower than anticipated, and the direct sale option would not be utilized.

Some early allowance transactions occurred at prices as high as $300 per ton in 1992. By 1993, the price had fallen to a range of $150 per ton to $200 per ton. Allowance prices—from EPA auctions, transactions through the Emissions Exchange, and through brokers—gradually fell to a low of $66 per ton through mid-1995 and, in general, remained below $120 per ton through 1997. (See Figure 6-2.) In 1998, allowance prices began to increase and exceeded $200 per ton by early 1999, peaking at $217 per ton in March. Prices then declined to about $130 ton by March 2000.[112]

Figure 6-2. Acid Rain Allowance Prices



Source: Exhibit 5 at http://www.epa.gov/airmarkets/cmprpt/arp99/index.html#so2compliance

Lower-than-forecast allowance prices have several explanations. Prices for virtually every form of compliance are well below anticipated levels. The price of low-sulfur western coal delivered to Mid-West and Eastern markets has declined due to productivity improvements in extraction and transport, and deregulation of rail rates. Engineers have found ways to blend low-sulfur Western coal with high-sulfur Eastern coal to meet emission limits in boilers that had been designed to burn high-sulfur coal. In addition, innovations in the scrubber market have cut the cost of scrubbing by approximately one-half. Many utilities committed themselves to scrubbers and other relatively expensive control measures, based on early engineering cost studies. If utilities had anticipated SO_2 control costs better, fewer scrubbers would have been placed in service. The consequence of greater-than- expected compliance is downward pressure on allowance prices in Phase I.

Analysts debate the role that allowance trading plays in stimulating cost effectiveness in SO_2 control from power plants. There is no doubt that SO_2 control has experienced tremendous technological and productivity improvement over a very short period of time, leading to approximately 50% lower costs for controlling emissions than had been anticipated. The issue is the extent to which allowance trading should be credited with these gains. Burtraw (1995) reached two conclusions. First, it is the flexible, performance-based design of the program that has stimulated the development of low-cost compliance measures seen in Phase I. Second, within that framework, allowance trading played an important, positive role. Ellerman (2000) attributes all of the cost savings to trading provisions. The difference in the two points of view is considerable. Ellerman gives credit to emissions trading for a dramatic fall in the cost of scrubbing emissions and for the growing use of low-sulfur Western coal. In contrast, Burtraw

A004187

credits performance standards and flexible program design, not emissions trading directly, for much of the cost savings.

Phase II of the Acid Rain Program is likely to see much greater reliance on allowance trading. Phase II will involve 700 additional sources, many of which are likely to select scrubbing as their method of compliance. More scrubbing should result in greater variation in the marginal costs of control across sources. Consequently, there should be greater incentives to trade allowances to achieve compliance in Phase II.

A 1995 EPA assessment of the Acid Rain Program put the costs at $1.2 billion annually in Phase I and $2.2 billion annually in Phase II.[113] The same EPA report estimated the mean value of annual health benefits at $10.6 billion in Phase I and $40 billion in Phase II. These health benefits are limited to benefits from reduced sulfates; total health benefits would be even higher. Interestingly, health benefits were not a major concern in the legislative decision to control acid rain, yet they now appear to be the dominant benefit component, dwarfing earlier estimates of environmental effects. Recall that early estimates of the costs of controlling acid rain put the costs at $4.5 billion to $6 billion annually with a traditional regulatory approach and benefits at $1 billion to $2 billion. An independent assessment reached a similar conclusion: Benefits will be much greater than costs.[114] More recent studies have estimated Phase II costs at $1.0 billion (Carlson et al., 2000) and $1.4 billion (Ellerman, 2000, p. 282).

To estimate the savings attributable to tradable allowances, Carlson et al. (2000) estimated marginal abatement cost functions for thermal power plants that were affected by Title IV. For plants that use low-sulfur coal as a means of compliance, they found that the main sources of cost reductions are technological improvements and the fall in low-sulfur coal prices, not allowance trading. Over the long run, the authors estimate that allowance trading could result in savings of $700 million to $800 million per year, relative to an "enlightened" regulatory approach with a uniform emission standard.

6.4 NO_x Regional Ozone Programs

The federal SO_2 control program shows that acid rain poses a number of difficult problems for policy makers, regulators, environmentalists, and industry. Experiences with the SO_2 program were instrumental in designing and implementing the recent NO_x control program.

Along with SO_2, NO_x contributes to the acid rain problem nationwide. NO_x also contributes to ground-level ozone and fine particulate problems in the East and in certain densely populated areas elsewhere. With respect to acid rain, both SO_2 and NO_x have cumulative and long-range impacts on the environment. With respect to ground-level ozone and fine particulate matter, the primary concern is ambient concentrations over short periods of time during the summer months.

NO_x trading is designed to account for these complex time and space dimensions in the need to control NO_x. Electric power generation peaks in summer months in the Northeast to meet air conditioning demands. Periods of peak power production are periods of peak NO_x emissions and tend to be periods of time when ambient ground-level ozone concentrations are most likely to exceed federal standards.

6.4.1 OTC NO_x Budget Program

In the 1990 Clean Air Act Amendments, Congress established the Ozone Transport Commission (OTC), a working group consisting of 12 Northeast states and the District of Columbia. OTC's mandate was to develop plans to meet national ambient air quality goals for ozone in the Eastern United States. With the help of EPA, the OTC developed a NO_x Budget Program to address regional ozone problems. Critical program elements, such as monitoring and reporting provisions, compliance determination, and penalties, were required to be uniform across states. A 1994 memorandum of understanding with EPA was signed by all of the OTC states, except Virginia. It put in place a NO_x cap-and-trade system within the OTC states. The intent of the agreement is to institute a cooperative effort to solve a common problem.

The agreement caps NO_x emissions at 219,000 tons during the May through September compliance period for the years 1999–2000 and at 143,000 tons starting in 2003. Both amounts are less than one-half the 1990 baseline of 490,000 tons. The cap affects 465 sources of NO_x in the participating OTC states, including utilities, industrial plants, and independent power producers.

The OTC NO_x trading program is implemented by states, as are many programs under Title I of the Clean Air Act. States are free to establish rules of their own choosing, including allocation provisions. (See Table 6-3.) The OTC made efforts to ensure that the rules were compatible across states to facilitate regional emissions trading. Some provisions, such as initial emission allocation formulas, differ across participating states. The program establishes that one allowance is good for one ton of NO_x emissions emitted during the compliance months. EPA administers the Allowance Tracking System and the Emissions Tracking System, but the states maintain all responsibility for compliance and enforcement.

Table 6-3. OTC's NO_x Budget Program Allocations and Emissions (1999)

STATE	BASELINE EMISSIONS (in tons)	1999 ALLOCATIONS[115] (in tons)	1999 EMISSIONS (in tons)
Connecticut	11,130	6,312	5,830
Delaware	13,510	6,142	6,160
Massachusetts	41,331	19,680	17,293
New Hampshire	14,589	6,788	3,463
New Jersey	46,963	21,292	15,390
New York	85,632	54,276	47,267
Pennsylvania	203,181	103,668	79,166
Rhode Island	1,099	580	274
TOTAL	**417,435**	**218,738**	**174,843**

Source: 1999 OTC NO_x Budget Program Compliance Report.

Unlimited banking of allowances is allowed, but sources are restricted in how they may use them for compliance. The constraints on banking address seasonal and spatial concerns regarding ozone formation. Eight states participated in the 1999 OTC NO_x Budget Program: Connecticut, Delaware, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Rhode Island. A total of 912 affected combustion units underwent reconciliation for 1999 to determine whether they held sufficient allowances to cover their emissions. The affected sources released emissions at a level nearly 20% below their allocations for 1999, banking the remainder for future use when emission limits will be stricter.[116]

The market is showing signs of maturing. Trades for future year allowances have higher prices, which reflect the anticipated difficulty of meeting a shrinking cap on emissions. Similar price spreads also exist in the SO_2 allowance market.

6.4.2 NO_X Budget Trading Program

EPA promulgated the call for State Implementation Plans (SIPs) on NO_X, (the NO_X SIP call) pursuant to the requirements of Section 110 of the Clean Air Act (CAA). Section 110 requires a SIP to contain adequate provisions that prohibit any source or type of source or other types of emissions within a state from emitting any air pollutants in amounts that will contribute significantly to non-attainment in, or interfere with maintenance of attainment of a standard by, any other State with respect to any National Ambient Air Quality Standard (NAAQS). Section 110 authorizes EPA to find that a SIP is substantially inadequate to meet any CAA requirement when appropriate, and, based on such finding, to then require the state to submit a SIP revision within a specified time to correct such inadequacies.

The final rule required 22 states and the District of Columbia to submit State Implementation Plans that address the regional transport of ground-level ozone. The rule will reduce total summertime emissions of nitrogen oxides by about 28% (1.2 million tons) in the affected states and the District of Columbia. The final rule includes a model NO_X Budget Trading Program that will allow states to achieve over 90% of the required emissions reductions from large electric generating sources and large industrial boilers in a highly cost-effective way.

The NO_X SIP call was challenged by representatives of both industry and affected states. In May 1999, the U.S. Court of Appeals for the District of Columbia Circuit stayed the submittal deadline of the NO_X SIP call indefinitely. In November 1999, oral arguments were heard and, in March 2000, the Appeals Court ruled in favor of EPA on all major issues, remanding to EPA only a few minor issues.

As a result of its ruling, three states were no longer required to comply with the NO_X SIP call (Wisconsin, Georgia, and Missouri), and EPA was required to take further notice and comment on a portion of its electric generation unit (EGU) definition. Sources in several states will be subject to this action: Alabama, Connecticut, District of Columbia, Delaware, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Michigan, North Carolina, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia. In June 2000, the Appeals Court lifted the stay and ruled that affected states must submit SIPs to EPA by the end of October 2000. In August 2000, the court made another ruling. This ruling moved the compliance date to submit SIPs to May 31, 2004, from its original date of May 1, 2003. As of September 2000, EPA had not yet decided whether to appeal this ruling.

The petitioners have asked the Supreme Court to review the Appeals Court's decision. As of August 2000, the Supreme Court had not decided to hear the case.

Section 126 of the Clean Air Act allows states that are adversely affected by interstate transport of pollution to petition EPA to set pollution limits on specific sources of pollution in other states. In a December 17, 1999 rule, EPA granted petitions filed by Connecticut, Massachusetts, New York, and Pennsylvania that sought to reduce ozone in these states through the control of NO_X

emissions from other states.[117] These states had petitioned that they could not attain the federal 1-hour ozone standard because of the interstate transport of ozone and its precursors.

Under its Section 126 authority, EPA published a final rule that affects 392 electric utilities and industrial boilers with rated output greater than 25 megawatts or a maximum heat input capacity greater than 250 MMBtu/hr. The Federal NO_x Budget Trading Program establishes emission limits for affected sources in the form of tradable NO_x allowances. One allowance authorizes the emission of one ton of NO_x. Sources in the program are located in Delaware, the District of Columbia, Indiana, Kentucky, Maryland, Michigan, North Carolina, New Jersey, New York, Ohio, Pennsylvania, Virginia, and West Virginia. Collectively, they must reduce NO_x emissions by nearly 530,000 tons per year by 2007 from levels had been allowed that year.

Both the NO_x SIP call and the Section 126 action require sources to reduce emissions of NO_x. However, the SIP call allows states the flexibility to choose how reductions will be made; under the 126 action, EPA directly regulates sources. Furthermore, the SIP call covers a larger geographic area. EPA is continuing to work with the states to determine how to integrate these two programs.

6.5 Chlorofluorocarbon (CFC) Production Allowance Trading

The Montreal Protocol on Substances that Deplete the Ozone Layer called for a cap on chlorofluorocarbon (CFC) and halon consumption at 1986 levels, with reductions in the cap scheduled for 1993 and 1998. At a second meeting in 1990, the parties to the Montreal Protocol agreed to a full phaseout of the already-regulated CFCs and halons, as well as a phaseout of "other CFCs," by 2000.[118]

The Montreal Protocol defined consumption as production plus imports, minus exports. Consequently, in implementing the agreement, EPA distributed allowances to companies that produced or imported CFCs and halons. Based on 1986 market shares, EPA distributed allowances to 5 CFC producers, 3 halon producers, 14 CFC importers, and 6 halon importers.

The marketable permit system for producers and importers resulted in a number of savings relative to a program that directly controlled end uses. EPA needed just 4 staffers to oversee the program, rather than the 33 staffers and $23 million in administrative costs it anticipated would be required to regulate end uses. Industry estimated that a traditional regulatory approach to end uses would cost more than $300 million for recordkeeping and reporting, versus only $2.4 million for the allowance trading approach.

Title VI of the Clean Air Act Amendments of 1990 modified the trading system to allow producers and importers to trade allowances within groups of regulated chemicals that were segregated by their ozone-depleting potential. As an example, EPA assigned producers and importers allowances for five types of CFCs (CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115). Producers and importers could trade allowances within this group. For example, 14 million kilograms of CFC-11 and CFC-113 were traded for CFC-12 in 1992 as air conditioner makers and foam producers reduced their use of these substances. At the same time, CFC-12 users maintained their demand. By 1994, the quantity of CFC-11 and CFC-113 swapped for CFC-12 grew to 26 million kilograms. EPA rules implementing Title VI specify that, each time a production allowance is traded, 1% of the allocation is "retired" to assure further improvement in the environment.

Congress coupled the marketable allowance trading system with excise taxes on CFC production, which are discussed in Chapter 4, Pollution Charges, Fees, and Taxes. The rationale for the excise taxes was that the restrictions on the quantity of CFCs and halons could be sold would lead to rapidly escalating prices. The excise taxes were designed to capture "windfall profits." In contrast, the allowance trading system was designed to assure that the production and import of the CFCs was cost-effective. The excise tax has the effect of making CFCs much more expensive in the United States than they are in developing countries where production is still allowed. Smuggling of these chemicals has become a serious problem.

6.6 Lead Credit Trading

As early as the 1920s, tetra-ethyl lead was added to gasoline by refiners to increase octane levels and reduce premature combustion in engines, which allowed more powerful engines to be built. Lead additives in gasoline were the least expensive of several ways of raising octane levels. The additives also prevented premature recession of soft-valve seats, a feature of most automobile engines that were manufactured prior to 1975 (but not after).

By the 1970s, virtually all gasoline contained lead at an average of almost 2.4 grams per gallon. EPA acted to curtail lead use in gasoline for two reasons. One, by 1975 new production vehicles were equipped with exhaust system catalysts, so these vehicles could meet the tailpipe emission standards for hydrocarbons, carbon monoxide, and nitrogen oxides that were mandated by the 1970 Clean Air Act. Unleaded fuel was required for vehicles manufactured after model year 1975, since exhaust system catalysts would be fouled and not function properly if vehicles were run on leaded gasoline. As catalyst-equipped vehicles began to dominate the fleet, sales of unleaded gasoline reached about 80% of all gasoline sales by the mid-1980s.

Two, concerns about the role of airborne lead in adult hypertension and cognitive development in children motivated EPA to limit the overall use of lead in gasoline. EPA required that the average lead content of all gasoline sold be reduced from 1.7 grams per gallon after January 1, 1975, to 0.5 grams per gallon by January 1, 1979. Initially, these limits were applicable as quarterly averages for the production of individual refineries, implicitly allowing trading across batches of gasoline at individual refineries. Later, EPA broadened definition of averaging to allow refiners who owned more than one refinery to average or "trade" among refineries to satisfy their lead limits each quarter.

During the late 1970s, the demand for unleaded gasoline grew steadily as more catalyst-equipped vehicles were sold. By the early 1980s, the market share of leaded gasoline had shrunk to the point that EPA's limits on the average lead content of all gasoline ceased to have an impact on the lead content in leaded gasoline. Meanwhile, evidence on the magnitude and severity of the health effects attributable to lead mounted.

EPA acted to curtail sharply the remaining use of lead in gasoline, initially setting a limit of an average level of 1.1 gm/gal beginning on November 1, 1982. EPA lowered the average to 0.5 gm/gal by July 1, 1985, and then to 0.1 gm/gal by January 1, 1986. To facilitate the phasedown, EPA allowed two forms of trading: inter-refinery averaging during each quarter and banking for future use or sale.

Inter-refinery averaging, which operated from November 1, 1982, to December 31, 1985, allowed refineries to "constructively allocate" lead. To take an example, suppose refiner A produced 200 million gallons of gasoline in the first quarter of 1983 with an average lead content

A004192

of 1.4 gm/gal. Refiner A could buy 60 million grams of lead credits from Refiner B, who produced an equal quantity of gasoline with lead content of 0.8 gm/gal. In 1985, EPA permitted refiners to bank credits for use until the end of 1987, which in effect extended the life of lead credits to that date.

Lead credits were created by refiners, importers, and ethanol blenders (who reduced the lead content of gasoline by adding ethanol). For example, when the average lead content was limited to 1.0 gm/gal, a refiner producing 1 million gallons of gasoline with an average lead content 0.5 gm/gal would earn 500,000 lead credits. EPA enforcement relied on reporting requirements and the random testing of gasoline samples. Reporting rules were simple. Each refiner or importer was obligated to provide the names of entities with whom it traded, the volumes for each trade, and the physical transfer of lead additives. The data allowed EPA to compare reported lead additive purchases and sales for each transaction to assure compliance. Discrepancies in reported figures could trigger investigations and enforcement actions. Well over 99% of all transactions were reported accurately; however, several dozen fraudulent transactions occurred.[119] In one quarter alone, the now-defunct Good Hope refinery in Louisiana accounted for over one-half of all reported lead credits sold during one quarter. Subsequent investigation uncovered the fraud.

Judged by market activity, lead credit trading was quite successful. Lead credit trading as a percentage of lead use rose above 40% by 1987. Some 20% of refineries participated in trading early in the program; by the end of the program, 60% participated.[120] Early in the program, 60% of refineries participated in banking, rising to 90% by the end. Trading allowed the EPA to phase out the use of lead in gasoline much more rapidly than otherwise would have been feasible. Given that refiners faced very different opportunities for reducing the lead content of gasoline, a rapid phase-down without trading would have rewarded refiners collectively, since the market price of gasoline would have been determined by the high-cost producers.

During the period of time when lead credits were traded, the price increased from about 3/4 cent/gm to 4 cents/gm.[121] Nearly one-half of all lead traded was between refineries owned by the same firm.[122] With external transactions, refiners revealed a preference to deal with normal trading partners, even though they could obtain a better price elsewhere. This preference indicates that trading did not produce the least cost outcomes, even though there was an active market in lead credits. In part, this result occurred because internal trades have lower transaction and information costs than inter-refinery trades. However, it also reflects strong preferences in the industry to avoid revealing potentially valuable information to competitors.

EPA estimated that the banking provisions alone would involve 9.1 billion grams of lead credits and save refiners $226 million. Subsequently, the amount of lead banked was placed at just over 10 billion grams. Lead credit trading may be viewed in retrospect as a considerable success. The use of lead in leaded gasoline was sharply reduced over a short period of time, without spikes in the price of gasoline that otherwise might have occurred. The market in lead credits was quite active, although, as noted in the previous paragraph, refiners did not maximize their gains from trade. In addition, some small refiners and ethanol blenders nonetheless sold many more credits than they had earned, despite seemingly foolproof procedures for catching fraudulent trades.

6.7 Gasoline Constituents

Title II of the Clean Air Act Amendments of 1990 imposes substantially tightened mobile source emission standards by requiring automobile manufacturers to reduce tailpipe emissions and by requiring refiners to develop reformulated fuels. The Amendments require reductions in tailpipe emissions of 35% for hydrocarbons and 60% for NO_x, starting with 40% of the vehicles sold in 1994 and increasing to all vehicles sold in 1996. Light-duty trucks are subject to similar requirements. EPA is required to impose further reductions of 50% below these standards by 2003 if it finds such reductions are necessary, technologically feasible, and cost-effective. EPA recently issued Tier 2 gasoline sulfur standards that implement this further reduction.

Title II requires that states having CO non-attainment areas with design values of 9.5 parts per million (ppm) or higher must implement a program to supply oxygenated fuels to motorists in winter months. (The term "design values" is defined as the second highest ambient reading measured over the most recent two years.) Gasoline sold in the 41 cities affected by this requirement must have an oxygen content of 2.7% starting in 1992. To meet the percent oxygen requirement, states are "strongly encouraged" to create a program for marketable oxygen credits to provide flexibility to gasoline suppliers.

In October 1992, EPA issued guidance for trading programs in oxygenates under the wintertime oxygenated gasoline program; however, participation is optional for the affected states.[123] In areas where trading is permitted, credits in oxygenates can be exchanged between parties that the state has designated as responsible for satisfying fuel requirements, also known as the Control Area Responsible Party or CAR. Normally the CAR is the party who owns gasoline at a terminal. The CAR receives data on the volume and oxygen content of all gasoline shipped to the terminal and assures that the average oxygen content is 2.7% by weight. Where trading is allowed, the CAR would be free to sell excess oxygenate credits to other CARs or buy oxygenate credits from a CAR to meet the 2.7% requirement. While trading in oxygenates theoretically offers a cost-effective means of meeting wintertime oxygenate requirements, in fact, the trading programs have been moribund. Only the Pennsylvania part of the Philadelphia ozone non-attainment area (which also includes parts of New Jersey) adopted trading rules. Within that area, no trades have been reported. Other areas have declined to allow trading, citing the costs of monitoring such a program as prohibitive.

Title II also requires that the 9 worst ozone non-attainment areas offer reformulated gasoline during the summer months. It also specifies several performance characteristics for reformulated gasoline as well as certain fuel properties, including a minimum oxygen content of 2% by weight beginning in 1995. Under so-called "opt in" provisions, an additional 31 areas applied to EPA, so they could participate in the reformulated gasoline program.

Title II requires that EPA establish trading systems for three constituents of reformulated fuels: oxygen, aromatics, and benzene. Under a trading system, refiners could meet reformulated content requirements by producing gasoline that met the specifications or by trading credits in these constituents with other refiners, so collectively the standards were satisfied. EPA's rules for reformulated gasoline set up an averaging-and-trading system as well as an averaging-and-trading system for meeting EPA's performance standards for VOCs and toxic air chemicals.

There has been considerable trading and averaging of reformulated gasoline requirements, mainly from the Midwest to the East Coast. That trading has led to some regional failures to meet oxygenate retail averages, and it has resulted in a tightening of the oxygenate standards for reformulated gasoline.

6.8 Tier 2 Emission Standards

On February 10, 2000, EPA promulgated new standards for tailpipe emissions of NO_x from passenger cars and light-duty trucks and for the sulfur content of gasoline.[124] The tailpipe emission action was taken under EPA's authority to set tailpipe emission standards for new vehicles (Section 202 of the Clean Air Act). The fuel standard action was based on EPA's determination that motor vehicle fuels contribute to air pollution and adversely affect the performance of emission control systems (an authority under Section 211 (c)(1) of the Clean Air Act).

Manufacturers will be able to average their Tier 2 vehicles to comply with the corporate average NO_x tailpipe standard of 0.07 grams per mile (gpm), which is more than a 75% reduction from the current 0.30 gpm. standard.[125] When a manufacturer's corporate average NO_x emissions fall below the standard, it will earn credits that may be banked for later use or sold to another manufacturer. These credits will be very similar to those currently in place for non-methane organic gas (NMOG) emissions under California and the federal National Low Emission Vehicle (NLEV) regulations. The NO_x credits will have unlimited life. Manufacturers would be permitted to run a credit deficit for 1 year and carry forward that deficit. If the manufacturer has a credit deficit in the second year, the manufacturer would be subject to an enforcement action.

Refiners and gasoline importers must satisfy a corporate average gasoline standard of 120 ppm and a cap of 300 ppm sulfur beginning in 2004. In 2005, this corporate average standard drops to 90 ppm sulfur, with the cap remaining at 300 ppm. The format of the program changes in 2006 from a corporate average to a per-refinery requirement. At that time, the cap will be 80 ppm sulfur, and most refiners will have to produce gasoline that averages no more than 30 ppm sulfur. Refiners who produce gasoline with a corporate average sulfur content lower than the standard will be allowed to bank credits for future use or for sale to other refiners that are unable to meet the standard. Credits produced under the phase-in years have a limited life. Those credits produced beginning in 2006 have an unlimited life. The program runs until 2010. However, refiners will be able to carry forward a deficit for 1 additional year, providing that the average is below 80 ppm sulfur.

The standards concern hydrocarbon emissions, which was termed "NMOG" in the rulemaking. Manufacturers would have to satisfy a corporate average standard, but they could meet this standard through the trading of credits earned by manufacturers that exceeded the corporate average standard. Banking also would be allowed. Banked credits, however, would be subject to discounting over time.

6.9 Heavy-Duty Truck Engine Emission Averaging

Title II of the Clean Air Act Amendments of 1990 authorizes EPA to set standards for particulate matter, NO_x, and other emissions from heavy-duty truck engines. The standards must represent the maximum degree of reductions achievable, taking cost and other factors into consideration. EPA has interpreted this provision to authorize the use of averaging, banking, and trading as part of the process of realizing the maximum degree of reductions achievable.

Under this program, there has been a great deal of averaging and banking but only one trade between firms, a 1996 exchange of rights to 5 tons of particulate matter from Navistar to Detroit Diesel. The averaging of emissions facilitates compliance, since not every class of engines has to meet the 75% reduction standard. How much engine manufacturers actually save is unknown. However, a recent paper examined a similar type of engine performance averaging program that was proposed in California for light-duty trucks. It concluded that the cost savings of the program were likely to be modest.[126]

6.10 Corporate Average Fuel Economy (CAFE) Standards

The Energy Policy and Conservation Act of 1975 established corporate average fuel economy (CAFE) standards for all manufacturers that sell vehicles in the United States. The standards were first imposed in 1978 and are now 27.5 miles per gallon (mpg) for production passenger cars and 20.7 mpg for production light-duty vehicles. (Light-duty vehicles include sport utility vehicles, minivans, and pickup trucks with gross vehicle weight ratings less than 8500 pounds.)

Corporate average fuel economy and compliance with the CAFE standard is determined as the harmonic mean of the fuel economy of automobiles produced by each manufacturer.[127] Harmonic average fuel economy is more difficult to achieve than is simple averaging. For example, to achieve a CAFE standard of 27.5 mpg, two 35-mpg vehicles must be sold for every 20-mpg vehicle sold. The penalty for failing to meet the CAFE standard is $5.50 per automobile for every 0.1-mpg shortfall. Carry back and carry forward provisions akin to banking do exist, and they allow shortfalls in one year to be met with credits from another year.

CAFE standards have been the primary national policy instrument for improving personal vehicle fuel economy and for reducing gasoline and oil consumption in the transportation sector. From the late 1970s through the mid-1980s, CAFE standards—working in concert with higher gasoline prices through most of that period—nearly doubled the average fuel economy of new personal vehicles. Throughout the 1990s, with oil and gasoline prices recording historic lows on an inflation-adjusted basis, CAFE standards provided a floor for automotive fuel economy. Fuel economy was higher than it would have been absent the standards. Therefore, compliance with these standards reduced gasoline consumption.

Since fuel economy is inversely proportional to carbon dioxide emissions, the primary greenhouse gas from motor vehicles, CAFE has yielded reductions in carbon dioxide emissions and overall greenhouse gas emissions. (Fuel economy is largely unrelated to emissions of criteria pollutants such as particulate matter, CO, and NO_x). In this regard, CAFE can be viewed as an intra-firm trading system to meet a de facto standard to reduce the carbon dioxide emissions from personal vehicles.

As a policy instrument, CAFE has both advantages and disadvantages. Some of CAFE's advantages follow.

- CAFE is in place, it has proven to be a workable program, and lessons have been learned about how it could be improved.
- CAFE has yielded significant reductions in gasoline consumption and carbon dioxide emissions, which would not have been the case without these standards.
- The general public strongly supports CAFE relative to other alternatives to increase fuel economy and reduce carbon dioxide emissions, such as higher gasoline taxes.
- CAFE includes many market elements, such as

- sales-weighted averaging (as opposed to a floor that every vehicle must meet),
- a 7-year rolling average for compliance (and credits can be carried back or forward for 3 years), and
- the option of paying monetary fines in lieu of meeting the standard, a choice that is left to the discretion of the manufacturer. (Several non-U.S. firms pay these fines. All U.S. automakers have chosen to meet CAFE standards in the past.)

Like any policy instrument, CAFE also has disadvantages. Some of them follow.

- CAFE is inconsistent with low fuel prices. That is, when gasoline prices are relatively low, there is less demand for high-fuel economy cars, and manufacturers must sell higher fuel economy than the market demands.[128]
- CAFE does nothing to reduce vehicle miles traveled (VMT). (Some analysts argue that CAFE increases VMT and emissions by lowering the cost of driving, i.e., raising the fuel economy of vehicles means, in theory, that less gasoline is needed to travel a certain number of miles. Other analysts assert that these effects are negligible.)
- CAFE does have a cost, either in terms of the higher prices of vehicles or the tradeoffs that must be made with other vehicle attributes such as utility, weight, or acceleration.
- CAFE is strongly opposed by automakers, whose objections include higher vehicle cost and the potential reduction in safety for passengers in these lighter weight vehicles.

Alternatives to CAFE standards would include higher gasoline taxes and "feebates," which would assess fees to the sale of vehicles with low-fuel economy and rebates for the purchase of high-fuel economy vehicles. Like CAFE, each of these options has advantages and disadvantages. The relative merits of these options relative to CAFE are debated, as is the magnitude required for such policies to provide the same benefits as CAFE.

6.11 Hazardous Air Pollutant (HAP) Early Reduction

In December 1992, EPA issued final rules for the early reduction of hazardous air pollutants.[129] If a facility qualifies for inclusion in the program by reducing hazardous air pollutants by 90%—95% in the case of hazardous particulate emissions—prior to EPA proposing maximum available control technology (MACT) regulations on the source category, the facility may defer compliance with the new MACT for as long as 6 years. Because participation in the program is voluntary, a source must anticipate cost savings, or it would not have an incentive to participate. Once a source is accepted into the program, it becomes legally obligated to meet the 90% (or 95%) reduction in emissions. Trading exists intertemporally across time in that sources exchange their early reductions for their later reductions. (The example in the next paragraph illustrates how this program works.)

EPA has shown that such a program can benefit the environment. Assume a source emits 100 tons per year. Under the early reduction program, it would emit 10 tons per year. Further assume that MACT would have the source reduce emissions to 2 tons per year in year 5 and thereafter. The source has reduced emissions by 360 tons in years 1 through—4 in exchange for 48 tons of emissions in years 5 through10. Total emissions are reduced by 312 tons. Table 6-4 illustrates the time profile of emissions.

A004197

By mid-1993, over 60 chemical plants had asked to participate in the program, so they could avoid the synthetic organic chemical MACT standard for 6 years. Other types of facilities also had applied to join the program.[130]

Table 6-4. Benefits of Achieving Early Emission Reductions

YEAR	MACT EMISSIONS (in tons)	EARLY REDUCTION EMISSIONS (in tons)
1	100	10
2	100	10
3	100	10
4	100	10
5	2	10
6	2	10
7	2	10
8	2	10
9	2	10
10	2	10
TOTAL	412	100

Source: 57 FR 61970

6.11.1 The Petroleum Industry NESHAP

EPA's National Emission Standard for Hazardous Air Pollutants (NESHAP) rule, promulgated on August 18, 1995, establishes Maximum Available Control Technology (MACT) requirements for process vents, storage vessels, wastewater streams, and equipment leaks at refineries. The rule specifically includes marine tank vessel-loading activities and gasoline loading racks.

The rule excludes distillation units at pipeline pumping stations and certain process vents that EPA determined would be subject to future NESHAP rules: catalyst regeneration on cracking units, vents on sulfur recovery units, and vents on catalytic reforming units.

On September 19, 1995, EPA issued a final NESHAP rule for marine vessel tank-loading operations. The rule affects new and existing marine bulk loading and unloading facilities that emit 10 tons or more of a single hazardous air pollutant (HAP) or 25 tons of any aggregate HAPs. Affected facilities must install a vapor collection system to collect volatile organic compounds (VOCs) that are displaced from marine tank vessels during loading. The vapor recovery system must achieve a 95% reduction in emissions, 98% if combustion is used.

Both of these NESHAP rules permit the use of emissions averaging among marine tank vessel-loading operations, bulk gasoline terminal or pipeline breakout station storage vessels and bulk gasoline loading racks, and petroleum refineries. Emissions averaging gives the owner the opportunity to find the most cost-effective control strategies for a particular situation. The owner may over-control at some emission points and under-control at others to achieve the overall level of emissions control that is required.

6.11.2 Hazardous Organic Chemical NESHAP

The Hazardous Organic Chemical NESHAP (or "HON") affects more than 400 facilities of the Synthetic Organic Chemical Manufacturing Industry (SOCMI). The final rule requires sources to limit emissions of organic hazardous air pollutants (HAPs) and to apply "reference control" or equivalent maximum available control technology (MACT). In recognition of the high costs of some MACT controls in this industry, the rule allows emissions averaging. Under this alternative method of compliance, sources engaging in pollution prevention measures that over-control at some points earn emissions credits that can be used to offset the debits they accrue when measures under-control at other points.

6.12 Regional Clean Air Incentives Market (RECLAIM)

Some of the highest ozone levels in the nation are recorded in the Los Angeles area. The South Coast Air Quality Management District (SCAQMD or District) also fails to meet the particulate matter and CO NAAQS, although not by such a large margin. Historically, the SCAQMD has relied on source-specific emissions regulations to limit the emissions of ground-level ozone precursors (as well as other pollutants).

Substantial progress has been made over the past three decades in improving the air quality in the Los Angeles Basin. However, it was apparent to SCAQMD officials that further progress toward attaining federal standards would be prohibitively expensive if they used traditional regulatory methods. By 1990, the marginal costs of NO_x control in the District had reached \$10,000 per ton to \$25,000 per ton at electric power plants, versus \$500 per ton to \$2000 per ton elsewhere in the United States. Proposed SO_x controls on catalytic cracking units at refineries would have cost \$32,000 per ton, versus the national costs of less than \$500 per ton for other methods of controlling SO_2 emissions. (See Section 6.3, Acid Rain Allowance Trading. Consequently, the District began to investigate the feasibility of creating a marketable permit in reactive organic gases (ROG) and NO_x as well as SO_x—the latter for its role in the formation of small particulate matter—as a means of accomplishing air quality goals at lower cost.

The District initially proposed a marketable permits program termed "RECLAIM" (for Regional Clean Air Incentives Market). The program would include about 2,000 sources of reactive organic gases (sources that represent about 85% of permitted stationary source emissions); 700 NO_x sources (sources that represent 95% of permitted NO_x emissions); and about 50 sources of SO_x (sources that represent about two-thirds of permitted stationary source emissions). Each market would start with an allocation of emissions to sources equal to the 1994 emissions target in the District's Air Quality Management Plan (AQMP). Each marketable permit program would be designed to reduce emissions annually by the amounts necessary to achieve the AQMP targets: Meeting air quality standards for SO_x and NO_x emissions by 2003 and meeting the goals for reducing ROG emissions by 2010.

For the NO_x and SO_x programs, emissions originated at combustion sources with well-defined exit points to the environment. Emission monitoring would be based on stack gas measurement using continuous emission monitors (CEM). For ROG, the market was based largely on evaporative emissions, which are inherently more difficult to measure. Prospective ROG trading also was complicated by the fact that ROG are not homogeneous; some react much more readily to form ozone than others do. Furthermore, some ROG are classified as toxic pollutants and regulated separately. After about 1 year of analysis and discussion, RECLAIM officials decided to defer including ROG in its program and to concentrate on the program's design for NO_x and SO_x.

A basic issue for both programs was which facilities would be included. Despite the prospect for lower control costs that would accompany participation in a marketable permit program, a

A004199

number of sources argued for exemptions. These sources were concerned about the future price and availability of marketable permits. District officials eventually exempted sewage treatment plants, landfills, and three small municipally owned power plants.

Baseline emission allocations proved contentious. According to the basic design features for RECLAIM, emission allocations would be based on the 1994 emission target for each source. This target was computed in the AQMP by taking reported 1987 emissions and deducting projected reductions that were mandated by air quality regulations. Due to a recession in the early 1990s, emissions in 1991, 1992, and 1993 were lower for many sources than what the AQMP required. Many interest groups, including the affected sources, argued that baseline allocations should be based on the AQMP. Environmental groups argued that actual 1993 emissions should serve as the baseline for emission allocations, not the AQMP. The compromise that was struck defines the emission cap for each source as the highest year of reported emissions between 1989 and 1991, less any reductions required by regulations that were implemented through 1993.

Monitoring and reporting issues also proved controversial, with lengthy debates over how emissions would be measured and how often reports would be filed. Industry sought to file one report per year, while public health agencies and environmentalists wanted daily or weekly reporting. The EPA sought assurance that the hourly NO_x standard would not be violated.

In an attempt to allay industry concerns that frequent monitoring would be too expensive, the AQMD developed a central computer that would accept data directly from the facilities participating in RECLAIM. Sources installed continuous emission monitors, or CEMS, which cost $100,000 to $150,000 each, on every boiler emitting 10 tons annually or more. These CEMs recorded pollutant readings minute by minute and sent the readings to a remote terminal that averaged the readings over 15-minute periods. The remote terminal then forwarded the number to the AQMD central computer. An artificial intelligence system analyzed the data and verified compliance by each boiler. When the system detected a potential problem, inspectors were dispatched to investigate further.

The District projected that the one-time costs of installing monitoring equipment would be approximately $13 million, with negligible annual operating costs. The District projected that annual savings in compliance costs relative to traditional forms of regulation would be an average of $58 million annually for each of the next 10 years. These calculations effectively muted the industry's complaints about the costs of monitoring equipment.

The actual trading works as follows. Each source has a declining allocation of RECLAIM Trading Credits (RTC) for each year from 1994 to 2003. After 2003, the balance remains constant. The RTC are denominated in pounds: one RTC equals one pound of emissions. Sources are free to trade RTC for the current year or for future years; however, all RTC are good only for the year for which they are issued. Trades in RTC are limited by geographical factors; for a potential buyer, the number of credits required to offset a pound of emissions varies with the location of the seller. The District maintains records of all transactions in RTC and shares that information with market participants.

Under RECLAIM rules, the District may impose penalties for net emissions (including trades) in excess of the permitted amounts. One such penalty would reduce next year's emission allocation by the amount that emissions exceeded the allowable limit. Other possible actions include civil penalties and the loss of the facility's operating permit.

In 1994, the NO_x and SO_x markets began with 370 sources and 40 sources, respectively. Both markets represented approximately 70% of stationary source emissions. Analysis shows that the program should reduce NO_x emissions by an average of 8.3% per year, which amounts to a cumulative reduction of 80 tons per day by 2003. It should also reduce SO_x emissions by 6.8% per year, which amounts to a cumulative reduction of 15 tons per day by 2003. The District projects that RECLAIM will lower compliance costs by $57.9 million a year when compared to a traditional regulatory approach: $80.8 million versus $138.7 million.

As a means of jump-starting the market, the SCAQMD held an auction of RTC on July 29, 1994. Utilities, which had by then installed new emission control equipment and did not need their full allocation, were large sellers of NO_x credits. A total of 114,676 NO_x credits and 9,400 SO_x credits changed hands at the auction. Prices for RTC were low for near years and much higher for more distant years. In all cases, though, the cost for a ton of credits was far lower than the marginal control costs incurred from recently enacted or proposed regulations. The per-ton price ranged from less than $20 to $2000, depending upon the credit's year of validity, prices that are very much in line with the 1994 auction. (See Table 6-5 for the prices of these credits.)

Table 6-5. Reclaim Trading Credit Prices

VINTAGE*	NO_x ($ per ton)**		SO_x ($ per ton)**	
	1994	1997	1994	1997
1994	2			
1995	334		1,500	
1996	574		1,900	
1997		227		64
1998				
1999	1,480			
2000	1,580			
2001	1,700			
2002	1,830			
2003	2,090			2,393
2010		1,880		2,385

Notes: * The term "Vintage" refers to the year in which the credit could be used. ** These figures are based on prices at a July 1994 auction and 1997 market prices.

Source: *BNA Daily Environment Report*, Aug. 10, 1994; SCAQMD 1998.

In June 1995, the SCAQMD proposed adding VOC emissions to RECLAIM; the initiative included almost 1,000 facilities in 14 industrial categories that generated 4 tons or more of VOC annually. In contrast to the NO_x and SO_2 programs that were scheduled to last for 7 years, the VOC program would last 14 years. Officials estimated that the program would reduce emissions from these sources from 53 tons a day, the projected level for 1996, to 15 tons a day by 2010.

The proposal to include the trading of VOCs within RECLAIM met with fierce opposition from environmentalists. They charged that the 1989 baseline selected for emissions by SCAQMD could result in a huge increase in emissions over 1993 levels when the program is fully implemented. Regulators sought the 1989 baseline to avoid locking industry into emission levels that were associated with the recessionary conditions that occurred in 1991, 1992, and 1993. Industry representatives note that the AQMP has a schedule for orderly reductions over time toward the 2010 goals. In their view, emissions increases that occur from 1993 to 1996 as the economy pulls out of a recession are not relevant so long as emissions remain below the target levels in the AQMP.

Unable to resolve the baseline issue, the 12-member governing board of SCAQMD set aside the proposed rule to include trading of VOCs within RECLAIM in January 1996. The board then directed its staff to develop a program to trade VOC emissions separately. Due to strong opposition in some quarters and to difficulties in accurately measuring these emissions, a subsequent VOC initiative ultimately was shelved.

RECLAIM has won praise for its progress to date. A state-mandated performance review found that the District has a state-of-the-art air quality program that is performing efficiently and effectively. According to the report, RECLAIM demonstration projects have helped stimulate technological development. Furthermore, its outreach and compliance programs have helped save or create more than 10,000 jobs, while, at the same time, these programs have improved air quality.

Trading in the program has been active, expanding from $2.1 million worth of credits in 1994 to $21 million worth of credits in 1997.[131] The largest buyers of credits have been large refineries and utilities, while the sellers were smaller refiners, glass container manufacturers and facilities that ceased operations. Of the sources that went out of business or left the area, only a handful cited environmental regulations as a factor in their decision.

RECLAIM credit prices have remained far below the prices that were projected at the time of program adoption. The average price in 1997 for NO_x credits of the same vintage was just $227 per ton, while 2010 vintage credits were $1,880 per ton. Average 1997 prices for SO_x credits were as low as $64 for 1997 vintage credits and as much as $2,393 per ton for 2003 vintage credits. According to Cantor Fitzgerald, a broker in emission reduction credits, the average price for SO_x RTC in early 2000 was about $1500 per ton for 2000 vintage credits and $2,300 per ton for 2005 to 2010 vintage credits.[132]

6.13 Other State Programs

In addition to RECLAIM, emission-trading programs are in various stages of development in several states. This section reviews activities in Illinois, Michigan, New Jersey, Texas, Pennsylvania, Colorado, and Washington. The state programs are an outgrowth of EPA's proposed 1995 Open Market Trading Rule.[133] While the 1995 proposal was never finalized, it was incorporated into Draft Economic Incentive Program (EIP) Guidelines in September 1999. The Open Market Trading Rule and the subsequent EIP Guidelines provided guidance for states that wish to institute emissions trading as part of their State Implementation Plans (SIP). As is the case with all draft guidance documents, the guidelines are subject to change. The advantage of EPA's generic emission trading rules over offsets, bubbles, netting, and banking is that individual trades do not require a SIP revision or EPA review. By following the generic rules, the transaction costs of emission trading can be reduced substantially.

6.13.1 Illinois Emission Reduction Market System

The Illinois Emission Reduction Market System (ERMS) allows the trading of VOC emission credits between firms in the Chicago non-attainment area. Like RECLAIM and the Acid Rain Program, the Illinois ERMS is an allowance program designed with an overall emissions cap and phased reductions to meet air quality goals. By 2007, when the market is scheduled to end, the

Chicago area must be in attainment for the national ambient air quality standard for ozone. Air quality modeling revealed that controlling emissions of volatile organic matter would be far more effective in reducing ozone than controlling NO_x emissions.

The ERMS is applicable to sources in the Chicago ozone non-attainment area that emit more than 10 tons per year of volatile organic matter (VOM) during the ozone season and that are subject to the Clean Air Act Permit Program. Sources receive an allocation of allotment trading units (ATU), each of which represents the right to release 200 pounds of VOM during the May 1-to-September 30 allotment period. Sources may receive a program exemption if they accept a 15-ton per season cap on emissions or if they agree to limit emissions to 82% of baseline emissions. Sources in the program receive an allocation that is 12% lower than their baseline emissions, defined as the two highest emission years during the 1994–1996 period.

6.13.2 Michigan Emissions Trading Program

The Michigan Air Emission Trading Program began in 1996.[134] It provides for the banking and trading of emission reduction credits (ERCs) in NO_x, VOCs, and all criteria pollutants except ozone. ERCs, which are denominated in tons per year, may be generated in the following ways: (1) through a facility shutdown; (2) through a permanent reduction in operations that results in reduced emissions; (3) through the use of new technologies, equipment, or inputs that result in reduced emissions; and (4) through the installation of pollution control equipment that decreases actual emissions. Various methods may be used to measure emissions: CEM; stack gas sampling; measuring surrogates (e.g., some VOC, but not all VOC); inputs; process conditions; etc. In general, credits obtained through a facility shutdown cannot be traded within a non-attainment area to satisfy a source's obligations.

6.13.3 New Jersey Emission Trading Program

The New Jersey Emission Trading Program is similar to Michigan's program, except that it applies only to NO_x and VOC.[135] The New Jersey Department of Environmental Protection maintains a registry of discrete emission reduction (DER) credits that are transferred. Average prices for 2000 are reported in Table 6-6.

Table 6-6. Open Market Emissions Trading Registry Report (2000)

POLLUTANT	OZONE SEASON	YEAR-TO-DATE AVERAGE PRICE PER DER
NO_x	No	$43.91
NO_x	Yes	48.40
VOC	No	127.50
VOC	Yes	127.50

Source: http://www.omet.com/scripts/omet/OMET_Report_Month_Selector.idc

6.13.4 Texas Emissions Trading Program

The Texas Natural Resource Conservation Commission (TNRCC) Emission Credit Banking and Trading Program provides a market-based framework for trading emission reductions of volatile organic compounds (VOC), nitrogen oxides (NO_x), and certain other criteria pollutants from stationary, area, and mobile sources. The program was designed to provide additional flexibility for complying with the Texas Clean Air Act while creating a net reduction in total air emissions with each transaction. At present, the TNRCC is developing a NO_x cap-and-trade for certain ozone non-attainment areas.

6.13.5 Pennsylvania Emission Trading Program

The Pennsylvania program is similar to the Michigan program, with some exceptions. ERCs may be generated only for VOCs and NO_x. ERCs can be transferred from dirtier areas—the five Philadelphia counties—to cleaner areas, but not from the cleaner areas to the dirtier ones.[136] ERCs may be transferred within the five-county Philadelphia area with some limitations. The Pennsylvania Department of Environmental Protection (DEP) maintains a registry of ERCs that are available for trade or future use. Buyers and sellers of ERCs are encouraged to contact DEP for assistance.

6.13.6 Wood Stove and Fireplace Permit Trading (Colorado)

During the 1970s and 1980s, a number of mountain communities in Colorado experienced unacceptably high levels of particulate pollution during winter months due to the use of wood-burning stoves and fireplaces. The growing popularity of skiing and other winter activities has exacerbated the problem in some of these areas.

Telluride tried to combat the problem through traditional forms of regulation. In 1977, the city passed an ordinance limiting new residential construction to one stove or fireplace per unit. This rule might have slowed the deterioration in air quality. However, new construction continued, which virtually guaranteed that air quality would continue to worsen, which it did into the 1980s.

In 1987, the city adopted a program that was part traditional and part modeled on air pollution offsets that would guarantee improvements in air quality. Owners of existing wood stoves and fireplaces were grandfathered with operating permits, but they were required to meet stringent performance standards within 3 years: 6 grams of particulate matter and 200 grams of CO per hour. During the first 2 years of the program, those individuals who converted their fireplaces and wood stoves to natural gas could earn a rebate of $750, which would partially defray their costs. For new construction, no new permits would be issued for wood-burning stoves or fireplaces. To install such an appliance in a newly constructed building, the owner must produce permits to operate two fireplaces or stoves. These permits could only be acquired from existing permit owners.

In a matter of months, a lively market in second-hand permits developed, with potential buyers and sellers making contact through classified advertisements. By the mid-1990s, permit prices were in the $2,000 range. In the years after Telluride adopted the program, it has reported no violations of the ambient air quality standard for particulate matter.

Other communities in Colorado soon implemented similar programs, which combined performance-based standards that encouraged the retirement of older inefficient fireplaces and wood stoves. All these programs focused on reducing the burning of wood, but some offered no rebates for converting these fireplaces and stoves to natural gas. From the available evidence, the programs appear to have been a success, achieving air quality goals quickly and at a relatively modest cost. A project for future research would compare and contrast the approaches taken by different communities in limiting the use of heavily polluting wood stoves and fireplaces, as well as assess the effectiveness of the programs.

6.13.7 Grass-Burning Permit Trading (Washington)

The City of Spokane, Washington, is nestled in the Spokane River Basin about 400 feet below the surrounding Columbia River Plateau. The basin forms a natural trap for air pollution during temperature inversions. The area exceeds the federal 24-hour standard for particulate matter several times each year, due to a combination of unpaved roads, wind-blown dust, grass burning, and wood-burning stoves.

Spokane is a major growing region for turf grass seed, with between 15,000 and 30,000 acres planted for seed production each year. After harvest each year, the fields are burned in August or September to control weeds and pests and to stimulate the grass to produce seed rather than concentrate its energy on vegetative growth. In 1990, air pollution authorities in Spokane County implemented an innovative program to reduce grass burning as a source of particulate matter.[137]

Grass burning had been subject to permitting for years. The program superimposes a countywide cap of 35,000 acres that may be burned each year onto the existing permit process. Growers are allocated permits to burn grass based on burning permits they held during the base period, 1985 to 1989. The overall cap does not appear to be binding; it exceeds the actual acreage burned in every year since 1971. However, some grass growers found themselves short of desired permits because they had planted other crops during the base period or because they had rented their land to tenants (who held the permits) during the base period.

The program allows transfers of grass-burning permits in three situations: permanent land transfers; temporary land transfers by lease; and transfer through an auction held by the Air Pollution District. When permits are transferred through the auction, 10% of the burnable acreage is deducted from the buyer's account, resulting in a small decrease over time in the total number of burnable acres. The auction mechanism is patterned after the acid rain allowance auction. Parties submit sealed bids and offers prior to the auction. The party with the highest bid is matched with the party with the lowest offer, with the actual transaction occurring at a price midway between the bid and offer. If the entire quantity offered was not purchased by that bidder, the bidder with the next lower price is then matched with the remaining offer. The process continues until all potential transactions are completed.

6.14 Effluent Trading

Despite many academic studies showing the potential benefit of effluent trading and considerable effort by EPA and the states to implement the concept, effluent trading has yet to live up to its full promise. While conceptually very similar to emission trading (which deals with emissions to the air), effluent discharge and its regulation also differ significantly from emission trading because effluent trading deals with emissions to the water.

Water pollution is caused by both point and non-point sources. *Point sources* discharge pollutants into surface waters through a conveyance such as a pipe or ditch. Primary point sources include publicly owned treatment works (POTWs) and industries. *Non-point sources* add pollutants from diffuse locations such as surface agricultural runoff or unchannelized urban runoff. The most important non-point source of water pollution is agriculture. The differences between emission trading and effluent trading have made it difficult to design practical programs that can capture the potential benefits of effluent trading. New efforts by EPA to implement its Total Maximum Daily Load (TMDL) program in areas with impaired water quality are expected

A004205

to vastly increase the use of effluent trading. For current EPA efforts to promote effluent trading, see http://www.epa.gov/owow/watershed/trading.htm.

6.14.1 Effluent Bubble

In concept, a water effluent bubble operates identically to the air emission bubble described in Section 6.2.2, Bubble Policy. A facility with multiple discharge points is wrapped in an imaginary bubble, with a facility-wide discharge limit rather than separate limits at the individual points of discharge. In contrast to the 100-some bubbles approved under the air emission trading program, only a handful of facilities within the iron and steel industry have received the authority to bubble effluents. The historical development of that program is described in the following paragraphs.

Asked by EPA to evaluate the potential for water effluent bubbling, a contractor ventured in 1981 that bubbling would not produce cost savings for most industrial facilities.[138] The reasons include the fact that most industrial facilities already have centralized wastewater treatment plants with a single point of discharge, trades between outfalls may be circumscribed due to water quality concerns, and some facilities already operated under permits that allowed all technologically feasible tradeoffs to be made.

Despite the acknowledged limitations, a subsequent study identified four plants in the iron and steel industry that would, potentially, benefit from water bubbling as they went from BPT (best practicable control technology currently available) to BAT (best available technology economically achievable).[139] The projected savings were less than $1 million annually. A retrospective study estimated the savings from effluent bubbles in the iron and steel industry were far larger: in excess of $122 million, as shown in Table 6-7.

Table 6-7. Estimated Cost Savings from Iron and Steel Intraplant Trades

FACILITY	OUTFALLS IN TRADE	TRADING PERIOD FOR ANALYSIS	PRESENT VALUE OF REDUCED CAPITAL COSTS (in millions of 1993 dollars)	PRESENT VALUE OF REDUCED OPERATING & MAINTENANCE COSTS (in millions of 1993 dollars)	PRESENT VALUE OF ALL REDUCED COSTS (in millions of 1993 dollars
A	5	1987–1993	$3.9	$2.4	$6.3
B	2	1983–1986	No Data	No Data	No Data
C	2	1985–1993	2.4	2.5	4.9
D	3	1984–1993	2.1	1.2	3.3
E	4	1986–1993	No Data	No Data	No Data
F	2	1983–1988	10.3	3.9	14.2
G	2	1984–1993	5.5	3.1	8.6
H	2	1984–1989	8.9	6.8	15.7
I	3	1983–1985	57.7	12.1	69.8
J	3	1984–mid-1980s	No Data	No Data	No Data
TOTALS			$90.8	$32.0	$122.8

Source: Kashmanian et al. 1995.

EPA's implementation of the effluent bubble for the iron and steel industry was dictated by a 1983 settlement agreement among EPA, the Natural Resources Defense Council (NRDC), and the American Iron and Steel Institute. The agreement supports the use of bubbling under the

Clean Water Act, but it imposes constraints on the approach. Bubbling of effluents from iron and steel plants is acceptable, provided that net reductions are achieved in each pollutant that is bubbled. Relative to the BAT limits that are in effect, bubbling must involve a reduction of at least 15% of the amount of both suspended solids and oil and grease and 10% of the amount of other pollutants. The NRDC reserved the right to challenge bubbles that might be proposed for other industries.

Complying with the steel effluent bubble has produced considerable cost savings for the industry. According to a former EPA employee who is now a consultant to the industry, however, the bubble has not resulted in any pollution control innovations.[140] EPA will soon propose revisions to the iron and steel regulations that would make the effluent bubble unnecessary.

6.14.2 Effluent Trading: Point-to-Point

Effluent trading dates to the early 1980s. At that time, the State of Wisconsin created a state-wide program to give sources such as wastewater treatment plants and pulp and paper mills added flexibility to meet the state's water quality standards through the trading of effluent rights. The first application of this authority was on the heavily industrialized lower Fox River.

The Fox River program applies to the last 35miles of the river, allowing trading between point sources with permits to discharge wastes that increase biochemical oxygen demand (BOD). Sources that control more waste than their discharge permit requires can sell those incremental rights to sources that control less waste than is required. Strict conditions are imposed on would-be buyers of rights: Trading of rights is allowed only if the buyer is a new facility, is increasing production, or is unable to meet required discharge limits despite optimal operation of its treatment facilities. Traded rights must have a life of at least 1 year, but they may not run past the expiration date of the seller's discharge permit, which is, at most, a 5-year period. Since effluent discharge limits may change with each permit renewal, there can be no guarantee that rights that were traded-in during one permit period would be available during subsequent permit periods. Analysis predicted that the potential gains from effluent trading among sources on the lower Fox River was significant: $7 million annually or roughly one-half of anticipated compliance costs for BOD regulations.[141]

Later, the state initiated BOD trading programs on 500 miles of the Wisconsin River. For administrative reasons, the Fox River was divided into three segments and the Wisconsin River into five segments. The Fox River program included 21 parties: five mills and two towns in each of the three administrative segments. Twenty-six parties are included in the Wisconsin River program. To date, trading under these programs has been disappointing, involving a single trade on the Fox River between a municipal wastewater plant and a paper mill. One reason for the limited activity is that dischargers developed a variety of compliance alternatives not contemplated when the regulations were drafted. Second, there were questions about the vulnerability of the program to legal challenge, and these questions remain since the Clean Water Act does not explicitly authorize trading. Furthermore, there is a requirement that all facilities meet minimum technology-based effluent limits. Finally, as noted in a previous paragraph, the state imposed severe restrictions on the ability of sources to trade.

6.14.3 Effluent Trading: Point-to-Non-point Sources

A number of programs allow the trading of nutrient discharges between point and non-point sources. Three such programs are described here; others are included in Table 6-8.

6.14.3.1 Dillon Reservoir

Dillon Reservoir, which supplies Denver with more than one-half of its water supply, is situated in the midst of a popular recreational area. Four municipal wastewater treatment plants discharge into the reservoir: the Frisco Sanitation District, Copper Mountain, the Breckenridge Sanitation District, and the Snake River treatment plant of the Keystone area.

Due to concerns that future population growth in the region could lead to eutrophic conditions in Dillon Reservoir, as well as the discovery that Copper Mountain was exceeding its discharge limits, EPA launched a study of the Dillon Reservoir in 1982 under its Clean Lakes program. The study indicated that phosphorus discharges would have to be reduced to maintain water quality and accommodate future growth. Point source controls alone were unlikely to be sufficient; runoff from lawns and streets and seepage from septic tanks also would have to be reduced.

A coalition of government and private interests developed a plan to reduce phosphorus releases to the reservoir. The plan established a cap on total phosphorus loadings, allocated loadings to the four wastewater treatment plants, and provided for the first-ever trading of phosphorus loadings with non-point sources.

The plan relies on 1982 phosphorus discharges as the baseline; that year represented a near worst-case scenario due to high rainfall and water levels that led to high non-point loadings. Discharges from new non-point sources are restricted through regulations that require developers to show a 50% reduction of phosphorus from pre-1984 norms. New non-point sources must offset all of their discharges by using a trading ratio of 1:1 with existing non-point sources. For point sources, the plan established a trading ratio of 2:1, whereby point sources that are above their allocation must obtain credits from point or non-point sources for twice the amount of the excess from sources that are below their allocation. The system would be monitored through existing NPDES (National Pollution Discharge Elimination System) permits for point sources.

Trading has been very slow. Not only has the region experienced a recession for a number of years that limited population growth, but the wastewater treatment plants have found cheaper means of controlling phosphorus than were previously envisioned. In the future, though, opportunities for further control at the wastewater treatment plants are thought to be limited. Population growth is once again evident, leading to the conclusion that more trading activity is likely.

6.14.3.2 Cherry Creek Reservoir

Like the Dillon Reservoir, Cherry Creek Reservoir also is a source of water for the Denver region and an important recreation area. The 800-acre reservoir attracts more than 1.5 million visitors annually. To protect recreational and water supply uses, the Cherry Creek Basin Authority developed a total phosphorus standard to limit algae concentrations and assigned wasteload allocations to the 12 wastewater treatment facilities in the watershed (a total maximum daily load for the reservoir). Source trading between point sources and non-point sources is authorized as an option for addressing the fact that 80% of the phosphorus load originates with non-point sources. To date, there has been no compelling need to trade at Cherry Creek since phosphorus effluent at municipal wastewater treatment facilities remain below the limits set by the Colorado Water Quality Commission. The Cherry Creek Basin Authority has designed a number of non-point pollution control projects that will generate phosphorus reduction credits. When regional economic growth compels wastewater treatment facilities to achieve greater phosphorus reductions, the credits will be available.

6.14.3.3 Tar Pamlico Basin

The North Carolina Environmental Management Commission designated the Tar-Pamlico Basin as nutrient-sensitive waters in 1989, in response to findings that algae blooms and low-dissolved oxygen threatened fisheries in the estuary. Upon designating an area as nutrient-sensitive, North Carolina law requires that the Division of Environmental Management (DEM) must identify the nutrient sources, set nutrient limitation objectives, and develop a nutrient control plan.

DEM prepared analysis showing that most of the nutrient loadings (nitrogen as the limiting factor but also phosphorus) came from non-point sources, principally agricultural runoff. Other identified sources included municipal wastewater treatment plants and industrial and mining operations. DEM proposed a solution to control both nitrogen and phosphorus discharge from wastewater treatment plants: nitrogen at 4 mg/l in the summer and 8 mg/l in the winter and phosphorus at 2 mg/l year-round.

Concerned about the potential costs of this regulation, municipal wastewater dischargers worked with state agencies and the North Carolina Environmental Defense Fund to design an alternative approach. Ultimately accepted by the DEM, the plan requires the parties to the accord to develop a model of the estuary, identify engineering control options, and implement a trading program for nutrient reductions. The trading program allows each of the 12 point source dischargers the opportunity to offset any discharges above their permitted limits. They may trade with feedlot operators on a 2:1 basis or with cropland managers on a 3:1 basis. To date, point source dischargers have found ways to meet new and stricter discharge limits without resorting to trading. In the future, trading may become more attractive as a compliance option. Hoag and Hughes-Popp (1997) provide a useful discussion of the program.

6.14.3.4 Other Effluent Trading Initiatives

EPA and the states are actively involved in a number of other effluent trading projects. These projects are summarized in Table 6-8 and in more detail in a recent EPA report entitled "A Summary of U.S. Effluent Trading and Offset Projects."[142] Many of these projects also are discussed on the Nutrientnet web site: http://www.nutrientnet.org.

6.14.4 Future Prospects for Effluent Trading

The Federal Water Pollution Control Act (FWPCA) of 1972 developed the basic framework for federal water pollution control. After amendments in 1977, the FWPCA has been known as the Clean Water Act (CWA). The FWPCA controls water pollution by regulating discharges of pollutants from point sources—such as industrial facilities, sewage treatment plants, and concentrated animal feeding operations—with a system of national effluent standards and permits for each class of point source discharge (the NPDES system). EPA sets effluent discharge standards based on the cost of control and the availability of control technology. By using this basic approach, many of the nation's streams and rivers are demonstrably cleaner than they were in 1972.

Table 6-8. Effluent Trading Projects

PROJECT	WATER BODY	STATE	ACTIVITY DESCRIPTION	STAGE	TRADES/ OFFSETS APPROVED?	SAVINGS ESTIMATE AVAILABLE?
Grassland Area Tradable Loads	San Joaquin River	CA	Watershed trading program	Implementation	Y	N
San Francisco Bay Mercury Offset	San Francisco Bay	CA	Regional offset program	Under development	N	N
Bear Creek Trading Program	Bear Creek Reservoir	CO	Watershed trading program	Approved	N	N
Boulder Creek Trading Program	Boulder Creek	CO	Watershed trading program	Implementation	Y	Y
Chatfield Reservoir Trading Program	Chatfield Reservoir	CO	Watershed trading program	Approved	N	N
Cherry Creek Basin Trading Program	Cherry Creek Reservoir	CO	Watershed trading program	Implementation	Y	N
Dillon Reservoir Trading Program	Dillon Reservoir	CO	Watershed trading program	Implementation	Y	N
Long Island Sound Trading Program	Long Island Sound	CT	Large watershed trading program	Under development	N	Y
Blue Plains WWTP Credit Creation	Chesapeake Bay	DC	Single trade	Under development	N	N
Tampa Bay Cooperative Nitrogen Management	Tampa Bay	FL	Regional cooperation	Implementation	Y	N
Cargill and Ajinomoto Plants Permit Flexibility	Des Moines	IA	NPDES permit flexibility	Implementation	Y	N
Lower Boise River Effluent Trading Demonstration Project	Boise River	ID	Watershed trading program	Under development	N	Y
Specialty Minerals Inc.	Hoosic River	MA	Offset for one discharger	Implementation	N	Some
Town of Acton POTW	Assabet River	MA	Offset for one discharger	Under development	N	Some
Wayland Business Center Treatment Plant Permit	Sudbury River	MA	Offset for one discharger	Implementation	Y	Y
Maryland Nutrient Trading Policy	Chesapeake Bay, other MD waters	MD	Statewide trading program	Under development	N	N
Kalamazoo River Water Quality Trading Demonstration	Kalamazoo River, Lake Allegan	MI	Watershed pilot program	Implementation	Y	N
Michigan Water Quality Trade Rule Development	MI Waters	MI	Statewide trading program	Nearing completion	N	Y

PROJECT	WATER BODY	STATE	ACTIVITY DESCRIPTION	STAGE	TRADES/ OFFSETS APPROVED?	SAVINGS ESTIMATE AVAILABLE?
Minnesota River Nutrient Trading Study	Minnesota River	MN	Watershed trading study	Completed	N/A	Y
Rahr Malting Plant	Minnesota River	MN	Offset for one discharger	Implementation	Y	N
Southern Minnesota Beet Sugar Plant	Minnesota River	MN	Offset for one discharger	Implementation	Y	N
Chesapeake Bay Nutrient Trading	Chesapeake Bay	multi	Large watershed trading program	Under development	N	N
Neuse River Nutrient Strategy	Neuse River Estuary	NC	Watershed trading program	Approved	N	Y
Tar Pamlico Nutrient Program	Pamlico River Estuary	NC	Watershed trading program	Implementation	Y	Y
Passaic Valley Sewerage Com. Effluent Trading	Hudson River	NJ	Pretreatment program	Implementation	Y	N
Truckee River Water Rights and Offset Program	Truckee River	NV	Offset for one discharger	Implementation	Y	N
New York Watershed Phosphorus Offset Pilot Programs	Hudson River	NY	Offset pilot programs	Implementation	Y	N
Claremont County Project	Little Miami River, Harsha Reservoir	OH	Potential regional trading project	Under development	N	N
Delaware River Basin Trading Simulation	Delaware River	PA	Watershed pilot program	Early discussion	N	N
Henry Co. Public Service Auth. and City of Martinsville	Smith River	VA	Single trade	Implementation	Y	N
Virginia Water Quality Improvement Act and Tributary Strategy	Chesapeake Bay, other VA waters	VA	Statewide trading program	Approved	N	N
Wisconsin Effluent Trading Rule Development	WI waters	WI	Statewide trading program	Pilots active	N	N
Fox-Wolf Basin Watershed Pilot	Green Bay	WI	Watershed pilot program	Approved	N	Y
Red Cedar River Pilot Trading Program	Tainter Lake	WI	Watershed pilot program	Approved	N	Y
Rock River Basin Pilot Trading Program	Rock River Basin	WI	Watershed pilot program	Under development	N	N

Source: EPA. Reinvention Activity Fact Sheets. Effluent Trading in Watersheds

According to data submitted by states in 1998, about 40% of the nation's streams and rivers do not meet the water quality goals set forth by states, Indian tribes, and territories.[143] For these water bodies, a little-known provision in Section 303 of the Clean Water Act will soon be used to achieve further improvements in water quality. Recently, EPA published final rules, which have not yet taken effect, concerning the Total Maximum Daily Load (TMDL) Program.

A TMDL is a calculation of the maximum quantity of pollution that a water body can accept and still meet designated water quality standards. The TMDL is then allocated to point and non-point sources. Effluent trading will be encouraged as a means of lowering compliance costs for affected sources.

Of concern is the CWA requirement that existing, expanding, and new facilities—including publicly owned treatment works, industrial dischargers, stormwater programs, and coastal zone measures—meet all applicable technology-based requirements. This requirement appears to represent a severe obstacle to trading.

The potential cost savings from effluent trading are impressive. Analysis by EPA suggests that trading among indirect dischargers could produce compliance cost savings of $658 million to $7.5 billion. Trading just among point sources could achieve cost savings of $8.4 million to $1.9 billion, while trading among point and non-point sources could yield compliance cost savings of $611 million to $5.6 billion.[144]

6.15 Wetland Mitigation Banking

Wetlands (also sometimes termed "swamps," "bogs," or "floodplain") were long considered unproductive wastelands. Over time, hundreds of thousands of acres of wetlands were drained by farmers, filled by developers, and otherwise converted to "productive" uses. From the 1780 to 1980, the contiguous 48 states lost over one-half of their original wetland acreage.[145]

In recent years, scientists pointed out the ecological importance of wetlands. Government policies at the federal, state, and local level have since come to emphasize wetland preservation, not development. Developers whose proposed actions would destroy wetlands are increasingly being forced to minimize damage to wetlands and to offset what damage occurs through wetland protection or enhancement offsite. Sometimes, the offset takes the form of compensation. That approach is described more fully in Chapter 4, Pollution Charges, Fees, and Taxes. This section describes wetland mitigation banking, a procedure for offsetting the adverse impacts of development on wetlands.

Wetland mitigation banks are created through a memorandum of understanding (MOU) among federal and state officials and a bank administrator. In most cases, the MOU would describe the responsibilities of each party, the physical boundaries of the bank, how mitigation credits will be calculated, and who is responsible for long-term management of the bank. Credits, which are usually denominated in terms of acres of habitat values, may only be used to mitigate development within the same watershed. State regulations would cover issues such as where mitigation credits can be used (e.g., statewide or within a watershed) and the compensation ratios that would be required for various types of development. Existing banks vary from a few acres to over 7,000 acres.

Among established wetland mitigation banks, most MOUs allow the bank operator to sell credits only after the bank has actually accomplished wetland enhancement or preservation. A few states allow the bank operator to sell credits concurrently as preservation or enhancement actions are undertaken.

The land for a mitigation bank could have any number of origins. Some of the more common sources of mitigation bank lands include existing natural wetland areas, enhanced natural wetland areas, pits created by the removal of landfill material, and lands that previously had been drained for agricultural use. State highway departments established approximately one-half of existing wetland mitigation banks to provide a means for mitigating losses due to highway construction. Conservation organizations and for-profit entities have set up mitigation banks that offer mitigation credits for sale.

Mitigation banking offers several advantages over more traditional on-site mitigation activities.

- Environmental values are better protected in large-scale developments.
- Economies of scale in wetland preservation and enhancement can be realized.
- The cost of wetland mitigation actions can be made known to developers very early in the development process.
- Mitigation banking offers greater assurance of long-term management of the protected area.

About 100 wetland mitigation banks in at least 34 states are currently in operation, and more are in advanced stages of planning. Wetland mitigation banking was featured in the 1996 Farm Bill as part of the Wetlands Reserve Program. Wetland mitigation banking has been endorsed by EPA, the Army Corps of Engineers (which oversees most development in wetlands under Section 404 of the Clean Water Act), and by the authors of leading legislative initiatives to reauthorize the Clean Water Act. All of these facts suggest that wetland mitigation banking will grow in importance as a means of protecting and enhancing the nation's wetlands.

6.16 Greenhouse Gas Emissions

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) establishes quantified emission limitations and reduction targets for greenhouse gases (GHG) that are to be achieved by the end of the first commitment period (2008–2012). On average, these commitments call for a 5.2% reduction from 1990 emission levels. (However, these commitments vary from one Party to the Convention to another.) To date, the Protocol has been signed by 38 industrialized countries and the European Community—the so-called Annex I Parties—but it has not been ratified by a sufficient number of Parties to come into effect.

Among other things, the Protocol includes basic provisions for the monitoring, reporting, and verification of greenhouse gas emissions (Articles 5, 7, and 8), and it outlines the need for effective procedures and mechanisms to address non-compliance (Article 18). Most remarkably, the Kyoto Protocol allows for the use of economic-incentive mechanisms, the so-called "flexible mechanisms," that enable the emission reduction targets to be met at least cost. These mechanisms, described in the following paragraphs, consist of Joint Implementation (Art. 6); the Clean Development Mechanism (Art. 12); and International Emissions Trading (Art. 17). They also include the use of Article 4 (the "bubble") by a group of Parties to fulfill their commitments jointly. At present, many of the rules and guidelines related to these provisions are in the process of being negotiated. How the issues are resolved will have an effect on the number of countries that will ratify the Kyoto Protocol and the cost of achieving these emission reduction targets. In November 2000, delegates met in The Hague, The Netherlands but were unable to resolve many of the issues concerning GHG trading. They have scheduled a resumed session for May 2001 in Bonn.[146]

Joint Implementation (JI): JI allows Annex I Parties to transfer and acquire "Emission Reduction Units" that are generated from project-level activities that reduce emissions by sources or that enhance removals by sinks in other Annex I countries. That is, a country or designated legal entity within a country can invest in a greenhouse gas (GHG) reduction project in another Annex I country and receive credits for the emissions reductions that the project generates. Project participants must show that the emissions reductions or removals are real, measurable, and additional to what would have occurred in the absence of the project activity.

Clean Development Mechanism (CDM): The CDM enables Annex I Parties or legal entities within these countries to invest in GHG emission reduction or removal projects in non-Annex I countries (i.e., developing countries), in exchange for "certified emissions reduction" units. The CDM would promote sustainable development in developing countries and help Annex I countries meet their GHG targets. Similar to JI, project participants must show that the emissions reductions or removals are real, long-term, measurable, and additional to what would have occurred in the absence of the project activity.

International Emissions Trading (IET): Under Article 17, Annex I Parties are able to participate in international emissions trading to meet their GHG targets. That is, countries with high costs of emissions abatement can provide funding for additional reductions in other Annex I countries that have low costs of emissions abatement, in exchange for the acquisition of assigned amount units. This ruling, in effect, enables Annex I Parties to reach their emission reduction targets at minimum cost.

The Article 4 Joint Fulfillment: Article 4 would allow a group of Parties in Annex I to choose to satisfy their emission reduction commitments jointly and to reallocate the commitments among the Parties within the group. The provision was designed to allow the European Union (EU) to change the distribution of reduction and limitation commitments set out in Annex B of the Kyoto Protocol for its members, with the absolute EU target remaining unchanged. The provision also enables other groups of Annex I Parties to enter into such an agreement, if they choose.

Activities Implemented Jointly (AIJ): At the first conference of the Parties to the UN Framework Convention on Climate Change, which was held at the 1990 Rio Earth Summit, the Parties agreed to a pilot program called "Activities Implemented Jointly." Under this program, government entities in one country could jointly undertake projects with similar entities in another country.

The United States Initiative on Joint Implementation (USIJI) was the first national program to adopt a formal set of criteria and an evaluation process for activities that could be implemented jointly (AIJ). An Evaluation Panel with representatives from U.S. government agencies determined the acceptability of proposed projects. The first United States AIJ projects were accepted in January 1995, and others followed soon thereafter. Central America hosted most of the early U.S. projects, but Russia and other nations also hosted AIJ projects. Projects involved energy end uses; energy production; biomass, geothermal, hydroelectric, and wind energy technologies; and forestry management. Through the end of July 1998, the USIJI panel had approved 32 projects out of 110 that had been submitted. (See Table 6-9.) The other projects were withdrawn or rejected.

Table 6-9. Accepted USIJI Projects

(As of October 25, 2000)

PROJECT NAME	COUNTRY	PROJECT TYPE
CAPEX, SA Electric Generation Project	Argentina	Energy production
Landfill Gas Management in Greater Buenos Aires	Argentina	Energy production
Rio Bermejo Carbon Sequestration Project	Argentina	GHG sink
Bel/Maya Biomass Power Generation Project	Belize	Energy production
Rio Bravo Conservation and Forest Management	Belize	GHG sink
Noel Kempff M. Climate Action Project	Bolivia	GHG sink
Rural Solar Electrification Project	Bolivia	Energy production
The Taquesi River Hydroelectric Power Project	Bolivia	Energy production
SIF Carbon Sequestration Project	Chile	GHG sink
The Rio Condor Carbon Sequestration Project	Chile	GHG sink
Wind Energy Project	Chile	Energy production
La Sierra Electricity Efficiency in Colombia	Colombia	Energy end use
Aeroenergia S.A. Wind Facility	Costa Rica	Energy production
Consolidation of National Parks & Biological Reserves as Carbon Deposit	Costa Rica	GHG sink
Dona Julia Hydroelectric Project	Costa Rica	Energy production
ECOLOAND: Piedras Blancas National Park	Costa Rica	GHG sink
Esquinas National Park	Costa Rica	GHG sink
Klinki Forestry Project	Costa Rica	GHG sink
Plantas Eolicas S.R.L. Wind Facility	Costa Rica	Energy production
Territorial and Financial Consolidation of Costa Rican National Parks and Biological Reserves	Costa Rica	GHG sink
Tierras Morenas Windfarm Project	Costa Rica	Energy production
City of Cecin: Fuel Switching, District Heating System	Czech Rep.	Energy end use
Bilsa Biological Reserve	Ecuador	GHG sink
Cemento de El Salvador, S.A. de C.V.	El Salvador	Energy end use
Matanzas Hydroelectric Project	Guatemala	Energy production
Rio Hondo II Hydroelectric Project	Guatemala	Energy production
Santa Teresa Hydroelectric Project	Guatemala	Energy production
Bio-Gen Biomass Power Generation Project, Phase I	Honduras	Energy production
Bio-Gen Biomass Power Generation Project, Phase II	Honduras	Energy production
Solar-Based Rural Electrification	Honduras	Energy production
The Bagepalli Project: Community-Based Fruit Tree Orchards for CO_2 Sequestration	India	GHG sink
Reduced Impact Logging for Carbon Sequestration in East Kalimantan	Indonesia	GHG sink
Energy Centers for Mali	Mali	Energy production
Solar Electric Generation for the Island of Rodrigues	Mauritius	Energy production
APS/CRD Renewable Energy Mini-Grid Project	Mexico	Energy production
Community Silviculture in the Siera Norte of Oaxaca	Mexico	GHG sink
Project Salicornia: Halophyte Cultivation in Sonora	Mexico	GHG sink
Scolel Té: Carbon Sequestration and Sustainable Forest Management in Chiapas	Mexico	GHG sink
El Hoyo-Monte Galan Geothermal Project	Nicaragua	Energy production

Continued on the next page

A004215

PROJECT NAME	COUNTRY	PROJECT TYPE
Commercial Reforestation in the Chiriqui Province	Panama	GHG sink
The Central Selva Climate Action Project	Peru	GHG sink
Energy Efficient Street Lighting Project in the Philippines	Philippines	Energy end use
District Heating Renovation in Lytkarino	Russian Fed.	Energy end use
Improving District Heating Efficiency in Metallurguichesky District of Cheliabinsk	Russian Fed.	Energy end use
Reforestation in Vologda	Russian Fed.	GHG sink
RUSAFOR--Saratov Afforestation Project	Russian Fed.	GHG sink
RUSAGAS: Fugitive Gas Capture Project	Russian Fed.	Energy end use
Zelenagrad District Heating System Improvements	Russian Fed.	Energy end use
Guguletu Eco-Homes Project	South Africa	Energy end use
SELCO—Sri Lanka Rural Solar Electrification Project	Sri Lanka	Energy production
Energy Center for Uganda	Uganda	Energy end use
Solar Light for the Churches of Africa	Uganda	Energy end use

Source: USIJI Secretariat, 2000.

Financing remains a major obstacle; just 13 of the 32 projects that were approved through July 1998 had obtained funding by sponsors. Participants in these projects assert that they faced large transaction costs in dealing with host governments and experienced significant delays in getting project approvals from the USIJI Evaluation Board and from host governments. Sponsors identified development of new contacts in the host country, early entry into a potentially profitable business, the possibility of influencing future AIJ criteria, and favorable publicity as motivating factors.

The record of the early AIJ projects offers important lessons regarding the CDM and how it should be structured. After-the-fact assessments of a large number of U.S. AIJ projects reveal difficulties in determining whether project activities truly are additional to activities that would have been undertaken without the AIJ program. Furthermore, monitoring progress and measuring the success of JI activities in reducing GHG emissions have proven to be a challenge, particularly for projects designed to create or enhance carbon sinks. Since pre-Kyoto AIJ was largely an experimental activity, the consequences of a shortfall were not large. If credits had been sold or traded to other parties, the consequences would have been more serious.

Implementation of the Kyoto Protocol will have major financial implications. EPA-sponsored studies by Koomey et al. (1998) and Laitner et al. (1999) suggest that market-based policies, including expanding EPA's own voluntary programs, could reduce domestic energy-related carbon emissions by as much as 300 million metric tons at a net positive benefit to the economy by 2010. Estimates of the potential savings from the use of trading to satisfy U.S. obligations, versus traditional alternatives, are as high as $100 billion per year.[147] Clearly, details regarding how the program will be designed and implemented are likely to have considerable financial implications.

7. Subsidies for Pollution Control

7.1 Introduction

For the purposes of this report, subsidies of interest involve financial support by the government of activities believed to be environmentally friendly. The types of subsidies described in this report include grants, low-interest loans, favorable tax treatment, and procurement mandates for products believed to have environmental advantages. Research and development, information dissemination, and other services provided by the government that are below their true cost could also be considered subsidies. However, such services are too varied and numerous to be included in this report.

Subsidies are often funded by the fees charged on environmentally harmful products or activities. Advance disposal fees, for example, provide revenues to subsidize the proper disposal of products after their use. Although it could be argued that such disposal activities are not truly subsidized by the government if they are funded entirely by the fees on the product that are paid by industry or consumers, this chapter includes such mechanisms for the purposes of discussion.

Given the variety of subsidies used in environmental management at all levels of government, this chapter does not attempt to cover the topic in a comprehensive way. Its purpose is, instead, to provide an overview, with illustrative examples of the types of subsidies and how they have been used to address specific environmental problems.

The following areas are considered: pollution prevention and control, cleanup of contaminated industrial sites, farming and land preservation, consumer product waste management, citizen monitoring of environmental regulations, alternative fuels and low-emitting vehicles, and municipal wastewater treatment. The chapter concludes with a discussion of subsidies that have had the unintended effect of promoting environmentally harmful activities.

Table 7-1 summarizes various subsidy instruments, most of which are discussed in this chapter. Column 2 shows who pays for the various subsidies. The issue of whether the costs of subsidies are passed on to other businesses or consumers in some way is not addressed. Information on funding sources other than general revenues is also included in parentheses, where available. Column 3 lists the recipients of these subsidies. Whether these parties pass on the benefits of subsidies to their customers or others is also not assessed.

7.2 Pollution Prevention and Control

This section discusses the use of tax benefits and loans to promote pollution prevention and control. It also discusses an EPA program under which fines for environmental violations are reduced in exchange for pollution prevention and control activities.

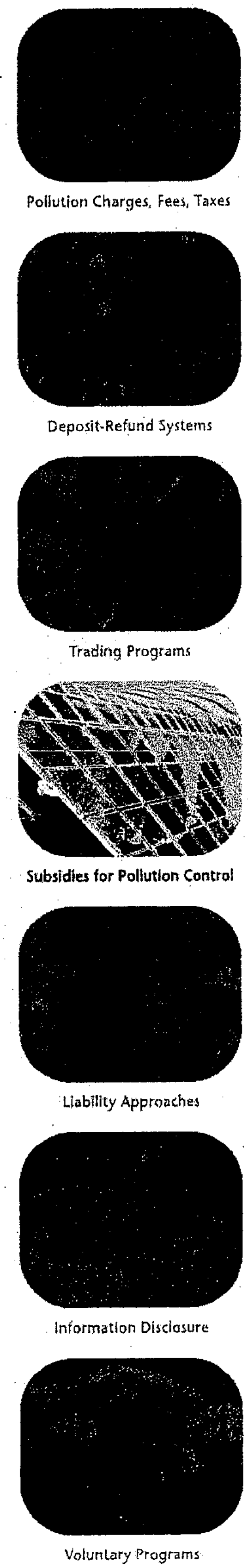


Table 7-1. The Use of Subsidies in Environmental Management

SUBSIDY INSTRUMENT	WHO PAYS?	RECIPIENTS
Grants		
Brownfields development grants	EPA, states	Communities, property owners
Cost sharing for land conservation	Federal government	Property owners
Conservation easements	Federal, state, and local governments (Land transfer taxes)	Property owners
Environmental violation reporting rewards	States of New Jersey, California	Individuals and organizations
Waste management and recycling grants	Federal, state, and local governments (advance disposal fees (ADFs), waste taxes)	Public and private organizations
Unit-based waste collection or reuse payments	State governments (ADFs, waste taxes)	Businesses
Unit-based payments for the use of alternative fuel vehicles (AFVs)	Federal government	Public bus systems and small businesses
Municipal sewage treatment plant construction grants (replaced by loans)	Federal and state governments	Communities
Loans		
Pollution control loans	State governments	Small businesses
Brownfields development loans	State governments (waste taxes)	Property owners
Recycling business loans	State governments (ADFs, waste taxes)	Businesses
Municipal sewage treatment plant construction loans (replaced previous grant program)	Federal and state governments	Communities
Tax Benefits		
Pollution control property	State governments	Private organizations
Louisiana environmental score-card deduction	State of Louisiana	Businesses
Brownfields development	State governments	Property owners
Land use credits	State governments	Property owners
Recycling benefits	State governments	Businesses
Credits for ethanol and compressed natural gas	Federal and state governments	Alternative fuel vehicle manufacturers
Credits for alternative fuel vehicles and equipment	Federal and state governments	Alternative fuel vehicle purchasers
Renewable electricity generation credits	Federal government	Businesses
Electric vehicle credits	Federal government	Businesses or organizations
Interest exemption of pollution control investment debt	Federal government	Businesses or organizations
Procurement Mandates		
Public procurement of recycled products	Federal, state, and local governments	Recycled products manufacturers
Public procurement of alternative fuel vehicles	Federal, state, and local governments	Alternative fuel vehicle manufacturers
Recycled content requirements	Private organizations	Recycled products manufacturers
Mandates for the use of alternative fuel vehicles	Private organizations	Alternative fuel vehicle manufacturers

SUBSIDY INSTRUMENT	WHO PAYS?	RECIPIENTS
Miscellaneous		
Reduced fines in return for supplemental environmental projects	Federal and state governments	Businesses
Accelerated review of applications for new pesticides	Federal government	Pesticide manufacturers
Relaxed regulatory requirements (e.g., ethanol Ried Vapor Pressure (RVP) waiver)	Federal, state, and local governments	Various organizations
Research & development; public education (technical assistance to participants in voluntary programs)	Federal, state, and local governments	Various organizations

7.2.1 Tax Benefits

Numerous states offer favorable tax treatment for the construction and installation of pollution control equipment. In most states that have such tax incentives, the equipment must have pollution control as its primary purpose. In some states, equipment with other purposes receives tax benefits on a prorated basis. Some states also require environmental regulators to certify equipment that is eligible for tax breaks.

The benefits usually apply to property or sales/use taxes but can apply to income tax in a smaller number of states. Air and water pollution equipment is commonly given tax benefits. However, New York offers a property tax exemption for industrial waste treatment facilities, and Ohio offers benefits for noise abatement equipment. Tax exemptions for production machinery and products used directly in manufacturing also apply to pollution control equipment in many cases.[148]

In Texas, for example, a constitutional amendment approved by voters in 1993 provided for exemptions of certain pollution control property from property taxes. The purpose of the amendment was to ensure that investments made to comply with environmental mandates did not raise the property tax payments of businesses. The exemptions applied only to "devices, equipment, methods, or land used to prevent, monitor, control, or reduce air, water, or land pollution" purchased in 1994 to "meet or exceed state, federal, or local laws, rules, and regulations." The vast majority of exemption requests were made for equipment that was used to comply with Clean Air Act requirements. The total value of the property for which businesses applied for exemptions was $1.2 billion. A state official estimated that the applications would lead to a loss of $26.6 million in tax revenue.[149]

One problem with such tax benefits is that they can erode state or local tax bases. In Texas, for example, the $26.6-million revenue shortfall is expected to affect mainly school districts, but also cities and counties. One tax district appraiser predicted that homeowners would make up the shortfall.[150]

The incentive effect of such preferential tax treatment is difficult to assess, in part because of the simultaneous presence of other policies that affect behavior. If the benefits are offered merely to subsidize compliance with regulations, the regulations themselves probably have a stronger incentive effect than the benefits. However, the favorable tax treatment could provide an incentive to exceed requirements.

7.2.2 Louisiana Environmental Scorecard

Louisiana's environmental scorecard program, which was in effect from October 1990 to January 1992, linked tax exemptions for companies to their environmental performance. The state's Departments of Economic Development and Environmental Quality built the scoring system into an existing 10-Year Industrial Property Tax Exemption Program (IPTEP). In contrast to the previous practice of awarding 100% exemptions for 20 years from local property taxes for new equipment and other capital expenditures, the scoring system determined that companies would receive a base exemption of 50% and then rated their environmental behavior to determine how much of the remaining 50% they could obtain.

Companies earned points based on their environmental violation record and the amount of emissions they generated per employee. Table 7-2 shows how these factors influenced point totals. Points for environmental violation records were calculated by adjusting the values in Column 2 of Table 7-2 for the age of the violation, i.e., how many years ago the violation occurred. Next, the number of years was multiplied by coefficients ranging from 1 for violations in the past year to 0 for violations 6 years or older. The results were then subtracted from 25. Points for emissions per employee were calculated by dividing total payroll by $25,000; then points were awarded as shown in Column 4. After the Department of Environmental Quality had assigned a preliminary score to an exemption request, a company that received fewer than 100 points could raise its score by developing an emissions reduction plan. Other criteria, such as recycling activities and creating jobs for high unemployment areas, could also increase point totals.

Table 7-2. Points Under Louisiana Scorecard System

VIOLATION FINE	POINTS AWARDED (25 minus the value in this column, adjusted for the age of the violation)	POUNDS OF EMISSIONS PER EMPLOYEE	POINTS AWARDED
$0–$3,000	1	0–500	25
$3,001–$10,000	5	501–1,000	20
$10,001–$25,000	10	1,001–2,500	15
Over $25,000	15	2,501–5,000	10
Criminal or felony violations	20	5,001–10,000	5

Source: Environmental Law Institute. 1993a, p. 119.

Data suggest that this program had a significant incentive effect. Final scores during the 15-month program averaged 94.9, which was significantly higher than preliminary scores. Twelve companies submitted emission reduction plans for bonus points worth $7,030,249 in tax exemptions. This amount is slightly greater than the $5.2 million of exemptions recovered by the state through the scorecard system. Since the system was built into an existing exemption, administrative costs were reasonably low. It also gave the state the opportunity to use the exemption "carrot" to promote not only economic but also environmental health.

Industry, however, opposed the program, perhaps in part because it attached conditions to what had previously been an unconditional tax exemption (the IPTEP). It was industry's opposition that led the Governor of Louisiana to terminate the program in 1992.

7.2.3 Supplemental Environmental Projects

Supplemental environmental projects (SEPs) are "settlements negotiated by EPA and an environmental law violator in which the company agrees to do an alternative environmental project in return for an agency agreement to lower the proposed penalty." Although such projects have existed since the early 1980s, their numbers have increased in the 1990s and they are now included in as many as 1-in-10 enforcement actions. More than 200 were approved in 1992. In the first six months of 1992, one EPA official estimated that EPA negotiated 164 SEPs worth approximately $23 million. In 1995, EPA negotiated 348 SEPs valued at $104 million.

Most SEPs have been pollution prevention activities that involve violations in the Toxic Substances Control Act (TCSA) or in the Emergency Planning and Community Right-To-Know Act (EPCRA). However, SEPs have also been negotiated for violations of other laws. In New England, for example, a sand blasting and paint company had its EPCRA fines reduced from $50,000 to $14,000 by agreeing to hire an environmental auditor and launch a five-year pollution reduction program. In Nebraska, a $5,000 fine for supplying restricted-use pesticide to an uncertified user in violation of the Federal Insecticide, Fungicide, and Rodenticide Act was reduced to $2,000 when the violating company agreed to install concrete containment dikes around its pesticide storage tanks and a shower/eye wash. The measures under the SEP were estimated to cost this company $7,496.

In a RCRA case involving the improper characterization of waste streams, leakage of hazardous wastes from a sewer, and operation of an unpermitted incinerator, Eastman Kodak had its penalty reduced by approximately $3 million in return for investing $12 million in six SEPs. These SEPs were expected to reduce hazardous wastes at its Kodak Park facility by 2.3 million pounds by the year 2001. In a Clean Water Act (CWA) case, the City and County of Honolulu agreed to spend $30 million on SEPs to treat and reuse wastewater and sludge. The Kodak and Honolulu SEPs are described in an EPA report.[151] Fines have also been reduced in cases in which businesses complied with existing environmental laws soon after being charged with a violation.

The advantage of SEPs for EPA is twofold: First, fines that would be paid to the Treasury are instead used for environmental protection activities; and second, the cost of these activities usually exceeds the negotiated reduction in the fine. Estimates place the cost of the SEP at one-half to one-sixth of the reduction in the fine. At the state level, on the other hand, SEPs have proven much less popular, in part because many states rely on the revenues from these fines to fund environmental activities.

Despite the high SEP-to-fine reduction ratio, SEPs can offer violators a number of potential advantages that are associated with improved environmental performance, including positive publicity, reductions in waste management costs, and early preparedness for increasingly stringent regulations. Another advantage is that, unlike fines, SEPs involve business expenditures that lower taxes. Since all SEPs represent voluntary agreements made by violators, the SEP mechanism appears to have a significant incentive effect.

7.2.4 Loans and Tax Exempt Bonds

The federal government exempts from taxation the interest on debt that is issued by state or local governments to finance pollution control or waste disposal facilities. This exemption cost the government an estimated $625 million in 1995.[152]

Although it is beyond the scope of this report to describe all state financing programs, several mechanisms used in California are discussed here. The California Pollution Control Financing Authority (CPCFA) issues tax-exempt bonds to provide low-interest loans of $1 million to $20 million to small businesses for pollution control and solid waste recovery projects. Loans in excess of $20 million are provided under a similar program for larger businesses. Repayment periods are usually longer than those of conventional bank loans. Proceeds from bonds issued by CPCFA on behalf of businesses are deposited into a fund held by the bond trustee. The borrower uses these funds for the project, making periodic repayments according to the terms of the loan agreement.

For example, about $1 million in tax-exempt bonds were issued to finance a dry ash waste recovery investment at an electricity generating facility at the Eel River Sawmills. The equipment purchased through this financing arrangement reprocesses ash waste through the electrical generating facility. This reprocessing reduces the amount of ash waste sent to landfills by 60%, from 24 tons per day to 10 tons per day.

In addition to these tax-exempt bond programs, CPCFA offered loans for pollution control investments under the California Loans for Environmental Assistance Now (CLEAN) program. Under this program, CPCFA issued bonds and lent proceeds at interest rates that were roughly 2% higher than bond rates. CPCFA hoped to repackage and sell these loans to raise more capital but was unable to do so. In three years, 38 loans ranging from $30,000 to $500,000 were issued, totaling approximately $3 million. Since CLEAN's subsidized interest rates attracted a number of businesses that could have obtained loans from commercial banks, it ended up financing many pollution control investments that would have been made without the CLEAN program. Moreover, CPCFA's loan disbursing process was slow, its loan marketing poor, and its administrative costs high. The program cost about $1.40 for every $1 lent.[153]

To address these problems, CLEAN was replaced by the California Capital Access Program (CalCAP), under which CPCFA sets up loan portfolio "insurance" to encourage banks to lend to small businesses. CPCFA matches the sum of premiums that are paid by the borrower and the lender and then puts that money into a loss reserve account for the lender. In case of default, the CPCFA account covers losses. The maximum individual loan is $2.5 million. As a result of improved marketing and loan disbursing procedures and the leveraging of reserve funds under CalCAP, $160 million has been lent in two years, as compared with only $3 million in 3 years under CLEAN. Under CalCAP, every dollar contributed by CPCFA has resulted in $23 in lending.

7.3 Brownfields Programs

Various measures have been taken to subsidize the development of brownfields, which are contaminated industrial sites that pose a relatively low risk to the environment as compared to the most heavily polluted Superfund sites. The number of brownfields programs has grown at the federal and state level because they deal successfully with an unintended consequence of hazardous waste cleanup laws, that is, laws that discourage developers from reusing contaminated property. Brownfields programs have included a variety of incentives, including grants, loans, and tax benefits. Liability incentives are another important aspect of brownfields programs; they are discussed in Chapter 8.

7.3.1 EPA Pilot Grant Projects

Under the Brownfields Initiative, EPA has funded several types of pilot projects to states, tribes, and local governments to encourage the assessment, cleanup, and reuse of brownfields. EPA has awarded 362 grants of as much as $200,000 each to assist communities in assessing contamination at brownfields; 104 grants of up to $500,000 to establish revolving loan funds for cleanup; and 37 grants of as much as $200,000 each to train local workers to assess and clean up brownfields. Through the Brownfields Initiative, communities report assessing almost 2,000 properties, leveraging more than $2.3 billion in economic development funds and generating more than 7,000 jobs. For more information on the Brownfields Initiative, see EPA's brownfields Internet site at www.epa.gov/brownfields.

7.3.2 Tax Incentives and Loans

New Jersey offers both tax benefits and loans to encourage brownfields development. Under the Environmental Opportunity Zone Act, which became effective in January 1996, developers of contaminated sites could receive a 10-year property tax exemption if they remediate the site in accordance with state standards and return it to commercial or industrial use. In 1998, the period of tax exemption was extended to 15 years. Loans for cleanups are funded by a dedicated 5% portion of the state's Hazardous Discharge Site Remediation Fund.

To qualify for tax benefits and loans, the contaminated land must be on the state's list of hazardous discharge sites, be vacant or underused, and need cleanup because of an actual or potential pollution discharge. The sites must also be located in environmental opportunity zones designated by state municipalities. The property tax exemption gradually decreases from 100% in the first year of development to 0% in the tenth year.[154]

Pennsylvania's Land Recycling and Environmental Remediation Standards Act established an Industrial Sites Cleanup Fund of up to $15 million to provide low-interest loans to help property owners clean up pollution that they did not cause.[155] Grants are available to finance activities by local governments and economic development agencies. These funds can cover up to 75% of cleanup costs. The Industrial Sites Environmental Assessment Act allows the U.S. Department of Commerce to make grants to municipalities and other local authorities, nonprofit economic development agencies, and similar organizations to fund environmental assessments of industrial sites in distressed communities. Up to $2 million is provided annually for such funding.[156] A key feature of the program is its reliance on risk assessments to dictate remediation strategies at individual sites.

A January 2000 legislative report assessed the program's effectiveness.[157] After approximately $20 million in expenditures, more than 650 sites have been cleaned up and over 300 additional sites are in the process of being cleaned. The program has received an award from the Ford Foundation as one of the 10 most innovative programs in government.

In 1995, Delaware added credits for brownfields development to its Blue Collar Jobs Tax Credit program.[158] Minnesota and Ohio offer loans to fund cleanups, and Ohio also provides tax incentives. Arizona and Tennessee pay for the cleanup of wastes that cannot be identified as to source or for which sources are no longer financially able to shoulder the cleanup cost burden.[159]

The Brownfields Tax Incentive was passed as part of the U.S. Taxpayer Relief Act of 1997. This federal tax incentive encourages the cleanup and redevelopment of brownfields by allowing the cleanup costs in certain areas to be fully deductible in the year expended, rather than capitalized over time. The U.S. Treasury Department estimates that the $1.5-billion incentive will leverage as much as $6 billion in private investment and return as many as 14,000 brownfields to productive use.

7.4 Farming and Land Preservation

Subsidies used in farming and land preservation include grants, loans, and tax benefits that are offered in exchange for improved conservation practices. Multi-year contracts pay landowners to either take land out of cultivation or to manage it in a certain way. In addition, benefits that support farm programs have, since 1985, been linked to environmental performance in a program called "Conservation Compliance." Table 7-3 shows the federal subsidy programs and the respective funding levels implemented expressly for conservation purposes. The conservation provisions achieved through cross-compliance are also described.

Table 7-3. Funding for Conservation Subsidy Programs of the U.S. Department of Agriculture (FY 1998) in millions of dollars

PROGRAM	AGENCY WITHIN USDA	CONSERVATION	WATER RESOURCES	RECREATIONAL RESOURCES	POLLUTION CONTROL	TOTAL NATURAL RESOURCES AND ENVIRONMENT
Conservation Reserve	FSA	2,096				2,096
Agricultural Conservation	FSA	44				44
Conservation Operations	NRCS	644				644
Wetlands Reserve	NRCS	38				38
Resource Conservation	NRCS	33				33
Water Bank	NRCS	8				8
Wildlife Habitat Incentives	NRCS	8				8
Forestry Incentives	NRCS	6				6
Colorado River Salinity	NRCS	4				4
Great Plains Conservation	NRCS	4				4
Resource Conservation	NRCS	1				1
Rural Clean Water	NRCS		279	1		280
Watershed and Flood	NRCS		57			57
Conservation Operations	NRCS		11			11
State and Private Forestry	FS	59				59
Other	USDA	2,462		125	20	2,607
TOTAL		**5,407**	**347**	**126**	**20**	**5,900**

Source: USDA. 2000. FSA is the Farm Service Agency, NRCS is the Natural Resources Conservation Service, and FS is the Forest Service.

A004224

This section concludes with a discussion of selected state subsidy schemes, including programs that allow the purchase of development rights to prevent the conversion of agricultural lands to alternative uses.

7.4.1 Conservation Reserve Program

The Conservation Reserve Program (CRP) was established by the U.S. Food Security Act of 1985 (also known as the "1985 Farm Bill") and modified by the 1990 and 1996 Farm Bills. The CRP seeks to protect soil and water resources and wildlife habitat by taking land out of cultivation. Participating farmers receive annual payments of as much as $50,000 per person to put land in the Conservation Reserve for 10 to 15 years. Applications to participate in this program must include conservation plans, which usually require the planting of grass cover). The federal government pays not only annual rents, so the land is not cultivated, but also one-half the cost of the required conservation measures.

Since landowners have offered more acres than the CRP can afford, they bid for enrollment. For the first nine opportunities to enroll through August 1989, bids had to be at or below the "maximum acceptable rental rate" for a given area. However, this approach did not actively target environmentally sensitive cropland. Consequently, farmers gradually increased their awareness of maximum rates and set their bids accordingly, often resulting in rental payments that were in excess of market value.[160]

The 1990 and 1990 Farm Bills shifted the emphasis of the CRP to protecting lands that were not only highly erodible but also important to water quality and wildlife habitat. The bidding system, as a result, has been changed several times, beginning with the 10th signup in May 1991. An Environmental Benefits Index (EBI) is used to evaluate bids at or below the market rental rate for comparable land. The EBI includes numerous factors relating to soil erosion, water quality, and the value of the land for wildlife habitat. Lands located in special Conservation Priority Areas are given additional preference, particularly if structural or land management practices proposed for the lands maximize environmental benefits per dollar expended. The EBI is compared with the bid amount to determine whether the parcel should be enrolled in the CRP.

Since August 1992, some 36.4 million acres, the maximum acreage allowed under the program, had been placed in the CRP. This figure is nearly 10% of the total U.S. cropland, an estimated 395 million acres. (See Table 7-4.) The first nine enrollments consisted mostly of land located in the Great Plains and Mountains states. Changing the program's emphasis to water quality and wildlife goals has led to increased concentrations of land in the Midwest and Great Lakes regions being enrolled in the program.

In 1990, when 33.9 million acres were enrolled, USDA estimated the net social benefits of CRP at $4.2 billion–$9.0 billion over the life of the program. Table 7-5 shows the estimated dollar value of different types of social costs and benefits.

Statistics on the first nine enrollments indicate annual reductions in soil erosion of 700,000 tons, an average of 19 tons per acre. This figure represents a 22% reduction in cropland erosion since the program was established.

Table 7-4. Conservation Reserve Acreage and Rental Payments

REGION	NUMBER OF ACRES	ANNUAL RENTAL PAYMENTS (in millions of dollars)	RENTAL PAYMENTS PER ACRE ($)
Appalachia	1,158,124	$62.5	$53.97
Corn Belt	5,603,333	416.1	74.26
Delta	1,248,403	55.3	44.31
Great Lakes	3,008,337	176.5	58.68
Mountain	6,687,264	265.3	39.67
Northeast	226,411	13.4	59.29
Northern Plains	9,664,110	444.5	46.00
Pacific	1,791,182	88.8	42.71
Southeast	1,692,580	72.3	42.71
Southern Plains	5,342,989	214.7	40.18
TOTAL	**36,422,733**	**$1,809.4**	**$49.70 on average**

Source: GAO. 1995b, p. 13.

The CRP could be more cost-effective by concentrating enrollment on land that is more environmentally sensitive, some critics claim. By concentrating on enrolling buffer zones alongside streams, rivers and lakes instead of entire fields, a GAO study claimed, only about 6 million acres would need to be enrolled in order to protect surface water, groundwater, air, and soil. However, protecting wildlife habitat would require significantly more acreage.[161] The buffers along streams can reduce sediment loadings by 50%[162] and nitrate concentrations[163] and herbicide concentrations[164] by 90%.

Table 7-5. Estimated Social Benefits and Costs of CRP

SOCIAL BENEFITS	RANGE OF VALUES ($billion)
Increases in net farm income	$2.1–6.3
Value of future timber	3.3
Preservation of soil productivity	0.6–1.7
Improved surface water quality	1.3–4.2
Lower damages caused by windblown dust	0.3–0.9
Wildlife enhancements	1.9–3.1
TOTAL BENEFITS	**$9.5–19.5**
SOCIAL COSTS	
Higher food costs for consumers	$2.9–7.8
Existence of vegetative cover on CRP land	2.4
USDA technical assistance	0.1
TOTAL COSTS	**$5.4–10.3**
NET BENEFIT	**$4.1–9.2**

Source: USDA.1994a, pp. 180-1.

The 1996 Farm Bill and subsequent rules developed by USDA addressed this criticism in reauthorizing the CRP through 2002. While maintaining the maximum number of acres to be enrolled at 36.4 million, the new bill also allows contract holders to terminate contracts entered into prior to 1995, provided the contract has been in effect for at least 5 years and the land in question is not of high environmental value. The USDA Secretary was given the authority to agree to future early terminations. The possibility that such terminations may be invoked will give USDA the opportunity to refocus enrollment in the program on land that is more environmentally sensitive.

Substantial bonus payments—including a 20% rental bonus, a $100 per acre up-front payment, and other incentives—now encourage the enrollment of these stream buffers as well as certain other practices that are of high priority. More than a million acres of these buffer areas have been enrolled since farmers were offered the new incentives for buffer zones.

7.4.2 Conservation Reserve Enhancement Program

Part of the 1996 Farm Bill, the Conservation Reserve Enhancement Program is an enhancement of the Conservation Reserve Program that creates federal–state partnerships for conserving environmentally sensitive farmland. This program uses financial incentives to encourage farmers and ranchers to participate in removing lands from agricultural production for periods of 10 to 15 years. The status of this program in each state is shown in Table 7-6.

Payments in the Conservation Reserve Program average about $50 per acre per year. The amount that farmers will be paid to participate in CREP is quite variable because it is tied closely to the rental rates of local land. The formula for calculating the amount to be paid to farmers includes base rental rates, the cost of installing conservation practices, annual maintenance costs, and any special incentives.

Table 7-6. Status of Conservation Reserve Enhancement Programs

STATE	STATUS	ACRES	TOTAL COST (in millions of dollars)	INCENTIVES	EASEMENT TERM	TARGET AREA	ENVIRONMENTAL OBJECTIVE
IL	Agreement signed March 30, 1998.	100,000	$250	30% for buffers, wetland restoration, wildlife food plots, & shallow water areas; 20% all other practices	100,000 acres, 15 yr. or permanent	Middle Illinois River	Reduction of sedimentation and soil erosion – 85,000 acres riparian buffers, wetland restoration, emphasis on native species; 15,000 acres Highly Erodible Land (HEL).
MD	Agreement signed October 20, 1997.	100,000	195	70% for riparian buffers; 50% for filter strips and HEL	25,000 acres, permanent	Chesapeake Bay	Reduction of nutrient loading -- 70,000 acres riparian buffers; 20,000 acres HEL; 10,000 acres wetland restoration
MN	Agreement signed February 19, 1998.	100,000	223	20% for all practices	100,000 acres, >20 yr. To perpetuity	Minnesota River	Water quality benefits from sediment and nutrient reduction and mitigation of flood damage. Native grasses and hardwoods, wetland restoration, and filter strips.
NY	Agreement signed August 26, 1998.	5,000	10	150%	N/A	New York City watershed/ Catskill/ Delaware system	Risk reduction of nutrient, pathogen, and sediment inputs to streams/reservoirs that supply drinking water to NYC – riparian buffers, filter strips, and erosion control on HEL

Continued on the next page.

A004227

STATE	STATUS	ACRES	TOTAL COST (in millions of dollars)	INCENTIVES	EASEMENT TERM	TARGET AREA	ENVIRONMENTAL OBJECTIVE
OR	Agreement signed October 17, 1998.	100,000	250	25% for filterstrips; 35% for riparian buffers; 50% for wetland restoration; Cumulative impact bonus equal to four times base rental rate	N/A	Streams providing habitat for endangered salmon and trout statewide	Restoration of salmon habitat through enhancement of riparian areas and wetland restoration.
WA	Agreement signed October 19, 1998.	100,000	250	50%, plus an additional 10% if designated under State growth management law	N/A	Salmon spawning streams statewide	Restore habitat for native anadromous fish species using riparian buffer conservation practice.
NC	Agreement signed March 1, 1999	.	.	.	.	.	.
DE	Agreement signed June 2, 1999	.	.	.	.	.	.
WY,ID WI,KY MO,ND	Proposals received						

Source: USDA/FAS. CRP State CREP Information.

Maryland recently sweetened its CREP program by adding a one-time signing bonus of $250 per acre in an attempt to increase enrollments to the program's goal of 100,000 acres. Under the Maryland program, participating farmers would plant trees and grasses along Maryland waterways to act as natural filters that absorb nutrients and chemicals before they entered the waters. When the Maryland program was launched in 1997, it was the first in the nation. In three years of operation, the program had enrolled only 20,000 acres, largely because farmers considered the rules complex and the reimbursement rate too low.[165]

7.4.3 Wetlands Reserve Program

Under the Wetlands Reserve Program (WRP), which was created by the 1990 Food, Agriculture, Conservation and Trade Act (a.k.a. the 1990 Farm Bill), farmed wetlands and agricultural land converted from wetlands as well as buffer zones and some riparian areas are eligible for 30-year easements or permanent easements. Participants in this program are required to implement conservation plans approved by the Natural Resources Conservation Service and the Fish and Wildlife Service. Agricultural activities on enrolled land must be compatible with wetlands protection. Participants receive a lump sum for permanent easements or 10 equal payments for 30-year easements. Payment amounts are limited to the loss of market value of the land as a result of the easement. In addition to paying for the easements, the government shares in the cost of approved conservation measures.

As shown in Table 7-7, the number of acres for which bids were made was roughly five times the acreage enrolled in WRP during its first enrollment. In 1994, WRP was expanded to several other states.

Table 7-7. Wetland Reserve Program's First Enrollment (1992)

STATE	BID OFFERS (in 1,000 acres)	ENROLLED LAND (in 1,000 acres)	TOTAL COST (in thousands of dollars)	COST PER ACRE ($)
California	34.3	6.0	10,768	1,787
Iowa	27.9	5.1	5,951	1,168
Louisiana	69.9	14.1	9,882	702
Minnesota	13.1	0.7	764	1,082
Mississippi	65.0	14.9	10,764	723
Missouri	14.6	2.7	2,753	1,032
New York	0.5	0.1	212	2,934
North Carolina	15.3	4.7	3,675	780
Wisconsin	8.5	1.6	1,287	782
TOTAL	249.1	49.9	46,056	923

Source: USDA. 1994a, p. 194.

The 1996 Federal Agriculture Improvement and Reform Act (a.k.a. the 1996 Farm Bill) reauthorized WRP through 2002 while capping total enrollment at 975,000 acres. Beginning October 1996, land enrolled in this program was to be divided in the following way: one-third (33%) will be given permanent easements; one-third, 30-year easements or less; and one-third, wetland restoration agreements with cost sharing. Seventy-five thousand acres of land in less-than-permanent easements must be placed in the program before additional permanent easements are placed. The Act provides cost-sharing assistance to landowners of 75%–100% for permanent easements and 50%–75% for 30-year easements and restoration cost-share agreements.

7.4.4 Compliance Provisions

Under the 1985 Farm Bill, farmers must adhere to two compliance provisions before they become eligible for farm support programs such as price support loans and technical assistance. First, they must implement approved conservation plans on highly erodible land (HEL). Second, they must refrain from draining wetlands. Considering the large amounts of financial support at stake—some $24 billion in support payments in 1999—compliance provisions have had a strong incentive effect.

7.4.5 Highly Erodible Land Conservation and Sodbuster Provisions

To ensure farmers' eligibility for receiving support under the highly erodible land conservation compliance provision, farmers are required to develop and implement approved conservation plans for designated "highly erodible" land that was farmed between 1981 and 1985. The plans typically entail adjustments in farming practices and rotations and could include measures such as the maintenance of crop residues on fields in winter, contour plowing, minimum tillage, and shelterbelts. The sodbuster provision is similar to the highly erodible land conservation compliance provision, except in two respects. One, it applies to highly erodible land that was *not* farmed between 1981 and 1985. Two, it is more stringent in that it requires the adoption of a conservation system that reduces erosion to a level above which long-term soil productivity may be depleted.[166]

This cross-compliance rule appears to have a strong incentive effect. Implementation costs for the conservation compliance provisions are estimated at $7–$17 per acre depending on the region, whereas a loss in farm support benefits would cost farmers between $37 and $62 per acre.[167]

As shown in Table 7-8, the estimated net benefit of the conservation compliance provision varies substantially across regions. The air quality benefits listed in the table are limited to household wind damage. Although the estimates show costs exceeding benefits in the Northern Plains, the benefits might exceed costs if air quality benefits were more broadly defined.

Table 7-8. Economic Benefits and Costs of Conservation Compliance

REGION	PER-ACRE BENEFIT (in $) FROM:			PER-ACRE COST (in $) TO:		NET ECONOMIC BENEFITS (in $)	BENEFIT/ COST RATIO
	Water Quality	Air Quality	Productivity	Producers	Federal Government		
Northeast	35.63	0	0.16	3.57	3.43	28.80	5.12
Lake States	21.99	0	0.12	0.32	3.43	18.37	5.90
Corn Belt	15.61	0	0.25	8.90	3.43	3.53	1.29
Northern Plains	3.47	3.00	0.19	3.35	3.43	-0.11	0.96
Appalachia	23.58	0	0.24	3.51	3.43	16.89	3.43
Southeast	25.63	0	0.12	8.18	3.43	14.15	2.22
Delta	35.50	0	0.12	1.97	3.43	30.22	6.60
Southern Plains	5.26	4.63	0.33	2.34	3.43	4.45	1.77
Mountain	5.10	4.01	0.15	0.20	3.43	5.63	2.55
Pacific	31.83	1.09	0.14	2.23	3.43	27.40	5.85
Entire United States	13.81	1.93	0.21	3.78	3.43	8.74	2.21

Source: USDA. 1994a. p. 186.

7.4.6 Swampbuster Program

Under the Swampbuster Program, program benefits are denied to farmers who plant crops on wetlands that were converted after 1985 or who drain or otherwise convert designated wetlands. Conversion is allowed if its impact on the hydrological and biological value of the wetland is limited or if the farmer restores wetlands of equivalent value.

The 1996 Farm Bill made several changes to provisions in the Swampbuster Program. According to USDA, these modifications "will give farmers more flexibility in complying with wetland conservation requirements while protecting natural resources."[168] The bill expands wetland mitigation areas and options, allowing mitigation through restoration, enhancement, or creation, provided that wetland functions and values are maintained. In addition, the bill also stipulates that conversion activities authorized by a Clean Water Act permit will be accepted for Farm Bill purposes if the conversions are adequately mitigated. The bill also establishes a pilot program for mitigation banking. (See Chapter 6 for information on mitigation banking.)

7.4.7 Subsidies Created Under the 1996 Farm Bill

In addition to modifying several existing programs in ways that USDA believes will simplify them and enhance their efficiency and flexibility, the 1996 Farm Bill created a number of new programs. The largest of these programs in terms of funding is the Environmental Quality Incentives Program. Others include the Farmland Protection Program, the Conservation Farm Option, and the Wildlife Habitat Incentives Program.

As shown in Table 7-3, Conservation Subsidy Programs of the U.S. Department of Agriculture (FY 1998), USDA has implemented a large number of conservation programs. A 1995 GAO study stressed the need to consolidate these programs, stating that "they frequently promote identical resource conservation purposes, use similar financial incentives, serve the same population, and finance the application of the same set of technical practices." The study asserted that program overlap made it more difficult for farmers to identify and apply for financial and technical assistance and increased the administrative burden on USDA.[169]

Environmental Quality Incentive Program (EQIP): This program replaced several programs, all of which were phased out in 1996: the Agricultural Conservation Program, the Colorado River Basin Salinity Control Program, the Water Quality Incentives Program, and the Great Plains Conservation Program. EQIP assists farmers and livestock producers with making environmental and conservation improvements. Participating landowners agree to establish conservation plans and implement them for periods of 5 to 10 years. In doing so, they receive cost-share or incentive payments for as much as 75% of their costs for adopting these conservation practices. Payments are limited to $10,000 per person per year or a total of $50,000 for any multi-year agreement.

The legislation and rules developed by USDA requires the Department to select projects that maximize the environmental benefits per dollar spent under EQIP. Priority areas must be targeted. Plans must be developed that identify both the main problems being addressed and the practices capable of solving these problems with available resources. These provisions effectively make watershed planning a major activity for the Natural Resource Conservation Service.

EQIP has placed added emphasis on livestock as a pollution problem. One-half of the program's funding is reserved for livestock-related conservation problems, and one-half for other conservation problems. The program was funded at $130 million in FY 1996 and $200 million annually from 1997 to 2002, although Congress subsequently reduced funding levels to $170 million a year. Most farmers attempting to enter the EQIP program are turned away due to the targeting process described in the previous paragraph and current budgetary limitations.

Farmland Protection Program: Under this $35 million program, USDA will work with state and local governments to purchase conservation easements on 170,000 to 340,000 acres of farmland of special interest. To be included in this program, land must be subject to a pending offer from a state or local government for the purpose of protecting topsoil by limiting nonagricultural uses.

Conservation Farm Option: Under this pilot program for producers of cotton, rice, feed grains, and wheat, producers may consolidate payments from three programs— CRP, WRP, and EQIP—into one annual payment. They can do so only in exchange for entering into 10-year contracts and implementing conservation plans that address water, soil and related resources as well as wildlife habitat. The incentive effect of being able to consolidate program payments is unknown. A total of $197.5 million will be provided for this program through 2002.

Wildlife Habitat Incentives Program: This program is intended to offer cost-sharing assistance to landowners to encourage them to plan and adopt approved management practices that ameliorate wildlife habitat. Total funding from FY 1996 to FY 2002 is $50 million.

7.4.8 Impacts of Conservation Programs

Table 7-9 presents some of the effects of USDA conservation programs. Activities of the Water Quality Program consist mostly of educational and technical assistance, but they also include some financial assistance. Monetary values of some of these impacts have been estimated. For example, the benefits of reducing salt loads under the Colorado River Salinity Control Program have been estimated at $61 per ton a year.[170]

Table 7-9. Impacts of Conservation Programs

PROGRAM AND IMPACTS	IMPACTS							
	1988	1989	1990	1991	1992	1993	1994	1995
	Reductions of Erosion (in 1,000,000 tons)							
Conservation Reserve Program	514	596	644	654	672	692	692	692
Conservation Compliance Provisions	0	0	0	NA	236	458	465	527
Agricultural Conservation Program	40	34	33	34	30	29	9	18
Conservation Technical Assistance and Great Plains Conservation Program	463	353	353	282	298	321	325	284
Annual Acreage Reduction Program	107	62	55	60	39	46	29	40
	Reductions (in 1,000,000 pounds)							
Water Quality Program: Reduction in Nitrogen Application	NA	NA	NA	10.7	53.3	NA	NA	NA
Water Quality Program: Reduction in Phosphorus Application	NA	NA	NA	6.1	70.5	NA	NA	NA
	Reductions of Active Ingredients (in 1,000 pounds)							
Water Quality Program: Reduction in Pesticide Load	NA	NA	NA	239	528	NA	NA	NA
	Reductions (in 1,000 Tons)							
Colorado River Salinity Control Program: Reduction in Salt Load	62	75	92	105	127	163	191	212

Source: USDA, ERS: Agricultural Resources and Environmental Indicators, Ch. 6.1

7.4.9 State Initiatives

In addition to the federal programs described in this chapter, various types of subsidies have been used to promote land preservation on the state level. A 1994 USDA report found that, as of 1990, 25 states had cost-sharing programs, 6 offered tax credits, and 5 offered low-interest loans to encourage the preservation of land.[171]

In Lake Okeechobee, Florida, phosphorus contained in the waste of dairy cattle has posed a threat to water quality. The "Dairy Rule" that entered into effect in June 1987 required Florida dairy farmers to use specific techniques to prevent discharges from barn wash water. The Florida State Legislature provided the Florida Department of Agriculture and Consumer Services

(DACS) with cost-share funds to facilitate the implementation of this policy. Of the 49 dairy operations in the state that were affected by the Dairy Rule, 18 chose to participate in a buyout program under which they received $602 for every cow they permanently removed from the basin. The buyout program took 14,039 cows out of the basin.

A survey of wildlife management programs in the 20-state region of the Northeast found that 5 states had cost-sharing programs, 5 offered equipment loans, 4 offered property tax incentives, 1 offered state income tax benefits, and 8 had tie-ins with federal programs. In Indiana, the Wildlife Habitat Cost-Share Project pays up to 90% of the cost of establishing permanent wildlife habitat, windbreaks, brush piles, vegetation management, and wetland improvement. Property tax assessments are lowered for landowners who adopt measures that enhance or preserve existing wildlife habitat.[172]

Minnesota has a property tax exemption for undisturbed wetlands and ungrazed prairie.[173] The state also has a Pheasant Habitat Improvement Program under which landowners can receiving cost-sharing assistance of up to 75% of their costs as well as technical assistance in return for improvements such as food plots, nesting cover, and woody cover.[174] In Texas, the Galveston Bay Comprehensive Conservation and Management Plan approved by the EPA in April 1995 called for economic incentives, such as tax breaks, for private landowners. The tax incentives are intended to encourage owners to preserve wetlands.[175]

In November 1995, voters in Texas approved a constitutional amendment to allow open-space land that is used for wildlife management to be taxed in the same manner as open-space agricultural land. Consequently, taxes will be based on the land's productive capacity rather than its higher market value. The Sierra Club lauded the measure, which it said "will allow landowners to take lands out of traditional agricultural production without penalizing them for protecting their property for wildlife."[176]

7.4.10 Purchase of Development Rights Programs

A number of states (11 as of April 1996) and several counties and local governments have purchase of development rights (PDR) programs in place under which landowners are paid *not* to convert farmland to commercial or residential uses. (Such rights are also known as "conservation easements.") As shown in Table 7-10, such programs are especially common in the Northeast and have covered more than 400,000 acres at a cost of almost $730 million. In addition to objectives of food security and agricultural production, PDR programs have several environmental objectives, including the maintenance of habitat and resting places for wildlife and the aesthetic value of open space. Among the advantages of PDRs are their voluntary nature, which helps avoid the legal conflicts that can arise from zoning laws, and the low cost of this form of land protection for state and local governments as compared to outright land purchase.

The funding mechanisms for PDR programs vary from state to state and include general revenues, land transfer taxes, property taxes, and bonds. Criteria used to select the land parcels that are to be purchased include cost, threat of conversion, and location. Many programs prefer to purchase development rights on parcels that are near each other.

Table 7-10. Purchase of Development Rights Programs in States

STATE	YEAR STARTED	NO. OF FARMS IN PROGRAM	NO. OF ACRES AFFECTED	STATE FUNDS SPENT (in thousands of dollars)	STATE FUNDS AVAILABLE (in thousands of dollars)
California*	1980	72	47,992	$46,515	$23,100
Connecticut	1978	164	25,042	73,430	8,800
Colorado*	1986	6	1,904	3,254	2,800
Delaware	1995	31	8,561	12,000	0
Maine	1990	1	307	380	0
Maryland	1977	809	117,319	125,099	8,100
Massachusetts	1977	398	35,907	86,109	6,000
Michigan	1993	2	79	709	10,000
New Hampshire	1979	57	9,148	no data	0
New Jersey	1981	189	27,924	88,463	107,000
New York*	1976	154	6,941	46,000	4,950
North Carolina*	1987	21	1,255	1,785	0
Pennsylvania	1989	596	74,500	148,000	31,000
Rhode Island	1982	30	2,428	14,000	0
Vermont	1987	140	45,511	26,304	2,000
Washington*	1979	187	12,600	58,000	1,500
TOTAL			417,418	730,048	205,250

*Denotes county or other local programs

Source: American Farmland Trust.

7.5 Consumer Product Waste Management

Managing the waste from consumer products is one area in which traditional regulatory measures may be *less* likely than incentives to protect the environment. It is difficult, if not impossible, to monitor the behavior of millions of consumers. For example, bans on the disposal of used motor oil or containers in landfills are hard to enforce. Consumers are more likely to respond positively to factors such as more convenient collection service—which subsidies make possible—or refunds.

Various types of subsidies, including grants, loans, payments, and tax incentives, have been used extensively in consumer product waste management. Also included in the following discussion are preferential procurement and recycled content policies, both of which encourage recycling by stimulating demand for recycled products. Most of these measures have been implemented at state and local levels. Table 7-11 identifies the various state subsidies that help manage the disposal of one consumer product, used tires.

7.5.1 Advance Disposal Fees

As noted in Chapter 4, advance disposal fees (ADFs) on consumer products generate revenues that subsidize the otherwise unprofitable activity of disposing of specific products after they have been used. In Rhode Island, for example, fees on "hard-to-dispose material," such as motor oil, tires, antifreeze, and solvents, are used to fund centers that collect these products after their use as well as research and public education on the disposal and reuse of these products.

Table 7-11. State Subsidies for Used Tire Management

TYPE OF SUBSIDY	NUMBER OF STATES
Tax benefits	13
Payments based on the number of tires recycled	7
Public procurement	28
Grants and loans	34

Source: *Scrap Tire News*, January 1996, p. 18.

In Virginia, an ADF of $0.50 per tire that has been in effect since January 1990 generates revenues for the state's Waste Tire Trust Fund. The fund finances several efforts: cleanup of used tire disposal sites, activities in several regions that manage the current flow of used tires, and subsidies of $22.50 per ton for the conversion of waste tires to other end uses such as blasting mats, fuel and rubberized surfaces. By 2000, the program had processed about 27 million tires at a cost of $11.6 million.[177] Similar programs are in effect in several other states.

7.5.2 Deposit Handling Fees

In most states that have mandatory bottle deposits, distributors are required to pay handling fees to retail outlets and other used bottle collection centers. In California and Maine, for example, handling fees are 3 cents per bottle. Such handling fees have encouraged the collection of used bottles to such a degree that many redemption centers have been created voluntarily by the private sector to earn profits. Chapter 5 has further details on deposit-refund systems in California, Maine, and other parts of the United States.

7.5.3 Recycling Loans and Grants

At least 24 states have grant or loan programs that promote the recycling industry.[178] Under Washington State's Model Litter Control and Recycling Act, grants are awarded to individuals who develop recycling programs. Under a state Litter Control and Recycling Act, Rhode Island provides grants to communities and organizations for creating litter and recycling initiatives.[179]

As shown in Table 7-12, Wisconsin offers both loans and grants to promote recycling. The largest program provides grants to municipalities and counties to fund various recycling activities. Recycling rebates can be of two types. One, they can be general rebates that are offered for as long as five years in order to offset the increased cost of making or processing recyclable materials that are generated in the state. Two, they can be property rebates that cover 5%–25% of the cost of qualified property. In 1993–94, 17 qualified property rebates worth $1,136,805 and 10 general rebates worth $4,599,334 were awarded.

Under the Waste Tire Reimbursement Grant Program, Wisconsin businesses receive payments of $20 per ton for using waste tires in any of the following ways: in energy recovery, including the production of combustible byproducts; as road base in highway improvement projects; in recycling to make a new product; and in other uses that are approved by the state's Department of Natural Resources (DNR). Other uses must be approved in advance by DNR. Businesses receive payments that are based on documented tire use over the course of a given calendar year. Wisconsin's expenditures under this program for 1990–94 totaled approximately $5.5 million.[180]

A004235

Table 7-12. Financial Assistance Programs in Wisconsin that Promote Recycling (1994–95)

STATE PROGRAMS	REBATES (in thousands of dollars)
Municipal and County Recycling Grants	$29,200
Waste Reduction and Recycling Demonstration Grants	1,750
Recycling Loans	2,519
Minority Business Recycling Grants and Loans	400
Recycling Rebates	5,100
Recycling Market Development Board Assistance	2,892
Waste Tire Reimbursement Grants	750
Waste Tire Management or Recovery Grants	250
TOTAL	$42,861

Source: Bonderud and Shanovich, p. 11.

As shown in Table 7-13, at least 16 states had loan funds in 1995 for businesses that recycle used products. In Iowa, for example, loans have included $485,000 for a project that converts waste gypsum into new wallboard; $145,000 for efforts to convert used electrical wire into padding for use in the dairy cattle industry; and $245,000 for a project to make rubber mats from used tires.

Table 7-13. State Loan Funds for Recycling Enterprises

STATE	MAXIMUM LOAN AMOUNT (in $)	INTEREST RATE	FUND SIZE (in $)	FUNDING SOURCE
California	$1 million	5.8%	$25 million by 1996	Landfill tipping fees
Colorado	150,000 initially	Prime Rate	1-1.5 million per year	1 tire fee
Florida	Unknown	<Prime Rate	3.5 million	ADFs
Illinois	750,000	5%	1-3 million per year	Landfill tipping fees
Indiana	500,000	<Prime Rate	3-4 million per year	Landfill tipping fees
Iowa	2 million	0%	4 million per year	Landfill tipping fees
Kentucky	None for cities	3.4%	4 million	General revenues
Louisiana	600,000	Unknown	2 million	Tire fees
Maine	100,000	4%-8%	About 100,000 per year	Brown goods disposal fee
Michigan	500,000	0%	4 million	Landfill tipping fees
Minnesota	500,000	2% below Prime Rate	4 million	General revenues
Mississippi	200,000	2% below Prime Rate	Unknown	Unknown
New Jersey	500,000	3% below Prime Rate	21 million	Landfill tipping fees
New York	500,000	<Prime Rate	5 million	Petroleum overcharge funds
Pennsylvania	300,000	3%	5 million	Landfill tipping fees
Vermont	To be determined	To be determined	To be determined	To be determined
Wisconsin	750,000	4%	5.6 million	Business tax

Sources: Trombly. 1995, p. 38; Louisiana Department of Environmental Quality; California Environmental Protection Agency.

The California Integrated Waste Management Board offers loans to organizations located in the state's 40 Recycling Market Development Zones. Zones range in size from a portion of a city to areas encompassing several counties. Loans are repayable within 10 years with a 5.8% interest rate and can be used to cover as much as 50% of the cost of a project, up to $1 million. In the three years leading up to March 1996, 67 loans totaling $28 million were approved, of which 42 totaling over $16 million have closed. The California Environmental Protection Agency has stated that these 42 loans have diverted nearly 1.4 million tons of waste from landfills annually. Recent loans include $1 million to finance the production of custom packaging out of shipping boxes and $475,000 to finance equipment for producing fire logs out of paraffin-saturated cardboard from grocery stores and sawdust from a local sawmill.[181]

Louisiana's used tire subsidy program combines a loan program with rebate payments that are based on the number of tires recycled. Loans of up to $600,000 are available for efforts to process waste tires. Each loan is limited to 25% of the value of the processing facility. The loan is repayable to the state, with interest, at a rate of $0.15 per tire processed. The state also offers rebates of $0.85 per tire processed.

7.5.4 Tax Incentives

Twenty-eight states have offered tax incentives for businesses that recycle used products. Idaho, for example, enacted a tax credit in 1994 for the purchase of equipment needed to manufacture post-consumer paper.[182] "An Act Concerning Solid Waste Management" in Kansas allows "up to $100,000 of income tax deductions determined at a rate of 20% of purchase price of new equipment that uses recycled materials to produce products or energy and expands the taxpayer's ability to use recycled goods."[183]

7.5.5 Preferential Procurement of Recycled Products

One type of policy measure that could be considered a subsidy is the preferential procurement of recycled products. By stimulating demand for recycled products, such policies are intended to promote recycling. This section of the chapter considers only government procurement practices as opposed to private-sector procurement practices. Mandates governing the private-sector use of recycled materials are discussed in the next section, Section 7.5.6, Recycled Content Policies.

Preferential procurement can take one of at least two forms: one, price preferences and two, set-asides and goals. In this context, price preferences refer to the public sector's willingness to pay a higher price for recycled products. Set-asides and goals refer to the rules or targets established by the public sector regarding the total percentage of products they purchase that must contain recycled materials.

Paper is the product most commonly subject to procurement policies on recycled goods. A 1993 survey conducted by the Northeast Maryland Waste Disposal Authority found that all 50 states and the District of Columbia (DC) favored recycled products, compared to only 13 states in 1986.

In the 38 states (including DC) that had price preference policies, 15 states were willing to pay 5% more for products that had recycled content than for comparable products that did not contain recycled materials, and 20 states had preferences that were 10%. Oregon had a preference of 12%, and two other states had preferences between 5% and 10%. In 21 of these states, the preferences applied not only to paper but also to other recyclable products. Vermont used life-cycle costing in deciding what to purchase, buying recycled products "where the added cost of using waste materials rather than virgin materials is less than the cost avoided by not having (that waste) in the waste stream."

The same survey found that 30 states had set-asides or goals, mostly for paper. Iowa, Montana, and Nebraska had the most stringent set-asides. By January 1, 2000, 90% of the printing and writing paper purchased by Iowa's public sector had to have recycled content, and two years later all the tissue paper products it purchased had to have recycled content. Montana had a set-aside of 95% by 1996. Nebraska bought only recycled paper and was considering similar purchasing policies for plastic bags, motor oil, and carpets. North Carolina required the use of recycled paper for all state government reports, memoranda, and other documents, unless written authorization was obtained from the head of the agency.

The 1993 survey also identified 186 local governments that favored recycled products, with some cities adopting price preferences as high as 20% and some having set-asides. The City of Newark, New Jersey, required its agencies to use recycled products if available, regardless of price.

In Florida, for example, prison industries reprocess tires for sale to state, county, and local governments, and state grants to counties are used to purchase products made from waste tires. The Florida State Department of Transportation uses 10,000 tons of crumb rubber (made from two million waste tires) annually in rubber-modified asphalt for roads. As a result of these initiatives and other market development activities, the percentage of tires dumped in Florida landfills has decreased since 1989.

7.5.6 Recycled Content Policies

Recycled content policies as defined here refer only to requirements that private-sector organizations use a percentage of recycled products. Recycled content rules applied to government purchases, such as the aforementioned executive order on paper purchases, have been placed under the heading of public procurement policies. Consequently, they have been discussed in the previous section, Section 7.5.5, Preferential Procurement of Recycled Products.

Although there is a large element of traditional regulation in policies that require a minimum recycled content for certain products or containers, such policies also create incentive effects by stimulating demand for recycled products. If manufacturers are forced to use a certain amount of recycled product, they or their suppliers are more likely to offer consumers better access to recycling services.

At least 13 states have passed laws mandating the use of recycled content in newspapers, and 15 states have created voluntary agreements for the same. (The voluntary agreement in Massachusetts is described in Chapter 10.) A typical example is the 1990 Wisconsin Recycling Law, which requires newspapers to use recycled content in newsprint. The minimum content requirements increased from 10% in 1992 to 45% in 2000. Publishers failing to meet these requirements are subject to fees that are based on the extent of non-compliance. In this respect, the law could be considered to act as a product charge on non-recycled newsprint. However, the Wisconsin Department of Natural Resources sometimes exempts publishers from these fees if they can show that they could not obtain recycled newsprint at a reasonable cost.

In 1992 and 1993, more than 90% of the 78 newspaper publishers in Wisconsin exceeded the state's minimum content requirement of 10%. Only one failed to meet the requirement. In 1994, however, when the minimum content standard was increased to 25%, 14 of the publishers in the state failed to meet the standard. Five of them paid the fee and the others were exempted.

7.6 New Jersey's Information Awards Program

Under this program, which became effective in 1990, New Jersey citizens who report illegal dumping to environmental authorities receive 10% of any civil penalty or $250, whichever amount is larger. Information leading to criminal convictions is rewarded by 50% of the collected penalty. The identity of those seeking rewards is protected.

Four other New Jersey statutes also contain provisions for monetary awards that are given to individuals who report violations.

1. The Major Hazardous Waste Facilities Siting Act awards 50% of any criminal penalty collected for the illegal treatment, storage, or disposal of hazardous waste.
2. The Regional Low Level Radioactive Waste Disposal Facility Siting Commission awards 50% of any penalty collected for the illegal treatment, storage, or disposal of low-level radioactive waste.
3. The Comprehensive Regulated Medical Waste Management Act awards 10% of any civil or criminal penalty collected for violations or $250, whichever amount is larger.
4. The Ocean Dumping Enforcement Act awards 10% of any criminal penalty collected for violations.

This scheme differs from most subsidies and other incentive mechanisms featured in this report. These programs seek to affect the behavior of citizens and businesses by making monetary awards to those individuals or organizations that notify authorities of acts of noncompliance, thus allowing those who report violations to benefit from the successful efforts of law enforcement. As of May 1996, three penalties had been collected as a result of information provided by citizens. One payment of $50,000 and two payments of $250 were awarded in these three cases. (The payments equaled 10% of the penalties collected in each case.) Other rewards are pending.[184]

A similar source of monetary support for environmental organizations is the fees awarded to attorneys who have won citizen suits against environmental violators. As noted in Chapter 8, these fees appear to create stronger incentives for private parties to initiate lawsuits under California's Proposition 65 than the so-called "bounty hunter provision." Under the bounty hunter provision, the person who brought the lawsuit can receive 25% of any fines collected.

It is possible for citizens or organizations to obtain rewards for reporting potential environmental violations or initiating lawsuits under other state and federal laws. However, it is beyond the scope of this report to determine their extent or their effects on environmental behavior.

7.7 Alternative Fuels and Low-Emitting Vehicles

Various levels of government subsidize alternative fuels (AF) and alternative fuel vehicles (AFV) through measures such as tax incentives, rebates, and preferential procurement. The annual costs of federal programs alone have been estimated at more than $1 billion. Some of these subsidies result in environmental improvements, but, as noted in the following section, alternative fuels are also subsidized for other reasons.

7.7.1 Federal Subsidies

As shown in Table 7-14, the largest subsidy in the area of cleaner fuels is the exemption of ethanol blends from $0.054 of the $0.184-per-gallon gasoline tax. Since ethanol blends of 10% receive this deduction, the exemption for ethanol is the equivalent of $0.54 per gallon.

The category of "other direct subsidies" shown in Table 7-14 includes preferential taxation of compressed natural gas (CNG) and payments to subsidize purchases of AFVs and AFV infrastructure. The CNG tax deduction is equivalent to $0.128 per gallon. Although this subsidy is small compared to ethanol tax deductions, it is expected to increase in importance by the year 2000 as the number of CNG vehicles increases. The federal government also subsidizes the purchase of alternative fuel mass transit buses and school buses, state AFV planning, and the purchase of alternative fuel vehicles by small businesses.

Table 7-14. Alternative Fuel and Vehicle Subisdies

TYPE OF SUBSIDY	1994 (in millions of dollars)	2000 (PROJECTED) (in millions of 1994 dollars)
Research & Development	$348	$350
Ethanol credit	573	914
Other direct subsidies	53	76
Preferential procurement	6	614
Tax credits for AFVs and equipment	20	100
Reid vapor pressure waiver for ethanol blends	95	120
TOTAL	$1,095	2,174

Source: Anderson. 1994, pp. 18-21.

At present, tax credits for AFVs and refueling stations amount to roughly $20 million each year. However, they are predicted to rise to $100 million annually by the year 2000. The federal government also subsidizes a number of research and development activities.

The RVP (Reid vapor pressure) waiver entitles ethanol blends to an extra pound of vapor pressure beyond the limits imposed on conventional gasoline. (Adding ethanol to gasoline raises vapor pressure about 1 lb. in a 10% ethanol blend.) This waiver is worth approximately $0.09 per gallon of ethanol, based on the additional costs incurred by refiners to produce an ethanol blend stock with lower vapor pressure.

Table 7-14 also shows that another type of subsidy, preferential procurement, is expected to rise significantly in value by the year 2000. This trend is due to the fact that many procurement requirements are only now entering into effect, and they are scheduled to become more stringent over time. Table 7-15 shows these requirements, many of which will eventually be applied to privately owned fleets of vehicles.

The federal government also provides income tax deductions of $2,000 to $50,000 to businesses, organizations, and citizens who purchase clean-fuel vehicles. Electric vehicle purchases are eligible for income tax credits of 10%, or up to $4,000. The cost to the government in 1995 of the electric vehicle credits has been estimated at $65 million. [185]

Table 7-15. Federal Procurement Requirements for Alternative Fuel Vehicles by Model Year

(percent of all vehicle purchases, except as noted)

MODEL YEAR	FEDERAL AGENCIES	STATE AGENCIES	SUPPLIERS OF ALTERNATIVE FUELS	OWNERS OF PRIVATE FLEETS
1993	5,000 vehicles			
1994	7,500 vehicles			
1995	10,000 vehicles			
1996	25%	10%	30%	
1997	33%	15%	50%	
1998	50%	25%	70%	
1999	75%	50%	90%	
2000	75%	75%	90%	
2001	75%	75%	90%	
2002	75%	75%	90%	20%
2003	75%	75%	90%	40%
2004	75%	75%	90%	60%
2005	75%	75%	90%	70%
2006 and beyond	75%	75%	90%	70%

Source: Anderson. 1994, p. 10.

7.7.2 State Subsidies

In addition to the federal purchasing requirements for AFVs that are imposed on state governments—shown in Table 7-15—several states, including New York and Massachusetts, have their own vehicle purchasing requirements. Furthermore, most states offer tax benefits or grants for AF or the purchase of AFVs.[186]

In Connecticut, for example, vehicles powered by natural gas, propane, or electricity; vehicle conversion equipment; and equipment for AF refueling stations are exempt from the state's 6% sales and use taxes. In addition, businesses are entitled to 50% tax credits for the investments they make in vehicle conversions and refueling stations. Companies that derive at least 75% of their income from alternative energy sources are exempt from income tax, and natural gas sales are exempt from gross earnings taxes of 4%–5%.

The California Air Resources Board (CARB) requires that vehicle sales by the seven largest vehicle manufacturers in the state include at least 5% alternative fuel vehicles in 2001 and 10% in 2003. The direct incremental and infrastructure costs of this mandate have been projected at $19.5 billion through 2010. This figure accounts for almost 80% of the expected costs of all the state's activities to promote the purchase and use of alternative fuel.[187]

A number of cities use AFVs in their mass transit systems. In Los Angeles, for example, the Board of Directors of the Metropolitan Transit Area has adopted a policy that requires all buses purchased by the transit agency in the future to be AFVs.

Table 7-16 focuses on the Ozone Transport Region (OTR), which consists of 12 Mid-Atlantic and Northeastern states as well as the District of Columbia. The table shows that state subsidies for AF and AFVs are expected to rise significantly over the next 15 years.

Table 7-16. Alternative Fuel and Vehicle Subsidies in the Ozone Transport Region

TYPE OF SUBSIDY (excluding federal mandates)	1995 (in millions of dollars)	2000 (in millions of dollars)	2005 (in millions of dollars)
AFV procurement requirements	$0	$153.3-930.5	$719.0-5,875.5
State and local tax incentives	4.3-4.8	(44.8)-12.0	Unknown
Other state and local incentives	2.9-10.5	0.0-4.0	Unknown
TOTAL	$7.2-15.3	$108.5-946.5	$719.0-5,875.5

Source: Perkins. September 1995, p. 9.

Some of the subsidies actually involve net costs. State and local tax incentives could range from a net cost of $44.8 million in 2000 to a positive subsidy of $12.0 million. The incentive effect of some of the AF and AFV subsidies is likely to be significant. Preferential tax treatment has played a large role in the rise in ethanol production in recent years. A 1995 GAO report found that without the partial excise tax exemption for ethanol, its use would fall by 50%-90%.[188] The purchase of AFVs has also stimulated demand for methanol and CNG.

The environmental impact of such incentive effects is unclear. Some alternative fuels are cleaner than gasoline. Alternative fuels are promoted for several reasons: to improve the environment, to help increase U.S. energy security, and (in the case of ethanol) to provide a market for part of the country's large agricultural surpluses.

7.7.3 Car Buyback Schemes

In a number of states, programs have been implemented that offer cash payments to motorists if they turn in old, high-emitting automobiles. In the RECLAIM program described in Chapter 6, the South Coast Air Quality Management District (SCAQMD) allows emission reduction credits to be generated if citizens scrap old vehicles and lawnmowers, both of which are blamed for significant quantities of air pollution.

In 1990, Unocal Corporation in Los Angeles purchased and scrapped 8,376 vehicles that were manufactured before 1971 for $700 per vehicle. SCAQMD estimated the per-ton cost of the combined reductions in oxides of nitrogen (NO_x) and reactive organic gas (ROG) emissions at $4,900 through the scrapping of pre-1972 vehicles. This figure is much less than the $10,000 to $20,000 per-ton cost for traditional control methods. The SCAQMD concluded that its vehicle-scrapping program was relatively cost-effective.[189]

7.8 Renewable Energy and Conservation

Renewable energy and conservation are subsidized by tax benefits. Renewable electricity generation earns income tax credits of 1.5 cents per kWh, adjusted for inflation. For 1995, the credit was 1.6 cents per kWh. It applies to closed-loop biomass and wind energy sources. The estimated cost of these credits to the government was approximately $970 million in 1995.

Conservation subsidies paid by utilities are also partly or fully excluded from income tax. Since 1992, subsidies to residential consumers have been fully deductible, and 65% of subsidies to non-residential consumers have been deductible. The annual cost to the government of this exclusion has been estimated at approximately $100 million.

In cooperation with the U.S. Department of Energy, the U.S. Department of Housing and Urban Development created the Energy Efficient Mortgages (EEM) Program to help homebuyers and homeowners finance new homes or the cost of adding energy-efficiency features to an existing home as part of their Federal Housing Administration-insured home purchase.[190] EEM makes mortgage credit available to borrowers who otherwise would not qualify for conventional loans or for affordable loan terms and to residents of disadvantaged neighborhoods. In FY 1996, 3,500 loans were approved under this program. In FY 1997, 4,700 additional loans were approved.

7.9 Municipal Sewage Treatment Plant Construction

The federal government has subsidized the construction of municipal sewage treatment plants since the 1956 Water Pollution Control Act Amendments. The subsidies took the form of cost-sharing grants in which the federal government's contribution was limited to 55% in 1956, raised to 75% by the Federal Water Pollution Control Act of 1972, then decreased back to 55% by the 1981 Municipal Wastewater Treatment Construction Grant Amendments.

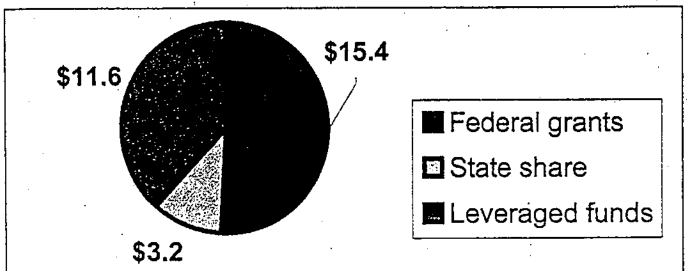
During the 1970s and 1980s, the Construction Grants Program provided more than $60 billion for the construction of public wastewater treatment projects: sewage treatment plants, pumping stations, and collection and intercept sewers; rehabilitation of sewer systems; and the control of combined sewer overflows.[191]

The 1987 Water Quality Act (commonly referred to as the "Clean Water Act") established 1990 as the last year for appropriating construction grant funds. With the phaseout of the Construction Grants Program and the initiation of the State Revolving Fund (SRF), Congress significantly reduced the amounts of funding available. They also provided for a transition from grants to loans.[192]

The grants undoubtedly encouraged construction activities that increased public access to sewage treatment. However, these grants have been criticized for giving municipalities "only weak incentives to hold the line on capital costs by seeking cost-effective design and technologies or by matching more carefully the designed capacity of the plant to projected need." This effect was compounded by state grants that covered part of the non-federal share, which effectively lowered communities' share of construction costs to 10%–25%.[193]

Under the Clean Water Act, grants were phased out by 1991 and replaced by federal contributions to state-managed revolving loan funds in what is known as the Clean Water State Revolving Fund (SRF) program.[194] SRFs in all 50 states and in Puerto Rico are capitalized by federal government grants. States are required to provide 20% matching funds for all federal grants, effectively making the state share 16.6% and the federal share 83.3%. By 1998, the SRF program was capitalized at approximately $30 billion.[195] (See Figure 7-1.) When loans are paid back, additional funds become available for new lending. FY 2000 appropriations for the SRF amount to $1.325 billion.

Figure 7-1. Cumulative SRF Investments
(in billions of dollars, 1988–1999)



Source: EPA. 1999a.

A004243

States are responsible for fund management. Interest rates vary from 0% to a market rate, the average being about 3%. Repayment periods are as long as 20 years, with reimbursement beginning one year after project start-up.

Data collected by the State of Ohio indicate that as of June 30, 1995, states collectively had lent \$14.6 billion, or 77%, of the \$18.9 billion available to them. The percentages of funds that were loaned varied significantly from state to state, with 8 states having loaned more than 90% of their funds; 11 states, less than 60%; and 3 states, less than 40%.

A GAO (1996c) study found that various obstacles had limited states' lending, including the lack of states' experience in managing revolving loan funds. In addition, the requirement that loans be repaid has discouraged applications from some small communities with a limited number of ratepayers to support project costs. In at least two states, the possibility of obtaining grants from other federal programs appears to have discouraged loan applications for SRF.

Eight federal agencies manage 17 different programs that may be used by rural areas for the construction, expansion, or repair of water and wastewater facilities. Some states report that larger communities with solid credit ratings may be able to borrow money at more favorable conditions from private-sector sources than from the SRF program.

Unlike the Construction Grant Program it replaced, the SRF program funds a number of initiatives other than municipal wastewater treatment, including projects that address stormwater; combined (sanitary and storm) sewer overflows; and agricultural runoff. Over 150 loans worth more than \$1 billion have financed investments to control combined sewer overflow. In addition, approximately 100 loans worth about \$100 million have financed measures to control agricultural and urban runoff.

Although it is beyond the scope of this report to provide an evaluation of the grant and SRF programs, the population served by modern sewage treatment has doubled over the past 30 years. EPA has stated that "the SRF is probably the most efficient program of its kind in the federal government."[196]

In addition to the SRF program, a number of other initiatives support the construction of sewage treatment works and related activities. A sampling of these initiatives follows.

- EPA's Public-Private Partnerships (P3) initiative tries to identify opportunities for municipalities to cooperate with the private sector to finance public wastewater treatment operations.
- The Hardship Grants Program for Rural Communities helps small, disadvantaged rural communities deal with their wastewater treatment needs. EPA provides funding for either the planning, design, and construction of wastewater treatment facilities or technical assistance on the operation and maintenance of such facilities. To qualify for this program, communities must meet the following criteria, among others:
    1. It must be located in a rural area.
    2. It must have a population of fewer than 3,000.
    3. It must have no centralized wastewater treatment facilities.
    4. It must have a per capita income that is 80% or less than the national average.
    5. It must have an unemployment rate that is at least 1% above the national average.

- Section 106 Water Pollution Control Program Grants help establish and implement ongoing water pollution control programs, including permitting, pollution control activities, surveillance, monitoring, enforcement, advice and assistance to local agencies, and the provision of training and public information. These grants provide federal assistance to states, territories, the District of Columbia, Native American Indian Tribes, and interstate agencies. Increasingly, Section 106 grants are focusing on basin-wide approaches to water quality management.
- Section 104(b)(3) Water Quality Cooperative Agreements are grants that promote the coordination of environmentally beneficial activities, including stormwater control, sludge management, and pretreatment. These grants provide federal assistance to state agencies that seek to control water pollution; interstate agencies; and other nonprofit institutions, organizations, and individuals.

7.10 Accelerated Review of New Pesticide Formulations

When a pesticide manufacturer makes application to EPA to register a new pesticide, that pesticide may move closer to the front of the queue if the new pesticide can be demonstrated to substantially reduce risk to human health and the environment relative to the pesticide that is currently available. EPA articulated this policy in the *1994 Annual Report of the Office of Pesticide Programs*.[197] OPP further clarified the policy on reduced risk in the staff paper that is part of the OPP public participation process. In that document, OPP described how registration actions are ranked in the queue.[198] Accelerated review for lower risk formulations is an important benefit to the manufacturer of the new product for two reasons. First, pesticide registration can take a number of years. Second, the patent protection clock generally is running during the period when the registration application is being evaluated by EPA. This open policy has incentives that are clear and recognized by all parties. It has been successful in communicating the benefits of generating new research on safer pesticides to pesticide registrants.

7.11 Subsidies That May Harm the Environment

Some subsidies are widely believed to have the unintended effect of encouraging environmentally harmful activities. In many cases, such subsidies were not designed as environmental policy instruments, but they have had adverse environmental consequences. This section briefly discusses a few examples of such subsidies.

7.11.1 Subsidies for Timber, Minerals, and Water Extraction

It has been widely asserted that timber, minerals, water, and public grazing land have been priced below their true social cost and, in many cases, even below their private cost. For all of these resources, user fees such as those described in Chapter 4 have been assessed. However, to the extent that these fees are lower than the private cost of the resources or services on which they are charged, such resources and services are actually being subsidized to the detriment of environmental protection.

As mentioned in Chapter 4, for example, livestock grazing fees on federal lands that are imposed according to a formula established by the 1978 Public Rangelands Improvement Act (PRIA) are widely believed to be below market value. Fees have been between \$1.35 and \$1.98 per animal unit month (AUM) since 1986. However, the Bureau of Land Management (BLM) and the

Forest Service estimated that fair market values in 1992 were $4.75 per AUM for sheep. Furthermore, they estimated that these market values varied across regions and ranged from $4.68 to $10.26 per AUM for cattle and horses. The costs of the grazing programs were $2.40 to $3.24 per AUM for the Forest Service and $2.18 to $3.21 per AUM for BLM.

The low end of the cost range applies only if the funding directly linked to the livestock grazing program is considered, while the high end considers all range management funding. Moreover, state and private fees are significantly higher than PRIA fees. Data from the National Agricultural Statistics Service indicate that, in 1993, private fees in 17 Western states averaged $9.80 and state government fees averaged $4.58. The PRIA fee that year was $1.86.

Table 7-17 shows that estimated irrigation water subsidies provided by the U.S. Bureau of Reclamation in selected areas ranged from 57% to 97% of the Bureau's full cost for water delivery. Excessive irrigation has been associated with a number of environmental problems, including water shortages and the contamination of water with natural pollutants and agricultural inputs.

Table 7-17. Water Subsidies of the U.S. Bureau of Reclamation

IRRIGATION DISTRICT	IRRIGABLE ACRES	SUBSIDY PER ACRE (in dollars)	SUBSIDY AS % OF FULL COST
Oroville-Tonasket	9,500	$417	82
Black Canyon #2	53,200	762	89
East Columbia Basin	134,500	1,619	97
Cachuma Project	38,700	1,378	81
Truckee-Carson	73,000	931	83
Glen	152,300	101	91
San Luis Unit	571,900	1,422	85
Coachella Valley	78,500	1,000	70
Wellton-Mohawk	65,800	1,787	89
Imperial Valley	519,500	149	74
Moon Lake	75,300	58	57
Grand Valley	23,300	1,623	85
Elephant Butte	102,100	363	64
Lugert-Altus	47,100	675	90
Malta	42,400	812	92
Lower Yellowstone #1	34,500	507	73
Farwell	50,100	1,446	93
Goshen	52,500	416	74

Source: U.S. Department of Interior, *Acreage Limitation*, Interim Report, Government Printing Office, Washington, DC, March 1980, pp. 38-41, as cited in Kanazawa (1994), p. 114.

Historically, the mining industries—which include the oil and gas industries—and timber industries have benefited from preferential taxation of their income. The effect of subsidizing mineral and timber production through the tax code is to favor virgin material use over secondary (recycled) materials. Two types of adverse environmental effects may result from such subsidies: (1) the destruction of natural areas as minerals and timber are harvested; and (2) the excessive disposal of materials that otherwise might be recycled.

Percentage depletion allowances for petroleum and other minerals, for example, allow companies to write off arbitrary percentage reductions in mineral deposits that result from their operations as expenses. The value of these allowances for the oil and gas industries was estimated at more than $2 billion annually from 1980 to 1982. Its value has since decreased to insignificant levels. One reason for the decrease is that only independent oil and gas companies (which account for about 30% of total U.S. oil and gas consumption) are now entitled to allowances. Moreover, only 25%–40% of these independent companies pay the standard tax (rather than the alternative minimum tax) required to maintain their eligibility for percent depletion allowance claims, Many of these companies are excluded from claiming percent depletion by other criteria under the tax code.

Percentage depletion allowances for other minerals were worth over $500 million annually for much of the early 1980s. These allowances, however, fell in value after the 1986 Tax Reform Act. Oil, gas, and other mineral extraction companies also have the advantage of being able to expense (rather than capitalize) exploration and development costs.

In the past, timber companies were allowed to consider certain income from timber as capital gains, which are subject to lower tax rates. This practice, worth about $800 million a year in the first half of the 1980s, was eliminated by the 1986 Tax Reform Act. However, the elimination of this practice led timber companies to increase their use of other previously underused tax advantages: (1) provisions that allowed timber management and reforestation costs to be expensed rather than capitalized; and (2) tax credits and accelerated amortization for reforestation activities. The federal government's construction of roads to facilitate the harvesting of timber is another form of subsidy for this industry.

7.11.2 Agriculture

The effect of the price support program for sugar on the Florida Everglades is frequently cited as an example of an environmentally harmful subsidy. The federal government subsidizes the sugar industry by guaranteeing a floor price of $0.18 per pound, which is almost twice the price on world markets. This U.S. policy is further supported by tariffs of $0.16 per pound on imported sugar that is in excess of quota levels. In 1992, this support program resulted in $161.5 million in benefits for sugarcane farmers and $107.7 million for processors.

The increases the amount of water diverted to sugarcane fields as well as the amount of runoff. The diversion and the runoff, which is contaminated with pesticides and fertilizers that sugarcane growers apply to maximize production, damage the ecosystem of the Everglades. Agricultural subsidies appear to be having similar adverse effects elsewhere in the United States. A Competitive Enterprise Institute study found that the use of pesticides and fertilizers in several Midwestern states was higher on subsidized fields than elsewhere. The study concluded that "the complete elimination of subsidies could result in a 35% reduction in chemical use per acre and a 29% reduction in fertilizer use per acre."

USDA's peanut subsidy program has also been accused of promoting environmental degradation. It requires farmers to grow peanuts on the same land so they can retain their production quotas. Thus, critics charge, the program results in the increased use of pesticides in order to counteract the negative effects of the lack of crop rotation.[199]

7.11.3 Mortgage Interest Tax Deduction

Although most interest deductions from personal income tax were eliminated by the 1986 Tax Reform Act, the deduction of mortgage interest remained in place. This deduction in effect subsidizes the construction and purchase of large homes. To the extent that larger homes use more building materials, take up more space, and require more energy, the deduction has a negative impact on the environment.

8. Liability Approaches

The purpose of liability mechanisms in environmental management is twofold: first, to give polluters an economic incentive to make more careful decisions; and second, to compensate the victims of pollution. The incentive effect is clear, since environmental values in effect become part of the overall cost of doing business. Avoiding harm to the environment is a good practice for companies when it reduces the overall cost of doing business.

Liability for harm to the environment acts as a financial incentive, much like a fee on emissions, with at least two important exceptions. One, liability for harm creates much greater uncertainty as to the magnitude of the payment that will be due for a given release of pollutants. Two, liability for harm can generate relatively large costs in terms of assessing environmental damage and the amounts due. These concerns aside, liability is an important incentive mechanism, one that is seeing increasing use in environmental policy.

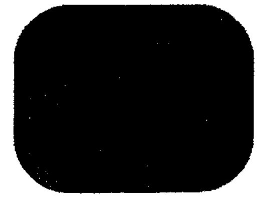
8.1 Introduction

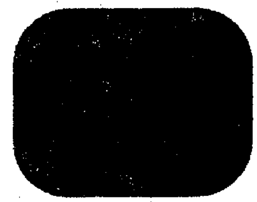
Two federal environmental statutes, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Oil Pollution Act of 1990 (OPA), provide liability for the cleanup of releases of hazardous substances and petroleum, respectively, that pose a threat to human health and the environment. The statutes also provide for compensation for the lost use of polluted natural resources and for the restoration of the environment.

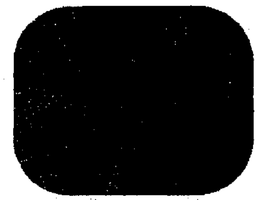
Several of the federal environmental statutes provide for civil and criminal liability for failure to comply with environmental regulations. The incentive effect of civil and criminal liability is to encourage individuals to comply with what are largely traditional forms of regulation. Such an incentive is qualitatively different from the subject matter contained in this report: incentives that put a price on pollution that harms health, the environment, or natural resources.

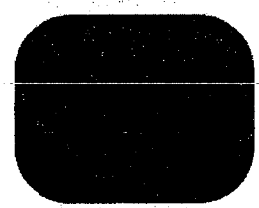
No study has attempted to address whether the existing combination of liability, penalties, and enforcement produce the correct incentive effect, which would encourage an optimal level of investment in pollution control. Excessive investment in pollution control is possible if entities seek to avoid penalties that are too harsh. It is also possible that firms will expend too little effort at pollution control if penalties are low and enforcement is lax. One recent study found that some types of chemical spills are more numerous in states that have imposed strict liability, an unexpected finding that calls into question many of the assumptions that policy makers have made regarding the effects of liability mechanisms as a tool of environmental management.[200]

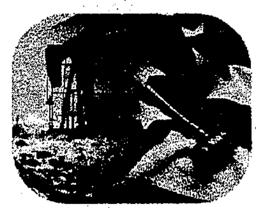
In addition to liability for cleanup, and civil and criminal liability for violating environmental laws, individuals may use tort law to seek compensation from polluters for harm to their property or person. The difficulty of proving harm caused by pollution, particularly chronic health effects, creates a severe barrier to such cases.

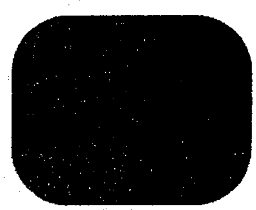

Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

A004249

Consequently, tort law has serious deficiencies as a mechanism to make polluters pay for the harms they cause. In fact, it was largely the failure of tort law to address many types of environmental harm that led to the passage of the principal environmental statutes.

8.2 Liability for Cleanup Costs

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 responded to an issue without precedent: the legacy of sites contaminated with hazardous wastes. Love Canal in New York was the most celebrated case, although others such as Times Beach, Missouri, also attracted national media attention. CERCLA established a trust fund (the Superfund) that was financed primarily by three mechanisms: (1) a tax on corporate income; (2) a tax on crude oil and certain chemicals; and (3) general appropriations. (The taxing authority expired in the 1990s, leaving the Superfund reliant on annual Congressional appropriations, cost recoveries, and interest on the existing fund.) EPA uses the fund to pay for cleanup and restoration activities at sites where no solvent responsible party can be identified or at sites where an immediate response is deemed necessary.

Section 107(a) of CERCLA provides for liability for anyone who caused, or threatened to cause, a release of a hazardous substance or for anyone who has threatened to cause a release that creates a need for cleanup actions. The courts have interpreted this section of the law as requiring strict, joint and several liability for parties that have been deemed responsible for disposing of—or generators that arranged for the disposal of—hazardous wastes that pose risks to human health and the environment. The term "joint and several liability" means that if the government can identify just one party out of many that contributed wastes to a site, then that one party can be held responsible, potentially, for all cleanup costs. In turn, any potentially responsible parties that have been identified by the government may seek to involve other potentially responsible parties. The term "strict liability" is a standard that holds parties responsible, regardless of the circumstances of their action, e.g., without regard to whether the party acted negligently.

The most important feature of CERCLA centers on the cleanup of hazardous waste sites that pose a threat to human health and the environment. CERCLA is unique among the principal environmental statutes in that it looks backward, seeking to remedy problems stemming from past actions, rather than forward by trying to prevent damage from current or future activities. Cleanup costs paid by the private sector under CERCLA could amount to several tens of billions of dollars. The incentive effects of being held responsible for cleanup must lie outside of the actual costs of cleanup, since the actions that precipitated the need for cleanup are historical, not contemporaneous. But the mere prospect of CERCLA cleanup liability is affecting current and future decisions regarding the disposal of hazardous waste.[201] Large firms are managing most of their hazardous wastes on-site so as not to commingle their wastes with others and face the possibility of strict, joint and several cleanup liabilities for wastes from other generators. At present, minimizing wastes and preventing pollution are definitely more attractive strategies for businesses than risking liability under CERCLA.

The Resource Conservation and Recovery Act (RCRA) creates cradle-to-grave responsibility for managing hazardous wastes. Generators, transporters, and disposal facilities face strict, joint and several liability for the ultimate disposition of hazardous waste into a federally permitted facility. Each shipment of hazardous waste must be accompanied by a manifest to facilitate enforcement. The system creates powerful incentives for each actor in the hazardous waste management chain to know the other parties and to be satisfied that they are acting responsibly. With this approach, Congress effectively multiplied the enforcement capabilities of EPA.

8.3 Liability for Damage to Natural Resources

Until 1990, damage to natural resources resulting from oil spills was within the scope of CERCLA. Where responsible parties can be identified, CERCLA provides for compensation to the public by the responsible party for the loss of services from natural resources. These so-called "interim lost uses" persist after a release of pollution until restoration is complete. Residual damages may exist if restoration is not complete.[202] CERCLA designates federal and state authorities as trustees for natural resources.

Trustees, in conjunction with the U.S. Justice Department, pursue damage assessments of natural resources. At the federal level, the U.S. Department of the Interior is the trustee for freshwater anadromous fish, migratory birds and waterfowl, and endangered species. The National Oceanic and Atmospheric Administration (NOAA) is trustee for the coastal and marine environment, including commercial and recreational fisheries, marine mammals, and anadromous fish in salt water.[203]

The Oil Pollution Act of 1990 (OPA), was enacted following the 1989 Exxon Valdez spill in Prince William Sound, Alaska. This Act created an independent statute separate from CERCLA for addressing damages resulting from oil spills. In Section 1006(e)(1), OPA directed NOAA, a part of the U.S. Department of Commerce, to promulgate regulations for assessing natural resource damages. On January 5, 1996, NOAA issued final regulations on natural resource damage assessment (NRDA) that was conducted under OPA. Later in 1996, the U.S. Department of the Interior issued regulations governing NRDA under CERCLA. These regulations were patterned closely after NOAA's approach.[204]

The OPA and NOAA regulations have two goals. First, they seek to restore the natural resources and services to their baseline condition. Second, they seek to compensate the victims of pollution for the interim lost use of natural resources and services through restoration, rehabilitation, or replacement, and through the acquisition of comparable resources, comparable services, or both. Damage assessments conducted by trustees in conformance with the NOAA regulations are accorded the status of a rebuttable presumption. This term, "rebuttable presumption," means that the parties responsible for the damage bear the burden of showing that damage claims presented by trustees are inappropriate.

The two components of a natural resource damage assessment ensure that the public is made whole following an oil spill: The resource and its services are restored, and the public is compensated for any lost use of the resource and resource services. OPA gives potentially responsible parties a financial incentive not to spill oil. Enforcement of the Act ensures that the responsible parties will pay the amounts necessary to restore the natural resource and compensate the public for lost use.

By 1996, under provisions of CERCLA, OPA, and the Clean Water Act, federal agencies had settled more than 100 natural resource damage cases. Awards for total damages reached well over $700 million. By that date, state agencies acting as trustees also had settled several cases on their own, with their awards totaling at least another $20 million.

In comparison, cleanup settlements by that date under CERCLA alone totaled at least $10 billion, approximately 10 times the magnitude of the natural resource damage settlements. If no settlement agreement can be reached with the responsible party, OPA authorizes the trustee to file a civil action for the damages in federal district court or to seek funds from the Oil Spill Liability Trust Fund administered by the Coast Guard.[205] The fund was financed by a fee of five cents per barrel on imported and domestic petroleum. Collection of the fee ceased at the end of 1994 as the trust fund had reached its funding limit. Because it is far easier to file a claim against the fund than to identify and pursue those responsible for "mystery" spills, this mechanism may reduce incentives for states to pursue those parties that are responsible for large numbers of small spills.

A number of large NRDA cases are still pending, at least three of which could amount to at least $500 million in awards. In addition, several important cases involving the federal government as a responsible party are outstanding. Table 8-1 summarizes the largest cases reported as settled (or partially settled) by 1996. The list excludes both the Exxon Valdez and the Shell Oil spill at Martinez, California. NOAA does not list the $620 million (present value) award in the Exxon Valdez case because it was settled before the NOAA Damage Assessment Center was established. The Martinez case is not listed because it was brought by the State of California, not by the U.S. government.

Table 8-1. Largest Natural Resource Damage Settlements Brought by the U.S. Government

CASE NAME	LOCATION OF DAMAGE	AMOUNT OF AWARD (in dollars)
Southern California	Palos Verdes Shelf, CA	$54,200,000
City of Seattle	Elliott Bay, WA	24,250,000
AVX	New Bedford, MA	21,127,000
Southern Pacific	Cantara Loop Derailment, CA	14,000,000
Simpson/Port of Tacoma	Commencement Bay, WA	13,035,000
Exxon Bayway	Arthur Kill, NY	11,113,000
Blackbird Mine	Salmon, ID	7,200,000
Apex Houston	San Francisco, CA	5,416,000
Tenyo Maru	Olympic Peninsula, WA	5,160,000
Eagle Pitcher Industries	Tri-State Site: MO, KS, OK	4,734,000
Nautilus	Kill Van Kull, NY/NJ	3,300,000
Sharon Steel Corp.	Midvale Tailing Site, UT	2,600,000
Schlumberger	Crab Orchard Wildlife Refuge, IL	2,500,000
New York Trap Rock Co.	Portland Cement Site, UT	2,207,510
Presidente Rivera	Delaware River, PA	2,141,000
Greenhill	Timbalier Bay, LA	1,878,000
Elepis	Florida Keys National Marine Sanctuary, FL	1,660,000
Charles George Trucking Co.	Charles George Reclamation Trust Landfill, IL	1,378,350

Sources: Guerrero. 1995; NOAA. 1996.

It is clear that liability for natural resources is having an effect on corporate behavior. Shortly after the Exxon Valdez incident and about the same time as the passage of OPA, the petroleum industry announced the creation of the $600 million, industry-funded Marine Spill Response Corporation, an organization that would develop response capabilities specifically for large spills. Another sign of change is the care taken when tankers transit congested waterways and load or offload petroleum. In the Arthur Kill and Kill Van Kull waterways of New York and New Jersey, tug escorts now accompany tankers, and offloading tankers are surrounded by booms.

One largely unresolved issue concerns oil spills and releases that are too small to justify a natural resource damage assessment under either CERCLA or OPA. For example, the Coast Guard has record of between 5,000 and 10,000 oil spills occurring per year, but fewer than 20 are followed by an assessment of natural resource damage. While the expected damage from many of the smaller spills may not justify the costs of a traditional damage assessment, some natural resource damage may nonetheless exist. Not charging for natural resource damage gives incorrect price signals to potential polluters, since pollution is free rather than costing the responsible source an amount equal to the damage that is caused.

The petroleum industry has argued that the magnitude of the fines assessed in all assessments, including those for small spills, should closely match the actual damage to the environment. The reason they take this position probably has more to do with their attempts to avoid damage assessments that are calculated according to a formula than with their quarrel over the incentive effect of such a formula. The correct economic incentive for a given spill is provided to potential polluters if the calculated value of the assessment equals the average harm done by such a spill.

Alaska, Washington, Florida, and Texas have enacted compensation formulas or tables that assess charges based on the volume spilled, the nature of the receiving waters, and other factors. In 1995, NOAA proposed a similar approach for small spills. NOAA later withdrew the initiative for further study when it was pointed out that the proposed method resulted in unrealistically large assessments in some cases.

8.4 Civil and Criminal Liability

Congress first decreed pollution of the environment to be a federal crime in the Refuse Act of 1899. This Act made it a misdemeanor to "throw, discharge, or deposit" refuse of any kind other than runoff from streets and discharge from sewers into navigable waters of the United States. Violators convicted of violating the Act could be punished by fines not less than $500 and not more than $2,500, or by imprisonment for not less than 30 days nor more than one year. The court had the discretion to reward persons who provided information leading to the conviction of responsible parties with one-half of the fine.

More recently, the 1970 Amendments to the Clean Air Act punished violations of the Act as a misdemeanor. The 1970 Amendments to the Federal Water Pollution Control Act established misdemeanor penalties for "negligent or willful" release of pollutants into navigable waters without a permit or in violation of a permit. The Resource Conservation and Recovery Act of 1976, as amended by the Solid Waste Disposal Act Amendments of 1980, provides felony penalties for treatment, storage, or disposal of hazardous waste without a permit.

Continuing through the 1980s, Congress further refined the scope of environmental crimes, as well as the maximum fines and terms of imprisonment, in the Hazardous and Solid Waste Amendments of 1984, the Superfund Amendments and Reauthorization Act of 1986, and the Water Quality Act of 1990. In the Clean Air Act Amendments of 1990, Congress included felony provisions in the Act for the first time.

By 1995, the Justice Department had indictments against 443 corporations and 1,068 individuals, and it had recovered $297 million in criminal penalties. Sentences for individuals totaled 561 person-years of prison for those convicted.

State and local prosecutors also can pursue environmental crimes. In fact, they are required to demonstrate such a capacity in order to obtain EPA authorization to locally administer programs of the Clean Air Act, the Clean Water Act, and the Resource Conservation and Recovery Act. While most states are not actively pursuing environmental crimes, there are a number of important exceptions. New Jersey, Ohio, Pennsylvania, and California are active in their prosecution of environmental crimes. Los Angeles maintains its own team of investigators and prosecutes these cases.

An important sanction in addition to fines and prison sentences is the mandatory "blacklisting" of contractors under the Clean Air Act and the Clean Water Act. Both statutes prohibit the federal government from entering into new contracts with, or issuing grants to, any organization convicted of environmental crimes under these laws. Federal agencies and all states also have the authority to temporarily disqualify contractors from new work, pending receipt of further information, when a contractor violates a permit and is suspected of harming the environment. Consequently, environmental violations can adversely affect a firm or individual even if no criminal conviction is imposed.

The remainder of this section describes the principal civil and criminal penalties available under the nation's environmental laws.

8.4.1 Resource Conservation and Recovery Act (RCRA)

The purpose of RCRA is to establish a legal framework for a national system that oversees the management of hazardous waste. Congress included within the RCRA statute several enforcement authorities and penalty provisions. EPA relies on four types of compliance orders as its primary enforcement tools.

1. EPA may issue an order requiring compliance within a set time frame (usually 30 days) to facilities in violation of a regulatory requirement of Subtitle C. Such EPA orders include penalties for any noncompliance period.
2. EPA may require monitoring, testing, analysis, and reporting for facilities that present a substantial threat to human health or the environment.
3. EPA may issue corrective action orders requiring corrective action of other measures to interim status facilities (those without full RCRA permits) to protect human health and the environment.
4. EPA may sue any person who contributes or contributed to solid waste management practices that pose an imminent and substantial threat to human health or the environment.

Beyond forcing compliance with RCRA and making owners of facilities take actions to protect public health and the environment, compliance orders may also assess a civil penalty for past and current violations. Civil penalties can be as large as $25,000 per day for each RCRA violation. Criminal penalties of up to $50,000 per day of violation or imprisonment for as long as 5 years may be meted out to any responsible person who knowingly

- transports hazardous waste to a facility not permitted under RCRA;

- treats, stores, or disposes of hazardous waste without a permit;
- makes a false statement or representation in an application, label, manifest, record, or other document used for compliance with RCRA;
- generates, treats, or disposes of hazardous waste and intentionally destroys records or other documents required for compliance with RCRA;
- transports hazardous waste without a manifest; or
- exports hazardous waste without the consent of, or in violation of, procedures of the receiving county.

8.4.2 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Any person in charge of a vessel or a facility who knows of a release of hazardous substances from a vessel (other than a federally permitted release) must notify the National Response Center. Anyone who fails to provide notification "immediately," or who knowingly supplies false or misleading information, may be imprisoned for not more than 3 years (5 years in the case of a subsequent conviction) and fined in accordance with Title 18 of the Act. In addition, the Emergency Planning and Community Right-to-Know Act (EPCRA) requires that the person notify state and local emergency response officials.

8.4.3 Clean Water Act (CWA)

EPA can begin civil actions against violators of CWA permits and seek appropriate relief, which includes the use of permanent or temporary injunctions. EPA can seek criminal penalties including fines, imprisonment, or both, as shown in Table 8-2. After a person's first conviction, the fines and prison terms for subsequent convictions can be doubled.

Table 8-2. Criminal Penalties for Violations of the Clean Water Act

SEVERITY OF VIOLATION	FINE	IMPRISONMENT
Parties who negligently violate permit conditions and limitations	Not less than $2,500 per day of violation nor more than $25,000 per day of violation	Not more than 1 year
Parties who knowingly violate permit conditions and limitations	Not less than $5,000 per day of violation nor more than $50,000 per day of violation	Not more than 3 years
Parties who violate permit conditions and limitations and knowingly place another person in danger of death or serious bodily injury	Not more than $250,000	Not more than 15 years
Organizations that violate permit conditions and limitations and knowingly endanger human health	Not more than $1,000,000	Not applicable

Source: Clean Water Act

The CWA also provides for civil penalties for offenses other than permit violations, offenses that include making false statements on records, reports, and other documents filed under the CWA and wrongfully introducing pollutants into public sewage treatment facilities.

8.4.4 Clean Air Act (CAA)

The Administrator of EPA can seek a permanent or temporary injunction and civil penalties of not more than $25,000 per day for permit violations by major stationary sources (in general, those emitting more than 100 tons per year of a regulated pollutant). Criminal penalties that include both fines and imprisonment for up to 2 years may be sought for any person who knowingly violates permit terms and conditions through such actions as making material false statements or omitting material information. Convicted second-time violators can have their fines and sentences doubled.

Parties who *negligently* place another human in imminent danger of death or serious bodily injury are liable, upon conviction, for fines and prison sentences of up to 1 year. Parties who *knowingly* endanger human health may, upon conviction, receive fines, prison sentences of up to 15 years, or both. Finally, organizations can be liable for fines of up to $1,000,000 for knowingly committing permit violations and similarly endangering human health.

8.5 Tort Liability

Litigation concerning claims of personal injury from chronic exposures to toxic agents in the environment is a relatively recent phenomenon. It is, for the most part, the domain of asbestos workers. Workplace-related injury claims are not within the scope of this paper. However, a few cases involve alleged exposure to toxic substances in ambient air and water supplies.

The law under which these tort actions are brought has undergone considerable evolution in recent years. These modifications are due to several factors, which include the following: (1) the need to accommodate improved scientific information on the effects of human exposure to toxic agents; (2) the recognition of the potentially long latency periods between exposure and onset of a disease; and (3) a growing desire by the courts to hold defendants to a standard of strict liability. Despite the evolution of tort law in favor of plaintiffs, relatively few cases that claim harm from pollution in the environment have been filed. Of these cases, very few that involve the effects of pollution on human health have been decided in favor of plaintiffs.

The statute of limitations is an important barrier to litigation in a few states. However, most states have struck down this once-important obstacle by allowing plaintiffs to file a case from 1 to 3 years *after* the discovery of an injury, rather than starting the clock at the date of initial exposure.

In many situations of environmental harm, plaintiffs find it difficult to identify the party responsible for the harm. Identifying the source of contamination in well water would be a challenge for most households. Even if the contamination could be traced to a waste disposal facility, it might be very hard to identify whose wastes caused the contamination. For toxic pollutants in the air, identifying the parties responsible for such releases is even more difficult.

Demonstrating causation represents a major challenge because most diseases that have been linked to toxic substance exposure can be caused by multiple factors. In general, tort law requires plaintiffs to demonstrate that the harm they experienced was "more likely than not" caused by the defendant. Courts usually interpret this phrase to mean that the probability that the defendant caused the harm was at least 50%. Imagine a situation in which a polluter increased the risk of cancer by 20% in a nearby residential area. Rather than 100 people dying of cancer each year, 120 die. None of the 120 cases would receive compensation under the "more likely than not" criterion. Two other issues should be noted: (1) that statistical data regarding causation are not likely to be accepted by courts, no matter what the standard of proof; and (2) that epidemiology is limited in its ability to detect elevated incidence of a disease, the smallest detectable rate of excess incidence being on the order of 30%.

In sum, the legal norms under which tort actions for harms caused by exposure to pollution are such that few cases can satisfy the burdens of identifying the responsible party and proving causation.

This page intentionally left blank

9. Information Disclosure

For the purposes of this chapter, information approaches to environmental protection may be defined as policy instruments that influence the behavior of firms and individuals through the dissemination of information on inputs, production processes, and the environmental consequences of final products. Some information approaches rely purely on voluntary reporting, while others have mandatory reporting.

The environmental information embodied in these approaches has economic value to consumers, individuals, scientists, academics, and state and local government officials even in the absence of any changes in emissions by firms. For example, information on the use of hazardous materials may reduce the uncertainty faced by local officials in planning for emergency preparedness. Regulators can use the information to monitor the progress of voluntary efforts to control pollution. Consumers may gain utility from assurances that products are manufactured in ways approved by the federal government. Individuals can make more informed decisions about where to live and work. And scientists and academics gain new sources of data that can be used in research on health, business management, and the environment.

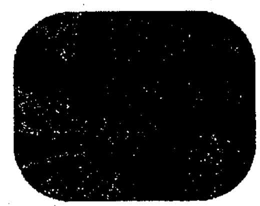
Information disclosure rules may have ancillary economic effects that stem from the incentives they create for change in producer or consumer behavior. For example, information disclosure approaches are an increasingly popular method of encouraging companies to voluntarily prevent pollution. In contrast to end-of-pipe traditional approaches or technological mandates, pollution prevention can be achieved through a much wider array of actions: changes in input use, technologies, processes, management, and other parameters. Because the full range of these parameters and possibilities cannot be well-known to regulatory agencies, governments try to stimulate firms to engage in pollution prevention by mobilizing workers, financial markets, and the community through the provision of information.

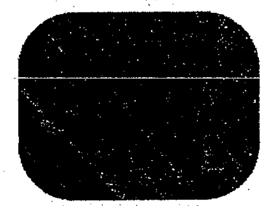
When a rule is promulgated, ancillary changes are hard to specify. The economic analyses of information rules often ignore these changes and consider the benefits and costs of environmental information as a good itself, one with independent production and consumption considerations. This chapter complements the partial equilibrium analysis of information embodied in many economic analyses by considering the incentives created by disclosure and the subsequent use of that information.

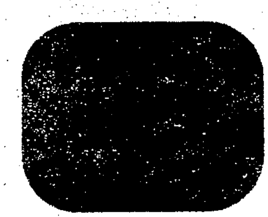
This chapter reviews many of the United States' unique experiences with information disclosure methods. Available evidence, some of it conjectural in nature, suggests that at least two factors are important in evaluating the incentive structure of information disclosure rules. First, the information should be accurate and credible. Perhaps the best information would be based on measured data and standardized criteria and provided or verified by an independent source, but few programs meet these ideals. Second, the information must be made available to the right people, at the right time, and in a format accessible to participants in an economic transaction. Unfortunately, not all information policies take note of these considerations.


Pollution Charges, Fees, Taxes

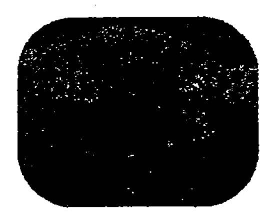

Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

9.1 Background

The earliest attempts at pollution control used approaches such as emissions standards, mandated reductions in emissions, or requirements that sources adopt particular control measures or technologies. After the most obvious and easily remedied pollution problems had been addressed, it became evident that the traditional regulatory approaches to pollution control would be excessively costly, incapable of achieving all environmental objectives, or both.

A second approach to pollution control responded to these limitations of traditional regulatory approaches by harnessing the forces of the market. These mechanisms included tradable permits, emission fees, deposit-refund systems, subsidies, and performance bonds. In most cases, they have complemented traditional regulatory remedies, but in some instances they are developed as stand-alone measures.

Although market-based approaches have helped improve the cost effectiveness of environmental regulation, the problems of pollution regulation have not been fully solved. Environmental regulators are burdened by the vast number of harmful substances that need to be controlled if environmental goals are to be achieved. Furthermore, they find that market-based mechanisms have limits in terms of the sheer numbers of substances that can be controlled and the modes of behavior that can be encouraged.

In response to these difficulties, pollution control policy evolved to provide information as a mechanism for making employees, shareholders, and customers of businesses active participants in the regulatory process. Information disclosure strategies are timely for at least three reasons. First, environmental regulators need more regulatory tools (as noted in the previous paragraph). Second, the means by which information is collected, processed, and disseminated are rapidly falling in cost. Third, with rising incomes and better education, the demand for environmental information by workers, shareholders, and consumers is increasing.

In the product market, consumers may react to environmental labels by buying "environmentally-friendly" products, even when they cost more. Some export markets for products may be effectively closed to firms until they achieve ISO (International Organization for Standardization) certification. Purchasers of intermediate products increasingly are concerned about a host of issues regarding their manufacture, such the raw materials used (e.g., virgin timber, recycled materials) and the environmental performance of the supplier. In the labor market, firms with better environmental records may be viewed as more attractive places to work, making it possible for them to hire more talented or productive employees. In the capital market, shareholders and lending institutions increasingly are concerned about the prospect of future environmental liability for pollution harms caused by a firm. Hence, firms with better environmental records may be rewarded with better access to, and a lower cost of, capital.

Information approaches have been used in environmental protection on both the state and federal levels. This chapter begins with a discussion of the National Environmental Policy Act, the first disclosure-type program.. Following is a review of the Federal Emergency Planning and Community Right-to-Know Act (EPCRA) and two similar state programs. The chapter then discusses California's Proposition 65 and reporting requirements for the release of air toxics, reporting requirements for environmental impact assessments, product labeling, environmental performance awards, the Securities and Exchange Commission's (SEC) environmental reporting requirements, and disclosure requirements for radon and lead paint. Other voluntary programs in which industry is encouraged to reduce pollution below permitted amounts are described in Chapter 10.

9.2 National Environmental Policy Act (NEPA)

The 1969 National Environmental Policy Act of 1969 (NEPA) is the basic environmental law of the United States.[206] The Act requires that environmental impact statements (EIS) be prepared for federal activities that significantly affect the environment. An EIS provides for a full, fair, public discussion of environmental impacts and an examination of reasonable alternatives that will minimize adverse impacts. Implementing regulations issued by the Council on Environmental Quality (CEQ) establish procedures to ensure that high-quality environmental information is available to public officials and citizens before decisions are made and actions are taken.[207] In numerous instances, the mere fact that potential adverse environmental impacts were anticipated and would have to be disclosed motivated project designers to alter their plans to reduce impacts.

9.3 Emergency Planning and Community Right-to-Know Act (EPCRA)

Enacted in 1986 as Title III of the Superfund Amendments and Reauthorization Act, the Emergency Planning and Community Right-To-Know Act (EPCRA) requires emergency planning and disclosure of information on the releases and transfers of hazardous chemicals to disposal facilities. Section 313 of EPCRA requires certain businesses to report each year on the amounts of toxic chemicals that their facilities release into the environment and transfer to treatment, storage, and disposal facilities. As a result of the 1990 Pollution Prevention Act, reporting requirements were expanded beginning in 1991 to include source reduction and recycling information. Data for a given year must be submitted by July 1 of the following year. EPA then compiles the information and makes it available to the public as the Toxics Release Inventory (TRI).

Through 1998, TRI reporting was required of all manufacturing facilities that met the three following criteria: (1)they had at least 10 employees;(2) they operated in Standard Industrial Classification (SIC) codes 20 through 39; and (3) they manufactured, processed, or otherwise used one or more of the chemicals listed in the TRI in quantities that exceeded certain threshold amounts. Threshold amounts are 25,000 pounds per year for manufacturing and processing, and 10,000 pounds per year for other uses of any listed chemical during the calendar year. In 1998, seven additional industries were added. (See text box entitled "Industrial Sectors Subject to TRI Reporting in 1998.") Federal facilities were required to submit their first TRI reports by July 1, 1995, for the 1994 calendar year. Data for 1998 were available in May 2000.[208]

Individuals and organizations can petition EPA to add or remove chemicals from the list. The number of listed chemicals was originally set at 320, but it has since increased. (A few chemicals have also been deleted from the list.) A significant expansion took place in 1994. That year, EPA added 286 new chemicals and chemical categories to the list, bringing the number to 654. These additions were in effect for the 1995 calendar year. In October 1999, EPA lowered the reporting thresholds for many persistent bioaccumulative toxic chemicals, and added several other such chemicals to the list.

Facilities that have a total annual reportable amount[209] of 500 pounds or less of a TRI chemical and that manufacture, process, or use 1 million pounds or less of a TRI chemical can now submit a shorter, annual certification statement in lieu of the longer Form R. These streamlined requirements became effective for the 1995 calendar year. The rule attempts to strike a reasonable balance between maintaining the community's right-to-know about toxic chemical releases and the economic costs to EPA and industry of collecting the information. EPA estimated that simplifying the reporting process for some facilities would result in annual cost savings of about $18.4 million for industry and $700,000 for federal, state, and local governments.[210]

EPA makes TRI information available to industry, environmental groups, and the general public, so they can know about the toxic releases and other waste management activities of facilities. This information is available via several media, including printed reports, CD-ROM, and the Internet. The emergency-planning component of EPCRA calls for the creation of state and local emergency response bodies that will develop emergency response plans.

This part of EPCRA also requires facilities to perform the following three tasks.

1. Facilities must inform these emergency-response bodies that certain hazardous substances are located on their premises.
2. They must give immediate notice of accidental releases to emergency response bodies.
3. They must develop response plans that can be implemented in the event of the accidental releases of hazardous substances.

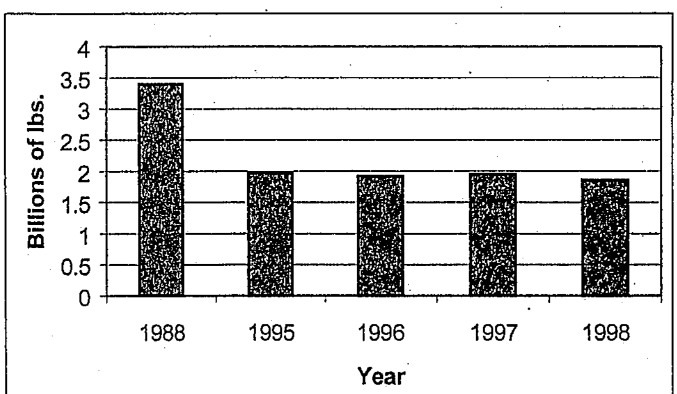
Information provided by facilities is available to the public.

Governments use TRI data to establish baselines, measure progress, set priorities, and identify targets of special concern. The general public uses TRI information to identify potential problems in their local environment and to take part in national and local debates concerning regulations that could affect their health and welfare. Corporations and investors use TRI data to gauge the performance of a corporation and individual facilities relative to their peers.

9.3.1 Trends in Toxics Release Inventory (TRI) Data

As shown in Figure 9-1, reported TRI releases have decreased 45.3% in the 10 years since 1988. Although the data suggest significant reductions in toxic releases, there are several reasons why these reported decreases may not be equal to *actual* decreases in releases. EPA points out that TRI increases and decreases can be "real changes" or "paper changes." The latter result from errors, changes in facilities' estimation or calculation techniques, changes in reporting guidance and facilities' interpretation of that guidance, and facilities' use of exemptions. In general, companies determine their TRI release amounts through an estimation process rather than through monitoring. EPA guidance has not been issued for all aspects of TRI reporting, and companies can sometimes lower reported releases by using different estimation techniques.

Figure 9-1. Reported TRI Releases



Source: www.epa.gov/tri/tri98

A004262

EPA indicates that estimation errors are more likely to occur for releases such as fugitive air emissions and complex wastewater effluent, releases for which little monitoring data are available. However, EPA audits have found companies' estimation techniques to be reasonably accurate. For example, EPA's review of TRI data quality for 1996 surveyed 60 industrial facilities: 27 in the primary metal industry, 14 in the electrical equipment industry, and 19 in the transportation equipment industry. The survey found that facilities were able to calculate thresholds for reporting correctly 95% of the time. For chemicals that exceeded the threshold, these facilities correctly identified the threshold 88% of the time. Reports by facilities concerning their releases agreed closely with an auditor's assessment in the transportation equipment industry. However, these reports differed significantly in the primary metals and electrical equipment industries. The differences were attributed to confusion over the definitions of the terms "recycling" and "reuse."[211]

Another potential problem is that most chemicals have not been subject to TRI requirements. A 1994 GAO study stated that over 70,000 chemicals are used commercially in the United States, of which only 320 had been included in the TRI. "Consequently," the study added, "the companies may maintain or even increase their usage of toxic chemicals while concurrently reducing the chemicals that are reported to EPA."[212] The original list focused on the most important toxics, and, as noted in a previous paragraph, EPA included another 286 chemicals in TRI requirements effective 1995. However, some highly toxic chemicals still have not been added to the list because they are generated in amounts that are too small to meet criteria for inclusion.

At present, facilities with fewer than 10 full-time equivalents employees in listed SIC codes are excluded from TRI reporting. Furthermore, all sources of releases outside that code range are also excluded. It is not known what percentage of releases is currently exempt from reporting.

Releases are not weighted according to the type of disposal method, the magnitude of potential population exposure to these toxic substances or the potential effects of these releases on human health and the environment. Moreover, the TRI data do not include information on the quantity of toxic chemicals in products leaving the facility. Such products themselves can eventually be released into the environment.

Although a reduction in releases is, for the most part, desirable, another important question is how the reduction is achieved. Methods include controlled disposal, recycling, conversion to energy, and source reduction. The 1990 Pollution Prevention Act set source reduction as the preferred method of reducing releases, but transfer data show no clear trend toward using this method. Since recycling and conversion to energy were not reported as transfers until 1991 (as required under the 1990 Pollution Prevention Act), 1988 total transfers are difficult to compare with total transfers in the subsequent period.

The assessment of achievements in source reduction is complicated by the lack of TRI data on the quantities of waste decreased by source reduction measures. Only the practices used to reduce waste— not their results—are included in the TRI. Changes in waste generation that are reported in the TRI could be due to factors other than source reduction, including estimation errors or changes in the production levels of specific products.

The trend of decreases in releases and transfers is more pronounced under the voluntary 33/50 program. (This program is discussed further in Chapter 10.) Total releases and transfers under this voluntary program have decreased every year from 1988 to 1994, with a total reduction of 51% during that period.

9.3.2 Incentive Effect of the Toxics Release Inventory

The incentive effect of the TRI program on polluters cannot be assessed solely on the basis of reported decreases in releases. A number of factors, including traditional regulations and other economic incentive mechanisms discussed in this report, have affected releases. Pollution prevention is also influenced by a number of factors unrelated to the TRI program.

Nonetheless, the TRI program is widely believed to have a significant impact on polluters.[213] EPA has called it "one of the most powerful tools in this country for environmental protection" and "one of the most successful policy instruments ever created for improving environmental performance."[214] Vice President Gore called the annual TRI publication "the single most effective common-sense tool" to promote environmental protection.[215]

Shortly after the first TRI data were released in 1989, citizens groups placed a full-page advertisement in the *New York Times* that listed "the corporate top ten" land, water, and air polluters. Several of these polluters subsequently promised EPA that they would improve their environmental performance, effectively beginning the 33/50 voluntary releases reduction program. [216] Monsanto, for example, promised 90% reductions of 1987 air emission releases by 1992. AT&T said it would halt all TRI air emissions by 2000. Dow announced it planned to reduce overall emissions by 50% by 1995, and Dupont promised to cut air emissions by 60% by 1993 and cancer-causing components by 90% by the year 2000. In Minnesota, public outcry over revelations that an electronic circuits manufacturer was emitting methylene chloride led the facility to promise 90% reductions in emissions by 1993. After 1987 TRI data found an IBM facility in California to be the state's largest emitter of chlorofluorocarbons (CFCs), a public interest group organized a campaign. IBM subsequently promised to end the use of CFCs at the plant by 1993.[217] TRI data also appear to influence investors. Some of the investor interest may be attributed not so much to socially responsible investing but rather to the belief that companies with relatively high emissions might face mounting environmental costs in the future.

Hamilton (1995) found that the 1988 TRI performance of companies (as reported in June 1989) was of interest to journalists and investors. The higher a firm's TRI pollution figures, the study found, the more likely journalists were to write about the firm's toxic releases, especially those firms that were less associated with pollution. Companies that reported TRI releases under-performed the stock market for five days after the data were released. The more chemicals for which a company submitted data, the greater was the extent of under-performance by the company. The under-performance was less significant, however, for companies previously associated with pollution.

The Investor Responsibility Research Center has analyzed TRI data to provide clients with environmental profiles of companies. The Clean Yield Investment Portfolio Management Group compares companies' TRI data with industry-wide averages of releases per unit of sales. *Fortune* magazine has used TRI data in its "green index" of American manufacturers, assigning scores of 0 to 10 in 20 performance categories, including toxic emissions per unit of sales.

The regulated community uses TRI data as well. Wolf (1986) examined the effects of the program on regulatory agencies, legislatures, public interest groups, and affected firms. He found that major corporations issue environmental progress reports to counter the publicity generated by their TRI reports. Often the progress reports specify baselines and milestones, so others can evaluate their progress. Pine (1997) suggested that TRI data are helping companies develop waste reduction strategies. Konar and Cohen (1997) studied the response of firms to large drops in their stock prices following the release of TRI data. The authors concluded that firms experiencing large, adverse impacts on the price of their stock reduced their TRI emissions more in subsequent reporting periods than the average firm in their industry. This action suggests that TRI reports *do* affect corporate behavior. EPA's economic analysis of the proposed rule to modify reporting requirements on persistent bioaccumulative toxic chemicals contains additional information on the beneficial effects of the TRI program.[218]

Although EPCRA's emergency-planning element has received less attention as an incentive mechanism than the TRI, EPCRA also could have a significant effect on polluters' behavior. Firms might reduce the amounts of hazardous substances on their premises if they are forced to disclose these amounts to local emergency response bodies and (indirectly) to the public. They might also manage hazardous substances more safely if they are required to plan for, and give immediate notice of, accidental releases.

9.4 State Chemical Reporting Programs

At least two states have toxic release reporting programs similar to the federal TRI program, but they have different reporting requirements. The requirements may cover additional chemicals, industries, or reporting elements; use of toxic substances and pollution prevention plans. The General Accounting Office (GAO) (Q: add to acronyms list) (1997b) conducted a survey of efforts to pass similar laws in other states, finding that initiatives had failed in California, Colorado, Florida, Hawaii, Maryland, and Michigan.

Programs in Massachusetts and New Jersey, for example, differ from their federal counterpart in that they require companies to use materials balance accounting to plan pollution prevention actions, to report their goals and progress on pollution prevention, and to examine whether material inputs to production are accounted for fully by the total of all outputs and pollution releases.

One advantage of requirements such as those in Massachusetts and New Jersey is that they offer more information on toxics use and wastes that could be of interest to companies, regulators, and the general public than do the TRI requirements. One disadvantage of these requirements appears to be the potential administrative burden they impose on polluters and regulators. If the state attempts to lessen its program costs by taxing the polluters, it adds to the polluters' burden. EPA has studied these programs in the context of its Phase III expansion, so the Agency can better understand how the federal EPCRA might be improved.

9.4.1 Massachusetts Toxics Use Reduction Act (TURA)

Enacted in 1989, the Massachusetts TURA requires the users of large quantities of toxic materials, including those in several SIC codes not covered by the federal EPCRA, to (1) submit an annual Toxic Use Report to the State Department of Environmental Protection, and (2) develop plans for using toxic chemicals and reducing waste. Facilities that are subject to these two requirements must report annually on their inputs and outputs of materials and on their waste generation and management methods.

Additional data must be reported every two years on actual and projected changes in chemical use and wastes compared to both planned and base-year amounts. Summaries of the chemical use and waste reduction plans also must be submitted biennially, but the detailed plans remain at the facilities to ensure confidentiality. These plans must be endorsed by state-certified Toxics Use Reduction Planners.

TURA also created two agencies to provide technical assistance to users of toxic substances and to conduct training and research on TURA and on techniques that reduce the use of toxic substances. The operations of these agencies and other program costs are covered by toxics use fees that are based on the number of employees at a facility and the number of chemicals it uses. These fees are limited to $31,450 per facility annually. They are not closely linked to the quantities or toxicities of the chemicals used. These fees generate roughly $5 million a year in revenues.

TURA FORMULA

For every production unit, facilities must also report on their use of chemicals and on use reduction techniques (within SIC range codes to protect confidential business information). Facilities must also indicate a Byproduct Reduction Index (BRI) and an Emission Reduction Index (ERI). ("Byproduct" can be considered "waste" in this context, although a byproduct may be reusable.) These two indices are determined in the following manner:

BRI = (A–B) x 100 and ERI = (C–D) x 100, where

A = Byproduct quantity in base year divided by the number of units of product produced in base year.
B = Byproduct quantity in reporting year divided by the number of units of product produced in reporting year.
C = Emissions quantity in base year divided by the number of units of product produced in base year.
D = Emissions quantity in reporting year divided by the number of units of product produced in reporting year.

Source : http://www.turi.org/turadata/WhatIsTURA/

TURA also contains provisions for citizen involvement. Citizens may assist in monitoring the use of toxic substances, and they can access the TURA information on toxics use that is reported to Massachusetts' Department of Environmental Protection. The Department is required to act on petitions to inspect a facility's plans and data if the petitions are filed by 10 or more residents living within 10 miles of the facility.

The information collected through TURA has also proven helpful to the subject facilities. By making facilities aware of the quantities of toxics used during production, released to the environment, and transformed into products, the reporting requirements allow them to identify improvements in their efficiency and cost-cutting opportunities relative to chemical use.

TURA set a waste reduction goal of 50% over 10 years, using 1987 as a baseline. Reporting began in 1991 for 1990 data. Between 1990 and 1997, toxics material use fell by 201 million pounds, toxic byproducts fell by 43.8 million pounds, and the on-site release of toxic materials fell by 16.2 million pounds. In 1999, the TURA program received an award for "Innovations in American Government."[219]

9.4.2 New Jersey Reporting Requirements

New Jersey's Worker and Community Right-to-Know Act was enacted in 1984, before the federal EPCRA. Since 1987, the state has collected data on inputs and outputs of materials and on the amounts of waste reduced through source reduction activities.[220]

The 1991 New Jersey Pollution Prevention Act required facilities to undertake pollution prevention planning. Like the Massachusetts law discussed in previous paragraphs, New Jersey set a goal of 50% reduction in waste output by 1997, with 1987 as a baseline. Plan Summaries must be submitted to the state's Department of Environmental Protection every 5 years.

Like Massachusetts, New Jersey requires the use of performance indices. Instead of focusing on waste generation and emissions, however, New Jersey has indices for waste generation and use of toxics. New Jersey requires that facilities making TRI reports provide additional information beyond the federal requirements. The additional information includes the quantities of each chemical brought on-site, produced on-site, used in the manufacturing process, and sent off-site in products or as waste. Such data, along with the federally required data on releases and transfers allows regulators to construct a materials balance for each chemical.

The New Jersey Department of Environmental Protection has conducted surveys showing that its reporting requirements have been beneficial to companies because the data helps them assess their options to minimize waste. Department officials also claim that the data allow companies to better manage their activities, including the implementation of the facility-wide permitting scheme described in Chapter 6.

9.5 Drinking Water Consumer Confidence Report

In an August 19, 1998, notice in the *Federal Register,* EPA required the suppliers of drinking water to provide households with information on the quality of their drinking water, beginning in 1999.[221] The reports must contain the following information:

- the lake, river, aquifer, or other source of the water;
- a brief summary of the susceptibility of the local drinking water source to contamination;
- how citizens can obtain a copy of the complete water system assessment from the supplier;
- the level (or range of levels) of any contaminants as well as EPA's health-based standards for the contaminants;
- the likely source of any contaminants;
- the potential health effects of any contaminants;
- the water system's compliance with other drinking water-related rules;
- an educational statement for vulnerable populations about how to avoid *Cryptosporidium;*
- educational information on nitrate, arsenic, or lead in areas where they are detected in quantities e that are more than 50% higher than EPA's standard; and
- the telephone numbers for additional sources of information.

EPA encourages water supply systems to post water-quality information online, and the Agency maintains links to this information on the Internet.[222]

9.6 EPA Reporting of Environmental Information

Several recent initiatives by EPA focus on two activities: (1) the aggregation or processing of environmental data that are submitted under existing programs; and (2) the reporting of this data in a form that is designed to be more useful to consumers, homeowners, and firms. This section describes three such initiatives.

9.6.1 Automobile Pollution Rankings

In 2000, the EPA launched a web site that uses emission certification data submitted by manufacturers to rank automobiles and light-duty trucks on the basis of their tailpipe emissions of hydrocarbons and NO_x.[223] Rather than report actual emission certification data, the site ranks emissions on a scale from 1 (worst) to 10 (best). The information can be used by consumers to make more informed choices. It also may indirectly pressure manufacturers to improve the emissions performance of their vehicles.

9.6.2 Envirofacts

EPA's Envirofacts database provides users with a single point of access to select EPA environmental data sets, as well as a mapping function that finds the geographic location for data of interest.[224] Envirofacts allows the user to retrieve environmental information on air emissions from sources and information on

- individual chemicals,
- facilities,
- hazardous waste generators and transporters,
- risk management plans for facilities,
- EPA's Superfund sites,
- toxic releases,
- water discharge permits,
- suppliers of drinking water, and
- microbes and disinfectants in drinking water.

9.6.3 Sector Facility Indexing (SFI)

Sector facility indexing is a pilot effort by EPA to integrate environmental data in each of five industrial sectors: petroleum refining, iron and steel, primary non-ferrous metals, pulp and paper, and automobile manufacture.[225] SFI combines data from TRI and EPA's national enforcement databases and provides information on releases, the number of inspections, compliance history, and enforcement actions. Users can review data on releases from, and the compliance history of, individual facilities and then compare these data with other facilities in the same industry. EPA recently announced that the program would be expanded to include certain federal facilities.[226]

9.7 Proposition 65

California's Safe Drinking Water and Toxic Enforcement Act, commonly referred to as "Proposition 65," was adopted by voter referendum in 1986. It requires polluters to issue warnings if they expose people to significant levels of carcinogens or reproductive toxicants that are included in a list maintained by the Office of Health Hazard Assessment.[227] As of August 2000, the list contained 461 carcinogens, 241 reproductive toxicants, 35 female reproductive toxicants, and 46 male reproductive toxicants.[228]

If a substance is listed as a carcinogen, businesses may not discharge it into drinking water unless the quantities discharged pose "no significant risk." State regulation sets the levels of "significant risk" for most of the most toxic and high volume chemicals on the list, but they can be superseded by more stringent exposure levels that are mandated by other environmental laws. The defendant bears the burden of proof that the exposure is below the level of significant risk. Drinking water utilities, government agencies, and organizations employing fewer than 10 people are exempt from the rule.

Citizens have the right to initiate lawsuits under Proposition 65 if authorities do not respond to their requests to pursue potential violators. Under the "bounty hunter provision," the person who brought the suit can receive 25% of any fines collected. Fines can be as high as $2,500 a day. Data obtained from the State Attorney General's office indicate that several environmental groups—including the Environmental Defense Fund and As You Sow—and individuals have been compensated for initiating lawsuits under Proposition 65.[229]

In some cases, businesses in California have avoided issuing clear warnings. They have been sued for providing warnings deemed too vague or inconspicuous. For example, the food, drug, and cosmetics industries established a toll-free product information number in lieu of placing hazard labels on their products. In another case, warnings for air emissions of ethylene oxide were published as advertisements in the classified section of a local newspaper. In both of these cases, the warnings were found by the courts to be insufficient.[230]

Process modifications, chemical substitution, and the use of pollution control devices have all been attributed to Proposition 65. Some products have been reformulated to avoid negative labeling. For example, solvents were removed from correction fluids and lead from foil and other products. The lead content of tableware was also reduced. However, products such as tobacco and alcohol have to bear warning labels. Businesses appear much more likely to take measures to avoid issuing warnings for products that consumers in general believe are safe, such as tableware, and for products that have unlabeled substitutes than they are for products that consumers know can be dangerous, such as spray paint.

At least one study found that consumers were indifferent to some warnings because they had become so prevalent. "Overuse of labeling may therefore result in a reduction of effectiveness."[231] Another study suggested that firms might collude to label in excess, thereby minimizing the impact of these warning labels.[232]

Proposition 65 gives polluters incentives not only to identify ways of reducing or eliminating toxic discharges but also to study the effects of toxics to determine safe exposure levels. Anecdotal evidence suggests that businesses devoted significant resources to assessing the risks of exposure to toxics after this law had been passed.[233] Business groups had asserted that compliance with the law would be very costly. However, they failed to provide evidence that significant costs actually were incurred when they were given the opportunity to do so by the State of California during a retrospective analysis of the law.

9.8 Hot Spots Act

Adopted in 1987, California's Air Toxics Hot Spots Information and Assessment Act (AB 2588) requires stationary sources to report releases of certain substances into the air. According to the California Air Resources Board (CARB), the goals of the Hot Spots Act are "to collect emission data, to identify facilities having localized impacts, to ascertain health risks, and to notify nearby residents of significant risks."[234] The Act uses at least two potential incentive mechanisms to reduce toxic air emissions: public notification requirements and unit-based fees. The latter mechanism, which is also intended to cover all of the administrative costs associated with the Act, is discussed in Chapter 4. The former mechanism, public notification requirements, is discussed here.

Facilities are required to submit an air toxics emission inventory plan and a subsequent inventory to their respective air pollution control district. Certain high-priority facilities must also submit a health risk assessment. If air quality managers in the district determine that a facility's emissions pose a potentially significant health risk, the facility operator must notify all persons who have been exposed.

The Hot Spots Act originally relied on the information requirement and fees to discourage risky toxic emissions. In 1992, however, it was amended to require facilities to reduce emissions below the significant risk level within 5 years or a period not to exceed 10 years, as determined by the district. This amendment introduced a considerable element of traditional regulatory policy to what previously had been an incentive-based instrument. However, emissions data and health risk assessments remain accessible to the public, and they could give polluters incentives to reduce their emissions more substantially and quickly than they would if this data were not in the public domain.

According to CARB, the Hot Spots inventory requirements have increased facilities' awareness of their toxic emissions, leading to reductions in emissions. Surveys have revealed voluntary reductions of over 1.9 million pounds per year of air toxics from 21 facilities. Potentially reduced costs, concern for worker health, improved community relations, and anticipation of future regulations are some of the motives for these reductions.

9.9 Labeling Schemes

Labeling products according to their effects on the environment is another type of information approach to environmental management. Consumers can use the information provided by such labels in making purchasing decisions. If consumers, investors, and others prefer companies and products they believe are environmentally friendly, businesses have an incentive to improve their environmental performance to receive a favorable label or to avoid a negative one.

Table 9-1 shows the classification scheme for environmental labeling programs that were proposed by a 1994 EPA study.[235] Programs can be either voluntary or mandatory. Moreover, the information provided by labeling may be characterized in general as negative, positive, or neutral.

Table 9-1. Classification of Environmental Labeling Schemes

PROGRAM TYPE	POSITIVE	NEUTRAL	NEGATIVE	VOLUNTARY	MANDATORY
Seal of Approval	X			X	
Single attribute	X			X	
Report card		X		X	
Information disclosure		X			X
Hazard warnings			X		X

Source: EPA (1994a), p. 9.

Seals of approval are given to products that have been deemed less harmful to the environment, and single attribute programs certify that a product has a certain positive environmental attribute. Report cards and information disclosure schemes inform customers of the various impacts of products on the environment. Hazard labels warn customers of the harmful effects of a particular product.

Experience with labeling schemes indicates that they are more likely to influence behavior if they are accompanied by promotional activities that target retailers and consumers. In many cases, the label itself is only one element of a larger effort to promote the use of environmentally friendly products. As a result, it is often difficult to isolate the incentive effect of a label from that of related promotional activities.[236]

Although the United States does not have a national, government-initiated environmental labeling program like many other industrialized countries, it does have a few labeling programs that have been created by the public- and private-sectors. The Consumer Labeling Initiative (CLI), a pilot program of the U.S. EPA, began in March 1996. Its goal is to foster pollution prevention, inform consumer choice, and encourage the safe use of household and consumer products.[237] In the pilot phases, the CLI is exploring issues such as how consumers react to different types of labels and the best ways to present information. This program could evolve into a national labeling program.

9.9.1 OSHA Warning Labels

The Occupational Safety and Health Administration (OSHA) promulgated hazard communication standards (29 CFR 1910.1200) in 1983 to assure that the hazards of chemicals in the workplace are evaluated and that hazard data subsequently are transmitted to employees and employers.[238] These standards require Material Safety Data Sheets (MSDS), container labeling, and employee training, as appropriate. Under a Presidential Directive, the Hazard Communication Workgroup began an evaluation of the program in 1995 and presented its report in September 1996.[239] The workgroup report determined that the standard was good and should not be reopened for comment. The workgroup also noted that MSDS tended to be overly lengthy and could be simplified to better communicate necessary information to workers and employers.

9.9.2 FTC Guidelines for Environmental Marketing Claims

The Federal Trade Commission's (FTC) Guidelines for Environmental Marketing Claims or "Green Guides" were issued in 1992 and, at the time of this writing, were under review for possible revisions. These guidelines do not constitute a labeling system as such, but they are designed to have an effect on labeling. They are intended to prevent false or misleading use of advertising claims such as "environmentally friendly," "degradable," and "recyclable."

Confusion over the meaning of such terms has affected not only consumers but also companie who were concerned about lawsuits over their environmental claims.

The guidelines outline four general principles for environmental claims: (1) qualifications and disclosures should be sufficiently clear and conspicuous to prevent deception; (2) claims should make clear whether they apply to the product, packaging, or just a component of either the product or packaging; (3) claims should not overstate environmental benefits; and (4) comparative claims should be presented in such a way that the basis for comparison is clear. The guidelines also address claims about environmental friendliness, degradability, compostability, recyclability, recycled content, source reduction, refillability, and ozone friendliness.[240]

9.9.3 Green Seal and Other Seals of Approval

Founded in 1989, Green Seal is the nonprofit organization that awards the Green Seal of Approval to products that it finds less harmful to the environment.[241] The organization develops a set of standards for each product category it studies. Categories are chosen according to the significance of their associated environmental impact and their range of products. Products within a category are then studied to determine their impacts on the environment in their various stages of production, use, and disposal. After public review and comment, Green Seal adopts a standard.

Standard criteria vary across categories but may include the reduction of toxic chemical pollution, improved energy efficiency, the protection of water resources, the minimization of impacts on fish and wildlife and their habitats, the efficient use of natural resources, the protection of the ozone layer, and the prevention of global warming. Products are not subjected to a complete life-cycle analysis. Instead, products are judged according to those aspects of the life cycle that have the most significant environmental impact. Standards are reviewed at least once every 3 years.

Manufacturers pay product evaluation fees to apply for the Green Seal mark, and accepted products are also subject to annual monitoring fees. The fees vary according to the product category and size and the number of manufacturing facilities. The Green Seal mark for approved products appears with an explanation of the basis for certification.

The organization has published environmental standards or criteria for about 35 types of products. Its list of certified products contains central air conditioning systems (1 brand); architectural coatings (2 brands); cleaning products (1 brand); compact fluorescent lamps (5 brands); recycled paper (5 brands); recycled newsprint (1 brand); re-refined engine oil (3 brands); reusable utility bags (3 models); showerheads (four models); toilets (2 brands); watering hoses (several models); one manufacturer's line of windows and doors; and one brand each of unbleached coffee filters, baking cups, and parchment. Readers interested in the specifications for these and other products may visit the Green Seal web page: www.greenseal.org/stanlist.htm.

Besides labeling, Green Seal helps market environmentally friendly products in several ways. A list of certified products is included in a catalog with product information and the addresses and the telephone numbers of product vendors. Documents entitled *Choose Green Reports* are available on topics such as "Environmentally Preferable Printing" and energy-efficient lighting, computers, and other office equipment. Organizations that agree to purchase environmentally friendly products, reduce waste, and increase recycling are eligible for the Green Seal Environmental Partners mark. This mark can be placed on reports, letterhead, and store signs.

In a Green Seal survey, 4 out of 5 consumers said that they would be more likely to purchase a Green Seal-certified product than other products of equal quality and price.[242] However, the incentive effects of Green Seal's activities do not appear to have been studied in any detail.

Some retailers have adopted labeling schemes for products they find environmentally friendly. In 1989, for example, Wal-Mart created a program under which shelves were labeled to indicate that certain products were environmentally friendly. Wal-Mart ended this program in 1992. Store officials had difficulty in determining the criteria for environmental friendliness and in assessing manufacturers' environmental claims.

Wal-Mart's experience illustrates one of the main problems encountered by environmental seal-of-approval schemes: the lack of agreed-upon criteria for assessing environmental friendliness. While seals of approval may be relatively easy for consumers to understand, they risk not only lacking agreed-upon standards but also oversimplifying complex environmental issues. Menell (1995) cites a number of cases in which the assessments of environmental friendliness that are necessary for labeling are difficult. For example, a study of the environmental impacts of disposable cups found that wax-coated paperboard was preferable to polystyrene in terms of reduced volumes of solid waste generation, but inferior in the areas of energy consumption, air emissions, water pollution, and weight of solid waste generation. Disposable diapers generate more solid waste than cloth diapers, but they also use less water and result in less water pollution. Another study cited by Menell found that the environmental impacts of washing machines depend less on the model of the machine than on how it is used.

9.9.4 Single-Attribute Labels

The problems of lack of criteria and oversimplification are likely to be less serious for labeling programs that are based on a single product attribute. EPA's office equipment label, Energy Star, is reserved for computers, printers, photocopiers, and typewriters that are relatively energy-efficient. This label is part of a voluntary initiative designed to promote the purchase and use of energy-efficient office equipment. (This program is described in Chapter 10.)

The Flipper Seal of Approval was created in 1992 and licensed by Earthtrust, a non-profit organization based in Hawaii. It is awarded to companies that harvest tuna in a manner that minimizes the number of dolphins killed. The seal has been awarded to tuna companies in the United States and abroad.

From 1986 to 1991, the Bonneville Power Administration, which supplies electric power in Oregon and Washington, managed a Blue Ribbon Award Campaign that promoted the use of energy-efficient refrigerators and freezers. Under this program, refrigerators and freezers in the top 15% of their size and function category were awarded blue magnetic ribbons.[243] A retailer's survey conducted early in the program estimated that about 22% of its customers had been "influenced" in their purchasing decisions by the presence or absence of these ribbons.[244]

Scientific Certification Systems (SCS), a for-profit business, has two single-attribute seal-of-approval programs. The first program, the SCS Forest Conservation Program, uses a 100-point index to evaluate the management of forest tracts by timber operations. A separate score is given for each of the following categories: the sustainability of timber resources, forest ecosystem maintenance, and the socio-economic benefits to the surrounding community. Scores over 60 are required in each category before timber companies can be awarded the "Well-Managed Forest" label. Operations scoring in the top 10% are further labeled as "State-of-the-Art."[245] In the second program, SCS can use chain-of-custody certification to verify that wood products sold to consumers come from well-managed forests. About 10 forestry operations in South, Central, and North America have been scored by SCS.

SCS has also certified more than 500 environmental claims by manufacturers concerning recycled content, recycling rates, energy efficiency, water efficiency, biodegradability, and the lack of smog-producing ingredients. Some claims concern materials, whereas others concern final products and packages. Certified products are allowed to bear an authorized certification emblem.

According to SCS, anecdotal evidence indicates that its labels are valued by businesses and individuals, with consumers willing to pay a premium for products identified as environmentally friendly. Glidden Company, for example, found that a label designating its paints as free of volatile organic compounds (VOCs) is valued by institutional customers such as hospitals.

9.9.5 Report Cards and Information Disclosure

SCS also issues environmental "report cards" that rate products according to various criteria. (The company refers to these report cards as "eco-profiles.") These profiles are based on a cradle-to-grave assessment of the environmental burdens associated with the raw material extraction, manufacture, transportation, use, and disposal of a product. These environmental burdens include resource depletion, energy use, air and water emissions, and solid wastes. Bar graphs for each of approximately 20 types of environmental impacts are included on the label. Eco-profiles have been done for Holiday Fair (handbags, accessories, and travel ware); North American Plastics (plastic bags); Plasti-kote (paints); Wellman, Inc. (polyester fiber); and Zeta Consumer Products (plastic bags). Some companies request eco-profiles for internal use rather than for marketing purposes.

The advantage of such an eco-profile is that it provides more information than simple seals of approval. Among the disadvantages are that the information on the card can be difficult to obtain and understand and that the report card may be misinterpreted by consumers as a product endorsement. Since the SCS report cards are voluntary and appear only on a limited number of products, they have led many consumers to believe that the card itself implies the environmental superiority of a product.[246]

9.9.6 Energy Efficiency Labeling

Two energy-efficiency disclosure programs are managed by the federal government. The first such program is EPA's Fuel Economy Information Program. It requires new cars to have labels in their windows that list their mileage-per-gallon for city and highway driving, the estimated annual fuel cost associated with their operation, and the fuel economy of comparable models. This program was voluntary at its inception in 1974 but was made mandatory by the Energy Policy and Conservation Act (EPCA) as of March 1976. Car dealers were also required to have the *Gas Mileage Guide* of car fuel efficiency available to customers.

A 1976 study found that more than one-half of new car buyers had seen the fuel economy label and that those aware of the label bought cars with higher fuel efficiency than other car buyers did. The program was credited with reducing fuel consumption for 1976 model cars by 893 million gallons. However, the influence of the labeling program decreased as a result of reductions in gasoline prices after the mid-1970s. Moreover, 64% of buyers did not believe the mileage estimates. Consumers believed that fuel efficiency was not assessed in realistic driving conditions and that mileage was therefore overstated. A 1981 DOE survey found that this skepticism was the main reason why more consumers did not rely on the fuel economy label. In 1985, EPA changed the procedure by which fuel efficiency was assessed to make it more realistic.[247]

The second energy efficiency disclosure program managed by the federal government is that for Energy Guide labels on household appliances. In 1975, EPCA required that these Energy Guide labels be placed on refrigerators, freezers, water heaters, washing machines, dishwashers, furnaces, air conditioners, and heat pumps. The content of the labels varies, depending on the type of appliance. At that time, however, all the labels included information on the manufacturer, appliance model number, and capacity as well as an energy-efficiency rating (EER) or estimated annual operating cost, the EER or annual operating cost of the most and least efficient comparable appliances, and a table showing the annual estimated costs of various patterns of usage for different energy prices. The 1992 Energy Policy Act expanded these requirements to include the labeling of fluorescent lamps, showerheads, faucets, water closets, and urinals.

The Federal Trade Commission changed the labels in 1994, so refrigerators, freezers, dishwashers, clothes washers, and water heaters now include the number of kilowatt hours (kWh) of energy used by the labeled appliance and a list of the most energy-efficient and least energy-efficient comparable appliances. Climate control appliances are labeled not according to kWh of energy use but rather to fuel efficiency indices such as EER, seasonal EER, annual fuel utilization efficiency, or heating seasonal performance factor. The energy cost table has been replaced by a single estimate of energy costs for products with kWh energy-use ratings and for room air conditioners. Other products must have operating cost information available either on fact sheets or in industry product directories. In a press release on the new labeling requirements, FTC stated that they would "make the labels easier to read and more useful to consumers in comparing the energy efficiencies of the appliances." [248]

An in-store survey of appliance buyers conducted for DOE showed that 90% of buyers had noticed the Energy Guide label and that three-fourths described it as "somewhat" or "very" helpful in comparison shopping. The same survey revealed that consumers found the labels confusing and believed that labels should emphasize one or two pieces of information, such as energy costs.[249] Studies have shown that the labels raise consumers' energy awareness without necessarily influencing their purchases. The energy efficiency of appliances has risen significantly since the adoption of EPCA, but this increase appears to be due more to traditional regulatory requirements than to the Energy Guide.[250]

FTC has also adopted labeling requirements for the resistance-to-heat flow in insulation materials, the emissions characteristics of alternative fuel vehicles, and the minimum content of alternative fuels.

The National Fenestration Rating Council (NFRC), which is an industry initiative, rates the energy efficiency of windows. More than 120 manufacturers have submitted over 25,000 window products for NFRC ratings. According to NFRC, building energy codes and utility programs rely increasingly on these ratings. In addition, manufacturers try to improve energy efficiency to avoid being listed in the NFRC directory as a company with poor ratings. [251]

9.9.7 Hazard Labels

Hazard labels inform consumers of the environmental risks associated with particular products. Proposition 65, which was discussed in Section 9.7 of this chapter, requires manufacturers to disclose information on the environmental hazards that could be caused by their products. This mandate frequently results in product labeling, and products have been altered to avoid a negative label. However, Proposition 65 warnings frequently take forms other than labels.

Ozone-depleting substances are subject to warning labels under the Clean Air Act. The incentive effect of this label might have been diminished by announcements that such substances would be phased out earlier than originally expected.

A variety of toxics, including polychlorinated biphenyls (PCBs) and asbestos, have been required to bear warning labels under authority granted to EPA by the Toxic Substances Control Act. Pesticides are subject to detailed labeling requirements under the Federal Insecticide, Fungicide, and Rodenticide Act.

Since 1991, retailers in Vermont have been required to identify household products that contain hazardous constituents with warning labels. These labels must be placed either on the shelves stocked with these products or near the subject products. The goal of this law is to discourage consumers from purchasing such products. Among the types of products subject to the requirement are cleaning agents, auto and machine maintenance products, hobby and repair products, shoe polish, aerosols, and butane lighters. The state's label bears the text: "REDUCE TOXICS USE. These products contain HAZARDOUS INGREDIENTS." Green exemption labels can be attached to shelves displaying products that have been included in the warning program but contain none of the 24 ingredients listed in the Vermont Community Right-to-Know list of hazardous chemicals. Vermont has a parallel warning program for pesticides and commercial fertilizers.

9.10 Environmental Performance Awards

EPA and numerous state and local governments periodically issue awards for environmental behavior they deem to be exemplary. To the extent that such awards generate positive publicity, they could encourage environmentally friendly behavior.

In California, for example, 305 businesses won awards under the Waste Reduction Awards Program (WRAP) in 1995. The Target department store chain won awards at 2 distribution centers and 90 stores for recycling and their efforts to minimize waste, activities that have resulted in a 75% reduction in garbage. Winners received certificates of recognition from the Integrated Waste Management Board as well as the right to use the WRAP logo to publicize their waste reduction achievements.

The California EPA announces winners each year. The 1999 winners include Autrey Museum of Western Heritage, Cagwin & Dorward Landscape Contractors, Investec, Kraft Foods Inc. Visalia, Memorial Hospitals Association, Pebble Beach Company, Straus Family Creamery, Swinerton & Walberg Company, Trips for Kids/Re-Cyclery, and Unisys Corp.[252]

In Texas, Governor's Awards for Environmental Excellence are issued for the following categories: large business; large technical business; non-technical, small business; government, civic, and non-profit organizations; education; youth organization; media; agriculture; individual; and special.[253] These awards are part of the Clean Texas initiative under the Waste Reduction

Act of 1991. In the large technical business category, Lockheed Martin Tactical Aircraft Systems was the 1995 winner. The company has also received awards from EPA for reducing emissions of ozone-depleting chemicals and VOCs. It has also received the EPA Regional Administrator's Environmental Excellence Award for Excellence in Hazardous Waste Minimization Program Development.[254]

9.11 Securities and Exchange Commission Disclosure Requirements

Section 14(a) of the Securities Exchange Act of 1934 empowers the Securities and Exchange Commission (SEC) to require disclosure by publicly owned companies "as necessary or appropriate in the public interest or for the protection of investors."[255] To date, the SEC has interpreted this statement to require the reporting of information that would be deemed important by investors.

The SEC requires disclosure of environmental liabilities that could have a "material" impact on the company's financial or competitive position, information that would be important to investors. Companies also must report individual environmental enforcement proceedings that are expected to cost more than $100,000 as well as environmental litigation that might have significant financial impact on the company. SEC access to information submitted by companies to EPA enables it to verify company disclosures on Superfund sites, RCRA sites, and federal enforcement actions. The SEC is authorized to require companies to revise their filings in case of inaccuracies. In the past, the Commission has written to companies to inquire why the companies did not disclose certain environmental information in their filings.

The number of large companies disclosing environmental information in SEC Form 10-Ks is increasing. Among Standard & Poor's 500 companies, 322 submitted environmental information in 1990 as compared to 217 companies in 1988. The incentive effect of these disclosure requirements is not known. However, evidence presented elsewhere in this chapter indicates that information on the environmental performance of companies is of interest to investors.[256]

9.12 Summary

Information programs have the potential for creating incentives for environmental change if they are credible and present data in a usable form. The best known of the information programs is the TRI. While changes in reported releases have been large following the establishment of the TRI program, its actual impact is difficult to assess quantitatively because the data are not measured or verified and no assessment of relative risks accompanies the reports. Information from the TRI program is widely distributed, well-used, and likely to be affecting environmental performance at many companies.

State information programs tend to base data on materials accounting and thus partially address the concern of data reliability. The New Jersey and Massachusetts programs seem to be well-regarded and well-used. Proposition 65 places the burden of proof on industry, which has incentive effects on firms similar to that of requiring more reliable data. Data collected as the result of Proposition 65 are well-used

Experience with labeling schemes indicates that they are more likely to influence behavior if they are accompanied by promotional activities that target retailers and consumers. In many cases, the label itself is only one element of a larger effort to promote the use of environmentally friendly products. As a result, it may be difficult to isolate the incentive effect of a label from that of related promotional activities.[257] One of the main problems encountered by environmental seal-of-approval schemes is the lack of agreed-upon criteria for assessing environmental friendliness. While seals of approval may be relatively easy for consumers to understand, they risk not only lacking agreed-upon standards but also oversimplifying complex environmental issues.

OSHA MSDS sheets have been criticized as overly lengthy and complicated. FTC Guidelines for Environmental Marketing are intended to prevent false or misleading use of advertising claims such as "environmentally friendly," "degradable," and "recyclable."

Experience with energy-efficiency labeling demonstrates the limitations of information that is perceived to be unrealistic, such as the fuel economy labels on automobiles before the 1985 revisions, or confusing, such as the Energy Guide labels on appliances.

SEC-mandated environmental disclosures by firms increasingly are used by investors as indicators of proactive management, legal liability, or risk at particular firms.

10. Voluntary Programs

An important new trend in environmental management is the use of voluntary programs to accomplish the goals of environmental protection. This trend involves implementing methods to cut waste, conserve materials, and improve efficiency—outcomes that increase the value added by business, improve competitiveness, and reduce pollution. Voluntary programs are an important addition to the more market-based incentive measures discussed elsewhere in this report. While the market-based programs offer financial and other closely related incentives to encourage firms and individuals to reduce pollution, voluntary programs offer less tangible rewards such as public recognition and access to information on ways to reduce pollution at low or no cost. Governments promote voluntary initiatives for a variety of reasons, including the pilot testing of new approaches and the absence of legislative authority to establish mandatory programs. As such, many voluntary programs offer unique approaches to environmental management.

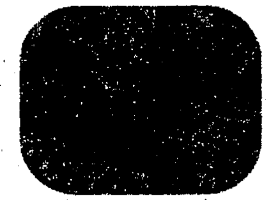
Two major federal initiatives are responsible for many of the federal voluntary programs. One is pollution prevention, particularly as articulated in the Pollution Prevention Act of 1990.[258] The second is the reduction of greenhouse gas emissions called for in the Clinton administration's 1993 Climate Change Action Plan (CCAP).[259] A variety of private-sector and state-led initiatives also are noteworthy.

Without other legislative authorities, the objectives of pollution prevention in the United States are pursued largely through voluntary actions by firms or agreements negotiated between government agencies and individual firms. The objective of pollution prevention is to reduce the pollution intensity of production through changes in input use, technologies, processes, management, and other parameters. Because the full range and effectiveness of these parameters cannot be well-known to regulatory agencies, governments pursue the goals of pollution prevention by providing information to firms and encouraging the firms to use production methods that are less pollution-intensive. Similarly, the Climate Change Action Plan relies on a series of voluntary initiatives that are supplemented by modest subsidy programs to induce meaningful reductions in greenhouse gas emissions.

10.1 Background

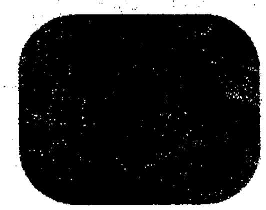
Because voluntary programs are relatively new and involve intangibles that are difficult to quantify (e.g., what would have been done anyway without the program), they are difficult to evaluate quantitatively. However, the Oak Ridge National Laboratory recently completed an initial assessment of about a dozen energy-related programs for EPA's Office of Atmospheric Programs (OAP). This assessment was conducted to support a forthcoming DOE study entitled *Scenarios for a Clean Energy Future.*[260] In addition, the proceedings from the American Council for an Energy Efficient Economy (ACEEE) have a number of peer-reviewed papers that review and evaluate a wide variety of voluntary energy conservation programs. These papers can be found in ACEEE's *Energy Efficiency Summer Studies* (1994, 1996, 1998, 2000).

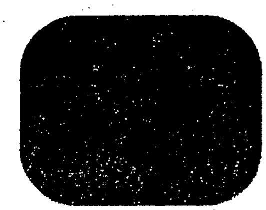

Pollution Charges, Fees, Taxes


Deposit-Refund Systems


Trading Programs


Subsidies for Pollution Control


Liability Approaches


Information Disclosure


Voluntary Programs

One incentive for businesses to take part in these voluntary programs appears to be favorable public relations (PR). Favorable PR could result in less public pressure to regulate participants, better relations with employees and the community, and increased market share at the expense of competitors perceived to be less environmentally friendly. For example, polls have shown that consumers are willing to pay a premium for products that have environmental advantages.[261] Henriques and Sadorsky (1996) found that pressure from shareholders and customers significantly influenced Canadian firms' decisions to formulate environmental plans. In this respect, voluntary programs could have effects similar to the information approaches discussed in Chapter 9.

Another reason for corporate participation in voluntary programs is that the sponsoring regulatory authority may provide technical assistance to participants. Such assistance could be regarded as a subsidy, as discussed in Chapter 8. As noted in subsequent paragraphs, several companies have saved money by implementing the activities associated with voluntary programs such as Green Lights and WasteWise.

Moreover, voluntary programs sometimes are structured to limit potentially high litigation, monitoring, and enforcement costs that otherwise could be incurred by regulators and businesses. Some voluntary programs offer participating companies the opportunity to identify and address environmental problems in the present, problems that could subject them to regulatory sanctions in the near future. On occasion, these programs also give companies the flexibility to improve their environmental performance at less cost.

A Resources for the Future (RFF) study of EPA's 33/50 program cited several reasons other than publicity benefits and added flexibility to explain why firms might voluntarily exceed the standards set in environmental regulations. (The 33/50 program is discussed in 10.3.1, 33/50 Program.) In some industries, firms might improve their performance in the hope of leading the government to make such performance mandatory, thereby creating barriers to the entry of potential competitors. It has also been suggested that firms over-comply to forestall additional mandatory regulation. Another possibility is that the "lumpiness" of pollution abatement investments means that large investments offer significantly more abatement per dollar than a series of small investments made to comply with progressively tighter restrictions.[262]

Most voluntary environmental programs in the United States have been designed and implemented by the U.S. EPA. Industry also is involved in the oversight of a number of voluntary programs. The programs that have been created and managed solely by the federal government are classified as "public voluntary" programs. Acting independently or with other federal agencies, EPA oversees programs directed at climate change and pollution prevention. Programs developed by industry trade organizations for their member companies are termed "unilateral" programs in this report. Finally, there are voluntary programs that involve significant negotiation between government regulators and participants. These programs are called "negotiated agreements." The following sections review many of these programs.

10.2 Federal Initiatives: Climate Change

The great majority of voluntary programs are concerned with reducing the emissions of greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFC), hydrofluorocarbons (HFC), and sulfur hexafluoride (SF_6). The 1993 Climate Change Action Plan responded to the 1992 Earth Summit's call for reducing greenhouse gas emissions by developing innovative public- and private-sector voluntary initiatives. Partnerships between the Environmental Protection Agency (EPA); the Departments of Energy (DOE), Agriculture (USDA), and Transportation (DOT); state and local governments; industry; farmers; nonprofit organizations; trade associations; and professional societies have focused on the low-cost and profitable opportunities for reducing greenhouse emissions. This collaboration has resulted in the development of more than 40 programs. The principal climate change programs are summarized in Table 10-1 and described in more detail in the following sections.

Table 10-1. Federal Voluntary Programs for Greenhouse Gases

PARTNERSHIP PROGRAMS (year program launched)	ENVIRONMENTAL GOAL
Green Lights (1991) www.epa.gov/energystar	Reduce energy consumption of lighting through cost-effective, energy-efficient lighting technologies.
WasteWise (1992) www.epa.gov/wastewise	Reduce municipal solid waste through waste prevention and the purchase/manufacture of products with recycled content. at business, government, and institutional partners
AgStar (1993) www.epa.gov/agstar	Promote cost-effective methods for reducing methane emissions at dairy and swine operations through improved manure management.
Climate Wise (1993) www.epa.gov/climatewise	Reduce industrial greenhouse gas emissions and energy costs through comprehensive pollution prevention and energy efficiency programs.
Commuter Choice (1993) www.epa.gov/ooaujeag/livability/com_choi.htm	Promote employer-provided commuting options designed to reduce traffic congestion, improve air quality, and allow employers to tailor transportation benefits to the needs of individual employees.
Natural Gas Star (1993) www.epa.gov/gasstar	Encourage natural gas industries to reduce methane emissions through cost-effective technologies and best management practices.
Ruminant Livestock Efficiency (1993) www.epa.gov/rlep	Reduce methane emissions from ruminant livestock operations.
Seasonal Gas Use to Control NO_x (1993)	Promote seasonal switching toward the use of low-carbon natural gas, particularly in the summer, in utility coal and oil plants and in industrial facilities.
State and Local Outreach (1993) www.epa.gov/globalwarming	Reduce greenhouse gas emissions from states and local communities by empowering officials with information and technical assistance.
The U.S. Initiative/Joint Implementation (1993) www.ij.org	Encourage private-sector investment and innovation in developing and disseminating technologies to reduce greenhouse gas emissions.
Environmental Leadership (1994) es.epa.gov/elp	Recognize and provide incentives to facilities that are willing to develop and demonstrate accountability for compliance with existing laws.
Energy Star (1994) www.epa.gov/energystar	Maximize energy efficiency in commercial, industrial, and residential settings by promoting new building and product design and practices.
Environmental Stewardship (1994)	Limit emissions of perfluorocarbons and hydrofluorocarbons in three industrial applications: electrical transmission and distribution systems, magnesium casting, and semiconductor production.
Coalbed Methane Outreach Program (1994) yosemite.epa.gov/methane/cmophome.nsf	Identify and remove obstacles to investment in coalbed methane recovery projects, which increases awareness of investment opportunities.
Landfill Methane Outreach Program (1994) www.epa.gov/lmop	Encourage profitable recovery of methane released from landfills by identifying viable technologies, markets, and financing sources.
Transportation Partners (1995) www.epa.gov/tp	Reduce the growth in vehicular travel through the voluntary adoption of local and regional transportation strategies that provide better, cheaper, transportation choices for citizens. Program was discontinued due to funding reductions at the U.S. DOT.
Voluntary Aluminum Industrial Partnership (1995) www.epa.gov/vaip	Reduce perfluorocarbon gas emissions from aluminum smelting.

10.2.1 Green Lights

One of the early voluntary partnerships between EPA and industry was the Green Lights Program. The primary purpose of the program was to encourage the use of energy-efficient lighting to prevent air emissions (CO_2, SO_2, and NO_x) and other emissions from the generation of electricity. By December 1994, Green Lights investments in energy-efficient lighting had resulted in annual energy savings of 1 billion kWh, translating into annual energy cost savings of about $92 million. By May 1996, the program had 1,316 Partners (corporations, industry groups, nonprofit organizations, hospitals, governments, and universities); 585 Allies (electric utilities, lighting manufacturers and distributors, and lighting management companies); and 286 Endorsers (professional and trade associations). In 1997, EPA consolidated Green Lights activities within the Energy Star Buildings program to encourage a more comprehensive approach to energy-efficiency investments.

Table 10-2 illustrates the energy savings achieved by three companies—Staples, the Atlanta Journal-Constitution (Cox Newspapers), and Mobil Corp—as a result of their participation in the Green Lights Program. More information on these and other success stories is available at the EPA Energy Star web site.[263]

Table 10-2. Energy Savings from Green Lights/Energy Star Program

PROJECT INFORMATION	STAPLES	ATLANTA JOURNAL-CONSTITUTION	MOBIL
Project costs ($) • Total expenditures • Costs per sq. ft.	$3.1 million $0.91	$1.007 million $0.53	$1.182 million $3.95
Cost savings ($) • Annual savings • $ saved/sq. ft.	$985,425 $0.29	$447,564 $0.53	$224,500 $0.75
Internal rate of return	29.3%	51%	19%
kWh savings	6.3 million	6.8 million	7.2 million
CO_2 savings (lbs.)	6.37 million	11.9 million	103 million

Source: http://www.epa.gov/buildings/esbhome

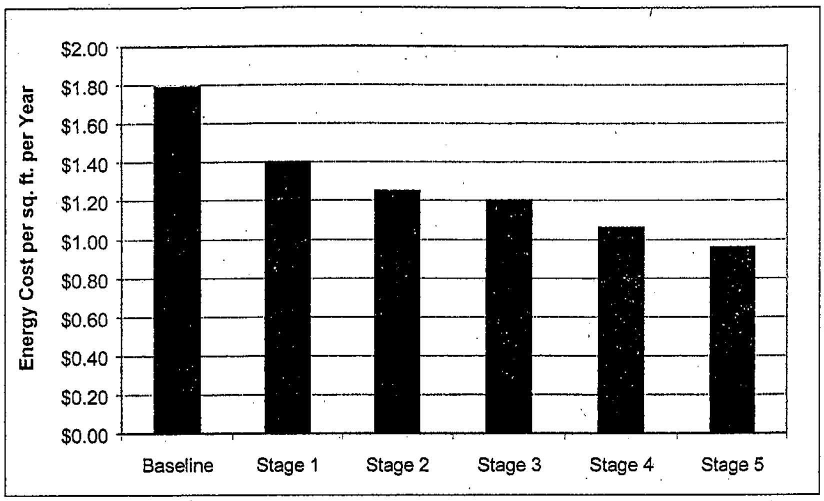
10.2.2 Energy Star Partnership Program

The Energy Star Partnership Program is designed to raise the level of public consciousness and action regarding energy conservation. Programs focus on fostering energy efficiency and reducing transaction costs for consumers and businesses. Three Energy Star programs discussed in this subsection have been especially successful in reducing annual carbon-equivalent pollution while maximizing energy cost savings.[264]

10.2.2.1 Energy Star Buildings

EPA asks participants in the Energy Star Buildings program to perform energy-efficiency upgrades in buildings where profitable. After installing energy-efficient lighting, participants tune up building systems, invest in upgrades to reduce heating and cooling loads, improve fans and air handling systems, and improve the heating and cooling plant. This five-stage upgrade process is part of an integrated approach to whole-building energy efficiency. Participants that follow this approach are often able to reduce their energy use by 30% while achieving an internal rate of return (IRR) of 20% or greater on their investment. As shown in Figure 10-1, EPA predicted that energy costs at Energy Star Showcase Buildings could fall by nearly 50%.[265]

Figure 10-1. Energy Savings in Showcase Buildings



Source: EPA. 1994h.

In 1999, EPA began providing an effective means of monitoring the progress of energy-efficiency upgrades to buildings; the mechanism was EPA's Energy Star Benchmarking Tool. Combining the values of building energy consumption and their relative impact on total energy consumption, performance levels can now be benchmarked against the top 25% of all similar-use buildings. Such information provides Partners with the opportunity to save energy and money and prevent pollution. It provides valuable input into business transactions involving the buying, selling, appraising, leasing, and insuring of the building as well as the contracting for energy, operations, and maintenance services.

Energy Star Buildings and Green Lights have over 5,500 participants. Partners have cumulatively invested more than $3.6 billion on energy-efficiency improvements. From 1995 to 1999, these upgrades have resulted in an estimated reduction in energy use of more than 108 billion kilowatt hours (kWh), with a corresponding reduction of over 23 million metric tons of carbon-equivalent (MMTCE). (See Table 10-2.)

10.2.2.2 Energy Star Products

Working with equipment manufacturers, the U.S. Department of Energy (DOE) and EPA are using Energy Star labels to promote highly energy-efficient products. Collaborations formed with DOE are also facilitating the development of initial markets for advanced technologies, for example, by encouraging large-volume purchases. These purchases help reduce manufacturing costs through economies of scale in initial production. More than 1,200 manufacturers now offer Energy Star products in over 30 commercial and residential product categories such as air conditioners, heating systems, and exit lights. These products are featured in over 4,000 retail stores. In 1999 alone, consumers purchased more than 100 million EPA-labeled Energy Star products, saving over 25 billion kWh of energy.[266]

10.2.2.3 Energy Star Homes

Jointly sponsored by DOE and EPA, Energy Star Homes promotes voluntary partnerships with homebuilders to construct homes that are 30% more energy- efficient than the guidelines of the Model Energy Code. (The Model Energy Code is a model national standard for residential construction.) The program also encourages lenders to provide Energy-Efficient Mortgages, which offer lower interest rates than conventional home loans, lower closing costs, up to a 4% extension of the maximum debt-to-income ratio, and a free home energy rating. (For more information on Energy-Efficient Mortgages, see Chapter 7, Section 7.8) Fannie Mae and Freddie Mac encourage lenders to offer energy-efficient mortgages by providing incentives and specific criteria for the purchase of such mortgages.

10.2.3 Climate Wise

Climate Wise is helping companies realize environmental and economic benefits through cost-effective industrial energy-efficiency and pollution-prevention actions. Designed to reduce greenhouse gas emissions across all sectors, Climate Wise challenges participants to devise and implement innovative ways of limiting, reducing, or mitigating greenhouse gases. Methods include process modifications, use of alternative raw materials, carbon sequestration, and other measures that abate emissions.

The program is a partnership between EPA and the DOE. Collaborative initiatives with industry include AT&T, British Petroleum, DuPont, General Motors, and Weyerhaeuser, as well as 30 states and local governments. Partnerships number more than 550 and represent more than 13% of U.S. industrial energy use.

Most recently, EPA has partnered with the United States Agency for International Development (USAID). This partnership will now extend technical assistance to local municipalities and companies who seek energy savings and emission reductions in Brazil, Central America, India, Mexico, and the Philippines.

10.2.4 WasteWise

Created in 1994, WasteWise is a voluntary program intended to reduce the solid waste generated by businesses. The program's source-reduction and recycling efforts are intended to reduce greenhouse gas emissions by (1) reducing methane emissions from the decay of waste in landfills, (2) increasing carbon sequestered by forests, and (3) reducing emissions resulting from extracting and processing virgin materials and manufacturing products. There are many additional benefits of WasteWise, including the following: reduced extraction and processing of virgin materials; reduced waste disposal; reduction in air, water, noise, and other pollution associated with waste disposal and manufacturing; reduced costs of managing municipal solid waste; and new jobs and income created by new recycling enterprises.

To participate, partners are required to implement three significant waste prevention activities, improve collection programs for recyclables on company premises, and increase either their purchases of recycled products or the recycled content of the products they manufacture. In the first year of the program alone, participating companies conserved over 240,000 tons of solid waste, mostly transportation packaging. They also recycled about 1 million tons of waste and purchased 20 different kinds of recycled-content products.

With more than 1,000 participating companies, members have saved a significant amount of money through the program. WasteWise partners reduced a total of 7.8 millions tons of solid waste in 1998. The cost savings they achieved by not having to dispose of these wastes increased from $38 million in 1994 to $280 million in 1998.[267]

10.2.5 Methane Reduction Programs

Methane, a potent greenhouse gas, can be recovered for energy use. To promote methane recovery, EPA has launched at least three voluntary programs: the Coalbed Methane Outreach

Program, the Landfill Methane Outreach Program, and Natural Gas Star. In addition, joint efforts of EPA and the U.S. Department of Agriculture (USDA) have encouraged the profitable collection and reuse of methane in two agriculture-based programs. These programs are the AgStar Program and the Ruminant Livestock Efficiency Program.

10.2.6 Coalbed Methane Outreach Program

In 1990, methane emissions associated with coal mining operations accounted for approximately 18% of human-related U.S. methane emissions. Launched in spring 1994, the Coalbed Methane Outreach Program disseminates information that addresses a number of obstacles to mine methane recovery and development, including the lack of information on recovery technology, difficulties in obtaining financing for recovery investments, the lack of markets for recovered methane, and the uncertainty concerning ownership of mine methane. EPA has also developed guides for state, local, and federal assistance programs that pinpoint sources of loans, grants, and technical assistance for profitable coal mine methane projects as well as a comprehensive guide for private-sector financing of coal mine methane projects.

Under this program and as a result of the Energy Policy Act of 1992, methane recovery by the coal industry has more than doubled since 1993. Partners increased the quantity of methane recovered to nearly 2.0 million tons of carbon equivalent (MMCTE), which is equivalent to eliminating the emissions from about 1.5 million cars per year.[268]

10.2.7 Natural Gas Star Program

Initiated in March 1993, the Natural Gas Star Program encourages natural gas companies to adopt cost-effective technologies and practices that reduce emissions of methane from natural gas transmission and distribution systems. Methane emissions can be decreased by up to one-third by improving inspection and maintenance practices to reduce fugitive emissions, replacing equipment that normally vents gas with low-emission technologies, and repairing or replacing leaking service lines.

More than 70 natural gas transmission and distribution companies have joined the program since it was expanded in the summer of 1995 to include gas producers. By working with the natural gas industry, the program has identified more than 50 cost-effective best management practices for methane-reduction.

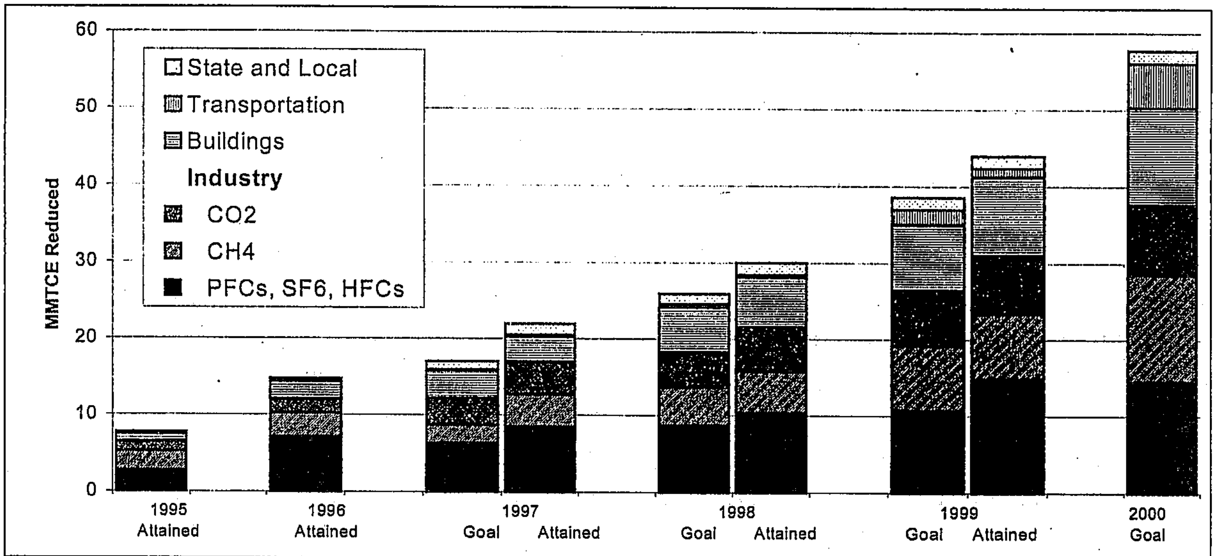
10.2.8 Agstar Program

The AgStar Program was launched in the summer of 1993. Under the program, EPA works with the Departments of Energy and Agriculture to encourage swine and dairy producers to recover methane from their animal waste management systems. Participants commit themselves to conducting three activities: (1) surveying their facilities, (2) installing AgStar-selected technology wherever profitable, and (3) appointing managers to oversee their participation in the program. EPA helps partners optimize systems and recoup some of their investments through energy recovery. More than 500 farms are currently AgStar Partners. The program also has 50 Allies, which represent system and equipment manufacturers, educational institutions, and state and local governments.

10.2.9 Assessment of Climate Change Programs

EPA reported to the U.S. Senate Appropriations Committee in February 2000 that the Agency's climate change programs have continued to meet their greenhouse gas reduction goal since 1995, as shown in Figure 10-2. Cumulatively, greenhouse gas emissions have been reduced by 118.2 MMTCE from 1995 to 1999, with 88.1 MMTCE of the reductions coming from the industrial sector. Within the industrial sector, carbon dioxide (CO_2) emissions have been reduced by 20.8 MMTCE; methane (CH_4) by 23.7 MMTCE; and perfluorocarbon (PFC), hydrofluorocarbon (HFC), and sulfur hexaflouride (SF_6) by 43.6 MMTCE. The baseline for evaluating program performance through 1999 has been a forecast of U.S. greenhouse gas emissions in the absence of the Climate Change Action Plan programs. This baseline was developed and updated as part of an interagency evaluation of the Climate Change Action Plan in 1997, which built on a similar baseline forecast that was developed in 1993 for the Climate Change Action Plan.

Figure 10-2. Goals and Accomplishments of EPA's Climate Change Programs: 1995–2000



Source: EPA. 2000c

Note: 1999 attained values are estimated.

EPA's own evaluation of climate change activities recognizes the difficulties of measuring effectiveness.

> *Prior studies have focused on estimating the localized energy savings that could be attributed to products and services that were purchased by eligible utility customers, with the incentives of rebates and subsidies. Participant micro data specifically, customer billing data and customer measure installation data, were used to estimate changes in customer energy consumption due to participation in the program.*
>
> *Recently, the market transformation programs operated by the federal government have shifted program emphasis away from energy savings and towards promoting market growth for energy-efficient products and services. This shift in program paradigms requires a parallel shift in program evaluation designs. Energy-efficiency program evaluation concepts such as free riders and*

free drivers have only indirect use for evaluating whether, and to which degree, a program has quickened the overall pace of market movement. For these reasons, the paradigm for evaluating market transformation programs cannot center on estimating changes in participant energy use and inferring participant intentions. Rather, it must focus on the dynamics and the determinants of market outcomes.

EPA is now moving to new methods of program evaluation that are more appropriate for the types of programs that EPA operates. These evaluations will assess the market transformation impacts success in promoting market growth for energy-efficient products and services, as well as the reductions in greenhouse gas emissions and energy consumption. With the programs now producing sizable results in the market place, EPA can use market-based assessments to evaluate its programs, as opposed to requiring an analysis of program participant micro data as a means of inferring market impact.[269]

10.3 Public Voluntary Initiatives: Pollution Prevention

EPA's first major voluntary program, 33/50, was designed to promote pollution prevention. Most prevention programs seek to reduce a subset of toxic chemicals released and transferred by manufacturers. Before the 33/50 Program ended in 1995, it encouraged manufacturers to voluntarily reduce emissions of 17 target chemicals by 50%. Other prevention programs, such as Design for the Environment and Green Chemistry, are designed to promote the development of cleaner products and industrial processes. This section reviews several of the public voluntary programs for pollution prevention identified in Table 10-3. Information on other programs not discussed here can be found on the web site of EPA's Office of Policy, Economy and Innovation and in various EPA publications.[270]

10.3.1 33/50 Program

The 33/50 Program, introduced by EPA Administrator Riley in 1991, encouraged industry participation through a challenge to the more than 16,000 facilities releasing any of 17 priority toxic chemicals. The challenge: Reduce your emissions (reported as TRI releases and transfers) by 33% by 1992 and by 50% by 1995, relative to a 1988 baseline for the facility.

EPA first issued invitations to take part in the 33/50 Program in February 1991, focusing initially on 555 primarily large companies that had the highest releases of the 17 chemicals targeted by the 33/50 Program. As of March 1994, EPA had invited more than 8,000 companies to join, and almost 1,200 had said they would participate.

Of the largest 600 emitters, approximately 60% agreed, ultimately, to participate. In the aggregate, the actual emissions reduced by these companies exceeded EPA's expectations and occurred ahead of schedule. From those perspectives, the program may be viewed as a considerable success. Zatz and Harbour (1999) cite six factors as key to the success of the 33/50 Program:

- voluntary participation
- flexibility in the goals and the methods used to reduce emissions
- no additional reporting requirements

- public recognition for participants and their successes
- finite life of program
- an economic benefit for companies

Table 10-3. Federal Voluntary Pollution Prevention Programs

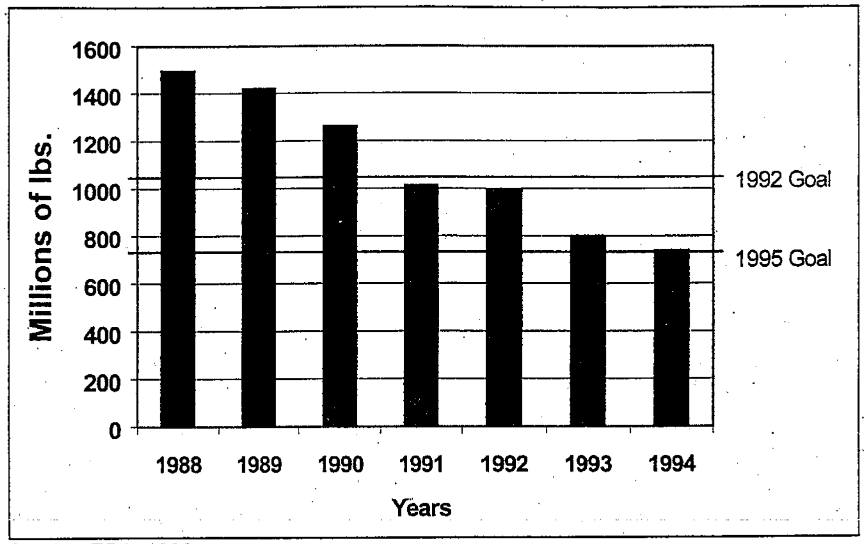
FEDERAL VOLUNTARY PROGRAMS (year program launched)	ENVIRONMENTAL GOAL
33/50 Program (1991)	Reduce total releases and transfers of 17 priority chemicals by 33% by 1992 and by 50% by 1995, relative to a 1988 baseline. Program ended in 1995.
Environmental Accounting (1992) www.epa.gov/oppintr/acctr	Increase corporate understanding of environmental costs and how to incorporate these costs into routine business operations.
Design for the Environment (1992) www.epa.gov/dfe	Help business incorporate environmental considerations into the design of products, processes, and technical systems.
Green Chemistry (1992) www.epa.gov/dfe/greenchem	Promote the design of chemical products and processes that reduce or eliminate the generation of hazardous substances.
Water Alliances for Voluntary Efficiency (1992) www.epa.gov/owm/genwave	Promote water efficiency in hotels, schools, universities, and office buildings.
Pesticide Environmental Stewardship (1993) www.pesp.org	Promote integrated pest management and pesticide risk reduction in agricultural and nonagricultural settings.
Waste Minimization National Plan (1994) www.epa.gov/wastemin	Reduce the presence of persistent, bioaccumulative, and toxic chemicals in hazardous waste.
Indoor Air Quality (1995) www.epa.gov/iaq	Promote simple, low-cost methods for reducing risks to indoor air quality.
Community-Based Environmental Protection (1998) www.epa.gov/ecocommunity	Integrate environmental management with human needs, consider long-term ecosystem health, and highlight the positive correlation between economic prosperity and environmental well-being.
Adopt Your Watershed (1994) www.epa.gov/adopt	Encourage and facilitate citizen involvement in local watershed protection activities.
Environmental Technology Verification (1995) www.epa.gov/etv	Verify the performance of innovative technologies to accelerate their entrance into the marketplace.
Voluntary Mobile Source Emission Reduction Program (1997) www.epa.gov/oms/transp/traqvolm.htm	Provide flexibility to states in meeting federal air quality goals.
Pesticide Environmental Stewardship Program (1994) www.epa.gov/oppbppd1/PESP	Reduce risk from pesticides through improved pesticide stewardship.
Commuter Choice Leadership Initiative (2000)	Promote the reshaping of employee benefits packages to include commuting benefits.

EPA data, shown in Figure 10-3, demonstrate that the program goals for 33/50 were achieved 1 year ahead of schedule and that the reductions were greater than anticipated. While some have criticized the methods by which EPA made these calculations, the program clearly seems to have been a success.

Aurora and Cason (1995) found that the 33/50 Program had a significant incentive effect. Although the willingness to participate varied greatly across industries and firms, and a relatively small percentage of any industry's firms participated, those that did participate were responsible for most of the toxic emissions within their respective industries. In the case of petroleum and chemicals, for example, participating companies were responsible for over 80% of their industries' total emissions. The participation of large polluters allowed the program to be effective in targeting the main sources of pollution.

Aurora and Cason also found that participation rates were higher for industries that were less concentrated (those having many firms) and that participants in Green Lights were significantly more likely to participate in 33/50 as well. This "suggests that 'environmentally conscious' firms seek to improve their reputation by participating in several voluntary pollution reduction programs at the same time."

Figure 10-3. Releases of TRI Chemicals (1988–1994)



Source: EPA. 1996c.

Some reviewers assert that the proclaimed benefits have been overstated. The baseline data and the date the program was initiated allowed participants who had already achieved the reductions to join the program after the fact. Indeed, some participants had achieved more than a 50% reduction before they joined 33/50 in 1991. Aurora and Cason (1995) found that one of the main determinants of participation in the program was a desire by the firm to achieve favorable publicity. Overall, the program achieved real reductions. GAO (1997b) estimated them to be on the order of 20%, and participants, in general, realized cost savings. Khanna and Damon estimated that participation in the program also resulted in a reduction of 28% in future TRI releases.[271]

10.3.2 Design for the Environment (DfE)

EPA's Design for the Environment (DfE) Program helps businesses incorporate environmental considerations into the design and redesign of products, processes, and technical and management systems. Initiated by EPA's Office of Pollution Prevention and Toxics (OPPT) in 1992, DfE forms voluntary partnerships with industry, universities, research institutions, public interest groups, and other government agencies.

Activities of Project Partners include broad institutional efforts aimed at changing general business practices as well as cooperative projects with trade associations and businesses in specific industries. The DfE Program ensures that the information developed through this voluntary effort reaches the people who make decisions—from managers to industrial design engineers to those who specify materials to buyers. By disseminating the information to these individuals, the program encourages its Partners to incorporate environmental considerations into their traditional decision-making process.

DfE works with entire industrial sectors, typically through trade associations and industry leaders. Several of the current DfE partnerships are highlighted below.

- The Printing Sector: DfE works with the screen printing, lithography, and flexography sectors to improve their environmental performance, principally through solvent use and reclamation technologies.
- The Printed Wire Board Sector: Traditional methods for making printed wire boards require the use of substantial amounts of water, energy, and certain toxic chemicals. DfE has collaborated with this sector to evaluate alternative methods and processes.
- The Computer Manufacturing Sector: DfE is collaborating with this sector to perform life-cycle cost assessments of cathode ray tubes and flat panel displays in computers, assessments that include environmental impacts.
- Garment and Textile Industries: DfE is working with this sector to reduce the public's exposure to perchloroethylene, a chemical used in dry cleaning. DfE is also exploring alternatives in the dyes and finishes used in textile processing or in clothing design (or in both) to reduce the need for dry cleaning.
- Industrial Cleaning Sector: Through partnerships with detergent formulators, DfE is trying to encourage the development and adoption of safer, more cost-effective effective industrial cleaning agents.
- Auto Refinishing Sector: DfE is working with auto refinishers to identify and adopt cleaner, safer, and more cost-effective practices that reduce the use of harmful chemicals and solvents.
- Manufacturers of foam Furniture and Bedding Adhesives: The adhesives used in these products can contain chlorinated and flammable solvents, and these solvents are increasingly coming under environmental regulation. DfE is working with manufacturers to develop adhesives that are more environmentally friendly.

10.3.3 Environmental Accounting Project (EAP)

EPA initiated the Environmental Accounting Project (EAP) in 1992 out of concern that pollution prevention would not be used to manage the environment until managerial accounting practices were modified to account for environmental costs. In cooperation with the Institute for Management Accountants, the American Institute for Certified Public Accountants, the U.S. Chamber of Commerce, the Business Roundtable, and the American Association of Cost Engineers, EPA developed agendas for 10 different stakeholder groups. The goal of the EAP is to help business understand the full range of environmental costs they incur and how to incorporate these costs into their decision-making.

The EAP encourages businesses to focus on energy costs, capital and operating costs of equipment that controls pollution, remediation efforts, salaries of environmental managers, public relations outlays, and other costs associated with the environment. Closer tracking of these costs enables businesses to identify opportunities to reduce or eliminate various elements of these costs. Companies can improve their environmental performance, gain a competitive advantage, and achieve cost savings or increased revenues.

EPA maintains a network of over 800 members of the EAP who share information and ideas. EAP has prepared several guidebooks for implementing these concepts, and it has developed a number of case studies that illustrate the gains that can be achieved. Much of this information is available on EPA's web site.

10.3.4 Environmental Leadership Program (ELP)

ELP uses innovative approaches to environmental protection by focusing on flexible laws and regulations. In addition, ELP seeks ways in which to use the greater availability of environmental information to empower citizens and communities. EPA launched the pilot phase of ELP in June 1994. In April 1995, ELP formally selected 12 projects from a pool of 40 proposals. The projects, which included 10 companies and two federal facilities, centered on compliance management systems, verification procedures, management accountability systems, and community access and participation in compliance. EPA indicated that participants would be allowed a limited period of time in which to correct minor violations that were discovered in their audits, without the application of penalties. Two conditions, however, were attached to this offer: The violations could not be criminal in nature; and they must not present an imminent and substantial risk to public health or the environment. Participants receive public recognition for their efforts.

One ELP participant, Gillette Co., is working with EPA and state authorities on auditing and certifying their environmental management system. The company's ELP project involves the following four steps: (1) developing criteria for compliance audits; (2) preparing detailed instructions for conducting such audits; (3) preparing guidelines for third-arty verification of these audits; and (4) using the guidelines when auditing three company facilities.

Gillette officials have cited several reasons for participating in the program. It prepares them for compliance with ISO 14000 environmental management certification standards, which are expected to become important in the years to come. The program also gives the company the chance to monitor itself, which will help the firm to avoid excessive monitoring by EPA.

It is not clear to what extent the results of audits conducted under ELP will be made available to the public. Public interest groups believe that they are entitled to access such information. Businesses, however, maintain that much of the data contained in audits should be kept confidential.

10.3.5 Water Alliances for Voluntary Efficiency (WAVE)

Another EPA initiative, Water Alliances for Voluntary Efficiency (WAVE), encourages businesses and institutions—primarily in the lodging sector—to reduce water use while increasing efficiency, profitability, and competitiveness. EPA says that the program "is designed to focus attention on the value of water and the need for efficient use of this important natural resource."[272]

WAVE participants include partners, supporters, and endorsers. Program Partners agree to equip new facilities with water-efficient equipment and to install such equipment in existing facilities wherever profitable. In exchange, they receive technical support and EPA assistance in publicizing their water efficiency initiatives. Program Supporters publicize the benefits of water use efficiency and assist partners in their conservation efforts. Supporters are also supposed to implement water efficiency measures. Endorsers include "conservation-minded environmental groups, trade and professional associations" who "are invited to review and endorse the WAVE program."[273]

As of April 2000, there were 40 WAVE industry partners, all of which were in the lodging sector. Several of the partners were large chains such as Westin, Hyatt, and Sheraton, with multiple facilities participating in the program. In addition, two hospitals and two educational institutions are counted as Partners. The list of Supporters consisted of more than 50 consulting firms, equipment distributors, manufacturing companies, utilities, and water management companies. The American Hotel & Motel Association, the American Water Works Association, Green Seal, and three other institutions were WAVE Endorsers as well.

EPA has stated that WAVE's measures can result in significant decreases in energy, water, and wastewater management costs. Through the program, the lodging industry potentially could save 32 billion gallons of water and more than 1 trillion Btu per year of related energy use. According to an EPA official, the main incentive for businesses to participate in WAVE is cost savings, but positive publicity is also a factor. Although the program has resulted in water and energy savings, it has not been without problems. The development of water management software has taken longer and has cost more than originally expected. In addition, marketing the program to hotels and motels has been slowed by a reluctance of the lodging industry to embrace change and by significant variations in the ownership and management structures of hotel branches.

10.3.6 Community-Based Environmental Protection (CBEP)

Initiated in 1997, this program integrates environmental management with human needs, considers ecosystem benefits, and emphasizes relationships between economic well-being and environmentally sustainable development. As its name implies, CBEP works with communities to protect and improve their local environment.

EPA has established several core principles for implementing CBEP.

- Focus on a definable geographic area.
- Interact with stakeholders through a range of partnership mechanisms.
- Determine overall environmental conditions in the area.
- Integrate environmental, economic, and social objectives and encourage local stewardship.
- Rely on appropriate public-sector, private-sector, regulatory, and non-regulatory tools.
- Monitor results and adjust programs in light of the results that are observed.

EPA's role in CBEP varies from one situation to another. In communities that cross state boundaries or are nationally important, EPA takes the lead role. In other cases EPA helps to define goals and methods, and provides environmental information, monitoring and scientific analysis to community organizers and stakeholders. Because individual projects are expected to take many years to achieve full success, the agency uses measures of performance that reflect incremental progress toward the goals.

10.3.7 Voluntary Mobile Source Emission Reduction Program (VMEP)

In the area of mobile sources, EPA has developed the Voluntary Mobile Source Emission Reduction Program (VMEP). This policy was initiated on October 23 1997, with the purpose of providing flexibility to states in meeting their federal air quality goals through State Implementation Plans (SIPs). Through this policy, EPA makes it easier for states to obtain SIP credits for voluntary activities, and it seeks to further encourage innovation and investment in effective programs and actions. Thus, the policy provides an incentive for states, localities, and the public to voluntarily reduce air pollution in their communities.

To obtain these SIP credits, a voluntary program under VMEP must be quantifiable; surplus (i.e., yield reductions in addition to those credited in other parts of the SIP); enforceable, and permanent. The most distinctive difference between a VMEP control measure and a regular SIP control measure is that the VMEP is enforceable against the state for the emission reductions only, as opposed to the regular SIP control measure that is enforceable against the regulated parties for specified actions to reduce emissions.[274] This provision encourages industry, community groups, and third parties to voluntarily agree to emission reductions. The state then estimates the reduction in emissions it expects will result from the agreements, and includes this as a control program in their SIP. VMEP submissions are limited to 3% of the emission reductions needed to obtain the National Ambient Air Quality Standards (NAAQS) in the non-attainment area.

The cities of Dallas, Houston, Chicago, Atlanta, and Las Vegas are including, or are planning to include, VMEP programs in their SIP. Programs include ozone action-day programs, technology retrofits, lawnmower buybacks, alternative fuel programs, commuter choice programs, and land use measures as well as many other programs. Support for the policy, in terms of technical and programmatic support, has been conducted through the Regional and State Programs Division of the Office of Transportation and Air Quality.

10.3.8 Pesticide Environmental Stewardship Program (PESP)

Under the Pesticide Environmental Stewardship Program (PESP), EPA works with many different organizations to promote environmentally responsible pesticide stewardship. Membership in PESP requires that organizations develop and adhere to well-defined goals for improving pesticide stewardship. Only those organizations that meet these goals are allowed to publicize their membership in the program in their promotional materials.[275]

10.3.9 Commuter Choice Leadership Initiative

On October 17, 2000, EPA and several leading U.S. employers launched the Commuter Choice Leadership Initiative. Under a Commuter Choice Leadership agreement, employers commit to working with EPA to develop new commuting benefits and services for their employees. (Employers who have joined this initiative are also known as "Commuter Choice Leaders.") This initiative is part of an effort to redefine the "comprehensive employee benefits package" to include commuting benefits alongside other standard employee benefits, such as health plans and retirement packages. New Commuter Choice benefits will help American employees get to and from work in ways that cut air pollution and greenhouse gas emissions, improve public health, increase worker productivity, and cut taxes and other expenses for employers and employees.

This initiative is the first step in a national effort to provide employers across the country with the opportunity to partner with EPA in providing new commuting choices and services to their employees. If one-half of all U.S. employers offered the same commuting benefits as those promised by Commuter Choice Leaders, air pollution in the United States would be cut by the equivalent of about 15 million cars.

The commuting options promoted through the Commuter Choice Leader Initiative include the following: parking cashout (allowing employees to trade their free parking space for cash), transit fare subsidies, telecommuting, compressed work schedules, flexible work schedules, carpools, vanpools, bicycling to work, walking to work, environmentally-friendly vehicles, and others.

Because of recent changes in the U.S. tax code, employees frequently enjoy a reduced tax burden when taking advantage of these commuting options. Likewise, U.S. employers enjoy a reduced tax burden when providing commuting benefits that encourage these commuting options. The initial Commuter Choice Leaders include The Calvert Group, GEICO DIRECT, Intel, Kaiser Permanente, Nike, Pitney Bowes, and The Walt Disney Company.

EPA has committed itself to helping Commuter Choice Leaders and their employees in several ways: (1) by providing public recognition to Commuter Choice Leaders; (2) by providing technical assistance on commuting options and services; (3) by providing communications and analytical tools; (4) by helping employers and employees identify federal, state, and local commuting options, benefits, and services; and (5) by providing a forum for exchanging ideas and experiences with other leading employers.

10.4 Industry Initiatives

In contrast to EPA programs, which primarily seek to reduce pollution, unilateral industry-led strategies are designed first and foremost to improve public opinion. They are also designed, however, to accomplish a broad range of worthy objectives. Responsible Care, which began as an initiative of the Chemical Manufacturers Association (CMA), a 190-member industry trade association in the United States, has grown to be truly international in scope. This initiative includes firms in at least 40 nations, firms that represent more than 85% of the global chemicals industry.[276] CMA provides its members with general guidance documents that explain how companies may adopt management codes in six areas:

- community awareness and emergency response
- pollution prevention
- process safety
- distribution
- employee health and safety
- product stewardship

For the most part, other industry-sponsored efforts in the United States could be characterized as extending the Responsible Care initiative to other industries. Examples include the American Petroleum Institute's (API) STEP program, "Strategies for Today's Environmental Partnership," and the American Forest and Paper Association's "Sustainable Forestry Initiative." The National Association of Chemical Recyclers has developed a "Responsible Recycling Code," which extends Responsible Care principles to chemical recycling. The Synthetic Organic Chemical Manufacturers Association has adopted the pollution prevention management codes of Responsible Care. The Great Printers Project is a hybrid effort developed by the Printing

Industries of America, the Environmental Defense Fund, and the governors from four states in the Great Lakes Region.

10.5 Federal Negotiated Agreements

Negotiated agreements are voluntary in the sense that firms are free to participate, or not, as they see fit. However, once a firm has signed a negotiated agreement, the firm is committed to fulfilling its part of the agreement. If the firm fails to deliver on agreed-upon actions or fails to achieve the results specified in the agreement, the firm risks adverse publicity and increased scrutiny by EPA. The goals of two negotiated voluntary programs are shown in Table 10-4.

Table 10-4. Federal Negotiated Voluntary Programs

PROGRAMS (year program launched)	ENVIRONMENTAL GOALS
Project XL (1995) www.epa.gov/ProjectXL	Develops innovative strategies to test better and more cost- effective ways of protecting the environment and public health.
Common Sense Initiative (1994) www.epa.gov/commonsense	Addresses environmental management by industrial sector rather than by environmental medium (air, water, land). Now an EPA Sector Program.

A primary goal of negotiated strategies is to improve efficiency by reducing regulatory burden. In practice, most Project XL and CSI (Common Sense Initiative) projects attempt to reduce the administrative costs associated with reporting, monitoring, and permitting.

10.5.1 Project XL

In 1995, EPA launched a portfolio of high-priority initiatives that sought new ways to protect the environment and public health, while demonstrating how EPA, the regulated community, and the public together can improve environmental management to address complex environmental issues. Since then, businesses, communities, and other federal agencies have responded to this challenge by participating in these initiatives, including Project XL (which stands for e*X*cellence and *L*eadership). Project XL was developed to accelerate environmental progress through collaboration on environmental problem solving, to modify certain constraints, and to reduce some costs that could be associated with environmental regulations.

Project XL solicits ideas from EPA's partners: private-sector and public-sector facilities, other government agencies, trade associations, and communities. The project then assesses those ideas that propose solutions to difficult regulatory or technical problems and that explore new approaches to protecting public health and the environment, usually at a lower cost or lessened regulatory burden for the project sponsor. The basic tenet of Project XL can be explained in terms of its three elements: Through prudent experimentation and regulatory flexibility, EPA and its partners can (1) find economic gains for businesses and government, (2) more effectively engage the public in decisions that affect their local environments, and (3) achieve a cleaner environment.

Project XL is providing a forum for companies to test new technologies and alternative regulatory approaches that eventually might be used more widely to boost energy efficiency and achieve greater environmental protection. One criticism of federal efforts to protect the environment is that EPA's regulatory requirements can be too prescriptive. For years, EPA has heard: "Give us environmental goals to meet, but don't tell us how to meet them." For the past decade, EPA has been building greater flexibility into regulatory programs through the trading of emission "allowances" and other approaches. Through Project XL, EPA is providing companies and other project sponsors with additional opportunities to demonstrate their abilities to find innovative approaches to environmental protection. EPA is finding that a little flexibility can go a long way toward getting better results.

The experiments being conducted under Project XL are in various stages. As of November 2000, 16 projects have been underway for a year or more, and 34 projects have been in progress for less than 1 year. Early evaluation results show benefits to the environment, project sponsors, and the communities. Data from several projects indicate the potential that innovative approaches have for significantly improving current methods for managing the environment.

Features of Project XL

- Superior Environmental Protection
- Cost Savings and Reduced Paperwork
- Stakeholder Involvement
- Innovative Pollution Prevention
- Transferability
- Feasibility
- Monitoring, Reporting, and Evaluation
- No Shifting of Risk Burden

In fact, Project XL's greatest opportunity, and its greatest challenge, is taking successful ideas from individual pilot projects and moving these ideas into system-wide practice and into EPA's everyday way of doing business. Through experimentation and evaluation, Project XL can add to an ever diversifying set of tools for environmental protection by identifying new approaches, discovering the keys to their effective use, and better enabling EPA to match the right tool to the right problem.

Under Project XL, project sponsors have gained operational flexibility, such as expediting or consolidating permitting, reducing the amount and frequency of recordkeeping and reporting, creating facility-wide emission caps, and supporting innovative technology. As a result of operational flexibility, project sponsors, in turn, gain additional benefits from improved administrative or technological efficiencies, industry recognition and leadership, better leveraging of employee expertise, better community and stakeholder relations, and improved relationships with regulators. EPA encourages firms to view the flexibility provided by Project XL as an opportunity to create real incentives for environmental improvement, whether they are financial, competitive, technological, community-related, or otherwise.

For example, Intel Corporation has announced that it will take advantage of some these concepts in their business planning. Early this year, Intel announced that it will build its first 300-millimeter, high-volume semiconductor manufacturing facility in Chandler, Arizona. Intel will be able to expand the Chandler facility under an existing air emissions cap that was established under Project XL in 1996. Table 10-5 provides examples of the actual and anticipated economic gains that have been reported by project sponsors.

EPA currently faces important questions regarding the Project XL challenge. As the information on project results expands exponentially, what are the best methods for transforming results into knowledge? As EPA evaluates and learns how these new tools work, how does it match the right tools to the right problems? How does the Agency increase its rate and scale of adopting new ideas into appropriate system-wide practice? How does EPA translate its innovation experience into improved processes that will enhance its ability to test new concepts?

Table 10-5. Economic Benefits for Select Project Sponsors of Project XL

- **Crompton Corporation's Sistersville plant** (formerly known as Witco) saved $58,000 from waste minimization and pollution prevention (WM/PP) activities in 1998 ($42,000 in one-time activities and $16,000 in savings from recurring air emissions reductions and methanol recycling). As of July 2000, 67 WM/PP initiatives have been implemented at the Sistersville plant, resulting in a total cost savings of an additional $1,010,000 during 1997-1999 and the first half of 2000. Crompton expects future savings of $800,000 over 5 years as a result of a negotiated deferral under the rules of the Resource Conservation and Recovery Act (RCRA). The company also identified potential, recurring cost savings of $620,000 per year that will be achieved through WM/PP activities.
- **Department of Defense Elmendorf Air Force Base** (Elmendorf AFB) aims to streamline the application, implementation, management, and renewal process for Elmendorf AFB's Title V permit through reduced monitoring and recordkeeping. EAFB estimates that total monitoring, recordkeeping, reporting, and overall permit management costs will decrease by about 80%, yielding about $1.5 million in savings over 6 years.
- **Department of Defense Vandenberg Air Force Base** (Vandenberg AFB) negotiated a protocol for source testing and validation with the Santa Barbara County Air Pollution District that is $2,400 cheaper than the standard EPA test ($600 per test rather than $3,000 per test). This protocol complies with administrative requirements to upgrade its infrastructure, pollution prevention programs, innovative technologies, and other approaches that will cost effectively reduce air emissions below mandated levels.
- **HADCO Corporation** has achieved some cost savings by reducing the number of sludge shipments it requires, an action that results from its voluntary installation of a sludge dryer. HADCO expects to see cost savings when it sends its sludge directly to a recycler instead of shipping it to an intermediate processor.
- **Intel Corporation** has avoided millions of dollars in production delays in the competitive quick-to-market semiconductor industry by eliminating 30 to 50 reviews per year. The company operates under a facility-wide permit that allows for equipment changes, process changes, and new construction at the site as long as the site's overall air quality limits are met. Early this year, Intel announced that it will build its first 300-millimeter, high-volume production manufacturing facility in Chandler, Arizona. Intel will be able to expand an existing facility under an air emissions cap that was established under Project XL in 1996.
- **Weyerhaeuser Company** achieved an estimated savings of $176,000 in reporting costs during the first year of operation as a result of the successful revision and reissue of the facility's air quality and wastewater discharge permits. The company is now saving $200,000 a year by recovering lime muds and reusing this solid waste in lieu of purchasing new lime for use in the mill's production. (It did incur a one-time cost of $150,000 in 1998 on related sampling collection and analysis.) Weyerhaeuser foresees avoiding $10 million in future capital spending. While it expects to spend $10 million on new water equipment, it will subsequently save $20 million that would otherwise have been spent on air pollution equipment.

Source: Project XL 1999 Comprehensive Report, and Project XL 2000 Comprehensive Report.
http://www.epa.gov/projectxl/guidexl.htm

10.5.2 Common Sense Initiative (CSI)

EPA designed the Common Sense Initiative (CSI) to take environmental protection beyond the command-and-control, pollutant-specific, and media-specific approaches. CSI used a sector approach, which focused on a particular business, service, or industrial sector, to achieve more efficient, effective, and timely environmental results. EPA believes that when industry works collaboratively with government and other stakeholders to consider releases to all environmental media concurrently rather in piecemeal fashion, industry sees more clearly the environmental and economic value of preventing pollution at the source. Furthermore, incentives can be tailored to meet the specific needs of an industry sector.

CSI was a 4-year (1994–98) pilot program for six large and small industry sectors. EPA worked with industry-sector representatives and other stakeholders in a consensus-based, federal advisory committee forum to find innovative ways to achieve "'cleaner, cheaper, smarter" environmental performance. The sectors involved in CSI were metal finishing, petroleum refining, printing, auto manufacturing, computers and electronics, and iron and steel. This effort produced more than 40 sector projects and one sector-wide stewardship initiative, the Metal Finishing Strategic Goals Program (SGP).

Among the 44 CSI projects, 23 addressed regulations, 20 promoted pollution prevention, 7 sought to reduce recordkeeping and reporting, 9 addressed compliance and enforcement, 6 addressed permitting, and 9 attempted to stimulate new environmental technology. True to its experimental nature, CSI produced expected and unexpected results. Some results are tangible, such as the implementation of many formal recommendations to the EPA Administrator, while others are intangible. It provided learning opportunities on a variety of environmental, economic, and social issues. For example, CSI significantly improved working relationships among stakeholders, many of whom had only interacted as adversaries in the past. In fact, the printing, petroleum, and metal finishing sectors are continuing to address issues in a multi-stakeholder, federal advisory committee forum.

SGP was adopted by the metal finishing industry in October 1997, and the program is still very active. While voluntary in nature, this stakeholder-driven program has led to regulatory and non-regulatory incentives, tools, and actions to improve performance by facilities within this sector. The agreement contains commitments on the part of EPA to change regulations that affect the industry, such as industry-wide goals for full compliance, improved economic payback, and reduced emissions from facilities. The agreement also includes a comprehensive action plan for state and local regulators and other stakeholders. As an indicator of the incentive nature of SGP, more than 400 companies, 21 states, and over 75 municipalities are participating.

With SGP as a model, EPA is developing similar, targeted programs to achieve better environmental performance and lower regulatory burden in the meat processing, shipbuilding/repair, specialty-batch chemical, and metal casting sectors. These programs also benefit from strong industry support. One of many EPA projects is a joint effort with the metal casting sector to produce information for states that will help them to permit safe uses for spent sand from foundries. This action will give the metal casting industry the economic incentive to re-use, rather than dispose of, the spent sand. Hence, millions of tons less waste will be sent to landfills each year, saving millions of dollars in waste disposal expenses for the industry.

With the growing knowledge of how to use sector approaches to tackle tough problems, in 1998 EPA began a process to integrate sector work into the Agency's core functions. Sector Action Plans were developed for FY1999 and FY2000 to guide this effort. EPA's program offices have been encouraged to consider, where appropriate, an integrated cross-Agency, multi-media sector approach as a way of conducting their everyday business. The draft *EPA Sector Program Plan 2001–2005,* which is being reviewed by stakeholders, provides a vision for environmental excellence by U.S. industries. The plan affirms the validity of using all types of sector tools and approaches to protect the environment, whether these tools and approaches are voluntary or regulatory, single-media or multi-media, issue-specific or industry-wide. The sector approach is also being extended to include related economic entities through the supplier-producer-customer chain and other networks that directly impact an industry sector.

Sector approaches are increasingly common. Through the shared experiences of CSI and other sector programs, leaders from government, industry, and other stakeholder groups have become more willing to sit down together to search for solutions to today's environmental challenges in a non-adversarial way.

10.6 An Assessment of Pollution Prevention Efforts

A 1998 EPA review of all of its Partners for the Environment efforts concluded that the results to date have been impressive. Environmental benefits achieved by EPA's Partners totaled

- 5.2 billion fewer tons of solid waste generated,
- 199 trillion fewer Btus of energy used,
- 24.7 million fewer tons of greenhouse gases emitted, and
- 1.2 billion fewer gallons of water used.

At the same time, these Partners saved $852 million in 1996.

10.7 Voluntary Programs Developed by EPA Regions

The regional offices of EPA have been active in the development and promotion of voluntary programs. Table 10-6 identifies many of these programs.

Table 10-6. Selected Regional Voluntary Programs of EPA

EPA PROGRAM	EPA REGION	EPA PROGRAM	EPA REGION
Agricultural Initiative	9	Metal Finishing Partnership	9
Air Quality Initiative	8	Osage Nation, Oklahoma, CBEP	6
American Heritage Rivers	8	Pollution Prevention (P2) Awards for Excellence	7
Bay Area Green Business Program	9	P2 Roundtable	7
Beneficial Landscaping	5	Pacific Northwest P2 Research Center	10
Brownfields Initiatives	1-10	Partners for Change	1
Business for the Chesapeake Bay	3	Partnership to Help Foundries Achieve Compliance	6
Center for Industry and Technology	1	PCB Used Oil Sweep	5
Chemical Safety Audit Program	3	Problem Oil Pit Initiatives	8
Chemical Safety Audit Program	4	Small Business Assistance Center	3
Chlor-Alkali Mercury Reduction	5	Southern Application Mountain Initiative	4
Clean Star Texas City	6	StarTrack	1
Community-Based Environmental Protection	8	StarTrack	3
Compliance Leadership	1	Sustainable Challenge Grants	4
Environmental Merit Awards	1	Texas City, Texas, CBEP	6
Evergreen Award	10	U. S. Auto P2 Project	5
Great Printers Project	5	Urban Initiatives	4
Greater Chicago P2 Alliance	5	Urban Initiatives for Sustainable Communities	4
Green Communities	3	Urban Livability	8
Headwaters Waste Mining Initiative	8	Utah 2002 Olympics	8
Henryetta, Oklahoma, CBEP	6	Voluntary Initiative for P2	3
Indoor Quality Initiatives	5	Waste Minimization Assessment	5
Merit Partnership	9		

10.8 State Programs

A comprehensive treatment of the hundreds of state and community voluntary programs for environmental protection is beyond the scope of this paper. However, a few programs are reported in the following paragraphs to illustrate the nature and scope of these activities.

10.8.1 Massachusetts Recycled Newsprint Program

Massachusetts has developed a voluntary newsprint recycling program. (This program can be contrasted to Wisconsin's program, which has recycled content requirements on newspaper publishers, and fees levied on those failing to meet the requirements. See Chapter 6.) Under the terms of a 1992 memorandum of understanding between the Commonwealth of Massachusetts and the Massachusetts Newspaper Publishers Association, the Commonwealth agreed to develop newsprint collection and processing programs within the state, and the Association agreed to increase its use of recycled content. The following targets for increasing the recycled content of newsprint were set: 13% of recycled content by December 1993, 23% by December 1995, 31% by December 1997, and 40% by December 2000.

The publishers agreed to give preference to purchasing newsprint that was recycled within the state. They are exempt from the targets described in the previous paragraph if high-quality recycled newsprint cannot be obtained at prices comparable to those of virgin newsprint.

In return for the publishers' efforts, the Commonwealth agreed to promote de-inking and processing facilities in an attempt to increase the supply of recycled-content newsprint that was available to the publishers. The state also agreed to oppose recycled-content mandates or penalties for the use of virgin newsprint and to facilitate private-sector investment in the publishing industry.

10.8.2 Adopt-a-Highway Programs

In Adopt-a-Highway Programs, volunteers agree to periodically clean up selected stretches of roadside. Although these programs vary from state to state, they typically involve agreements by organizations to clean up a stretch of roadside that is approximately two miles long and to do so two to seven times a year, for 1 to 3 years. The state usually offers trash bags, safety vests, and other gear. Perhaps most important for businesses that participate, the state usually provides at least one sign to be placed on the adopted roadside that indicates the name of the adopting organization. However, a 1994 survey revealed that 10 states did not allow businesses to adopt highways, and 33 states did not allow adopting organizations to contract others to perform the cleanup.

Adopt-a-Highway programs offer advantages both to states and to adopting organizations. They allow states to maintain roadsides at lower state expense, and they generate positive publicity for businesses and other adopting organizations.

Although there is no federal Adopt-a-Highway Program, state programs have spread rapidly since Texas created the first one in 1985. The number of states with programs increased to 41 by 1990. The aforementioned 1994 survey revealed that all states except Maine and Vermont had these programs. According to the same survey, 121,700 adopting groups composed of 1.3 million volunteers were participating in the programs, and over 200,000 miles of roadside had been adopted.

10.8.3 State Voluntary Cleanup Programs

More than 40 states have voluntary cleanup programs that offer a wide range of incentives for cleaning up and reusing brownfields. The voluntary programs vary by funding levels, types of activities funded, and the eligibility of entities. State incentives can include financial support, regulatory streamlining, and liability relief. EPA provides about $10 million annually to support state voluntary cleanup programs. In addition, 14 state voluntary cleanup programs have signed memoranda of agreement with EPA that clarify state and federal responsibilities and strengthen the role of the state programs.

10.9 Conclusions

Voluntary programs in the United States combine the features of unilateral, negotiated, and public voluntary approaches employed in the European Union (EU). In the United States, voluntary agreements have been crafted under the aegis of the Pollution Prevention Act, through the Climate Change Action Plan, by industry associations, and by state and local governments. Most U.S. voluntary efforts would be characterized as cooperative, non-mandatory strategies. Several authors have claimed that existing legislation impedes the implementation of industry-led voluntary agreements and public-sector projects that employ negotiation (Davies and Mazurek 1996; Kappas 1999; Boyd, Krupnick, and Mazurek 1998). The consequence is that voluntary approaches serve as a supplement to the main thrust of federally mandated air, water, waste, and toxic control programs.

In most of the U.S. voluntary programs, the task of evaluating program effectiveness is hampered by unique program features as well as limited data and monitoring relative to baseline conditions. While there are some data illustrating the administrative costs of developing certain types of voluntary agreements and the environmental effectiveness of a few of the energy conservation measures, a comprehensive cost-effectiveness assessment has not been performed for any of the voluntary programs.

EPA reports and other literature mention a number of desirable effects besides environmental improvement that result from these programs. Participants in Responsible Care, 33/50, CSI, and Project XL all cite enhanced public opinion or goodwill with regulators as significant benefits. In fact, a motivating factor for several Project XL participants was to improve relations with the community (Boyd, Krupnick, and Mazurek 1998). The Chemical Manufacturers Association (CMA) advocated Responsible Care primarily as a means of improving public opinion. CMA convinced its membership that the future of the chemical industry depended on their reversing the negative public perception of the industry. To facilitate the adoption of its program, CMA patterned Responsible Care on its members' ongoing environmental, health, and safety (EHS) programs.

Voluntary agreements appear to contribute to constructive dialogue among groups that normally act as adversaries. Voluntary agreements also provide for more opportunity for stakeholder participation than the status quo does. With improvements in administrative, monitoring, and participatory procedures, voluntary agreements could become an important element of the U.S. strategy for improving the cost effectiveness of environmental management.

Unilateral, industry-led voluntary agreements can suffer from what is termed the "free rider" problem. Such agreements provide benefits in the form of publicity and goodwill for all members. Members of an industry association may join a voluntary agreement, yet take minimal actions to comply. Members can also choose not to join the voluntary agreement, but they can still benefit from the actions of those who have joined. Understandably, an association would be reluctant to eject members, since it depends on dues from them to survive. Thus, free-riding may be a significant problem from the point of view of truly motivating participants to join unilateral agreements. This problem was evident in the STEP program of the American Petroleum Institute (API). In this case, several API members joined STEP, yet they failed to follow through with all of its provisions.

Implementation of negotiated agreements is slowed because Congress did not give EPA the authority to offer firms relief from existing laws and regulations (Davies and Mazurek 1996). Two consequences follow. The first issue relates to procedure. Whenever government or trade associations have less than strong legal authority for their initiatives, they act through consensus-building processes. This approach gives individual participants potential veto power over such initiatives, and it may result in large transaction costs. Second, reliance on consensus-based methods also tends to result in goals that reflect the basic common denominator on which all parties agree.

While there were difficulties in the initial implementation of CSI, the experiment has demonstrated the value of collaborative, sector-based approaches to environmental protection. Many of the 300 participants in CSI have built positive relationships with former adversaries that have outlasted the program itself. Based on its experiences with CSI, EPA has expanded opportunities for involving stakeholders in the Agency's decision-making processes. EPA is using voluntary collaboration to improve traditional EPA functions such as regulation, permitting, and compliance assistance. By applying the many lessons learned from this unique program, EPA attempts to ensure that the next generation of initiatives for environmental protection is based on common sense and cost effectiveness.

The first few XL projects posed many challenges. EPA had never attempted this type of experiment. As a regulatory agency, EPA was cautious in the early stages. EPA and others had concerns about how to test new approaches and yet still maintain the same level of protection that the current regulatory system provides. The Agency had to learn as Project XL progressed. Project sponsors, regulators, and citizens alike invested significant resources and time in XL's creative and complex experiments. After gaining experience, the Agency had a better idea of what information was important for industry to include in their proposals and how decisions should be made. In 1998, EPA and its partners worked hard to streamline Project XL, so negotiations would go more smoothly, quickly, and predictably. This new process now yields agreements for most projects in six months to a year, compared to 24 months or longer under the old process. For example, the Atlantic Steel project, in Atlanta, Georgia, has already shown results by producing a signed project agreement for Phase One, just eight months after initial pre-proposal discussions with EPA.

The Agency's rapidly growing partnership programs continue to show promise for effecting improved stewardship.[277] These programs typically improve efficiency, cut waste, and conserve resources, thus lowering costs and yielding environmental benefits. As such, EPA has used partnership programs to address a variety of issues, including climate change, solid waste, pesticide risks, and to advance new environmental technologies and practices. These experiences have shown that voluntary approaches can be a strong complement to the traditional regulatory system and a tangible means for getting better environmental results.

Index

A004305

T

V

W

Bibliography

Ackerman, Frank. 1994. "Advance Disposal Fees and Incentives for Waste Reduction." *New Partnerships: Economic Incentives for Environmental Management*. Air and Waste Management Association.

Ackerman, Frank, Dmitri Cavander, John Stutz, and Brian Zukerman. 1995. *Preliminary Analysis: The Costs and Benefits of Bottle Bills*. U.S. EPA Office of Solid Waste and Emergency Response. Draft Report. Boston: Tellus Institute.

Acton, Joe. 1996. Personal communication. Environmental Protection Agency.

Alberini, Anna and David Austin. 1999a. *Accidents Waiting to Happen: Liability Policy and Toxics Pollution Releases*. Resources for the Future. Discussion Paper No. 99-29.

Alberini, Anna and David Austin. 1999b. "Strict Liability as a Deterrent in Toxic Waste Management: Empirical Evidence from Accident and Spill Data." *Journal of Environmental Economics and Management*. 38(1): 20-48.

Amendola, Gary. Memo citing conversation with Gary Amendola. (as cited in TBS report, p. 12) .

American Farmland Trust. Center for Agriculture in the Environment. http://www.farmlandinfo.org/cae/home.html.

Anderson, Robert. 1977. "Economic Incentives for the Recovery of Secondary Lead." *Resource Recovery and Conservation*. 2: 193-209.

Anderson, Robert C., Mike Rusin, and Lisa Hoffman. 1990. *The Use of Economic Incentive Mechanisms in Environmental Management*. American Petroleum Institute. Research Paper No. 051. June. http://www.api.org/cat/.

Anderson, Robert and Mark Rockel. 1991. *Economic Valuation of Wetlands*. American Petroleum Institute. Discussion Paper No. 065. April. http://www.api.org/cat/.

Anderson, Robert. 1994. *Federal Subsidies for Alternative Fuels and Alternative Fuel Vehicles*. American Petroleum Institute. Discussion Paper No. 076. September. http://www.api.org/cat/.

Anderson, Robert and Andrew Lohof. 1997. *The United States Experience With Economic Incentives in Environmental Pollution Control Policy*. Environmental Law Institute. Washington, D.C. EE-0216A. http://www.epa.gov/economics

Anderson, Robert. 1999. *Economic Savings from Using Economic Incentives for Environmental Pollution Control*. Environmental Law Institute. Washington, D.C. EE-0415. http://www.epa.gov/economics.

Arner, Robert and Kimberly Davis. 1994. *Northern Virginia Variable Rate Demonstration Project: "Pay as you throw" Interim Report*. Northern Virginia Planning District Commission. 17 May.

Arnold, Frank. 1995. *Economic Analysis of Environmental Policy and Regulation*. New York: John Wiley and Sons, Inc.

Arora, Seema and Timothy N. Cason. September 1995. *Why Do Firms Overcomply with Environmental Regulations? Understanding Participation in EPA's 33/50 Program*. Resources for the Future. Discussion Paper No. 95-38. http://www.rff.org/disc_papers/abstracts/9538.htm.

Atkinson, Scott and D. Lewis. 1974. "A Cost-Effectiveness Analysis of Alternative Air Quality Control Strategies." *Journal of Environmental Economics and Management*. 1: 237-250.

Atkinson, Scott and Tom Tietenberg. 1991. "Market Failure in Incentive-Based Regulation: The Case of Emissions Trading." *Journal of Environmental Economics and Management*. 21: 17-32.

Barrett, Julia. 1996. Personal communication. Wisconsin Department of Natural Resources. May.

Barthold, Thomas A. 1994. "Issues in the Design of Environmental Excise Taxes." *Journal of Economic Perspectives*. 8(1).

Baton Rouge Advocate. 1995. "DNR Sets New Rules for Wetlands Mitigation." August 27.

Batteese, Robert. 1988. *Returnable Pesticide Containers: Maine's Deposit and Collection System*. Maine Board of Pesticides Control. Unpublished speech. October.

Batteese, Robert. 1996. Personal communication. Maine Board of Pesticides Control.

Bauer, Scott and Marie Lynn Miranda. 1996. *The Urban Performance of Unit Pricing: An Analysis of Variable Rates for Residential Garbage Collection in Urban Areas*. Report prepared for Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency. April. EE-0304. http://www.epa.gov/economics.

Beverage World 1995-1996 Databank.

Blackman, Allen and Janice Mazurek. 1999. *The Cost of Developing Site-Specific Environmental Regulation: Evidence from EPA's Project XL*. Resources for the Future. Discussion Paper No. 99-35.

Bohi, Douglas R. and Dallas Burtraw. 1997. *SO_2 Allowance Trading: How Experience and Expectations Measure Up*. Resources for the Future. Discussion Paper No. 97-24.

Bonderud, Kendra and Ron Shanovich. 1995. *Solid Waste Recycling and Waste Reduction.* State of Wisconsin Legislative Fiscal Bureau. January.

Boroski, Rob. 1996. Personal communication. Texas Natural Resource Conservation Commission.

Boyd, James, Alan Krupnik, and Janice Mazurek. 1998. *Intel's XL Permit: A Framework for Evaluation.* Resources for the Future. Discussion Paper No. 98-11.

Boyd, James. 1998. *Searching for the Profit in Pollution Prevention: Case Studies in the Corporate Evaluation of Environmental Opportunities.* Resources for the Future. Discussion Paper No. 98-30.

Brooks, Greg. 1996. *91 Express Lanes Transponder Distribution Ahead of Schedule: Transponders in Use on World's First Fully Automated Toll Road Ahead of Forecasts by Four Months.* Congestion Pricing Forum release. 19 March.

Brooks. 1996. Untitled. CPTC Earthlink Release. www.iti.nwu.edu/clear/high/toll.txt.

Brown, Kelly M., Ronald Cummings, Janusz R. Mrozek, and Peter Terrebonne. Forthcoming. "Scrap Tire Disposal: Three Principles for Policy Choice." *The Natural Resources Journal.*

Buist, Henry, Carolyn Fischer, John Michos, and Abebayehu Tegene. Undated. *Purchase of Development Rights and the Economics of Easements.* USDA Economic Research Service AER-718.

Burtraw, Dallas. 1995. *Cost Savings Sans Allowance Trades? Evaluating the SO_2 Emission Trading Program to Date*. Resources for the Future. Discussion Paper No. 95-30.

Burtraw, Dallas. 1998. "Cost Savings, Market Performance, and Economic Benefits of the U.S. Acid Rain Program." Resources for the Future. Discussion Paper 98-28. www.rff.org/disc_papers/PDF_files/9828rev.pdf.

Button, Kenneth. 1994. "Road User Charging With Particular Reference to Urban Areas." *Applying Economic Instruments to Environmental Policies in OECD and Dynamic Non-Member Economies.* OECD.

Cadmus Group. 1999. *Characterization of Selected EPA Partnership Programs.*

Cain, Charles. 1998. "Bottle deposit fraud costs Michigan millions that could be spent on environment." *The Detroit News*. 31 August.

California. 1986. Safe Drinking Water and Toxic Enforcement Act of 1986. http://www.oehha.ca.gov/prop65/law/p65.html.

California Air Resources Board. *Hot Spots (AB 2588) Program*. Air Toxics. http://www.arb.ca.gov/ab2588/ab2588.htm.

California Attorney General's Office. 1996. *Proposition 65 Litigation*. Unpublished document. Oakland. 1 May.

California Department of Toxic Substances. 1996. *Hazardous Waste Fee Summary Effective January 1, 1996*.

California EPA. 1996a. "305 State Businesses Win Awards for Reducing Waste." 1996. *CAL/EPA Report* 5. No. 1/2. January/February.

California EPA. 1996b. *State Waste Board Lowers Interest Rate on Recycling Loan*. March.

California EPA. 2000. Office of Health Hazard Assessment. *Chemicals Known To The State To Cause Cancer Or Reproductive Toxicity*. 4 August. http://www.oehha.ca.gov/prop65/pdf/80400LSTA.pdf.

California LAO. *LAO Analysis of the 1995-96 Budget Bill, Resources, Part II*. http://www.lao.ca.gov/a96b2.html.

California Pollution Control Financing Authority. Various informational brochures.

California Waste Reduction Awards Program. *1999 WRAP of the Year*. http://www.ciwmb.ca.gov/WRAP/WOTY/woty99.htm.

California Water Resources Control Board. *Schedule of Fees for Bay Protection and Toxic Cleanup Program*. http://www.swrcb.ca.gov/fesfund/fees/feebptc.doc.

Cameron, Michael. 1991. *Transportation Efficiency: Tackling Southern California's Air Pollution and Congestion*. Environmental Defense Fund and Regional Institute of Southern California. March.

Cantor Fitzgerald Environmental Brokerage Services. *Documents on Emissions Trading*. http://www.cantor.com/ebs/.

Carlin, Alan. 1992. *The United States Experience With Economic Incentives To Control Environmental Pollution*. EPA Office of Policy Planning and Evaluation. July. EE-0216. http://www.epa.gov/economics.

Carlson, Curtis, Dallas Burtraw, Maureen Cropper and Karen Palmer. 2000. "Sulfur Dioxide Control by Electric Utilities: What are the Gains form Trade? Resources for the Future. DP 98-44-rev. www.rff.org/disc_papers/PDF_files/9844rev.pdf.

Carraway, Candace. 1996. Personal communication. Environmental Protection Agency.

Cason, Timothy. 1995. "An Experimental Investigation of the Seller Incentives in the EPA's Emission Trading Auction." *American Economic Review:* 905-922.

Chance, Clifford. 1995. *Economic and Fiscal Instruments and the Environment: the Example of ECO-taxes*. Summer. http://www.cliffordchance.com/eer_f02.htm.

Charles River Associates. 1991. *Policy Alternatives for Reducing Petroleum Use and Greenhouse Gas Emissions*. Boston.

Chemical Manufacturers Association. *Documents on Responsible Care*. http://www.cmahq.com/.

A004309

Clarke, Stephen F. 1992. "International Comparison of the Tax Treatment of Pollution-Control Investment." *U.S. Environmental Policy and Economic Growth: How Do We Fare?* American Council for Capital Formation Center for Policy Research. March.

Coase, Ronald H. 1960. "The Problem of Social Cost." *Journal of Law and Economics*. 3: 1-44.

Cody, Betsy A. 1994. *Grazing Fees: A Primer*. Congressional Research Service. December. http://www.cnie.org/nle/ag-5.html.

Congressional Budget Office. 1985. *Hazardous Waste Management: Recent Changes and Policy Alternatives*. Government Printing Office.

Congressional Research Service (CRS). 1994. *Market-Based Environmental Management: Issues in Implementation*. March.

Congressional Research Service (CRS). 1996. *Report for Congress Grazing Fees: An Overview*. 96-450 ENR. 21 May. http://www.cnie.org/nle/ag-5.html.

Congressional Research Service (CRS). 1998. *Global Climate Change: The Energy Tax Incentives in the President's FY1999 Budget*. 98-193E.

Consumer Reports. various issues.

Container Recycling Institute. 1994. *Beverage Container Reuse and Recycling in Europe: A Survey of Nine Countries*. April.

Cook, Elizabeth. 1996. *Making a Milestone in Ozone Protection*. World Resources Institute. January.

Cooney, John F. et al. 1996. Criminal Enforcement of Environmental Laws. in *Environmental Crimes Deskbook*. Washington D.C.: Environmental Law Institute.

Council of Economic Advisors. 1996. *Economic Report of the President*.

Council on Environmental Quality. Regulations for Implementing NEPA. http://ceq.eh.doe.gov/nepa/regs/ceq/toc_ceq.htm.

Crandall, Robert W., H.K. Gruenspecht, T.E. Keeler, and L.B. Lave. 1986. *Regulating the Automobile*. Washington D.C.: The Brookings Institution.

Criner, George K., Steven L. Jacobs, and Stephanie R. Peavey. 1991. *An Economic and Waste Management Analysis of Maine's Bottle Deposit Legislation*. Maine Agricultural Experiment Station Miscellaneous Report 358. April.

Criner, George, Stephanie Seguino, Margarita Suarez, Jeff Young, Robert McKay, and Christopher Spruce. 1995. *Solid Waste Management (SWM) Options: The Economics of Variable Cost and Conventional Pricing Systems in Maine*. June.

Crocker, Thomas. 1966. "The Structuring of Air Pollution Control Systems" in: H. Wolozin ed. *The Economics of Air Pollution*. New York: W.W. Norton.

Crookshank, Steven. 1994. *Air Emissions Banking and Trading: Analysis and Implications for Wetland Mitigation Banking*. American Petroleum Institute. Discussion Paper No. 074.

Crookshank, Steven. *1995. Alternative Wetland Mitigation Programs*. American Petroleum Institute. Discussion Paper No. 077. http://www.api.org/cat/.

Cropper, Maureen and Wallace Oates. 1992. "Environmental Economics: A Survey." *Journal of Economic Literature*. 30: 675-740.

Dahl, T.E. 1979. *Wetlands Losses in the United States, 1780's to 1980's*. Washington, D.C.: U.S. Department of the Interior, Fish and Wildlife Service.

DEN *(Daily Environment News)*. various issues. published by the Bureau of National Affairs.

Dales, John. 1968. *Pollution, Property and Prices*. Toronto: University of Toronto Press.

David, Martin, Wayland Eheart, Erhard Joeres, and Elizabeth David. 1977. *Marketable Permits for the Control of Phosphorus Effluent in Lake Michigan*. Social Science Research Institute Working Paper. University of Wisconsin.

Davies, Terry and Janice Mazurek. 1996. *Industry Incentives for Environmental Improvement: Evaluation of U.S. Federal Initiatives*. Washington D.C.: Global Environmental Management Initiative.

DOE (Department of Energy). 1996. *Clean Cities Guide to Alternative Fuel Vehicle Incentives & Laws*. http://www.ccities.doe.gov/.

Dewees, Donald. 1983. *Instrument Choice in Environmental Policy. Economic Inquiry*. 9(2): 323-31.

Deyle, Robert and Stuart Bretschneider. 1990. Public Policy Impacts on the Generation and Disposal of Hazardous Waste in New York State. *Journal of the Air and Waste Management Association*. 40: 462-468.

Dower, Roger C. 1995. *The Right Economic Instrument for the Right Task: The Case of Pollution Fees and Information Programs*. World Resources Institute. Comision Nacional del Medio Ambiente. Draft report. July.

Dudek, Daniel and John Palmisano. 1988. "Emissions Trading: Why is This Thorough-bred Hobbled?" *Columbia Journal of Environmental Law*. 13:217-56.

Dudra, Paul. 1996. Personal communication. Rhode Island Department of Environmental Management.

Duhl, Joshua. 1993. *Effluent Fees: Present Practice and Future Potential*. American Petroleum Institute. Discussion Paper No. 075. December. http://www.api.org/cat/.

Eheart, Wayland, E. Downey Brill, Jr., and Randolph M. Lyon. 1983. "Transferable Discharge Permits for Control of BOD: An Overview." In Erhard F. Joeres and Martin H. David, eds. *Buying a Better Environment: Cost-Effective Regulation through Permit Trading*. Madison: University of Wisconsin Press.

Ellerman, A. Denny, Richard Schmensee, Paul Jaskow, Juan Pablo Montero and Elizabeth Bailey. 1997. *Emissions Trading Under the U.S. Acid Rain Program: Evaluation of Compliance Costs and Allowance Market Performance*. MIT Center for Energy and Environmental Policy Research.

Ellerman, A. Denny, et al. 2000. *Markets for Clean Air: The U.S. Acid Rain Program*. Cambridge University Press.

Environmental Defense Fund. 1995. *New Highway Uses Economic Incentives to Stem Air Pollution*. press release. 7 December. http://www.edf.org/pubs/NewsReleases/1995/Dec/catoll.html.

Environmental Law Institute. 1993a. *Information Access Mechanisms: Collecting and Disseminating The Information Necessary for Environmental Protection*. June.

Environmental Law Institute. 1993b. *New State and Local Approaches to Environmental Protection*. August.

Environmental Law Institute. 1993c. *Wetland Mitigation Banking*.

Environmental Law Institute. 1995. *An Analysis of State Superfund Programs: 50-State Study, 1995 Update*.

EPA. Acid Rain Program. http://www.epa.gov/acidrain/ardhome.html.

EPA. *Monthly Average Price of Sulfur Dioxide Allowances*. Acid Rain Program. http://www.epa.gov/acidrain/ats/prices.html.

EPA. *Brownfields Cleanup Revolving Loan Fund Pilots*. http://www.epa.gov/swerosps/bf/rlflst.htm#list.

EPA. *Effluent Trading in Watersheds Policy Statement.* http://www.epa.gov/owow/watershed/trading.htm.

EPA. *Partner Success Stories*. Energy Star Buildings. http://www.epa.gov/buildings/esbhome/newsroom/case_studies.html.

EPA. *Brownfields*. Office of Solid Waste and Emergency Response. http://www.epa.gov/brownfields/.

EPA. *Answers to Frequently Asked Questions*. Brownfields. Office of Solid Waste and Emergency Response. http://www.epa.gov/swerosps/bf/.

EPA. *Total Maximum Daily Load Program*. Office of Water. http://www.epa.gov/owow/tmdl/index.html.

EPA. *The Clean Water State Revolving Fund (SRF) Program.* Office of Water. http://www.epa.gov/owm/finan.htm#whatwedo.

EPA. *Effluent Trading in Watersheds*. Reinvention Activity Fact Sheets. http://www.epa.gov/reinvent/notebook/etw.htm.

EPA. *EPA's Voluntary Programs: A Summary List Prepared by the 33/50 Program.* Undated internet document (no longer on the web site).

EPA. *Water Alliances for Voluntary Efficiency (WAVE)*. http://www.epa.gov/owm/faqw.htm.

EPA. 1980. *Emissions Reductions Banking and Trading Update 2*. Office of Air Noise and Radiation. Washington, D.C.

EPA. 1984. *The Feasibility and Desirability of Alternative Tax Systems for Superfund: CERCLA Section 301(a)(1)(G) Study.*

EPA. 1986. *Emissions Trading Policy Statement; General Policies for Creation, Banking, and Use of Emission Reduction Credits; Final Policy Statement and Accompanying Technical Issues Document.* 51 FR 43814-60. 4 December.

EPA. 1988. *CFC Regulatory Impact Analysis*. Vol. 2.

EPA. 1991. *Economic Incentives: Options for Environmental Protection*. Office of Policy, Planning, and Evaluation. EE-0315. March. http://www.epa.gov/economics.

EPA. 1992a. *Guidelines for Oxygenated Credit Programs and Guidelines on Establishment of Control Periods*. Section (m) of the Clean Air Act as Amended. 57 Federal Register 47853.

EPA. 1992b. *Final Rule on Early Reduction of Hazardous Air Pollut*ants. 57 Federal Register 61970. 29 December.

EPA. 1993a. *Status Report on the Use of Environmental Labels Worldwide*. Office of Pollution Prevention and Toxics. September.

EPA. 1993b. *WasteWise: EPA's Voluntary Program for Reducing Business Solid Waste*. Office of Solid Waste and Emergency Response. October.

EPA. 1994a. *Determinants of Effectiveness for Environmental Certification and Labeling Programs.* Office of Pollution Prevention and Toxics. April.

EPA. 1994b. *Landfill Methane Outreach Program.* Office of Air and Radiation. April.

EPA. 1994c. *Metal Recovery, Environmental Regulation and Hazardous Wastes.* Office of Solid Waste and Emergency Response. June.

EPA. 1994d. *The Climate Is Right for Action: Voluntary Programs to Prevent Atmospheric Pollution.* Office of Air and Radiation. August.

EPA. 1994e. *Federal Disincentives: A Study of Federal Tax Subsidies and Other Programs Affecting Virgin Industries and Recycling.* Office of Policy, Planning, and Evaluation. August.

EPA. 1994f. *Introducing WAVE - Water Alliances for Voluntary Efficiency: Hotel Water Management for the 21st Century.* Office of Water. September.

EPA. 1994g. *Introducing.The Energy Star Buildings Program.* Office of Air and Radiation. November.

EPA. 1994h. *Update: Energy Star Showcase Buildings.* Office of Air and Radiation. EPA 430-F-94-027. November.

EPA. 1995a. *The Clean Water State Revolving Fund: Financing America's Environmental Infrastructure--A Report of Progress.* Office of Water. EPA 832-95-R-001. January.

EPA. 1995b. March "Opting Into the Acid Rain Program; Final Rule." 60 FR 17100. www.epa.gov/docs/fedrgstr/EPA-AIR/1995/April/Day-04/pr-537.html.

EPA. 1995c. *Expanding Community Right-to-Know: Recent Changes in the Toxics Release Inventory.* Office of Pollution Prevention and Toxics. March.

EPA. 1995d. *Enforcement and Compliance Assurance Accomplishments Report: FY 1994.* Office of Enforcement and Compliance Assurance. May.

EPA. 1995e. *Green Lights Fourth Annual Report.* Office of Air and Radiation. June.

EPA. 1995f. *Summary Report to the President: The Presidential Regulatory Reform Initiative.* 15 June. (Reprinted in Daily Environment News. 23 June 1995).

EPA. 1995g. Open Market Trading Rule for Ozone Smog Precursors. 60 FR 39668. 3 August.

EPA. 1995h. *Pollution Prevention Incentives for States: Grant Summaries 1989-1995.* Office of Pollution Prevention and Toxics. September.

EPA. 1995i *Expansion of Toxic Release Inventory, TRI Phase 3.* Office of Pollution Prevention and Toxics. (Reprinted in Daily Environment News. 10 October 1995).

EPA. 1995j. *Human Health Benefits From Sulfate Reductions Under Title IV Of The 1990 Clean Air Act Amendments.* Office of Air and Radiation. November.

EPA. 1996a. *Partnerships in Preventing Pollution: A Catalogue of the Agency's Partnership Programs.* Office of the Administrator. Spring.

EPA. 1996b. *Consumer Labeling Initiative Phase II Report.* March. http://www.epa.gov/opptintr/labeling/cliphase2/index.html.

EPA. 1996c. *1994 Toxics Release Inventory: Public Data Release.* Office of Pollution Prevention and Toxics. June.

EPA. 1996d. *Project XL: Final Project Agreement for the Intel Corporation* Ocotillo (Chandler) Site.

EPA. 1997a. *Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines. State Commitments to National Low Emission Vehicle Program.* 16 December.

EPA. 1997b. *Community Water System Survey, Volume I: Overview.* Office of Water. EPA 815-R-97-001a.

A004313

EPA. 1998a. "Economic Analysis of the Proposed Rule to Modify Reporting of Persistent Bioaccumulative Toxic Chemicals Under EPCRA Section 313." Economic and Policy Analysis Branch, Economics, Exposure and Technology Division, Office of Pollution Prevention and Toxics.

EPA. 1998b. *A Catalog of the Agency's Partnership Programs*. EPA 100-B-97-003.

EPA. 1998c. *National Air Quality and Emissions Trends Report, 1998.* www.epa.gov/oar/aqtrnd98.

EPA. 1999a. *Cumulative U.S. Clean Water SRF Investment.* Office of Water. 15 October. http://www.epa.gov/r5water/cwsrf/pdf/invus.pdf.

EPA. 1999b. *Findings of Significant Contribution and Rulemaking on Section 126 Petitions for Purposes of Reducing Interstate Ozone Transport.* 63 Federal Register 57356. 17 December.

EPA. 1999c. *Report to Congress Regarding EPA's Climate Change Activities.* p. 35.

EPA. 1999d. *Aiming for Excellence.*

EPA. 2000a. *Innovations in Environmental Management.* Office of Policy, Economics and Innovation. http://www.epa.gov/opei/industry/.

EPA. 2000b. *Control of Air Pollution from New Motor Vehicles: Tier 2 Motor Vehicle Emission Standards and Gasoline Sulfur Control Requirements; Final Rule.* 65 FR 28 6697-6746. 10 Feb.

EPA. 2000c. *Report to Congress Regarding EPA's Climate Change Activities.* 24 February.

EPA. 2000d. *TRI 1998 Data Release*. May. http://www.epa.gov/tri/tri98/.

EPA. 2000e. *Power to Make A Difference: Energy Star and Other Partnerships: 1999.* Climate Protection Division. EPA 430-R-00-006. July.

Environment Reporter. various issues.

Ernst & Young. *1994 National Water & Wastewater Rate Survey.*

Executive Office of the President. 1993. *Environmental Quality: The Twenty-Fourth Annual Report of the Council on Environmental Quality.*

Executive Office of the Present, Executive Order 11821. 1974. "Inflation Impact Statements." 39 FR 41501.

Executive Office of the Present, Executive Order 11949. 1976. "Economic Impact Statements." 42 FR 1017.

Executive Office of the Present, Executive Order 12044. 1978. "Improving Government Regulations." 43 FR 12261.

Executive Office of the Present, Executive Order 12291. 1981. "Federal Regulation." 46 FR 13193.

Executive Office of the Present, Executive Order 12548. 1986. "Grazing Fees." 51 FR 5985. 14 February.

Executive Office of the Present, Executive Order 12866. 1993. "Regulatory Planning and Review." 58 FR 51735.

Executive Office of the Present, Executive Order 13101. 1998. "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition." 63 FR 49643. www.nara.gov/fedreg/eo1998.html.

Executive Office of the Present, Executive Order 13123. 1999. "Greening the Government through Efficient Energy Management." 64 FR 30851. www.nara.gov/fedreg/eo1999.html.

Executive Office of the Present, Executive Order 13134. 1999. "Developing and Promoting Biobased Products and Energy." 64 FR 44639 www.nara.gov/fedreg/eo1999.html.

Executive Office of the Present, Executive Order 13148. 2000. "Greening the Government through Leadership in Environmental Management." 65 FR 24595 www.nara.gov/fedreg/eo2000.html.

Faeth, Paul. 2000. *Fertile Ground: Nutrient Trading's Potential to Cost-Effectively Improve Water Quality.* Washington D.C.: World Resources Institute.

Federal Highway Administration. 1996a. *BUYLINE: Congestion Pricing Updates.* Spring.

Federal Highway Administration. 1996b. Congestion Pricing Notes. Spring.

Federal Trade Commission. 1994. *FTC Updates Energy-Usage Disclosures for Home Appliances.* News release. 24 May.

Ferguson, Amanda. 1996. Personal communication. Environmental Protection Agency.

Fertilizer Institute. Unpublished list of state fertilizer taxes.

Field, Barry C. 1994. *Environmental Economics: An Introduction.* New York: McGraw Hill.

Financial Times. various issues.

Florida Department of Environmental Protection. 1995. *Waste Tires in Florida: State of the State.* October.

Flowers, John. 1996a. Memorandum on WAVE program to Michelle Price of the EPA. 25 April.

Flowers, John. 1996b. Personal communication. EPA.

Fortney, Catherine S. 1996. Personal communication. Bay Area Air Quality Management District.

Foster, Vivien and Robert Hahn. 1995. "Designing More Efficient Markets: Lessons from Los Angeles Smog Control." *The Journal of Law and Economics.* 38: 19-31.

Franklin, Pat. 1996. Personal communication. Container Recycling Institute. April.

Freedgood, Julia. 1991. "PDR programs take root in the Northeast." *Journal of Soil and Water Conservation.* 46(5).

Freeman III, A. Myrick. 1990. "Water Pollution Policy." *Public Policies for Environmental Protection.* Portney, Paul, ed. Resources for the Future.

Frisvold, George B. and Peter Condon. 1994. "Biodiversity Conservation and Biotechnology Development Agreements." *Contemporary Economic Policy.* 7.

Fullerton, Don and Thomas C. Kinnaman. 1995. "Garbage, Recycling, and Illicit Burning or Dumping." *Journal of Environmental Economics and Management.* 29(1).

Fullerton, Don. 1995. *Why Have Separate Environmental Taxes?* National Bureau of Economic Research. Working Paper No. 5380.

GAO. (General Accounting Office) 1990. *Solid Waste: Trade-offs Involved in Beverage Container Deposit Legislation.* November.

GAO. 1994a. *Toxic Substances: EPA Needs More Reliable Source Reduction Data and Progress Measures.* GAO/RCED-94-93. September.

GAO. 1994b. *Electric Vehicles: Likely Consequences of U.S. and Other Nations' Programs and Policies.* GAO/PEMD-95-7. December.

GAO. 1995a. *Solid Waste: State and Federal Efforts to Manage Nonhazardous Waste.* GAO/RCED-95-3. February.

GAO. 1995b. *Conservation Reserve Program: Alternatives Are Available for Managing Environmentally Sensitive Cropland.* GAO/RCED-95-42. February.

GAO. 1995c. *Agricultural Conservation: Status of Programs That Provide Financial Incentives.* GAO/RCED-95-169. April.

GAO. 1995d. *Animal Agriculture: Information on Waste Management and Water Quality Issues.* GAO/RCED-95-200BR. June.

GAO. 1996a. *Water Pollution: Differences Among the States in Issuing Permits Limiting the Discharge of Pollutants.* GAO 96-42. January

GAO. 1996b. *An Integrated Approach Could Reduce Pollution and Increase Regulatory Efficiency.* GAO/RCED-96-41.

GAO. 1996c. *Clean Water Act: Use of State Revolving Funds Varies.* GAO/T-RCED-96-140. April.

GAO. 1997a. *Superfund: State Voluntary Programs Provide Incentives to Encourage Cleanups.* GAO/RCED-97-66.

GAO. 1997b. *Environmental Protection: Challenges Facing EPA's Efforts to Reinvent Environmental Regulation.* RCED-97-155.

GAO. 1999. *Climate Change: Observations on the April 1999 Report on Climate Change Programs.* GAO/T-RCED-99-1999.

Gibbons, Diana C. 1986. *The Economic Value of Water.* Washington, DC: Resources for the Future.

Girasole, Rich. 1996. Personal communication. Rhode Island Department of Environmental Management.

Goldhammer, Earl, Jerry O. Allen, Mark G. Ancel, Mark A. Engel, Duane T. Phillips, and Raymond P. Reichert. 1995. *State Tax Treatment of Pollution Control Equipment -- A Survey and Commentary.* American Bar Association State and Local Taxes Subcommittee. August.

Goldstone, James. 1996. California Pollution Control Financing Authority. Personal communication.

Goulder, Lawrence H., Ian W. H. Parry, Roberton C. Williams III, and Dallas Burtraw. 1998. *The Cost-Effectiveness of Alternative Instruments for Environmental Protection in a Second-Best Setting.* Resources for the Future. Discussion Paper No. 98-22.

Green, David L. 1990. "CAFE or PRICE?: An Analysis of the Effects of Federal Fuel Economy Regulations and Gasoline Price on New Car MPG, 1978-90." *The Energy Journal.* 11(3): 37-57.

Green Scissors Campaign of Citizens United to Terminate Subsidies (CUT). 1995. *Sacred Cows: Grazing Fees -- Fair Market Value.* January.

Green Seal. Various documents and web site. http://www.greenseal.org/

Greening, Lorna A., Alan H. Sanstad, and James E. Hanson. 1997. "Effects of Appliance Standards on Product Price and Attributes: An Hedonic Pricing Model." *Journal of Regulatory Economics.* 11: 181-194.

Grocery Manufacturers of America. 1995. *GMA Praises Florida Legislature for Killing Two-Cent 'Container' Tax.* Internet press release. 12 May.

Guerrero, Peter F. 1995. *Status of Natural Resource Damage Claims.* Testimony (for GAO) Before the Subcommittee on Commerce, Trade, and Hazardous Materials, Committee on Commerce, House of Representatives. 20 June.

Hahn, Robert and Gordon Hester. 1989. "Where Did All the Markets GO? An Analysis of EPA's Emissions Trading Program." *Yale Journal on Regulation.* 16: 109-153.

Hahn, Robert and Roger Noll. 1982. "Designing a Market for Tradable Emissions Permits." *Reform of Environmental Regulation*: 132-133.

Hahn, Robert. 1989. "Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders." *Economic Perspectives*. 3: 95-114.

Hahn, Robert. 1995. "Choosing Among Fuels and Technologies for Cleaning Up the Air." *Journal of Policy Analysis*: 533-551.

Hahn, Robert. 2000. "The Impact of Economics on Environmental Policy." *Journal of Environmental Economics and Management*. 39(2): 375-399.

Hamilton, James. 1995. "Pollution as News: Media and Stock Market Reactions to the Toxics Release Inventory Data." *Journal of Environmental Economics and Management* 28: 98-113.

Hamilton, Randy. 1996. Personal communication. Texas Natural Resource Conservation Commission. June.

Harris, Jeffrey P. and Nancy Casey-McCabe. Undated. *Energy-Efficient Product Labeling: Market Impacts on Buyers and Sellers*. Lawrence Berkeley National Laboratory, Energy and Environment Division.

Harrison, David. 1983. "The Regulation of Aircraft Noise." *Incentives for Environmental Protection*. Thomas Schelling, ed. Cambridge, MA: MIT Press.

Helfand, Gloria E. 1994. "The Role of Information as an Incentive for Environmental Control." *New Partnerships: Economic Incentives for Environmental Management*. Air and Waste Management Association.

Hendricksen, Toni. 1996. Personal communication. New Jersey Department of Law and Public Safety. May.

Henriques, Irene and Perry Sadorski. 1996. "The Determinants of an Environmentally Responsible Firm." *Journal of Environmental Economics and Management*. 30(3).

Hewitt, Julie A. and W. Michael Hanemann. 1995. "A Discrete/Continuous Choice Approach to Residential Water Demand under Block Rate Pricing." *Land Economics*. 71(2): 173-192.

Hewitt, Julie A. 2000. "An Investigation into the Reasons Why Water Utilities Choose Particular Residential Rate Structures." in *The Political Economy of Water Pricing Reforms*. Ariel Dinar, ed. Oxford University Press.

Hickle, Garth. 2000. "Whose Responsibility?" *Environmental Forum*. 17(4).

Hoag, Dana and Jennie Hughes-Popp. 1997. "Theory and Practice of Pollution Credit Trading." *Review of Agricultural Economics*. 19(2).

Hodge, Ian. 1995. *Environmental Economics*. St. Francis Press. New York.

Hoerner, J. Andrew. 1995. "Life and Taxes." *The Amicus Journal*.

Hoerner, J. Andrew. 1998. *Harnessing the Tax Code for Environmental Protection: A Survey of State Initiatives*. World Resources Institute.

Huslin, Anita. 2000. "MD Seeks to Convert Farmland Into Wetland." *The Washington Post*. 11 August.

ICF Resources. 1989. *Economic Analysis of Title V of the Administration's Proposed Clean Air Act Amendments*.

ICF Resources. 1989. *Economic, Environmental, and Coal Market Impacts of SO2 Emissions Trading under Alternative Acid Rain Control Proposals*. Prepared for the Regulatory Innovations Staff, Office of Policy, Planning and Evaluation, U.S. EPA.

Illinois Department of Nuclear Safety. *Radon Program Strives to Increase Public Awareness.* http://www.state.il.us/idns/radon/prgdescr/radonprg.htm.

Illinois EPA. 1995. *Design for VOC Emissions Trading System.*

Innovations in American Government. 1999. *Toxics Use Reduction Program.* Commonwealth of Massachusetts. http://www.excelgov.org/innovations/innov99/turprog.htm

Interagency Environment Technologies Office. 1995. *National Environmental Technology Strategy.* Washington, D.C. 18 March. (available through etstrategy@gnet.org).

Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies. 2000. *Scenarios for a Clean Energy Future.* Washington, DC: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy (forthcoming).

International Energy Agency (IEA). 1995. *Energy Prices and Taxes*. 3rd Quarter.

Investor Responsibility Research Center. 1993 *Corporate Environmental Profiles Directory: Executive Summary and Appendices.* 1.

Jaeger, William. 2000. "Optimal Environmental Taxation." working paper, University of Oregon and Williams College departments of economics. http://www.williams.edu/Economics/Jaeger/

Jenkins, Glenn P. and Ranjit Lamech. 1992. *Fiscal Policies to Control Pollution: International Experience.* Harvard Institute for International Development Discussion Paper No. 439. Taxation Research Series No. 5. November. http://www.hiid.harvard.edu/

Johnson, Edwin. 1967. "A Study in the Economics of Water Quality Management." *Water Resources Research.* 3.

Joskow, Paul, Richard Schmalensee, and Elizabeth Bailey. 1998. "The Market for Sulfur Dioxide Emissions." *American Economic Review.* 88(4) 669-685.

Kanazawa, Mark T. 1994. "Water Subsidies, Water Transfers, and Economic Efficiency." *Contemporary Economic Policy.* vol. 12. April.

Kappas, Peter. 1999. "When Is Industry Self-Regulation Meaningful." presented at 1999 APPAM conference. Washington D.C.

Kashmanian, Richard, Mahesh Podar, Mark Luttner, and Robert Graff. 1995. "The Use and Impact of Intraplant Trading in the Iron and Steel Industry to Reduce Water Pollution." *The Environmental Professional.* 17: 309-315.

Katzen, Sally. 1996. Unpublished memorandum for members of the Regulatory Working Group with an Economic Analysis of Federal Regulations Under Executive Order No. 12866. Office of Management and Budget. January.

Keller, Richard. 1993. Unpublished memorandum on state and local procurement of recycled products. Northeast Maryland Waste Disposal Authority. 19 February.

Kennedy, Victoria S., Stuart I. Bretschneider, John E. Petersen, Myung-Jae Moon, Todd A. Nash, and Jason Gross. 1995. *Fee-Based Models for Funding Water Quality Infrastructure.* Draft Final Report prepared by the Environmental Finance Center, Syracuse University Maxwell School of Citizenship and Public Affairs for the Office of Water, U.S. EPA. April.

Kerr, Suzi C. 1993. "The Operation of Tradable Rights Markets: Empirical Evidence from the United States Lead Phasedown." *New Partnerships: Economic Incentives for Environmental Management.* Anderson and Marshall, eds. Air and Waste Management Association. SP-90. Pittsburgh, PA.

Kerr, Suzi and David Mare. 1995. *Market Efficiency in Tradable Permit Markets with Transactions Costs: Empirical Evidence from the United States Lead Phasedown.* Draft manuscript. Harvard University: Cambridge.

Khanna, Madhu, W. Quimio and D. Bojilova. 1998. "Toxic Release Information: A Policy Tool for Environmental Protection." *Journal of Environmental Economics and Management.* 36(3): 243-266.

Khanna, Madhu and L. Damon. 1999. "EPA's Voluntary 33/50 Program: Impact on Toxics Releases and Economic Performance of Firms." *Journal of Environmental Economics and Management.* 37(1):1-25.

Khazzoom, Daniel. 1995. "An Econometric Model of the Regulated Emissions for Fuel-Efficient New Vehicles." *Journal of Environmental Economics and Management.* 28: 190-204.

Kinnaman, Thomas C. and Don Fullerton. 1998. "Garbage and Recycling with Endogenous Local Policy." Memo.

Kohn, Robert E. 1978. *A Linear Programming Model for Air Pollution Control.* Cambridge: MIT Press.

Konar, Shameer and Mark A. Cohen. 1996. "Information as Regulation: The Effect of Community Right to Know Laws on Toxic Emissions." *Journal of Environmental Economics and Management.* 32: 109-124.

Koomey, J. G., R.C. Cooper, J. A. Laitner, R. J. Markel, and C. Marnay. 1998. *Technology and Greenhouse Gas Emissions: An Integrated Scenario Analysis Using the LBNL–NEMS Model.* LBNL–42054 and EPA 430–R–98–021. Lawrence Berkeley National Laboratory and US Environmental Protection Agency. September. http://enduse.lbl.gov/Projects/GHGcosts.html.

Krupkick, Alan and Virginia McConnell, with Matt Cannon, Terrell Stoessell and Michael Batz. 2000. *Cost-Effective NOx Control in the Eastern United States.* Resources for the Future. Discussion Paper 00-18.

Krupnick, Alan. 1986. "Costs of Alternative Policies for the Control of Nitrogen Dioxide in Baltimore." *Journal of Environmental Economics and Management.* 13: 189-197.

Laitner, S., K. Hogan and D. Hanson. 1999. "Technology and Greenhouse Gas Emissions: an Integrated Analysis of Policies that Increase Investments in Cost Effective Energy–Efficient Technologies." Proceedings of the Electric Utilities Environmental Conference. Tucson, CA. January.

Larson, Walt. 1996. Personal communication. California Department of Toxic Substances Control. May.

Lentz, James M. and Patricia Leyden. 1996. "RECLAIM: Los Angeles' New Market-Based Smog Cleanup Program." *Journal of the Air & Waste Management Association:* 195-206.

Limouze, Richard. 1996. Personal communication. Maine Air Quality Bureau.

Linsenbigler, Michael. 1996. Personal communication. USDA Economic Research Service. July.

Liroff, Richard. 1986. *Reforming Air Pollution Regulation: The Toil and Trouble of EPA's Bubble.* Washington, D.C.: The Conservation Foundation.

Loeb, Alan P. 1996. *A Short History and Analysis of the Lead Phasedown Lead Credit Market.* Argonne National Laboratories. Washington, D.C. 1 September.

Louisiana Department of Environmental Quality. 1995. *DEQ Announces Programs to Aid Tire Dealers and Tire Processors.* Internet press release. 25 January.

Lucas, Tom. 1996. Personal communication. New Jersey Taxation Division's Special Audit Section.

Maabs-Zeno, Carl C. 1981. "Design of Programs Using Transferable Development Rights to Preserve Farmland in the Northeast." *Journal of the Northeastern Agricultural Economics Council*. 10: 57-62.

Maine Legislature Office of Policy and Legal Analysis. 1996. *Final Report of the Task Force to Review the Beverage Container Deposit Laws*. January.

Maloney, Michael T. and Bruce Yandell. 1984. "Estimation of the Cost of Air Pollution Control Regulation." *Journal of Environmental Economics and Management*. 11.

Marine Spill Response Corporation. http://www.msrc.org/

Martin, Russ. 1994. "Avoiding the Stick: Improving Recycling Through Market Forces." *BioCycle*. October.

Massachusetts Department of Environmental Protection. 1994. *Massachusetts Toxics Use Reduction Program: 1994 Data Release*.

Mayes, Donna Purcell. 1996. Personal communication. Virginia Department of Transportation. May.

McCarthy, James E. 1993. *Bottle Bills and Curbside Recycling: Are They Compatible?* Congressional Research Service. January.

McLean, Brian. 1996. "Evolution of Marketable Permits: The US Experience with Sulfur Dioxide Trading."

McGartland, Albert M. 1984. *Marketable Permit Systems for Air Pollution Control: An Empirical Study*. Ph.D. Dissertation. University of Maryland.

Menell, Peter S. 1995. "The Uneasy Case for Ecolabelling." *RECIEL*. 4(4).

Michigan Air Emission Trading Program. http://www.deq.state.mi.us/aqd/eval/e_trade/etbank.html

Micozzi, Martine. 1996. Personal communication. Transportation Specialist. Federal Highway Administration. May.

Mikrut, Joe. 1996. Personal communication. U.S. Congress Joint Committee on Taxation. July.

Miller, Edgar M. National Recycling Coalition. Undated. *Economic Policy Options to Achieve Sustainable Resource Utilization and Environmental Quality Goals Relative to Resource Management and Waste Reduction*. Report submitted to Economic Policy Cluster, Eco-Efficiency Task Force, President's Council on Sustainable Development.

Miranda, Marie Lynn and Joseph E. Aldy. 1996. *Unit Pricing of Residential Municipal Solid Waste: Lessons from Nine Case Study Communities*. Report prepared for Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency. EE-0306. March. http://www.epa.gov/economics.

Miranda, Marie Lynn, Scott D. Bauer, and Joseph E. Aldy. 1995. *Unit Pricing Programs for Residential Municipal Solid Waste: An Assessment of the Literature*. Report prepared for Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency. EE-0305. August. http://www.epa.gov/economics.

Mooney, Saskia. 1996. Personal communication. Weinberg, Bergeson & Neuman. April.

Moore, Robert. 2000. "Nitrogen Credit Trading in the Long Island Sound Watershed." Water Research Economics Foundation (97-IRM-5B).

Morandi, Larry, Deb Starkey, and Addie Romero. 1995. *Alternative Funding Mechanisms for State Drinking Water Programs, 1994-1995*. National Conference of State Legislatures. March.

Morgenstern, Richard D. 1997. *Economic Analyses at EPA: Assessing Regulatory Impact*. Washington D.C. Resources for the Future.

Morgenstern, Richard. 1995. *Environmental Taxes: Dead or Alive?* Resources for the Future. Discussion Paper No. 96-03. October. http://www.rff.org/disc_papers/PDF_files/9603.pdf.

Muller, Frank. March 1996. "Mitigating Climate Change: The Case for Energy Taxes." *Environment*. 38(2).

Musgrave, Warren. 1995. "Interstate Water Management: The Case of the Murray-Darling Basin in Australia." *Water Quantity/Quality Management and Conflict Resolution: Institutions, Processes, and Economic Analyses*. Dinar, Ariel and Edna Tusak Loehman, eds. Prager. Westport, Connecticut and London.

NAPA (National Academy of Public Administration). 2000. *environment.gov, Transforming Environmental Protection for the 21st Century*. Washington D.C. November. http://www.napawash.org/NAPA/NewNAPAHome.nsf/64d8f1d54bd9b146852564ff00048cc7/6a4ccda68a00fa6485256999006c4c45?OpenDocument.

National Environmental Policy Act (NEPA) of 1969. http://ceq.eh.doe.gov/nepa/regs/nepa/nepaeqia.htm.

NOAA (National Oceanic and Atmospheric Administration). 1966. *Natural Resource Damage Assessments: Final Rule*. 61 Federal Register 440-510.

NOAA. 1996. *The Damage Assessment and Restoration Program*. http://www.darp.noaa.gov/.

Nestor, Deborah and Michael Podolsky. 1998. "Assessing Incentive-Based Environmental Policy for Reducing Solid Waste." *Contemporary Economic Policy* 401-411.

New Jersey Department of Health and Senior Services. 1984. *Worker and Community Right to Know Program*. http://www.state.nj.us/health/eoh/rtkweb/.

New Jersey Department of Transportation. 1996. *Adopt-A-Highway National Survey*. January.

New Jersey Emission Trading Program. http://www.state.nj.us/dep/aqm/omet/.

Nichols, Albert L. 1983. "The Regulation of Airborne Benzene." *Incentives for Environmental Protection*. Thomas C. Schelling, ed. Cambridge: MIT Press.

North Carolina Department of Environment, Health, and Natural Resources. Undated document on white goods and scrap tires. http://wastenot.ehnr.state.nc.us/SWHOME/grants.txt.

North Carolina State Law 1998-24. "White Goods Disposal Tax."

Novello, Daniel and Robert Martineau Jr. 1993. "Better Earlier Than Later: EPA's Air Toxics 'Early Reductions' Program." *Environment Reporter* 401.

Nutrientnet. http://www.nutrientnet.org.

Oates, Wallace E., Paul R. Portney, and Albert M. McGartland. 1989. "The Net Benefits of Incentive-Based Regulation: A Case Study of Environmental Standard Setting." *American Economic Review*. 75:1223-1242.

Oates, Wallace. 1994. "Environment and Taxation: The Case of the United States." *Environment and Taxation: The Cases of the Netherlands, Sweden and the United States*. Paris: OECD.

OSHA (Occupational Safety and Health Administration). 1983. *Hazard Communication Standards*. 29 CFR 1910.1200. http://www.osha-slc.gov/OshStd_data/1910_1200.html.

OSHA. 1996. *Report of the Hazard Communication Workgroup to the National Advisory Committee on Occupational Safety and Health (NACOSH)*. September. http://www.osha-slc.gov/SLTC/hazardcommunications/wgfinal.html.

Oklahoma Department of Transportation. 1994. *Adopt-A-Highway National Survey.*

OMB (Office of Management and Budget). 1996. *Economic Analysis of Federal Regulations.* Executive Order 12866. 11 January. http://www.whitehouse.gov/OMB/inforeg/riaguide.html.

OMB. 2000. *Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements.* 22 March. http://library.whitehouse.gov/media/pdf/m00-08.pdf.

O'Neil, William B. 1980. *Pollution Permits and Markets for Water Quality.* Ph.D. Dissertation. University of Wisconsin-Madison.

O'Neil, William B. 1983. "Transferable Discharge Permits Trading Under Varying Stream Conditions: A Simulation of Multiperiod Permit Market Performance on the Fox River, Wisconsin." *Water Resources Research.* 19: 608-612.

Opaluch, James J. and Richard Kashmanian. 1985. "Assessing the Viability of Marketable Permit Systems: An Application in Hazardous Waste Management." *Land Economics*. 61: 441-47.

Organization for Economic Cooperation and Development (OECD). 1989. *Economic Instruments for Environmental Protection.*

Organization for Economic Cooperation and Development (OECD). 1994a. *Managing the Environment: The Role of Economic Instruments*.

Orr, Joanne S. 1996. Personal Communication. Oklahoma Department of Transportation. May.

Osborn, C. Tim, Daniel Hellerstein, C. Matthew Rendleman, Marc Ribaudo, and Russ Keim. 1994. *A Preliminary Assessment of the Integrated Crop Management Practice.* USDA Economic Research Service. February.

Osborn, C. Tim, Felix Llacuna, and Michael Linsenbigler. 1995. *The Conservation Reserve Program: Enrollment Statistics for Signup Periods 1-12 and Fiscal Years 1986-93.* USDA Economic Research Service. Statistical Bulletin 925. November.

Osborn, C. Tim. 1996. Personal Communication. USDA Economic Research Service.

Ozone Transport Commission. 2000. *1999 OTC NOx Budget Compliance Report.*

Palmer, Karen L, Hilary Sigman, Margaret A. Walls, Ken Harrison, and Steve Palmer. 1995. *The Cost of Reducing Municipal Solid Waste: Comparing Deposit-Refunds, Advance Disposal Fees, Recycling Subsidies, and Recycling Rate Standards*. Resources for the Future. Discussion Paper No. 95-33. July. http://www.rff.org/disc_papers/abstracts/9533.htm.

Palmisano, John. 1994. "Environmental Fees in Russia." *New Partnerships: Economic Incentives for Environmental Management.* Air and Waste Management Association.

Parker, Bill. 1996. Personal Communication. Florida Department of Environmental Protection. May.

Parry, Ian W.H. and Antonio Miguel Bento. 1999. *Tax Deductible Spending, Environmental Policy, and the 'Double Dividend' Hypothesis.* Resources for the Future. Discussion Paper No. 99-24.

Parry, Ian. 2000. *Comparing the Efficiency of Alternative Policies for Reducing Congestion.* Resources for the Future. Discussion Paper 00-28. http://www.rff.org/disc_papers/PDF_files/0028.pdf.

Paton, Bruce. 1999. "Resources as Capital: Insights on Efficiency Gains from Voluntary Environmental Policies." a working paper for the European Research Network on Voluntary Approaches (CAVA). http://www.akf.dk/cava/wp.htm.

Pennsylvania Department of Environmental Protection (DEP). Undated. *Land Recycling Fact Sheet 8: Financial Assistance (Grants and Loans).* http://www.dep.state.pa.us/dep/deputate/airwaste/wm/landrecy/facts/fs8.htm.

Pennsylvania DEP. Undated a. *Pennsylvania's Land Recycling Program: Six-Month Progress Report.* http://www.dep.state.pa.us/dep/deputate/airwaste/wm/landrecy/facts/6monrpt.htm.

Pennsylvania DEP. Undated b. *Emission Reduction Credit Registry System.* http://www.dep.state.pa.us/dep/deputate/airwaste/aq/permits/ercmain.htm.

Pennsylvania DEP. Undated c. *Pennsylvania's Land Recycling Program.* http://www.dep.state.pa.us/dep/deputate/airwaste/wm/landrecy/default.htm.

Pennsylvania DEP. Undated d. *Fact Sheet: Overview Of The Land Recycling Program.* http://www.dep.state.pa.us/dep/subject/pubs/arr/lrwm/fs1843.pdf.

Pennsylvania DEP. 2000. *Land Recycling Program Evaluation of Effectiveness January 2000 Legislative Report.* http://www.dep.state.pa.us/dep/deputate/airwaste/wm/landrecy/facts/Leg_Rpt.htm.

Perkins, Jody. 1995. *Subsidies to Alternative Transportation Fuels and Alternative Fuel Vehicles in Twelve Eastern States and the District of Columbia.* American Petroleum Institute Research Study 080. September. http://www.api.org/cat/.

Pine, J. 1997. "Louisiana Environmental Leadership Pollution Prevention Program." 1997 Toxics Release Inventory and Right-to-Know Conference Proceedings. pp. 61-63. EPA/749-R-98-001. Washington, D.C.: EPA.

Pollution Prevention Act of 1990. 42 U.S.C. 1301. http://www.epa.gov/opptintr/p2home/uscode.htm.

Portney, Paul. 1990. "Economics and the Clean Air Act." *Journal of Economic Perspectives*. 4(4): 173-181. Fall.

President Bill Clinton and Vice President Al Gore. 1995. *Reinventing Environmental Regulation.* http://www.npr.gov/library/rsreport/251a.html

President's Council on Sustainable Development. 1996. Report. March. http://www.whitehouse.gov/PCSD/Publications/index.html.

Project 88: Harnessing Market Forces to Protect Our Environment: Initiatives for the New President. Study sponsored by Senators Timothy E. Wirth and John Heinz.

Project 88: Round II: Incentives for Action: Designing Market-Based Environmental Strategies. Study sponsored by Senators Timothy E. Wirth and John Heinz.

Putnam, Hayes & Bartlett, Inc. 1981. *Evaluation of the Potential Cost Impact of Plantwide Effluent Limitations (The Water Bubble Concept).* Prepared for the Office of Policy, Planning and Evaluation, U.S.EPA.

Quinn, Barbara. 1996. "Ten Years Later, The Awards, and Rewards, Keep Coming." *Pollution Engineering*. March.

Quinn, James J. 1992. *Water Quality Management: Policy and Practice in Selected Countries*. American Petroleum Institute. Discussion Paper No. 072. March. http://www.api.org/cat/.

Raffle, Bradley I. and Debra F. Mitchell. 1993. *Effective Environmental Strategies: Opportunities for Innovation and Flexibility under Federal Environmental Law.* Chicago: AMOCO.

Reese, Andrew J. 1996. "Storm-Water Utility User Fee Credits." *Journal of Water Resources Planning and Management.* 122(1): 49-56. January/February.

Rendleman, C. Matthew, Kenneth A. Reinert, and James A. Tobey. 1995. "Market-Based Systems for Reducing Chemical Use in Agriculture in the United States." *Environmental and Resource Economics*. 5: 51-70.

Repetto, Robert, Roger C. Dower, Robin Jenkins, and Jacqueline Geoghegan. 1992. *Green Fees: How a Tax Shift Can Work for the Environment and the Economy.* World Resources Institute. November.

Riley, Gwen, John Warren, and Eun-Sook Goidel. 1994. "Assessment of Changes in Reported TRI Releases and Transfers Between 1989 and 1990." *Air and Waste* 44: 769-772.

Roach, Frederick, Charles Kolstad, Alan V. Kneese, Richard Tobin, and Michael Williams. 1981. "Alternative Air Quality Policy Options in the Four Corners Region." *Southwest Review.* 1:44-45.

Rolfe, Christopher J. B. 1993. *Using Subsidies to Promote Environmental Protection in Agriculture: A Review of Programs in North America and Europe.* West Coast Environmental Law Association. December. http://yvrww1.pwc.bc.doe.ca/ec/frap/fr-pof.html.

Rubin, Jonathan and Catherine Kling. 1993. "An Emission Saved is an Emission Earned: An Empirical Study of Emission Banking for Light-Duty Vehicle Manufacturers." *Journal of Environmental Economics and Management*: 257-274. November.

Ruffing, Kenneth G. 1995. "Setting Consumption as a Global Agenda." Unpublished document presented at Policy Measures for Changing Consumption Patterns conference. Seoul. http://www.ksdn.or.kr/index_e.htm?.

Rusin, Michael, Robert C. Anderson, Thomas J. Lareau, G. Prasad Rao, and Arthur Wiese. 1996. *Analysis of the Costs and Benefits of Regulations: A Review of Historical Experience*. American Petroleum Institute Discussion Paper No. 084. June.

Schiff, Stanley D. Undated. *Real World Experience with TDRs - An Update*. Piedmont Environmental Council. Warrenton VA.

Schmutzler, Armin and Lawrence Goulder. 1977. "The Choice between Emission Taxes and Output Taxes Under Imperfect Modeling." *Journal of Environmental Economics and Management*. 32: 51-64.

Scientific Certification Systems. Various documents.

Scientific Consulting Group (SCG). 1997. *Review of the Common Sense Initiative*. Gaithersburg, Maryland.

Scrap Tire News Legislative Report. 1996. "Scrap Tire Laws and Regulations." January.

Selmi, Daniel P. 1994. "Transforming Economic Incentives From Theory to Reality: The Marketable Permit Program of the South Coast Air Quality Management District." *Environmental Law Reporter*: 195-206.

Sendak, Paul E. 1995. "The Role of Economic Incentives in Conserving Wildlife Habitat." Paper presented at IUFRO XX World Congress, Wildlife and its Habitats. August.

Seskin, Eugene, Robert J. Anderson, and R. Reid. 1983. "An Empirical Analysis of Economic Strategies for Controlling Air Pollution." *Journal of Environmental Economics and Management*. 10: 112-124.

Shabman, Leonard and Kurt Stephenson. 1998. "Nitrogen Allowance Trading for Point Sources in the Connecticut Region of the Long Island Sound Watershed." Department of Agricultural and Applied Economics, Virginia Tech, Blacksburg.

Shapiro, Michael and Ellen Warhit. 1983. "Marketable Permits: The Case of Chlorofluorocarbons." *Natural Resources Journal*. 23: 577-591.

Sidhu, Ranjit. 1993. *Current Status of Watershed Management in the United States*. American Petroleum Institute. Discussion Paper No. 074. November. http://www.api.org/cat/.

Sierra Research, Inc. 1995. *Institutional Support Programs for Alternative Fuels and Alternative Fuel Vehicles in California*. April.

Sigman, Hilary. 1994. "State Hazardous Waste Fees: An Assessment." *New Partnerships: Economic Incentives for Environmental Management*. Air and Waste Management Association.

Sigman, Hilary. 1995. "A Comparison of Public Policies for Lead Recycling." *RAND Journal of Economics*. 26(3): 452-478. Autumn.

Sigman, Hilary. 1996. "The Effects of Hazardous Waste Taxes on Waste Generation and Disposal." *Journal of Environmental Economics and Management*. 30(2). March.

Sims, William A. 1977. *Economics of Sewer Effluent Charges*. Ph.D. Thesis, Political Economy. University of Toronto.

Skelton, Eric P. 1994. "Small Scale Marketable Permits Programs: Grass Field Burning and Wood Stove Permits." *New Partnerships: Economic Incentives for Environmental Management*. Pittsburgh: Air & Waste Management Association.

Skumatz, Lisa and Phillip Zach. 1993. "Community-Level Adoption of Variable Rates: An Update." *Resource Recycling*.

Skumatz, Lisa A. 1994. "Pay as You Throw: Variable Rate Incentives in Solid Waste Management." *New Partnerships: Economic Incentives for Environmental Management*. Air and Waste Management Association.

Skumatz, Lisa A. 1995. "Continued Growth for Variable Rates." *BioCycle*. November.

Skumatz, Lisa A. 1996. *Economic Research Associates*. Unpublished memorandum to whom it may concern. 21 March.

Smith, Bucklin and Associates, Inc. 1995. *1994 National Recycling Rate Study*. Prepared for Battery Council International. November.

Smith, Stephen. 1995. *"Green" Taxes and Charges: Policy and Practice in Britain and Germany*. The Institute for Fiscal Studies. November. http://www.ifs.org.uk/.

South Coast Air Quality Management District (SCAQMD). 1992. *Regional Clean Air Incentives Market*. Diamond Bar, CA.

South Coast Air Quality Management District (SCAQMD). *Rule 301: Permit Fees*, as amended May 10, 1996. www.aqmd.gov/rules/html/r301.html.

South Coast Air Quality Management District (SCAQMD). *Rule 303: Hearing Board Fees*, as amended May 10, 1996. www.aqmd.gov/rules/html/r303.html.

South Coast Air Quality Management District (SCAQMD). *Rule 1610. Old-Vehicle Scrapping*. http://www.aqmd.gov/rules/doc/r1610.doc.

South Coast Air Quality Management District (SCAQMD). 1998. *RECLAIM Program*, Three-Year Audit and Progress Report.

Spofford, Walter O., Jr. 1984. *Efficiency Properties for Alternative Source Control Policies for Meeting Ambient Air Quality Standards: An Empirical Application to the Lower Delaware Valley*. Resources for the Future. Discussion Paper No. D-118.

Stavins, Robert. 2000. *Experience with Market-Based Environmental Policy Instruments*. Resources for the Future. Discussion Paper No. 00-09. http://www.rff.org/disc_papers/PDF_files/0009.pdf.

Stein, Rafael. 1996. Personal communication. Environmental Protection Agency.

Sterner, Thomas and Lena Hoglund. 2000. "Output-Based Refunding of Emission Payments: Theory, Distribution of Costs, and International Experience." Resources for the Future Discussion Paper 00-29. http://www.rff.org/disc_papers/PDF_files/0029.pdf.

Steuteville, Robert. 1995. "BioCycle Nationwide Survey: The State of Garbage in America." *BioCycle*. May.

Surface Mining Control and Reclamation Act. 1977. http://www.osmre.gov/smcra.htm.

Takemoto, Carla. 1996. Personal communication. California Air Resources Board.

Temple, Barker & Sloane. 1981. *The Effect of the Water Bubble Policy on Individual Iron and Steel Facilities*. Prepared for the U.S. EPA.

Texas Natural Resource Conservation Commission (TNRCC). 1994. *Marketable Permits: Final Report Grant Period 1993-1994*. Austin.

Texas Natural Resource Conservation Commission (TNRCC). 2000. http://www.teea.org/home.htm.

Thorning, Margo. 1992. *International Comparison of the Tax Treatment of Pollution-Control Investment.* American Council for Capital Formation. Center for Policy Research. February.

Tietenberg, Thomas H. 1985. *Emissions Trading: An Exercise in Reforming Pollution Policy*. Resources for the Future.

Tietenberg, T. H. 1990. "Economic instruments for Environmental Protection." *Oxford Review of Economic Policy*. 6:17-33.

Tolman, Jonathan. 1995. *Federal Agricultural Policy: A Harvest of Environmental Abuse.* Competitive Enterprise Institute. August.

Trombly, Jeanne. 1995. "Credit where credit is due: Targeted loan funds for recycling." *Resource Recycling*. June.

U.S. Coast Guard. Natural Resource Damage Claims Division. http://www.uscg.mil/hq/npfc/nrd.htm.

USDA (U.S. Department of Agriculture). 1994a. *Agricultural Resources and Environmental Indicators.* Economic Research Service Agricultural Handbook 705. December.

USDA. 1994b. Forest Service. *Debt for Nature Swaps and Alternative Financial Instruments for Financing Environmental Programs.* International Forestry Issue Brief No. 9. September. http://www.fs.fed.us/global/.

USDA. 1996a. "1996 Grazing Fees Announced." Internet press release. January.

USDA. 1996b. "1996 Farm Bill Press Release." April.

USDA. 2000. *Agricultural Resources and Environmental Indicators.* Economic Research Service. http://www.ers.usda.gov/briefing/arei/newarei/index.htm.

USDA/FAS. CRP State CREP Information. http://www.fsa.usda.gov/dafp/cepd/crep/crepstates.htm.

U.S. Department of the Interior. 1995. *CERCLA Natural Resource Damage Assessment Regulations.* Office of Environmental Policy and Compliance. http://www.doi.gov/oepc/frlist.html.

U.S. Department of the Interior. 1996. *Natural Resource Damage Assessment Regulations*. 43 CFR PART 11 (1995), Amended at 61 Fed. Reg. 20609. 7 May. http://www.doi.gov/oepc/wp_docs/43cfr11.html.

Vice President Gore. 1999. "Vice President Gore And Premier Zhu Rongji Announce Environmental Agreements at U.S.-China Policy Forum on Environment and Development." Press release. April 9. http://www.pub.whitehouse.gov/uri-res/I2R?urn:pdi://oma.eop.gov.us/1999/4/12/8.text.1

Virginia Department of Environmental Quality. 1996. *Waste Tire Program.* January. http://www.deq.state.va.us/wastetires/.

Virginia Department of Environmental Quality. *Waste Tire Management Program.* http://www.deq.state.va.us/wastetires/.

Virginia Department of Transportation. Various documents on adopt-a-highway program.

Wall Street Journal. various issues.

Ward, Kevin and John Duffield. 1992. *Natural Resource Damages: Law and Economics*. New York: John Wiley & Sons.

Ward, Rebecca. 1996. Personal Communication. Scientific Certification Systems. May.

Warmer Bulletin. 1996. February. http://www.residua.com/index.html.

Weil, Edward. 1996. Personal Communication. California Deputy Attorney General.

Weinberg, Bergeson & Neuman. 1996. *Summary of State Lead-Acid Battery Recycling Law.* 8 April.

Weitzman, Martin. 1974. "Prices vs. Quantities." *Review of Economic Studies*. 41: 477-491.

Wellman Inc. 1994. *PET Recycling Supply/Demand Analysis*. December.

White, Lucinda. 1996. Personal Communication. Maine Assistant Attorney General.

White House. 1993. *Climate Change Action Plan*. October.

Whitehouse, Edward. 1996. "Tax Expenditures and Environmental Policy." *Subsidies and Environment: Exploring the Linkages*. OECD.

Widawsky, David. 2000. Personal communication. Office of Pesticide Programs. October 2.

Williams, Susan. 1999. "Something New Under the Sun: The SEC and Corporate Disclosure." *Environmental Forum.*

Wisconsin Department of Natural Resources. Undated. *Wisconsin's Newspaper Recycled Content Requirements: 1994 Update.*

Wisconsin Department of Natural Resources. 1993. *Order of the State of Wisconsin Natural Resources Board Creating Rules in the Matter of Creating Ch. NR 546 of the Wisconsin Administrative Code Pertaining to Newspaper Recycling Fee.*

Wolf, S. 1986. "Fear and Loathing About the Public Right to Know: The Surprising Success of the Emergency Planning and Community Right-to-Know Act." *Journal of Land Use & Environmental Law.* 11 Spring.

World Bank. 1992. *World Development Report 1992: Development and the Environment.*

Yellen, Janet. 1998. "The Economic Impact of Kyoto." Testimony given before the House of Representatives Commerce Committee. March 4.

Young, C. Edwin and C. Tim Osborn. 1990. *The Conservation Reserve Program: An Economic Assessment.* USDA Economic Research Service AER-626. February.

Young, Terry F. and Chelsea H. Congdon. 1994. *Plowing New Ground: Using Economic Incentives to Control Water Pollution from Agriculture*. Oakland CA: Environmental Defense Fund.

Zatz, Michael and Shana Harbour. 1999. "The United State's Environmental Protection Agency's 33/50 Program: the anatomy of a successful voluntary pollution reduction program." Journal of Cleaner Production. 7:17-26.

About the Report

This report has been prepared by the National Center for Environmental Economics in the EPA Office of Policy, Economics, and Innovation, which is a part of the Office of the Administrator. It builds on two previous reports (Carlin, 1992, and Anderson and Lohof, 1997) with similar titles. This report both updates and substantially expands on the United States portions of these earlier reports and was authored by Robert C. Anderson. The report has been extensively revised as a result of reviews by many EPA staff both inside and outside NCEE for both policy and technical accuracy. Comments were received from the following EPA offices, among others:

Office of the Administrator:
  Office of Policy, Economics, and Innovation
  Office of Communications, Education, and Media Relations
Office of Air and Radiation
Office of Enforcement and Compliance Assurance
Office of General Counsel
Office of Prevention, Pesticides and Toxic Substances
Office of Research and Development
Office of Solid Waste and Emergency Response
Office of Water
Region 10

Graphical, editorial, and typographical assistance was obtained under Work Assignment WA4-24 under EPA Contract 68-W6-0029.

Because of the desirability of making possible future reports in this series as comprehensive as possible, readers who are aware of interesting applications of incentive mechanisms that they believe should be included in subsequent reports are encouraged to send that information to Alan Carlin (Carlin.alan@epa.gov) at EPA Mailcode 1809, Washington, DC 20460, who served as the principal coordinator for this report.

This page intentionally left blank

Endnotes

Chapter 1

[1] Carlin. 1992.
[2] Anderson and Lohof. 1997.
[3] Stavins, Robert. 2000; Hahn, Robert. 2000; NAPA. 2000.

Chapter 2

[4] Project 88.
[5] EPA. 1991.
[6] OMB. 1996.
[7] OMB. 2000.
[8] More detail regarding the tax credits is in Congressional Research Service. 1998.
[9] http://www.npr.gov/library/nprrpt/annrpt/wrkcst94/create.html
[10] President Bill Clinton and Vice President Al Gore. 1995.
[11] EPA. 2000a.
[12] http://es.epa.gov/ncerqa/rfa/
[13] Vice President Gore. 1999.

Chapter 3

[14] Coase. 1960.
[15] Sterner and Hoglund. 2000.
[16] Hahn and Noll. 1982.
[17] ~~Hahn. 1989.~~
[18] Burtraw. 1995; Kerr and Mare. 1995.
[19] Alberini and Austin. 1999.
[20] Marine Spill Response Corporation.
[21] Riley et al. 1994.; Konar and Cohen. 1997.
[22] Jaeger. 2000.
[23] EPA calculated ratio from costs estimated in Krupnick study.
[24] Atkinson and Tietenberg. 1991.
[25] See Atkinson and Tietenberg. 1991; Dudek and Palmisano. 1998; Hahn. 1989; Hahn and Hester. 1989; Liroff. 1986; Tietenberg. 1985; and Tietenberg. 1990.
[26] Hahn and Noll. 1982.
[27] Oates, et al. 1989.
[28] Oates, et al. 1989.

Chapter 4

[29] Sims. 1977.
[30] EPA. 1997b, p. 15.
[31] Gibbons. 1986, pp. 10-11; EPA.. 1991, p. 4-5.
[32] Morandi, et al. 1995.
[33] http://www.epa.gov/owm/npdes.htm
[34] http://www.epa.gov/owm/wm05000.htm#state
[35] GAO. 1996a. pp. 1-4.
[36] Duhl. 1993.
[37] Limouze. 1996.
[38] SCAQMD Rule 303.
[39] Environmental Law Institute. 1993b. p. 22-23.
[40] Skumatz. 1996. p. 1.
[41] Skumatz.1996. p. 2.
[42] Miranda and Aldy. 1996. p. 16.

[43] Miranda, Bauer, and Aldy. 1995.
[44] Kinnaman and Fullerton. 1998.
[45] Skumatz. 1993.
[46] *Warmer Bulletin*. February 1996.
[47] Miranda and Aldy. 1996. p. 19.
[48] Skumatz. 1993.
[49] Skumatz. 1996.
[50] Repetto, et al. 1992.
[51] Skumatz. 1996.
[52] Repetto, et al. 1992.
[53] Miller. Undated.
[54] GAO. 1995a. p. 23.
[55] Hoerner. 1998.
[56] Larson. 1996.
[57] Deyle and Bretschneider. 1990
[58] Hickle. 2000.
[59] Barthold. 1994. p. 146-147.
[60] Fullerton. 1995.
[61] http://www.unep.ch/ozone/mp-text.htm
[62] Cook. 1996.
[63] CRA. 1994. p. 72-75.
[64] Cook. 1996. p. 5.
[65] Brown, et al. 2000.
[66] Fullerton. 1995. A7.
[67] DEN. October 5, 1993.
[68] Ackerman. 1994.
[69] Hoerner. 1995.
[70] Grocery Manufacturers of America. 1995.
[71] North Carolina State Law 1998-24.
[72] Environmental Law Institute. 1993b.
[73] Cameron. 1991.
[74] Parry. 2000.
[75] Brooks. 1996.
[76] http://www.fhwa.dot.gov/policy/13-hmpg.htm.
[77] http://www.fcn.state.fl.us/gfc/viewing/mitigation/mit_intro.html.
[78] Congressional Research Service. 1996.
[79] Executive Order 12548.
[80] Hoerner. 1995.

Chapter 5

[81] Criner, Jacobs, and Peavey. 1991.
[82] White. 1996.
[83] Cain. 1998.
[84] Cited in Criner, Jacobs, and Peavey. 1991.
[85] See for example: http://www.economagic.com/em-cgi/data.exe/bci97/lsm023.
[86] Batteese. 1996.
[87] As calculated by Batteese. 1996.
[88] Surface Mining Control and Reclamation Act of 1977.

Chapter 6

[89] Crocker. 1966; Dales. 1968.
[90] Dewees. 1983; Harrison. 1983.
[91] 45 FR 80824. Dec. 8, 1980.
[92] 45 FR 52676.

[93] Hahn and Noll. 1982.
[94] South Coast Air Quality Management District Rule 1610.
[95] EPA. 1986.
[96] Hahn and Hester. 1989.
[97] EPA. 1980.
[98] Crookshank. 1994.
[99] Hahn and Hester. 1989.
[100] EPA. Acid Rain Program web page: http://www.epa.gov/acidrain
[101] Portney. 1990.
[102] ICF Resources Inc. 1989.
[103] Ellerman. 2000. p. 296
[104] EPA. 1995b.
[105] Atkeson. 1997.
[106] Ellerman. 1997.
[107] Cason. 1995.
[108] Hausker. 1992.
[109] Cason. 1995.
[110] McLean. 1996. p.12.
[111] Ellerman. 2000.
[112] EPA. Acid Rain Program. Monthly Average Price of Sulfur Dioxide Allowances Under the Acid Rain Program.
[113] EPA. 1995b.
[114] Burtraw. 1998.
[115] The 1999 allocations include one-time early reduction credits (24,635) in addition to annual allocations.
[116] Ozone Transport Commission. 2000.
[117] EPA. 1999b.
[118] www.unep.ch/ozone/mp-text.htm
[119] Loeb. 1996.
[120] Hahn and Hester. 1989.
[121] Anderson, Rusin, and Hoffman. 1990.
[122] Kerr. 1993.
[123] EPA. 1992a.
[124] EPA. 2000b.
[125] Tier 1 and Tier 2 emission standards are specified in the Clean Air Act Amendments of 1990 and implemented through EPA regulations. Tier 2 standards will be phased in during the period 2004-2009.
[126] Rubin and Kling. 1993.
[127] The harmonic mean is computed as the mean obtained by taking the reciprocal of the arithmetic mean of the reciprocals.
[128] Green.1990.
[129] EPA. 1992b.
[130] Novello and Martineau. 1993.
[131] South Coast Air Quality Management District. 1998.
[132] Cantor Fitzgerald.
[133] EPA. 1995g.
[134] Michigan Air Emission Trading Program.
[135] New Jersey Emission Trading Program.
[136] Pennsylvania Department of Environmental Protection. Emission Reduction Credit Registry System.
[137] Skelton. 1994.
[138] Putnam, Hayes & Bartlett. 1981.
[139] Temple, Barker & Sloane. 1981.
[140] Amendola, Gary.
[141] O'Neil. 1983.
[142] http://www.epa.gov/owow/watershed/trading/traenvrn.pdf
[143] EPA. Office of Water. Total Maximum Daily Load Program.
[144] EPA. Reinvention Activity Fact Sheets. Effluent Trading in Watersheds.

[145] Dahl. 1979.
[146] http://cop6.unfccc.int/modules/none.asp?pageid=16
[147] Yellen. 1998.

Chapter 7

[148] Goldhammer, et al. 1995. p.1-5.
[149] DEN. March 24, 1995. B1-2.
[150] DEN. March 24, 1995.
[151] EPA. 1995c. p. 2-14.
[152] Whitehouse. 1996. p. 74.
[153] Goldstone. 1996.
[154] DEN. January 16, 1996. p. A10.
[155] Pennsylvania DEP. Pennsylvania's Land Recycling Program.
[156] Pennsylvania DEP. Fact Sheet: Overview Of The Land Recycling Program.
[157] Pennsylvania DEP. 2000.
[158] DEN, July 18, 1995. p. B2.
[159] Environmental Law Institute. 1995. p. 76.
[160] GAO. 1995c. p. 13.
[161] GAO. 1995b.
[162] National Research Council. 1993.
[163] Jacobs and Gilliam. 1985.
[164] Haycock and Pinay. 1993.
[165] Huslin. 2000.
[166] USDA. 1994a. p. 182.
[167] Rolfe. 1993. p. 21.
[168] USDA. 1996b.
[169] GAO. 1995c. p. 17-18.
[170] USDA. 1994a. p. 166.
[171] USDA. 1994a. p. 175.
[172] Sendak. 1995. p.5.
[173] DEN. July 14, 1995.
[174] Sendak. 1995.
[175] DEN. May 2, 1995. B1.
[176] DEN. November 14, 1995. B5.
[177] Virginia Department of Environmental Quality. Waste Tire Management Program.
[178] Steuteville. 1995.
[179] Beverage World Databank.
[180] Bonderud and Shanovich. 1995. p. 11-32.
[181] California EPA. 1996b.
[182] Steuteville. 1995.
[183] Beverage World Databank.
[184] Hendricksen. 1996.
[185] Whitehouse. 1996. p. 74.
[186] DOE. 1996.
[187] Sierra Research. 1995.
[188] DEN. September 26, 1995, p. 25.
[189] Environmental Law Institute. 1993b.
[190] http://www.hud.gov/progdesc/energy-r.html
[191] EPA. The Clean Water State Revolving Fund (SRF) Program.
[192] Freeman. 1990. p. 100-101.
[193] Freeman. 1990, p. 138.
[194] EPA. 1995a.
[195] EPA. 1999a.
[196] EPA. 1995a.

[197] http://www.epa.gov/oppfead1/annual/1994/94annual.pdf
[198] http://www.epa.gov/oppfead1/trac/tracpps3.htm
[199] Tolman. 1995.

Chapter 8

[200] Alberini and Austin. 1999b.
[201] Some firms cite expected future liability for clean-up costs as one of the costs of hazardous waste disposal. For example, see EPA. June 1994a.
[202] U.S. Department of the Interior. CERCLA Natural Resource Damage Assessment Regulations.
[203] NOAA. 1996.
[204] U.S. Department of the Interior. 1996.
[205] U.S. Coast Guard.

Chapter 9

[206] National Environmental Policy Act (NEPA) of 1969.
[207] Council on Environmental Quality.
[208] EPA. 2000d.
[209] The annual reportable amount is equal to the combined total quantities recycled, combusted for energy recovery, treated, or released.
[210] 59 FR 61501. November 30, 1994.
[211] www.epa.gov/tri/dq.htm.
[212] GAO. 1994a. p. 14.
[213] Khanna et al. 1998.
[214] EPA. 1995c. p. 3.
[215] Wall Street Journal. June 27, 1996. p. B12.
[216] Aurora and Cason. 1995. p. 9.
[217] EPA. 1996c. p. 2.
[218] EPA. 1998a.
[219] Innovations in American Government. 1999.
[220] New Jersey Department of Health and Senior Services. 1984.
[221] 65 FR 4451, August 19, 1998. See also http://www.epa.gov/safewater/ccr1.html
[222] http://www.yosemite.epa.gov/ogwdw/ccr.nsf/America?OpenView
[223] http://www.epa.gov/autoemissions
[224] http://www.epa.gov/enviro/index_java.html
[225] http://es.epa.gov/oeca/sfi/
[226] http://es.epa.gov/oeca/sfi/frjun00.htm
[227] California. 1986.
[228] California EPA. 2000.
[229] California Attorney General's Office. 1996.
[230] Helfand. 1994. p. 289.
[231] EPA. 1994a. p. 29.
[232] Helfand. 1994. p. 291.
[233] Helfand. 1994. p. 293.
[234] California Air Resources Board. Air Toxics "Hot Spots" (AB 2588) Program.
[235] EPA. 1994a. p. 9.
[236] EPA. 1994a. p. 49.
[237] EPA. 1996b.
[238] OSHA. 1983.
[239] OSHA. September 1996.
[240] DEN. October 23, 1995. p. A3.
[241] Green Seal: www.greenseal.org/
[242] Harris and Casey-McCabe. p. 8.
[243] EPA. 1994a. p. 13.
[244] Harris and Casey-McCabe. p. 8.

[245] EPA. 1993a. p. 118.
[246] EPA. 1993a. p. 145-146.
[247] The studies cited in this paragraph are discussed in EPA (1994a).
[248] Harris and Casey-McCabe. p. 11.
[249] Harris and Casey-McCabe. p. 9.
[250] EPA. 1994a. p. 27-28.
[251] Harris and Casey-McCabe. p. 10.
[252] California. Waste Reduction Awards Program.
[253] TNRCC. 2000.
[254] Quinn. 1996. p. 25.
[255] Williams. 1999.
[256] Investor Responsibility Research Center. p. 11, 61-62. Also: http://www.irrc.org/
[257] Investor Responsibility Research Center. p. 49.

Chapter 10

[258] Pollution Prevention Act of 1990.
[259] White House. October 1993.
[260] Interlaboratory Working Group on Energy-Efficient and Low-Carbon Technologies. 2000.
[261] Aurora and Cason. 1995.
[262] Aurora and Cason. 1995. p. 3-4.
[263] EPA. Energy Star Buildings. Partner Success Stories.
[264] EPA. 2000e.
[265] Energy cost savings are calculated for an upgrade of a 7-story 196,000 square foot office building in Washington DC.
[266] EPA. 2000e. p. 6.
[267] EPA. 1999c.
[268] EPA. 2000c. p. 25.
[269] EPA. 2000c.
[270] EPA. 1998b.
[271] Khanna and Damon. 1999.
[272] DEN. June 23, 1995. p. E11.
[273] EPA. Water Alliances for Voluntary Efficiency (WAVE).
[274] http://www.epa.gov/oms/transp/trancont/vmep-gud.pdf
[275] http://www.epa.gov/oppbppd1/PESP/
[276] Chemical Manufacturers Association.
[277] USEPA. 1999d.

Measurement of the Ocean and Coastal Economy: Theory and Methods

Charles S. Colgan
Chief Economist, National Ocean Economics Project

Professor of Public Policy and Management
Edmund S. Muskie School of Public Service
University of Southern Maine

December 2003

Table of Contents

1. Introduction

The goals of the National Ocean Economics Project are 1) to compile a comprehensive collection of data on the economic value of the ocean and coastal resources of the United States; 2) and to define and describe the ocean and coastal economies. By "ocean economy" we use the definitions in the Coastal Zone Management Act which includes the Great Lakes in the concept of "coast" and thus oceans.

A major part of this data collection is the creation of data sets that permit consistent measurement of the contribution of the ocean to the U.S. economy across time, and regions including the nation, states, and counties. Contributions can be measured in terms of output (gross domestic product or its related measures), employment, and wages. Thus a key product of the NOEP is the creation of a nationally and regionally consistent data set that measures employment, output and wages for the ocean and coastal economy.

Data on population and housing growth in the coastal areas are also critical to understanding the overall socio-economic dimensions of the coastal and ocean areas. This data is available from the U.S. Census, and relevant data is included in the database constructed by the NOEP. Since this data is presented as reported by the Census, the methodological issues involved in this data are the same as those of all census data. For more information on these issues, see (Census 2000).

This paper supplements reports and data released on the coastal and ocean economy of the United States by the National Ocean Economics Project. It provides a discussion of the relevant literature involved in the investigation of the ocean and coastal related economy, the theoretical background of measures such as gross domestic and gross state product, and provides details on sources, methods, assumptions, and limitations of the data provided by NOEP.

Data and analysis produced by the National Ocean Economics Project are part of an ongoing research project to measure the coastal and ocean economy of the United States. As such, this information is not to be construed as official data of the National Oceanic and Atmospheric Administration, the Bureau of Labor Statistics, the Bureau of Economic Analysis, or any other state or federal agency.

As the product of research, data are subject to revisions as refinements to the methodology are developed. Users should check the website of the project (www.oceaneconomics.org) for regular updates of the data and methodology.

2. Previous Studies

The concept of an "Ocean GDP" is not new. In 1974, the Bureau of Economic Analysis, the agency responsible for maintaining the National Income and Product Accounts, undertook a special study for the Assistant Secretary of Commerce for Policy to identify the contribution of the ocean to the Gross National Product[1] (Nathan Associates

1974). In that study, BEA developed estimates for Gross Product Originating from the Ocean using the economic census data for 1972. Two follow-up studies used a similar approach to estimate the values for 1977 and 1987. (Pontecorvo *et al.* 1980; Pontecorvo 1988) All of these studies focused on the most clearly identifiable industries and economic activities, those activities that either, as defined in the Nathan Associates study, "utilized an ocean resource in a production process" or "produced a product or service that was demanded because of some quality attributable to the ocean". Sixty-six sectors from the national income accounts were selected for analysis based on these criteria.

Other studies have focused attention on the coast rather than the ocean. Following Pontecorvo, Luger developed a methodology for measuring coast-dependent, coast-linked, and coastal-service activities. (Luger 1991) This approach significantly expanded the types of economic activities brought into the measurement process. By focusing on the coastal zone, Luger also brought the Great Lakes into the analysis, since they are defined for federal management purposes as part of the coastal zone.

The last decade has seen increasing attention to the concept of extending the national income accounts to incorporate the kind of resource-related sources of economic value that were attempted in the earlier studies cited above. This attention has stemmed in part from long-standing concerns that the national income accounts are a good, but imperfect, measure of economic well-being. Thus, there have been new attempts to include important aspects of economic welfare that were traditionally excluded from the systems of national accounts used by various nations (Eisner 1989)

In 1992, the Bureau of Economic Analysis began work to extend the national income accounts to include assessment of natural resource values. However, in 1995, the United States Congress directed the Commerce Department to suspend further work and to obtain an external review of environmental accounting. The National Academy of Sciences, through a panel formed by the National Research Council, examined the experience in European countries and Canada in trying to incorporate the role of natural resources in the economy and affirmed both the desirability and possibility of integrating economic and environmental accounts. (National Research Council 1999)

Another group of studies on the economic value of the oceans has focused on the economy of various regions as influenced by the oceans. Some of these studies have been done at the state level (Moeller and Fitz 1994) while others have been done at the multi-state and international level (Colgan and Plumstead 1993). Studies of the ocean economy in Canadian provinces have also been undertaken (Mandale *et al.* 1998; Mandale *et al.* 2000). These studies have tended to rely on employment in specific industries or estimates of output from regional econometric models, and have thus focused on the market-related activities that are the most easily measured

3. Defining the Ocean and Coastal Economy

Two concepts underlie the data on economic activity associated with the ocean: the coastal economy and the ocean economy. The two are related, but not identical.

- The **coastal** economy consists of all economic activity in the coastal region, and is thus the sum of employment, wages, and output in the region. Some of the coastal economy is the ocean economy, but the coastal economy incorporates a broader set of economic activity.

- The **ocean** economy consists of all economic activity which derives all or part of its inputs from the ocean or Great Lakes. The definition of the ocean economy is a function of both industry and geography and is described in detail below. While most of the ocean economy is located in coastal regions, some of the ocean economy (for example, some boat building and seafood retailers) is located in non-coastal regions.

A major issue in this field is the definition of the coastal region. The term "coast" has taken on a wide variety of physical definitions ranging from the strip of land immediately adjacent to the shoreline of the oceans and Great Lakes to the headwaters of the watersheds of major rivers. The term has different meanings depending on whether one approaches the coast from a geological, biological, hydrological, ecological or political perspective.

The offshore boundaries of the "coast" vary with activities, depending on legal definitions, such as 200 mile exclusive economic zones for fisheries and outer continental margin definitions for offshore minerals development. The inland boundaries of the coast for economic and demographic analysis are even less clear. Definitions have included arbitrary distances such as 100km from the shore (which begs the question of the shore boundary in estuarine areas), or a "days drive" from the shore, which could easily change depending on transportation systems and their capacity.

For purposes of the analysis of the coastal economy, three tiers of "coast" are selected based on the boundaries of administrative and political jurisdictions. These regional tiers are imperfectly related to geographic or ecological features, but are selected to at least roughly coincide with natural features. In general, the administrative and political boundaries include more land than a strict ecological or geographic interpretation would probably support. For example, coastal watersheds include the Santa Ana River in California, which rises in San Bernardino County, a county which extends all the way to the Nevada border. Similarly, the coastal zone in New York State extends as far up the Hudson River as Albany, which is some 200 miles from the sea.

The three tiers of coast are:

- Near Shore region. This is defined by zip codes adjacent to the shores of the oceans, Great Lakes, and major bays. The selection of these zip codes is discussed in greater detail in the section below on the ocean economy.

- Coastal Zone Counties. Coastal zone counties are any county which includes in whole or part the area under the jurisdiction of the Coastal Zone Management Act of 1972 as defined for that purpose by each state participating in the program. Four states include the entire state in the coastal zone (Rhode Island, Delaware, Florida, and Hawaii). Nine states (Washington, Alaska, Texas, Louisiana, Georgia, South Carolina, North Carolina, Virginia, and Maryland) define their coastal zones using county or county-equivalent boundaries. Other states use various combinations of political (e.g. town boundaries) and geographic features (adjacency to tidal waters) to define their coastal zones for purposes of the CZMA. All counties which include territory defined as the coastal zone in such circumstances are included in this category.

  Coastal zone counties were identified using geographic information systems. Data showing the boundaries of each state's coastal zone were obtained from NOAA's Office of Coastal Resource Management and overlaid on Bureau of the Census county boundary data to determine the intersection. In the case of Illinois, which does not participate in the CZM program, Cook County was included to provide for nationally consistent totals.

- Coastal Watershed Counties. These are defined by NOAA as the coastal zone counties plus counties that include the headwaters of coastal rivers. This definition excludes major continental river systems such as Mississippi-Missouri-Ohio system.

The accompanying document, *Coastal and Watershed Counties used by the National Ocean Economics Project* lists the counties defined in each group by state.

All population and housing data reported by NOEP is from the Census of Population and Housing for 1970, 1980, 1990 and 2000. All calculations of population and housing density were made using the Census Bureau's data on land area for each jurisdiction. Land area excludes water bodies and wetlands.

In the summary of trends by ocean/Great Lakes region, the Atlantic region includes counties from Washington County, Maine to Miami-Dade County, Florida. The Gulf of Mexico includes counties from Monroe County, Florida to Cameron County, Texas. The Great Lakes region includes counties from St. Lawrence County, New York to Cook County, Illinois. The Pacific region includes all shore counties in California, Oregon and Washington; all shore boroughs in Alaska, including those bordering the Arctic Ocean, and all of Hawaii.

Rural and urban counties were identified using the Department of Agriculture's Urban Influence Codes, for all counties. For a definition of these codes, see (Ghelfi and Parker 2001)

4. Issues in Defining the Ocean Economy

Although the problem of defining an ocean economy appears at first glance to be a problem of defining the economic value of a natural resource, it is perhaps more properly thought of as a problem in defining the characteristics of a regional economy whose boundaries are tied to the ocean (and Great Lakes). A regional approach requires the use of such data as employment, income, and output. It leaves open the question of the marginal value of the natural resources of the ocean for additional studies within a traditional resource economic framework. The current approach may thus be considered the measure of economic activity *associated with* the ocean. Both types of information are necessary for a full understanding of the economy of the ocean, but the economy of an "ocean region" is the place to start given available data.

The estimation of the economic activity associated with the ocean is inherently limited by data availability, conceptual difficulties, and the need to make some arbitrary choices about what to include and exclude. The choices that must be made in the design of statistical measures of ocean economic activity should be informed by clear objectives for the system. The NOEP methodology has the following objectives:

- *Comparability across industries and space* The data should be consistent from the national to the local level and across all states. The measure of employment in one location should be the same as all other locations.

- *Comparability across time* The data should be sufficiently consistent over time that changes can be observed and measured with the same data at all points

- *Theoretical and accounting consistency* The data should reflect standard economic theory describing the measurement of economic activity. It should not permit double counting of economic activity, meaning all measures can be summed across industries and geography.

- *Replicability* The assembly of the data should be done using a methodology that can be replicated by other researchers and that can form the basis for continued generation of data series into the future in order to establish long term time series measures of the ocean economy.

5. The Basic Data: ES-202 Employment and Wages

The methodology developed to do this is based on using the ES-202 employment data which is collected monthly by each state's department of labor and reported to the U.S. Department of Labor. The ES-202 data is used as the basis for administering the nation's unemployment insurance laws, and covers about 90% of all employees. The data series excludes farm and self employment. It also excludes almost all employment in the commercial fishing harvesting industry. Fisheries harvesting employment is ~~also~~ excluded from this analysis, since the fish harvesting industry is not covered by the federal law requiring reporting of employment.

ES-202 data is at the establishment level. Any single place of business is an establishment, regardless of who owns it. A business firm may have many establishments or only one. Nonprofit organizations and government also report their employment through this system.

All ES-202 data is reported to the Bureau of Labor Statistics of the U.S. Department of Labor, which compiles the state reports into a longitudinal data base (LDB) of all reporting establishments in the U.S. Because of differences in revisions of the data between the LDB and state labor agencies own records, there may be minor differences between totals reported here and those available from state departments of labor or publications of the Bureau of Labor Statistics or Bureau of Economic Analysis.

Except where noted, all reported employment data is annual average data from monthly reports. All wage data is annual totals from monthly reports.

All data derived from the ES-202 data series are subject to confidentiality screening. Federal law prohibits the release of data at any level of aggregation which could reveal the employment or wages of a single firm. The estimates for employment and wages were developed using the original data series, which includes all establishments and is thus not restricted by confidentiality. However, all reported data are screened for confidentiality by the Bureau of Labor Statistics before being released. This screening includes comparing the released data with other published data sources to be certain that no confidential data could be imputed based on combining this data series with any other data.

In all tables, totals of the sectors, regions, and the state include all data from all establishments selected as above. Industry level totals may be suppressed to prevent disclosure of confidential data. In any sector where one industry's data is suppressed, a second industry's data will also be suppressed to prevent complementary disclosure.

6. Industrial Definitions

The NOEP methodology defines the ocean economy as comprised of nine sectors. Currently, data is available from for six of these categories, noted in Table 1 . Data on ocean related activities of federal, state, and local governments, as well as on the real estate industry and research and development values are not available. Their values are not easily extracted from these data sources, and will be compiled using different methods in later phases of the project.

For purposes of the NOEP methodology, establishments (see table 1) are defined as ocean related based on their SIC (Standard Industrial Classification) code and, for certain industries (shown in italics in Table 1), on the location of a given establishment in a zip code adjacent to the shore.

Table 1

Construction	***Tourism & Recreation***
Marine Construction	*Amusement and Recreation Services not elsewhere classified*
Living Resources	*Zoos and Aquaria*
Fish Harvesting	
Aquaculture	*Boat Dealers*
Seafood Processing	*Eating and Drinking Places*
Minerals	*Hotels and Motels*
Limestone, Sand, and Gravel	*Marinas*
Oil and Gas Exploration	*Recreational Vehicle Parks and Campgrounds*
Oil and Gas Production	*Sporting Goods*
	Transportation
	Deep Sea Freight Transportation
	Marine Passenger Transportation
Ship & Boat Building	Marine Transportation Services
Boat Building	Search and Navigation Equipment
Ship Building	*Warehousing*

Most of the industries defined in this table are single 4-digit SIC codes. Some 4-digit SIC industries have been combined to create the industries as shown in order to minimize the disclosure of data for single firms, which is prohibited. Table 2 shows the industries and corresponding SIC codes (1987 Revision). Table 2 also shows the correspondence between the SIC and NAICS codes.

The choice of industries to include in the ocean sector is inherently arbitrary. This list was based in part on prior studies such as those of Pontecorvo et al (1980) and Pontecorvo (1988) and Luger et. Al (1990) and Luger (1991) present the most complete list of ocean and coast related sectors. The NOEP industries basically follow the definitions used in these previous studies, with some differences. Table 3 compares the NOEP industries as defined above with the Pontecorvo et. al. and Luger studies, showing which NOEP industries were included in the previous work.

Table 2
Ocean Economy Sectors and Industries by SIC and NAICS Codes

Sector	Industry	NAICS Code	NAICS Industry (1997 NAICS)	SIC Code	SIC Industry (1987 SIC)
Construction	Marine Related Construction	237120	Oil and Gas Pipeline and Related Structures	1629	Heavy Construction Not Elsewhere Classified
		237990	Other Heavy and Civil Engineering Construction		
Living Resources	Fish Hatcheries & Aquaculture	112511	Finfish Farming and Fish Hatcheries	0273	Animal Aquaculture
		112512	Shellfish Farming	0921	Fish Hatcheries and Preserves
	Fishing	114111	Finfish Fishing	0912	Finfish Fishing
		114112	Shellfish Fishing	0913	Shellfish Fishing
	Seafood Processing	311711	Seafood Canning	2077	Animal and Marine Fats and Oils
		311712	Fresh and Frozen Seafood Processing	2091	Canned and Cured Fish and Seafoods
				2092	Fresh and Frozen Fish and Seafoods
Minerals	Limestone, Sand & Gravel	212321	Construction Sand and Gravel Mining	1422	Crushed and Broken Limestone
		212322	Industrial Sand Mining	1442	Construction Sand and Gravel
	Oil & Gas Exploration and Production	211111	Crude Petroleum and Natural Gas Extraction	1446	Industrial Sand
		213111	Drilling Oil and Gas Wells	1311	Crude Petroleum and Natural gas
		213112	Support Activates for Oil and Gas Operations	1321	Natural gas liquids
		541360	Geophysical Exploration and Mapping Services	1381	Drilling Oil and Gas Wells
				1382	Oil and Gas Field Exploration Services
				1389	Oil and Gas Field Services Not Elsewhere Classified
Ship & Boat Building	Boat Building & Repair	336612	Boat Building & Repair	3732	Boat Building & Repair
	Ship Building & Repair	336611	Ship Building & Repair	3731	Ship Building & Repair
Tourism & Recreation	Boat Dealers	441222	Boat Dealers	5551	Boat Dealers
	Eating & Drinking Places	722110	Full Service Restaurants	5812	Eating Places
		722211	Limited Service Eating Places		
		722212	Cafeterias		

A004347

Table 2
Ocean Economy Sectors and Industries by SIC and NAICS Codes

Sector	Industry	NAICS Code	NAICS Industry (1997 NAICS)	SIC Code	SIC Industry (1987 SIC)
		722213	Snack and Nonalcoholic Beverage Bars		
	Hotels & Lodging Places	721110	Hotels (Except Casino Hotels) and Motels	7011	Hotels and Motels
		721191	Bed and Breakfast Inns		
	Marinas	713930	Marinas	4493	Marinas
	Recreational Vehicles Parks & Campsites	721211	RV Parks and Recreational Camps	7033	Recreational Vehicles Parks & Campsites
	Scenic Water Tours	487210	Scenic and Sightseeing Transportation, Water		
	Sporting Goods	339920	Sporting and Athletic Goods Manufacturing	3949	Sporting and Athletic Goods Manufacturing Not Elsewhere Classified
	Amusement & Recreation Services	487990	Scenic and Sightseeing Transportation, Other	7999	Amusement and Recreation Services Not Elsewhere Classified
		611620	Sports and Recreation Instruction		
		532292	Recreation Goods Rental		
		713990	Amusement and Recreation Services Not Elsewhere Classified		
	Zoos, Aquaria	712130	Zoos and Botanical Gardens	8422	Zoos and Aquaria
		712190	Nature Parks and Other Similar Institutions		
Transportation	Deep Sea Freight	483111	Deep Sea Freight Transportation	4412	Deep Sea Foreign Transportation of Freight
		483113	Coastal and Great Lakes Freight Transportation	4424	Deep Sea Domestic Transportation of Freight
				4449	Water Transportation of Freight Not Elsewhere Classified
	Marine Passenger Transportation	483112	Deep Sea Passenger Transportation	4481	Deep Sea Transportation of Passengers Except by Ferry
		483114	Coastal and Great Lakes Passenger Transportation	4482	Ferries
				4489	Water Transportation of Passengers Not Elsewhere Classified
	Marine Transportation	488310	Port and Harbor Operations	4491	Marine Cargo Handling

Table 2
Ocean Economy Sectors and Industries by SIC and NAICS Codes

Sector	Industry	NAICS Code	NAICS Industry (1997 NAICS)	SIC Code	SIC Industry (1987 SIC)
	Services	488320	Marine Cargo Handling	4492	Towing and Tugboat Services
		488330	Navigational Services to Shipping	4499	Water Transportation Services Not Elsewhere Classified
		488390	Other Support Activities for Water Transportation		
	Search and Navigation Equipment	334511	Search, Detection, Navigation, Guidance, Aeronautical and Nautical System and Instrument Manufacturing	3812	Search, Detection, Navigation, Guidance, Aeronautical and Nautical System and Instrument Manufacturing
	Warehousing	493110	General Warehousing and Storage	4225	General Warehousing and Storage
		493120	Refrigerated Warehousing and Storage	4222	Refrigerated Warehousing and Storage
		493130	Farm Product Warehousing and Storage	4221	Farm Product Warehousing and Storage

This comparison shows that the NOEP industries include four industries (boat dealers, recreational vehicles parks and campgrounds, marinas, and search and navigation equipment) which were not included in the other studies. The inclusion of these industries in the NOEP definitions is due in part to the consistent availability of four-digit SIC data in the ES-202 dataset, in part to revisions to the SIC codes which broke these industries out from other aggregations, and in part to the growing importance of these sectors in the ocean economy since the earlier studies.

Table 3

NOEP Industry	Pontecorvo et. al 1980	Luger et al 1990
Marine Construction	●	°
Fish Harvesting	●	●
Aquaculture		●
Seafood Processing		●
Limestone, Sand, and Gravel	●	°
Oil and Gas Exploration		1
Oil and Gas Production	●	
Boat Building	●	●
Ship Building	●	●
Amusement and Recreation Services not elsewhere classified	●	●
Zoos and Aquaria	●	●
Boat Dealers		
Eating and Drinking Places	●	°
Hotels and Motels	●	°
Marinas		
Recreational Vehicle Parks and Campgrounds		
Sporting Goods		°
Deep Sea Freight Transportation	●	●
Marine Passenger Transportation	●	●
Marine Transportation Services	●	●
Search and Navigation Equipment		
Warehousing	●	●
1 Services component only ° = defined as "coastal services" ● = defined as "coast dependent"		

A004350

In the Luger et al and Luger studies, a distinction was made between those industries that are "coast dependent", "coast linked" and "coast related". Some of the industries shown in Table 3 were included as coast dependent, and were the closest to the ocean sectors as defined by Pontecorvo and NOEP, except that no attempt was made to estimate a geographic component to these industries. Others were defined as coastal services, which were held to be indirectly related to the coastal economy. In cases such as restaurants and lodging, the addition of a geographic component allows a better ocean relationship to be defined.

In the case of oil and gas, Luger does not include offshore oil and gas production or exploration since they were outside his definition of the coastal zone. Only the services component was included in his analysis. Pontecorvo on the other hand includes both exploration and production.

Both Pontecorvo et al and Luger et al include a number of industries that are related to ocean or coastal activity by virtue of intermediate linkages. A portion of these industries, such as telephone communication, marine insurance, food stores, building materials, etc. are estimated by both previous studies. Pontecorvo et al designate these as being defined by "demand side" criteria, while Luger defines them within "coastal services". These studies rely on estimates of the share of each of these intermediate industries.

The NOEP selection of industries uses a different approach. The chosen industries may be seen as those whose output is most directly tied to the ocean and may be considered the "primary" sectors of the ocean economy. Economic activity associated with secondary and tertiary economic stemming from intermediate connections to the primary industries can best be estimated using the national input/output tables. This study will be a future task of the NOEP. This approach will both more fully capture the linkages to other intermediate industries, but better capture the "multiplier" effects of the primary ocean-related economic activity.

Greater geographic specificity does not eliminate the problem of counting more activity than is directly tied to the ocean. For example, hotels and restaurants, which are clearly an important part of the tourist economy related to the ocean and which provide the bulk of the employment in the reported data, serve customers who do more than go to the beach or engage in other ocean-recreation activities. For restaurants, there is a mixture of local and tourist customers, while hotels have a mixture of leisure and non-leisure travelers (though even business travelers may specifically seek a coastal location for the amenities it provides.)

Ideally, data would be available that would permit the tourism and recreation or minerals sectors to be further disaggregated by ocean related activity. Such data does exist in some locations, but not others. For example, California has good survey data on hotel patrons on the proportion that are leisure related and the proportion traveling on business. But this data is not available for all states, and no one state is likely to be sufficiently representative of all states that its data could be used for national data. Geographic location, on the other hand, is reasonably consistently measured across all jurisdictions.

Where data permit, more refined estimates of ocean-related activity are available, they will be used in studies of those region's. This is currently being done in a project estimating the California ocean and coastal economy. Again, however, alternative methods do not necessarily mean greater accuracy. This can be seen using the example of offshore oil and gas activity. The method employed here uses ES-202 employment and wages for all establishments located in the near shore area as defined by shore-adjacent zip codes (see below) and attributes the offshore oil and gas economic activity to a region based on these observations.

An alternative method apportions employment, wages and output in the oil and gas industry based on production of oil and gas onshore and offshore. Such data is reported by the U.S. Minerals Management Service of the Department of the Interior and by comparable agencies in the states. Such an apportionment makes intuitive sense, but would miss employment and related activity associated with exploratory activities (from which no production is currently being derived) and redevelopment activity in producing areas, when production may fall but employment may rise. Given the different meanings that can be attached to different methods of estimating activity in this sector, we find it most appropriate to develop alternative estimates in specific regional studies and permit readers to select.

The use of SIC codes for the industrial selection also entails some compromises. For example, marine construction is included in SIC 1629 (heavy construction) which also includes other types of heavy construction activity. Again, geographic location of establishments is used as the criterion for assigning activity to the ocean sector. In the revised industrial taxonomy provided by the North American Industrial Classification System, marine construction activity is broken out as two separate 6 digit industries, allowing much greater precision for this sector. NAICS will be used in data releases on employment and wages from the project for 2001 and later. NAICS will be used for estimates of GSP when BEA converts to a NAICS based GSP reporting, expected for the GSP data for 2002 to be released in 2004.

A somewhat similar problem occurs with search and navigation equipment. This industry produces primarily electronic equipment such as radar, sonar, geographic positioning systems, etc. These products all have applications in marine transportation (and increasingly in recreational boating) but also in aviation. No information exists to separate the applications to which the products of this industry may be put. All of the output is counted in marine transportation, which probably overstates the actual marine component of the output.

Another problem arises from the grouping of industries into sectors. Industries could be included in more than one ocean sector. The example of search and navigation equipment just discussed indicates that the products of the industry may be used both in marine transportation of goods and people as well as in recreational boating. We have assigned it to transportation since the largest dollar volume of marine related products is in the commercial side of the business.

Marinas are another example of possible sectoral confusion. Marinas are the home to both recreational boats and some commercial boats, primarily in the fishing industry.

However, the vast majority of boats in marinas are recreational boats and so this sector is assigned to tourism and recreation. Where data for the individual industries is available, users may adjust the sector totals to suit their preferences of sectoral definition.

The use of the SIC classification undoubtedly leaves out a number of industries that are directly related to the ocean. These include:

- Specialized services like boat designers
- Rental of homes as temporary lodging
- Sales in food stores to tourists
- Sales from miscellaneous retail outlets in tourism areas
- Ocean related production that does not take place in coastal states, for example of recreational boats and other recreational equipment.

These omissions can be addressed, at least in part, by using the national input/output tables to estimate total national direct and indirect economic activity based on the data estimated as described here. This is a future task in the project.

7. Conversion to the North American Industrial Classification System

One of the byproducts of the 1993 North American Free Trade Agreement (NAFTA) was the need to standardize the system of industrial classification used by the United States, Canada, and Mexico in order to implement some of the provisions of the agreement. This need arose just as the U.S. economy was undergoing a significant transformation as information technologies and other complex shifts in the services sector were transforming the economy in ways that could no longer be adequately captured by the Standard Industrial Classification (SIC) system, which, though revised many times (most recently in 1987), had been in use since the 1930s. Thus the North American Industrial Classification System (NAICS) was created.

NAICS began to be implemented in federal statistical programs with the 1997 Economic Census. Gradually all government statistics programs that are compiled on an industrial basis are being migrated to NAICS. Employment and wage data began to appear in this format in 2002; GSP data will be on a NAICS basis when that data is released for 2002 as well.

In order to accommodate the shift to NAICS, data compiled by the National Ocean Economics Project will shift to a NAICS basis beginning with the 2001 data.

- For 2001, establishment, employment and wage data will be produced in both an SIC and a NAICS series for each state and for the U.S. GSP data for 2001 will be calculated only on an SIC basis, since the Bureau of Economic Analysis released the 2001 data on an SIC basis only.

- For 2002 and beyond, all data will be released on a NAICS basis only.

The shift to the NAICS system will represent a significant shift in the basis of estimating the ocean economy. Releasing establishment, employment, and wage data on both bases for 2001 will allow users to see where the differences in the taxonomies affect the estimates of ocean-related economic activity.

NAICS: An Overview

There are a number of changes between the SIC and NAICS systems. For a complete discussion see Office of Management and Budget 1998 North American Industrial Classification 1997 Lanham, MD Bernan Press and North American Industrial Classification System 2002. The major changes made include:

- Shifting from a four-digit classification system to a six-digit classification, permitting a larger number of industries to be identified.
- The creation of new sectors, particularly in the services industry sectors, showing a much greater diversity of industries.
- With the additional industry codes created and the evolution of different types of economic activity, many SIC groups are now split into multiple NAICS groups resulting in less mixing of dissimilar activities.
- A shift in the basis upon which establishments are classified. Under the SIC, an establishment was classified in the code appropriate to what the firm produced. Under NAICS, the classification is based on what the establishment produces. For example, if a ship building firm had two establishments, a corporate headquarters and a ship yard located in two different towns, both would be classified as "ship building and repair" (3731) under the SIC code, but only the ship yard itself would be classified as "ship building and repair", while the corporate headquarters would be classified as a service industry establishment.

  This change primarily affects the manufacturing and the oil and gas exploration and production industries in the ocean economy, resulting in a significant reduction in the number of establishments in these sectors.

NAICS and Ocean Industries

Table 4 shows the ocean economy sectors and industries as defined by the National Ocean Economics Project along with the SIC codes and industries and the NAICS codes and industries for each ocean economy industry. Many of the ocean industries are essentially unchanged in classification between SIC and NAICS. The major changes in classification are:

1. SIC 2077 Animal and Marine Fats and Oils. Under NAICS, a separate code is created for animal fats and oils. Marine fats and oils are now incorporated in NAICS 311711, Canned and cured seafood.

2. SIC 5810 Eating and Drinking Places. This sector is broken into 5 NAICS industries. Alcoholic beverage bars are excluded from the tourism and recreation ocean sector; all others are included.

3. SIC 7999 Amusement and Recreation Services Not Elsewhere Classified. This industry is divided into a number of NAICS industries. Those included in the ocean industry are shown in Table 4. Excluded are firms involved activities such as theater booking agents, dance studios, travel agents, ticket agents, etc.

4. SIC 4449 Water Transportation of Freight Not Elsewhere Classified and SIC 4489 Water Transportation of Passengers Not Elsewhere Classified. These industries were reclassified as inland transportation of freight and inland transportation of passengers (not including the Great Lakes) and are not included in the ocean economy. SIC 4489 also included activities now included in NAICS 487210, scenic water tours. This industry is included in the tourism and recreation sector.

5. SIC 4225, General Warehousing. This sector is now divided between commercial warehouses and mini-warehouses and storage facilities. The former group is included in the ocean economy, the latter is excluded.

6. SIC 7011 Hotels and Lodging Places. Hotels that are parts of casinos are now a separate NAICS code. These are excluded from the ocean sector. Casinos that were owned and operated by Native American tribes were classified under the SIC system in local government, and were not included in SIC 7011.

Table 4 shows a national summary of ocean sectors and industries for 2001. The NAICS based estimates show total employment of 1.86 million SIC estimates of 2.2 million. The largest differences are in oil and gas exploration and production, ship and boat building, and hotels, for the reasons indicated above.

Table 4 Ocean Economy Measured by SIC and NAICS (2001)

Sector	Industry	Establishments SIC	Establishments NAICS	Employment SIC	Employment NAICS	Wages ($Millions) SIC	Wages ($Millions) NAICS
Construction	Marine Related Construction	1,919	1,702	30,992	24,304	$1,421.9	$1,149.6
	Total	1,919	1,702	30,992	24,304	$1,421.9	$1,149.6
Living Resources	Fish Hatcheries & Aquaculture	601	658	4,756	5,044	$117.4	$123.1
	Fishing	2,304	2,290	6,175	5,779	$240.8	$221.2
	Seafood Processing	1,272	1,061	49,562	42,751	$1,396.2	$1,110.7
	Total	4,177	4,009	60,492	53,573	$1,754.5	$1,455.1
Minerals	Limestone, Sand & Gravel	280	276	4,883	4,744	$218.4	$212.4
	Oil & Gas Exploration and Production	6,124	941	106,957	19,749	$10,231.6	$1,399.9
	Total	6,404	1,217	111,839	24,493	$10,450.0	$1,612.4
Ship & Boat Building	Boat Building & Repair	2,954	1,303	51,886	43,284	$1,592.0	$1,329.5
	Ship Building & Repair	805	639	116,260	111,220	$5,395.8	$5,192.7
	Total	3,759	1,942	168,146	154,504	$6,987.8	$6,522.3
Tourism & Recreation	Amusement and Recreation services	6,578	4,747	114,175	44,399	$2,648.4	$874.8
	Boat Dealers	2,032	2,029	15,395	15,390	$498.9	$498.4
	Eating & Drinking Places	70,825	65,990	1,084,479	1,012,925	$14,824.7	$13,421.9
	Hotels & Lodging Places	10,599	10,520	353,472	299,624	$7,853.6	$6,240.7
	Marinas	1,947	1,944	13,944	13,869	$386.8	$385.4
	Recreational Vehicles Parks & Campsites	643	642	4,762	4,747	$84.7	$83.9
	Sporting Goods	402	417	8,472	8,363	$350.4	$342.0
	Zoos, Aquaria	163	162	7,914	8,194	$183.6	$262.1
	Scenic Tours		1,367		8,124	$0.0	$174.8
	Total	93,189	87,818	1,602,614	1,415,635	$26,831.1	$22,284.0
Transportation	Deep Sea Freight	935	625	33,756	20,313	$2,055.0	$1,348.3
	Marine Passenger Transportation	997	212	25,715	13,155	$886.5	$559.5
	Marine Transportation Services	3,638	3,205	95,005	91,217	$4,470.4	$4,235.8
	Search and Navigation Equipment	174	165	34,564	34,453	$2,869.8	$2,861.0
	Warehousing	3,259	1,410	45,738	34,709	$1,438.6	$1,137.9
	Total	9,003	5,617	234,778	193,847	$11,720.3	$10,142.6
Total Ocean Economy		118,451	102,305	2,208,861	1,866,355	$59,165.5	$43,165.9

NOTE: Excludes Massachusetts.

8. Geography

The geographic dimension of the ocean industry was implemented by using the zip code of the establishment. This required identifying all zip codes adjacent to the oceans and Great Lakes in the coastal zone counties defined by each state, which was accomplished based on analysis using geographic information systems. Arc Map® was used, combining zip code polygons from ESRI with Census boundary files from the Bureau of the Census.

Three addresses appear on the record of the ES-202 data. The zip code of the physical address of the establishment as recorded in the ES-202 data was used to determine location where available on the record. If not available, the zip code of the mailing address or unemployment insurance address was used, with preference to the mailing address. If no zip code was present on the record, the record was excluded. Less than 1% of records were thus excluded.

As with industries, the selection of geography involves some arbitrary choices. The identification of coastal zone counties was described above. The selection of zip codes is relatively straightforward in most of the coast, but the complex geography of the U.S. coast makes some selections difficult. This is particularly true with rivers, estuaries, and bays. The general approach used was to include the borders of all major bays (Long Island Sound, Chesapeake, Tampa, Galveston, San Francisco, and Puget Sound, and the Sacramento River Delta), but to limit the selection of zip codes up rivers, particularly in urban areas.

This results in some arbitrary selections in major urban areas. In New York City, Manhattan is excluded; only zip codes bordering the ocean in Brooklyn and Richmond counties are selected. The District of Columbia is excluded, as are New Orleans and Portland, Oregon. On the other hand, given its peninsular geography, virtually all of San Francisco is included. The estimates of total ocean-related activity are undoubtedly affected by these choices. However, until there is a generally accepted principle about how to define ocean-related geography for economic purposes, these choices represent a conservative approach to selecting the appropriate geography.

9. Special Note: Massachusetts

The one exception to the methodology described above was Massachusetts, whose state legislature prohibits, by statute, access by researchers to their establishment-level ES-202 data. In order to estimate Massachusetts' data, the publicly available ES-202 data from the Bureau of Labor Statistics was used. This permitted estimates to the two and in some cases three digit levels. Where four digit data was required, the Massachusetts estimates were derived by taking national ratios of four-digit to two-digit employment and wages.

Where zip code level data was required for the tourism and recreation industries, data from the Bureau of the Census Zip Code Business Patterns, which shows aggregate employment and wages by zip code, was used to estimate shares of employment and wages.

For major tourist counties, such as Dukes, Nantucket, and Barnstable, all of the tourism and recreation employment reported by BLS as defined above was included.

These estimating methods for Massachusetts probably result in an over-estimate of the ocean sector in that state since, in general, only 2-digit SIC industry data is available and the same level of geographic precision is not possible, though the size of that error is unknown

10. Ocean Economic Values in a National Income Accounting Framework

Previous measures of the ocean economy (for example, (Pontecorvo, Wilkinson et al. 1980; Pontecorvo 1988; Luger 1991)) have sought to measure the ocean economy as a proportion of the national economy. This is an important first step, but measurement of the ocean's contribution to the economy should go beyond simply measuring the share of the national economy to meet three criteria:

- Measures should be consistent across time and space and should sum to national, state, and regional measures of the economy.
- Measures must be able to show detail at the industrial level.
- Measures must be able to reflect the geographic character that defines ocean industries such as tourism and recreation, which is ocean related only when located in certain areas.

This section discusses the derivation of the measures used at the national level and their adaptation to the ocean economy.

The National Income and Product Accounts are the basic measure of the level of economic activity in the United States. These accounts have been developed to the values to ultimate consumers as the principal measure of value. This means distinguishing between final goods and services (those purchased by ultimate consumers) and intermediate goods and services. These latter are the inputs to the production process that creates final goods and services; their value is subsumed within the final market prices of goods sold at final demand. (Seskin and Parker 1998)

The total market value of goods and services can be measured each year as the Gross Domestic Product. This measure provides the sum of the value of goods and services measured at market prices to the final consumers. Three broad classes of final consumers are considered: households and businesses, government, and those in other countries. A fourth category, investment, counts the purchases of long-lived goods by households, businesses and government. GDP is thus defined as:

$$GDP = C + I + G + X$$

where:

A004358

GDP=Gross Domestic Product
C= Expenditures for personal consumption of goods and services
I= Net private investment
G= Government purchases of goods and services for both consumption and investment
X = Net Exports (Total Exports– Total Imports)

The measurement of GDP is also based on the equivalence between production and consumption. GDP is a measure of production (what the economy produces) but is measured as consumption (what is bought) in order to avoid the problem of double counting. If each sale of goods or services in the economy were simply summed, many values would be counted twice. For example, the sale of cod from the fishing boat to the processor to the restaurant constitutes three separate sales, but only the final sale to the consumer at the restaurant includes all the previous sales. It is this value that is counted in the GDP as the value of the ocean's output of fish for food.

Gross Domestic Product by Industry (Gross Product Originating)

Because the Gross Domestic Product is measured at the values paid by the final customers (whether of consumer or investment goods and services), it is not possible to identify the contribution of any particular industry to the nation's output of goods and services. To address this need, the BEA has developed a companion measure to the GDP, Gross Product Originating (GPO), which measures output by sector of production. This measure is also called "Gross Domestic Product by Industry". It is derived from the Gross Domestic Income data (Lum. and Moyer 1998) and is defined as:

$$GPO = \sum_{i}^{n} S_i - \left(L_i + \sum_{i}^{n} I \right)$$

Where:

S_i = sales by industry i
L_i = labor inputs purchased by industry i
I_i^n = intermediate inputs (goods and services) purchased from all other industries i to n.

As this definition indicates, GPO is the "value added" of each sector and thus is consistent with the GDP calculations.

Gross State Product

As noted, the GDP measure does not permit disaggregation by contribution, so the GPO figure was developed for this purpose. Similarly, the way GDP is defined and measured, it is not possible to disaggregate it by region since no regional measure of consumption is available. The regional counterpart to the GDP by industry is the gross state product, which is estimated by BEA for all states. GSP is equivalent to GDP, when certain statistical discrepancies and adjustments are made. For regional data, BEA estimates gross product by industry only at the state level because detailed data required to construct these estimates is not available consistently at levels below the state.

Like the GDP, GSP is a measure of value added designed to avoid double counting of output. The GSP for each industry is defined as the sum of employee compensation (wages and salaries, employee contributions to social insurance, and other labor income), indirect business taxes and non-tax business liabilities, and property type income (including corporate profits, proprietors' income, rental income of persons, capital consumption allowances, net interest, business transfer payments, and the income of government enterprises less subsidies). (Panek and Obidoa 2003) GDP is equivalent to GSP, except:

- Government wages and salaries for personnel outside the United States are excluded from GSP.
- The sum of GSP is equal to GDI (gross domestic income)
- GSP and GDP are estimated and revised on different schedules by BEA. GDP is released and revised quarterly, generally about two quarters after the close of the subject quarter. GSP is released and revised once a year, about 18 months after the close of the year.

Since the goal of the NOEP estimates is to have data that is available at the national, state, and local levels, the GSP is the appropriate measure of output, since regional variations in output for each industry are best captured using this measure rather than the national estimates of gross product by industry. Gross state product allows differences in industries across states to be measured so that both state and national estimates can be made. For example, the transportation equipment industry is dominated by the automobile industry in some states (e.g. Michigan) and the ship building industry in other states (e.g. Maine). If firms in the transportation equipment industry were measured using a single national figure for the industry, automobiles would be overemphasized in Maine and underemphasized in Michigan. These differences are essential to correctly measuring the ocean economy.

Gross State Product for each industry in the ocean economy is estimated using equation 1, which states that an establishment's share of the state's GSP is based on the establishment's share of the appropriate industry GSP for that state. Wages as reported by the Bureau of Economic Analysis are multiplied by the GSP for that two digit industry, and then summed across all establishments in that industry.[1] This method assures that the sum of wages and GSP for the ocean sector is consistent with the total GSP for the state as reported by BEA.

[1] The Standard Industrial Classification (SIC) system uses a four digit code to denote industries. Thus SIC 2092 is fresh and frozen seafood, with 2 denoting the manufacturing sector, 20 the food and kindred products industry, 209 the seafood industry, and 2092 fresh and frozen seafood.

$$GSP_r^i = \sum_{i=1}^{n} \left(\frac{W_e^i}{W_S^I} \right) GSP_S^I$$

Where:

GSP_r^i = the Gross State Product for industry i in region r

W_e^i = the wages for a given establishment in industry i

W_S^I = the total wages in industry i in state S (from BLS data)

GSP_S^I = the total gross state product for industry I in state S from BEA.

Disaggregation of GSP by wages represents the most practical method of developing specialized regional or industrial estimates of GSP, since the BLS data provides primary observations of wages. Wages and salaries are also a major component of GSP, which is calculated from employee compensation, indirect business taxes, and property income by industry. Employee compensation used by BEA in estimating GSP includes more than wages. It also includes benefits and self employment income. But wages comprise the vast bulk of employee compensation, so the disaggregation using wages is a reasonable, if an imperfect approach to estimating sub-state and detailed industry GSP.

Gross state product is reported by the Bureau of Economic Analysis for 63 industries which are generally consistent with the two-digit SIC level. Many of the industries in the ocean sectors are defined at the four digit level. This introduces some distortions into the results. For example, in the SIC codes, boat dealers are a subgroup of auto dealers, which are part of the retail industry. But the retail industry is not broken down in the BEA GSP figures, meaning that this methodology groups boat sales with all other retail industries, and thus understates the value of boat sales since boats are among the highest value items sold at retail. Possible future disaggregation of the GSP data for retail by the Bureau of Economic Analysis would address this issue.

An exception to the GSP being available at the two digit level is in the transportation equipment industry (SIC 37), where data is reported for the automobile industry and the "rest of transportation equipment". Boat and ship building would be included in the latter category, but so is aviation-related manufacturing. The GSP estimates for ship and boat building are computed as a share of the "rest of transportation equipment", but this may distort upward the GSP figures in regions such as Washington State where there is a much higher degree of aviation-related manufacturing than of boat and ship building in the "rest of transportation equipment" category. These distortions are embedded in the BEA GSP data and cannot be countered without further disaggregation of that data. This is an issue for future research.

The use of this method for estimating GSP represents a departure from the "establishment level up" methodology that forms the basis of the estimates; the estimates of GSP are based on a disaggregation of higher level data to the establishment level. This disaggregated data is then reaggregated the appropriate industry and geography. An alternative methodology would have been to use the data from the Economic Census to derive GSP estimates for the specific firms and industries selected for this study using a process similar to that which the BEA uses in developing its own GSP estimates. However, the Bureau of the Census refused permission to use their data for this purpose, citing concerns about data disclosure.

11. Strengths and Weaknesses of the NOEP methodology

The NOEP methodology was developed to overcome the limitations of other approaches to measuring the ocean economy, particularly the reliance on only disclosure-screened data and the lack of geographic specificity. This methodology met the objectives set out at the beginning of the discussion, and may also be considered to have the following strengths:

- Use of primary data. The use of the ES-202 data permits all estimates to be based on primary reporting data from almost all establishments in the U.S. The data is verified by both the state and U.S. Departments of Labor and is the basis for all employer-related government employment statistics in the United States.

- Consistency and comparability. The data is collected using consistent methodologies across all fifty states. It can be aggregated by industry and geography (although small area geographies do have limitations discussed below). The data is also consistent over time, at least until the implementation of the new North American Industrial Classification System in 2001, which created a break in the industrial data series.

- Estimates are derived from the bottom up. Employment and wage estimates are the sum of actual reported data and, except where limited by confidentiality restrictions, are the sum of firm-level reports.

- Using the zip code permits a much finer geographic level of detail than the county level at which employment data is normally released. This is especially important in states like California, where large urban counties such as in Southern California seriously distort the picture of ocean related activities measured at the county level only.

Weaknesses:

- At the same time, this data series does have some weaknesses: Zip code geography is imperfect. Zip codes change over time, and available GIS files on zip codes (from Environmental Systems Research Institute) do not always contain correct historical or recent revisions. The zip code data used here was for 1999. It matches very closely with 2000 data, but there may be unknown errors in the 1990 data since zip code information in GIS format was not available for that year.

- There are errors in the original employment reports. Firms make errors in reporting their SIC codes and may make errors in reporting addresses. For example, while required to give the physical location of each establishment, not every record contains this information. In such cases, alternative mailing addresses on the record were used. If no address was given, the record was omitted. These reporting errors introduce biases in the data of unknown directions and sizes which may be amplified in the fine-level geographic detail examined here.

- Industry definitions related to the ocean are imperfect. Some industries, such as those in SIC 44 (Water Transportation) are reasonably well related to the oceans. Others such as restaurants and hotels will always present problems in determining the degree to which they are related to the ocean.

- Still others, such as SIC 1629 (Heavy Construction) and SIC 3999 (Sporting Goods not elsewhere classified) do not separate a marine from a non-marine component. In these cases, the assumption is that the marine component (dredging and pier construction companies or surfboard manufacturers) are most likely located near the shore and so may be captured in a shore-adjacent zip code.. But in both cases it is likely that other non-marine related firms may be located in a near shore zip code and thus over-counted in the data.

On balance, the strengths of the methodology outweigh the weaknesses, primarily because they meet the objectives for the data collection that were defined for the project. For the most part, the weaknesses are inherent to either the original data sources used or to the nature of any taxonomic process, or to data availability limitations that cannot easily be overcome.

12. Future Developments

The NOEP data on the ocean and coastal economy remains under development. In 2003-2004, the data on employment, wages, and GSP will be published for the years 2001 and 2002. Beginning with 2001, the data will be made available in the North American Industrial Classification System in addition to the Standard Industrial Classification. From 2002 on, data will only be provided in NAICS to be consistent with other government data series. This shift to NAICS will improve, but not eliminate, many of the issues discussed above with industry definitions since any industrial classification system contains aggregations that are suitable for some purposes and not others.

Improved estimating methods for some sectors will also be sought. The highest priority will be to seek improved estimates for the oil and gas sector, and means of refining the tourist and recreation data.

Comments on the NOEP methodology are welcome. Comments should be directed to the author at csc@usm.maine.edu and the Principal Investigator of the NOEP project at Judith_Kildow@csumb.edu.

References

Census (2000). Notes and Errata: 2000 Census of Population and Housing. Washington DC, U.S. Bureau of the Census.

Colgan, C. S. and J. Plumstead (1993). Economic Prospects for the Gulf of Maine. Augusta, ME, Gulf of Maine Council on the Marine Environment.

Eisner, R. (1989). The Total Incomes Systems of Accounts. Chicago, University of Chicago Press

Ghelfi, L. M. and T. S. Parker (2001). "A County Level Measure of Urban Influence." Rural Development Perspectives 12(2): 32-41.

Luger, M. (1991). "The Economic Value of the Coastal Zone." Environmental Systems 21(4): 278-301.

Lum., S. K. S. and B. C. Moyer (1998). "Gross Product by Industry 1995-1997." Survey of Current Business November.

Mandale, M., M. Foster, et al. (2000). The Economic Value of Marine Related Resources in New Brunswick. Fredericton NB, New Brunswick Department of Fisheries and Aquaculture.

Mandale, M., M. Foster, et al. (1998). Estimating the Economic Value of Coastal and Ocean Resources: The Case of Nova Scotia. Chester NS, Oceans Institute of Canada.

Moeller, R. M. and J. Fitz (1994). Economic Assessment of Ocean Dependent Activities. Sacramento, CA, California Research Bureau.

Nathan Associates (1974). Gross Product Originating from Ocean-Related Activities. Washington DC, Bureau of Economic Analysis.

National Research Council (1999). Nature's Numbers: Expanding the National Economic Accounts to Include the Environment. Washington, National Academy Press.

Panek, S. D. and N. O. Obidoa (2003). "Gross State Product by Industry 1999-2001." Survey of Current Business 83(6): 63-88.

Pontecorvo, G. (1988). "Contribution of the Ocean Sector to the U.S. Economy: Estimated Values for 1987- A Technical Note." Marine Technology Society Journal 23(2): 7-14.

Pontecorvo, G., M. Wilkinson, et al. (1980). "Contribution of the Ocean Sector to the U.S. Economy." Science 208(30 May 1980): 1000-1006.

Seskin, E. and R. Parker (1998). "A Guide to the NIPA's." Survey of Current Business March.

The Changing Ocean and Coastal Economy of the United States: A Briefing Paper for Governors

Charles S. Colgan
Professor of Public Policy and Management
Edmund S. Muskie School of Public Service
University of Southern Maine

Chief Economist
National Ocean Economics Project

Prepared for National Governors Association

March 25, 2004

TABLE OF CONTENTS

SUMMARY OF FINDINGS

The United States Commission on Ocean Policy (Commission) has undertaken a major review of factors affecting the nation's coasts and oceans and will be reporting on its recommendations for changes in national policy in 2003. An important part of the changes affecting the coasts and oceans have been changes in the demographic and economic environment as well as the natural environment. To help understand these changes, the Commission asked the National Ocean Economics Project (NOEP) to prepare an analysis of these factors based on the Project's data on the ocean and coastal economy. The NOEP is an independent research project located at universities on the east and west coasts, and funded by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protect Agency (EPA.).

This paper provides a summary of key findings on the socio-economic factors influencing the coastal and ocean economy that have been provided to the Commission and explores the implications of those trends. The report to the Commission primarily considers these trends from a national perspective; this paper explores some of the implications of these trends for state policies are discussed.

Ten major conclusions have been drawn from the socio-economic analysis:

1. The "coast" is not a single area. Socio-economic data suggests at least four different regions that are coastal (coastal states, coastal watershed counties, coastal zone counties, and the near shore).

2. The common perception that "everyone is moving to the coast" is incorrect. The pressure of population growth in coastal regions comes from the increasing size of the population within a fixed land area, not from a disproportionately large amount of growth. While the population growth rate in coastal areas has been consistent with national trends, the sheer size of the population density in the coastal area has major effects.

3. The most dramatic changes in the coast have come about from employment and economic growth, particularly in the near shore area. Nationally, employment growth was nearly three times population growth nearest the shore. North Carolina more than doubled its employment in the near shore area between 1990 and 2000, while four other states (Alabama, Mississippi, Florida, and New York) saw employment grow by more than 50% in the near shore area.

4. The coastal and ocean economy are related but not identical. The coastal economy comprises all economic activity in the coastal regions, while the ocean economy is that activity directly related to the ocean as an input. The ocean economy includes ocean dependent activities such as minerals extraction, fisheries, and marine transportation, while the coastal economy is a region which provides access to the services of the ocean as well as being a specific economy within a larger region.

5. Economic activity in coastal regions is very large. Seventy-five percent of the nation's Gross State Product came from the coastal states in 2000. Almost half of the economy came from the coastal watershed counties, and more than one-third came from those counties in which states operate their Coastal Zone Management programs. The near shore area, which is 4% of the nation's land, produces more than 11% of the nation's economic output.

6. The ocean economy is also large, with 2.3 million people employed and $117 billion in output (gross state product) in 2000. The ocean economy comprised 1.6% of the nation's employment - ranging from 17.7 % of Hawaii's employment to 0.6% of Ohio and Indiana's employment.

7. The ocean economy has undergone dramatic change over the past decade. Tourism and recreation provided all of the job growth, while the other ocean economy sectors declined in employment (living resources, minerals, ship and boat building, and transportation) or grew only slightly (marine construction). The ocean economy grew more slowly than the national economy.

8. While the tourism and recreation sector has displayed significant job growth, the transportation and minerals industries play much larger roles in the ocean economy in their contribution to the economy than their employment share implies. These sectors, along with ship and boat building, pay the highest wages in the ocean economy.

9. More than 90% of the employment in the ocean economy is located in urban areas, but the ocean economy comprises a much larger proportion of employment in rural areas.

10. We have invested very little in the understanding of the ocean and coastal economy and in the value of its resources. Sound policy will require improved understanding of socio-economic factors, including expanding data collection, reporting, and management. States will play a critical role, in partnership with the federal government, in collecting the required data.

IMPLICATIONS FOR STATES

These findings suggest several important implications for state policies in several different areas, including coastal resource management, transportation, land use planning, economic development and state economic data collection and management:

For coastal resource management:

- From a population growth perspective, the coast is moving inland. Population growth is an issue for all coastal areas, but there are different trends within the different sub-regions of the coast that must be considered. Upland areas are growing faster than the near shore, in part due to the limited amount and high price of shoreline real estate. Thus population growth pressures are more likely to occur in the counties near the shore, but away from the immediate shoreline.

- The real population growth on the coasts is not from permanent residents near the shore but the large number of people who come to the shore for short periods of time. These include the large number of employees who must commute into the near-shore region to take the growing number of jobs there but who cannot live there because of high real estate prices. It also includes large numbers of tourists and recreationists who increase the population in coastal areas several fold in the summer. Cruise ship calls are an extreme example of short term population booms in a coastal community.

- The nature of economic growth in coastal regions is pushing up demand for land conversion from open space and wildlife habitat to residential and commercial uses. Land conversion for housing is occurring at a far faster rate than population growth alone suggests and is creating subsequent problems associated with "sprawl" such as increased nonpoint source pollution and storm water runoff.

For Transportation

- Coastal states and communities must plan for and build a transportation infrastructure to serve a much larger population in coastal areas than actually live there. Maine, for example, has a summer time population of 7 million but a year-round population of only a million. Because of rapid employment growth in near shore areas, transportation infrastructure must have the capacity to move employees on a daily basis and tourists on a seasonal basis. States should consider the best method for moving these populations while maintaining community and environmental character.

- State and local investments in marine transportation (facilities for the transportation of freight and passengers) are providing increasingly valuable services to the economy as a whole- particularly the economies of coastal states. But competitive pressures on the transportation industry and improved technologies are reducing the demand for labor, particularly in the handling of freight, even as the overall economic importance grows. Marine transportation investments will become increasingly critical to the competitiveness of state economies as a whole, as port facilities, even in neighboring states, play a larger role in moving the increasing volume of imports and exports. The development of the cruise ship industry as a increasing component of the fast-growing "ocean tourism" business also presents opportunities – and challenges- for virtually all coastal states.

For Land Use Planning

- The problem of "sprawl" is different in different parts of the coast. In some regions, population growth may drive sprawl, but in much of the coast it is commercial and retail growth- and its employment- that is driving changes in land use patterns. Residential sprawl is likely to be the greatest issue in inland areas away from the coast, where land prices are lower and population growth faster. But commercial growth is likely to be the major issue in sprawl the nearer the coast, with shopping malls, strip developments, and commercial office space growth rising the fastest in the near-shore areas. This trend of faster growth in employment near the coast and of residences away from the coast creates additional strains on transportation systems, as well as requiring even more land space to accommodate the needs of roads and parking.

- These trends are greatly exacerbated by the concentration of growth in tourism and recreation industries. This growth must accommodate seasonal peaks in population, and is centered in those retail and service activities which require the greatest amount of land for development. Finding ways to better accommodate the growing demand for coastal and ocean tourism within the limited resources of the coastal environment needs to be a high priority for coastal states.

For Economic Development

- Changes in the ocean economy are presenting major economic development challenges. Tourism and recreation is growing robustly, but coastal states may be competing with one another for that market.

- Tourism and recreation are increasingly taking over for other traditional uses of the ocean, such as fisheries, boat building, and marine transportation. Those uses remain very valuable to state economies, and cannot be forgotten merely because they are in decline. These issues can be especially acute for rural coastal economies.

- Coastal and ocean resources are key resources to the nation's urban regions. The growth of tourism and recreation in urban coastal areas reflects both an attraction for national and international tourists, but also a key part of making coastal cities attractive places in which to live and work.

- The transition of people and communities away from dependence on declining fisheries will continue to be an issue for the foreseeable future. Aquaculture will only partially replace the employment and economic activity associated with wild fisheries.

For Economic Data and Information

Knowledge of the ocean and coastal economy is very imprecise because little has been invested in developing the needed data, especially in comparison with the investment in understanding other natural resource industries. States need to work closely with the federal government to provide the basic data that measures the coastal and ocean economies.

- One needed improvement is the development of systematic measures of employment in the commercial fishing industry, which is largely exempt from all state and federal reporting requirements. State departments of labor and marine resources agencies will have to work cooperatively with their federal counterparts to develop this critical information.

1. Defining the Coast

Numerous studies have been done describing population changes in the coastal region. The coast, it is said, is the home to over half the population of the U.S. But what is the coast? A moment's reflection will indicate that it is unlikely that half the population of the United States (over 140 million people) lives immediately adjacent to the shore of the ocean or Great Lakes. In fact, the term "coast" has been used to apply to a wide variety of geography, sometimes defined by political boundaries, other times by natural features. The first step in understanding the demographic and economic factors affecting the "coast" is to define that term. For purposes of analysis, the coast consists of four tiers. From largest to smallest they are:

- *Coastal States* – The 30 states bordering an ocean or Great Lakes. Currently, the coastal and ocean economic data is available only for states, not for Commonwealths or territories.

- *Coastal Watershed Counties* – Coastal watershed counties have been defined by NOAA as a means of more closely aligning political and natural boundaries. There are 640 watershed counties covering the areas in which major rivers and streams flowing into the oceans and Great Lakes are found.[i]

- *Coastal Zone Counties* – This category includes counties which are defined by the states for purposes of the Coastal Zone Management Act (CZMA).[ii] The CZMA definition of coastal zone varies significantly from state to state. In four states, the coastal zone includes the entire state.[iii] In other states the coastal zone is defined by political jurisdictions such as towns and counties. Others define it by natural features.[iv] There are 340 coastal zone counties.

Near shore – The near shore is defined using zip codes for both population and employment data. These definitions are imperfect, since they vary in size and shape across the country and are only loosely related to natural features of shoreline or rivers. But they are consistent with existing demographic and economic data sets and permit broad trends to be identified.

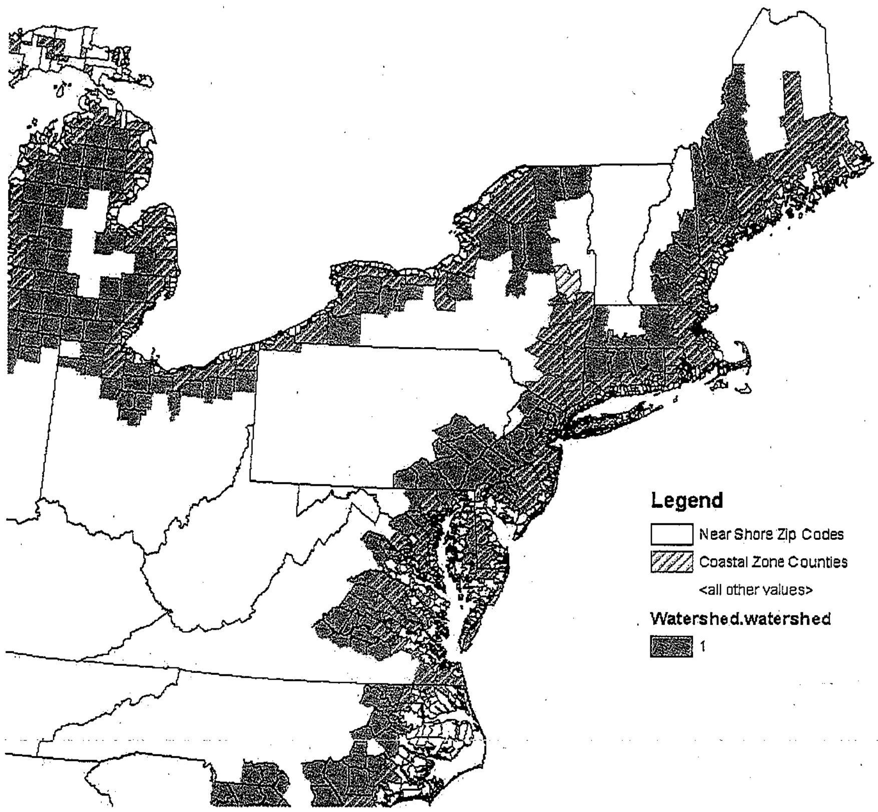


Figure 1: Illustrates the Four Definitional Tiers that Comprise the "Coast" in Northeast and Great Lake States.

2. Population Growth Pressures

Population growth pressures in coastal regions arise from significantly increasing population densities rather than a trend of disproportionate growth.

The common perception that "everyone is moving to the coast" is incorrect measured over the three decades. The pressure of population growth in coastal regions comes from the increasing size of the population on the fixed land of the coastal area, not from a disproportionate "move to the coasts." The share of U.S. population accounted for by each of the four coastal regions in 1970 and 2000 was roughly the same. As Figure 2 demonstrates, the coastal watershed counties actually grew slightly slower than the national population and housing figures over this thirty year period. Coastal watershed counties also grew at a reduced rate. Over the 1990 to 2000 decade (the only decade where the near shore region can be measured using zip codes), the near shore region population grew at 11% compared with the U.S. growth of 13%.

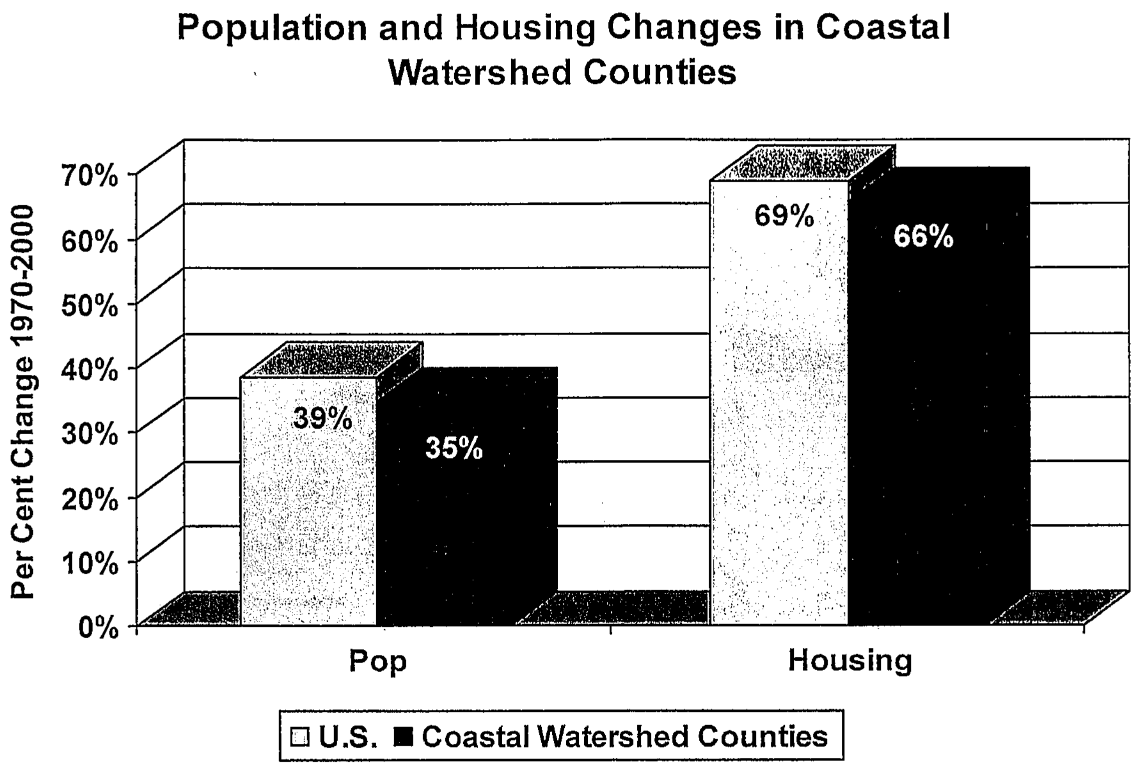


Figure 2: Illustrates Population and Housing Growth Rates for the U.S. versus Coastal Watershed Counties.

The oft-cited fact that the coastal regions are growing disproportionately greater was true during the 1980s, but not during the 1970s or 1990s or over the whole thirty year period. The slower growth in coastal areas should not be surprising. The coastal regions contain many of the nation's largest cities, which have not been growing rapidly. Moreover, land nearest the shoreline is among the most expensive real estate in the nation. Within the coastal watersheds, population and housing growth has been fastest in the coastal zone counties over 1970-2000 (37%) compared with coastal watershed counties (35%).

The impact of population growth on the coast does not depend on the percentage of growth, but rather on the sheer magnitude of growth in such a finite geographic area. In 1970, the coastal watershed counties held 53% of the U.S. population, and, in 2000, they held 52% of the population, all on slightly less than 25% of the land area. But during those three decades, a population equal to the State of California today was added to those counties, increasing the population density of these counties from 123 people per square mile to 167 people per square mile. (Figure 3)

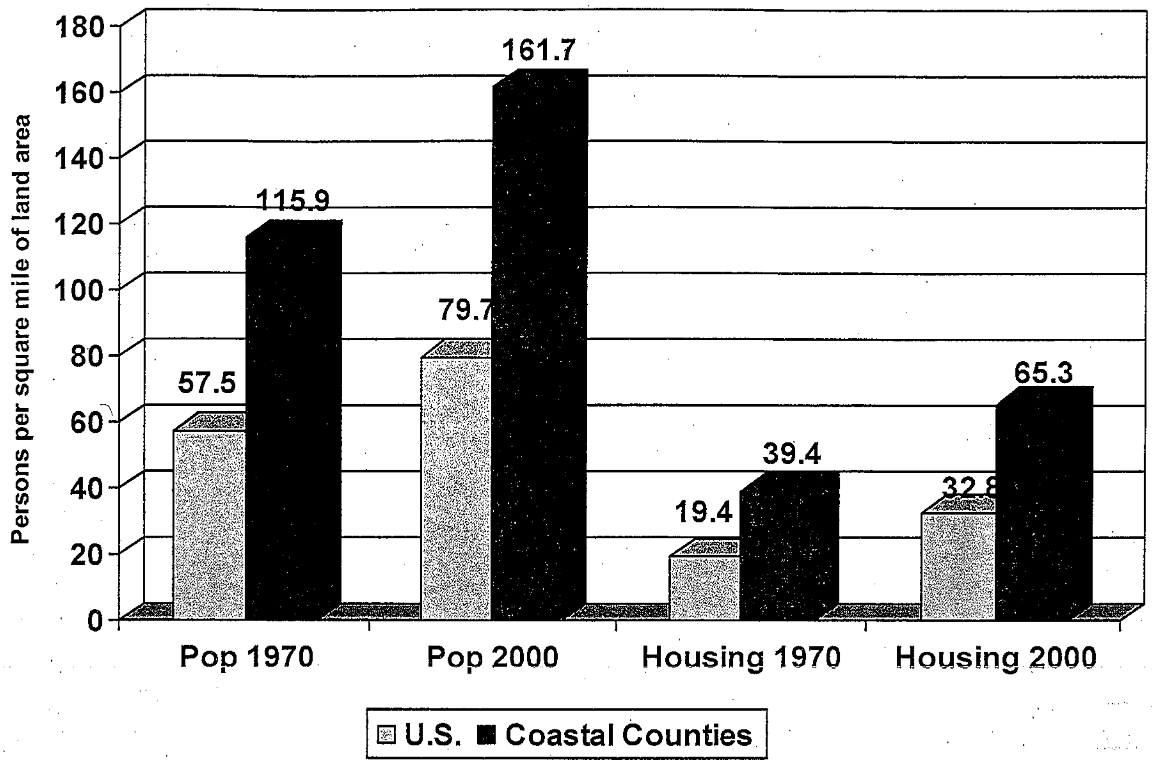


Figure 3: Illustrates Population and Housing per Square Mile of Land Area

The issue of population density is particularly acute in the near shore area. This region contains 11% of U.S. population on 4% of the land. At over 230 persons per square mile, the population density of the near shore is three times that of the nation as a whole.

3. Employment Growth Pressures

The socio-economic dimension that is changing the most in the coastal region is employment and economic growth.

Employment growth is substantially outpacing population growth in coastal regions, with the greatest difference coming in the near shore area. Between 1990 and 2000, employment in this region grew by nearly 35%, compared with population growth of just over 11%. (Figure 4)

These trends make the near shore among the most economically vibrant regions in the states. But that vibrancy on the narrow land base of the near shore region makes for potentially large stresses on its natural resources. This is particularly acute when combined with the population growth and the stresses of seasonal tourism demands (discussed below).

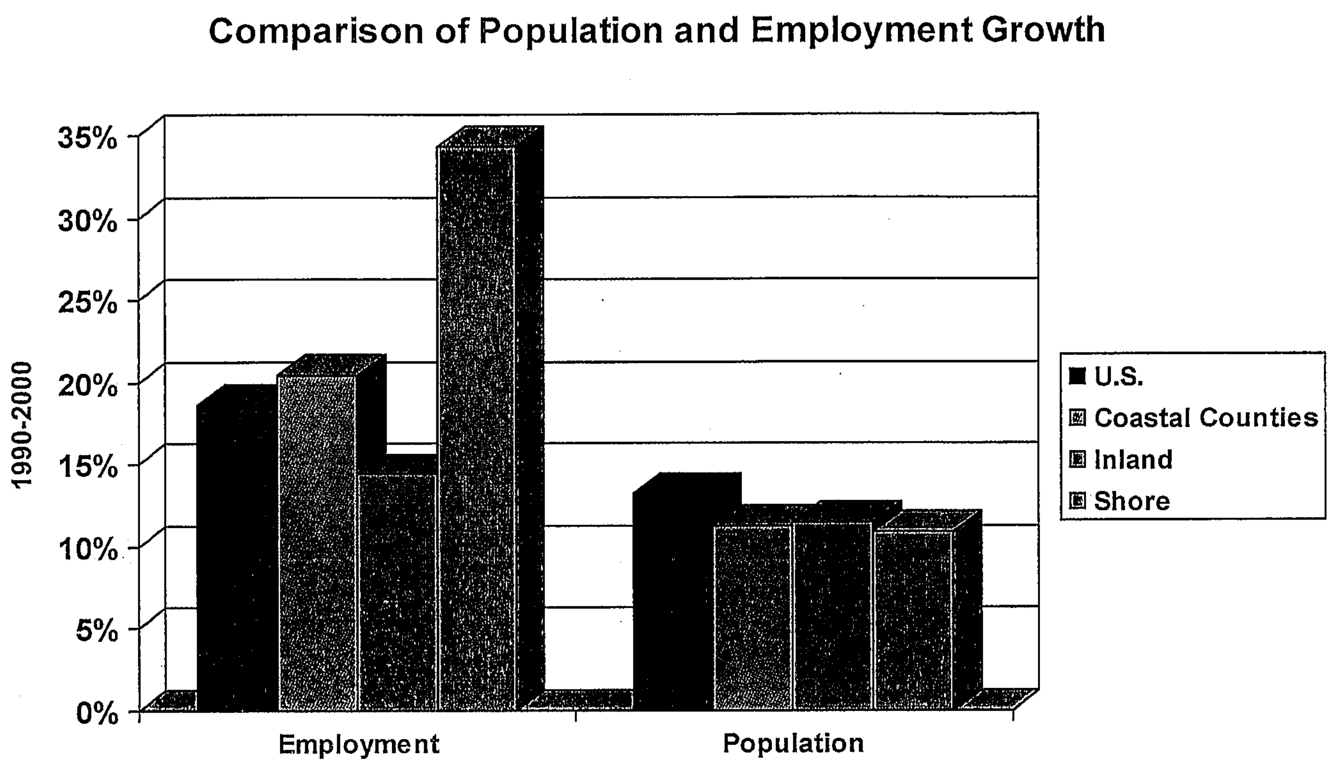


Figure 4: Demonstrates Percentage of Employment in a Coastal Region versus Population

The types of industries that have been growing in the near shore areas enhances the stress on the resources of the region. Growth has primarily been concentrated in nonmanufacturing industries which generally require more employees per unit of output. Major industries in these sectors, such as retail, also pay less meaning that employees often cannot afford to live in the more expensive near shore regions and, therefore, must commute in and out of the region daily.

4. Coastal Economy v. Ocean Economy

The terms "ocean" and "coastal" economy are often applied in a way that implies they are synonymous, but they are not.

The *ocean economy* is that portion of the economy which relies on the ocean as an input to the production process or which, by virtue of geographic location, takes place on or under the ocean.

The *coastal economy* is that portion of economic activity which takes place on or near the coast (whether defined as coastal watershed, coastal zone, or near shore areas).

The reason for this distinction stems from the fact that the "ocean" and "coast" are two different resources. The "ocean" provides a variety of products and services such as food, recreation, and transportation. The "coast", on the other hand, is a region which provides access to the services of the ocean as well as being a specific economy within larger regions. The coast contains both ocean and many non-ocean related economic activities, and is much larger than the ocean economy. The coast economy describes the category of economic activity that creates much of the impact on coastal resources, while the ocean economy is the direct connection between the sea, the Great Lakes, and the nation's overall economic growth.

This size of the coastal economy is impressive.

Three quarters of the American economy is generated coastal states. Nearly half comes from the 25% of the land that is the coastal watershed counties, and more than 11% of the economy comes from the 4% of the land in the near shore area. Regardless of the definition of coast being used, the coastal economy has grown faster than the national economy.

The ocean economy- the economic activity directly associated with using ocean resources - is considerably smaller than the coastal economy, but important nonetheless.

In 2000, the ocean economy is estimated to have employed over 2.2 million people and contributed more than $117 billion to the national economy.

The ocean economy is generally proportionate to the size of each state's economy, but it is more important in some states than others. Ocean economy employment is

DEFINING THE OCEAN ECONOMY

The ocean economy can be divided into the following broad sectors and industries:[1]

- *Living resources* (fisheries harvesting and processing, aquaculture, seaweed harvesting)
- *Marine construction* (construction of piers and wharves, dredging, beach reconstruction)
- *Ship and boat building*
- *Marine transportation* (transportation of both freight and passengers plus manufacturing of equipment used in marine transportation)
- *Minerals* (oil and gas, sand and gravel, miscellaneous other mineral resources)
- *Tourism and recreation* (restaurants, lodging, recreation services, marinas, boat dealers)

Two sectors are also important, but are not included because of data limitations.

- *Scientific Research* (oceanographic, biological, ecological)
- *Government* (Federal, state, and local agencies that use or manage ocean resources).

Some of these industries are related to the ocean by what they do, such as marine transportation of goods and people. Other industries are ocean-related because of where they are. Tourism and recreation industries such as hotels or recreation services are ocean related when located in the near shore area

The data used in this analysis is based on the ES-202 data employment and wage data series collected by the U.S. Department of Labor Bureau of Labor Statistics. It is based on establishment level monthly reports of employment and wages. Estimates of gross output are based on the gross state product estimates from the U.S. Department of Commerce Bureau of Economic Analysis. Data for ocean-related government employment is not currently available. For more information see (Colgan 2003) largest in Hawaii (18%) and Alaska (11%), as might be expected given their geography. The ocean economy as a proportion of gross state product is largest in Alaska (19%) and Hawaii (10%).

Among the continental states, ocean employment comprises the largest proportion of the economy in Washington State (6%) and the largest proportion of gross state product in Louisiana (11%)

5. Changes in the Ocean Economy

The ocean economy has undergone dramatic changes in the past decade.

Employment in the ocean economy remained proportionate to U.S. employment over the decade, but the share of national wages paid and share of national gross state product has declined. (Figures 6 and 7) These changes have occurred despite the addition of nearly 300,000 jobs over the decade. To understand why the ocean economy has not fared well, it is necessary to examine the composition of that economy.

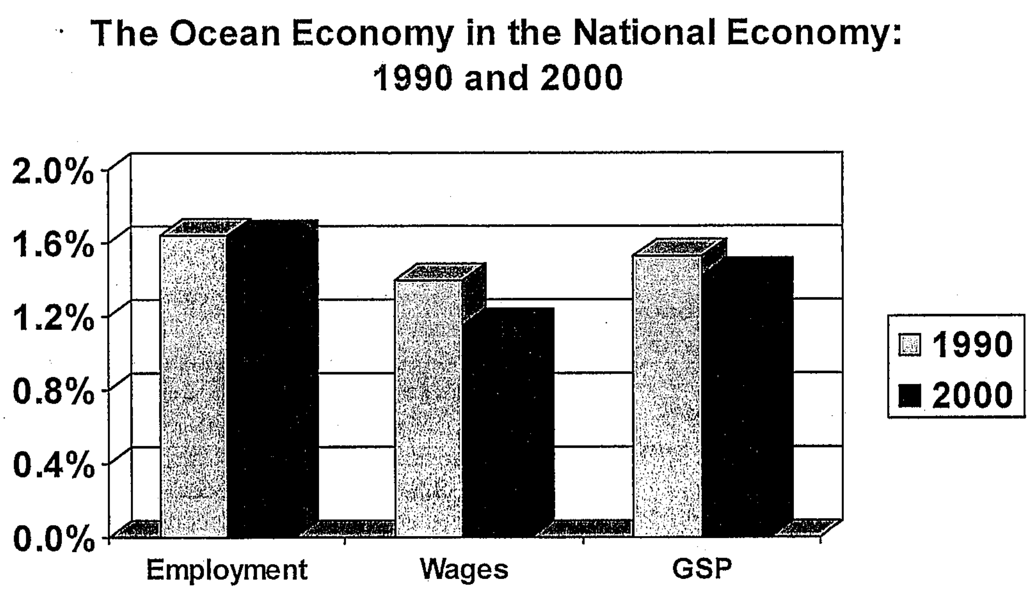


Figure 6; Illustrates the Growth in the Ocean versus National Economy

Figure 7 shows the changes in employment, wages paid, and gross state product for the six major sectors of the ocean economy for which measurement is currently available. Tourism and Recreation related activity is the only sector of the ocean economy sectors to show growth in employment, wages, and output that is even close to the national economic growth over the period. All other sectors grew more slowly than the U.S. in output measured in current dollars. There was slight growth in marine construction employment, but every other sector saw dramatic declines in employment.

A number of factors have resulted in these changes. Growth in tourism and recreation reflects both the unique attractions of the oceans and coasts for these purposes and rising affluence. Declines in fisheries from over-fishing and government-mandated reductions in effort have resulted in sharp declines in the seafood industry.

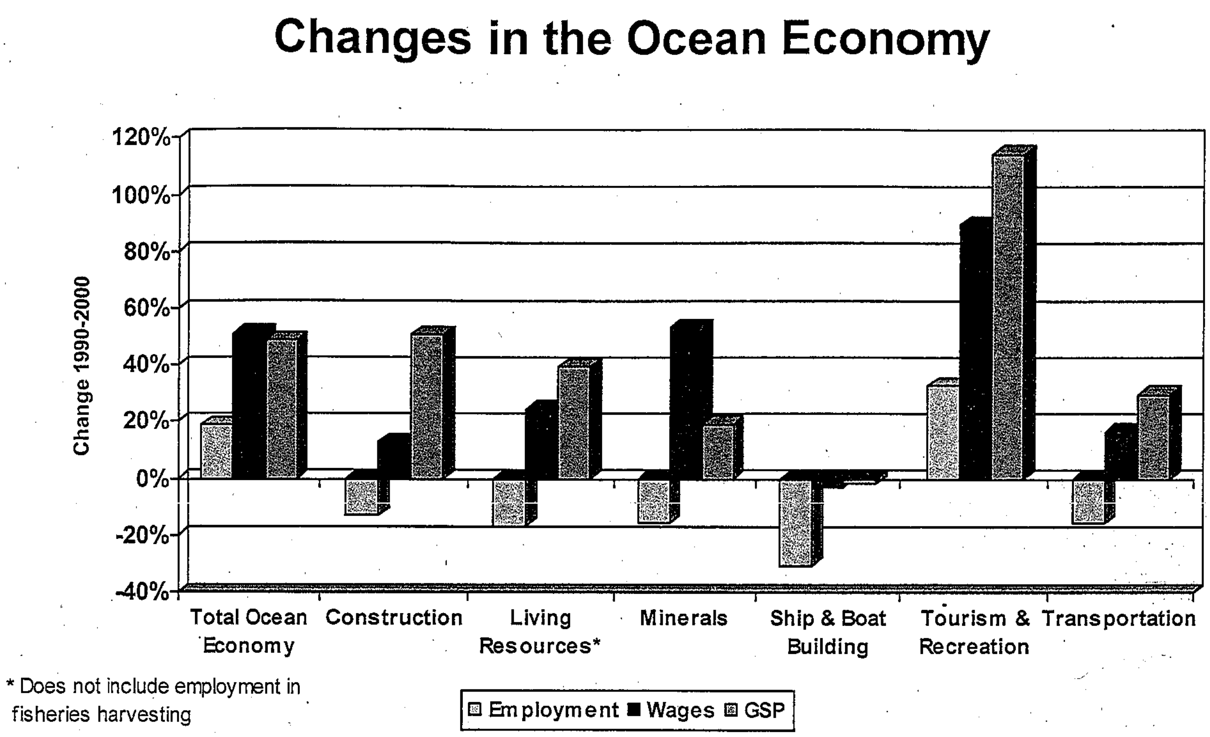


Figure 7: Illustrates Changes in the Ocean Economy by Sector

The end of the Cold War resulted in a dramatic drop in ship building for the Navy, which was not offset by a rise in the boat building industry for the recreational market. The offshore oil and gas industry declined in output and became more productive. The end of the Cold War also resulted in a sharp decline in demand for search and navigation equipment, the "high tech" end of the ocean economy. Finally, despite a significant increase in the demand for marine transportation services for handling the increasing volume of international trade (90% of which by volume is carried by sea) freight and passengers, employment in deep sea freight handling industry has declined because of improved productivity.

Ocean economy growth trends are moving away from the sectors that are most valuable to state economies.

The changes in the ocean economy away from sectors like minerals production, ship building and offshore oil and gas production should not obscure the importance of these industries in state economies. These industries, along with fishing and transportation, continue to provide high wages and make major contributions to the state and national economy.

Figure 8 compares the distribution of establishments, employment, wages, and contribution to gross state product. Tourism and recreation firms dominate the number of establishments and employment, comprising about 80% of the ocean economy on these measures. But the minerals and transportation sectors show much higher proportions of wages paid and gross state product. Their contribution to output is two times or more their share of employment.

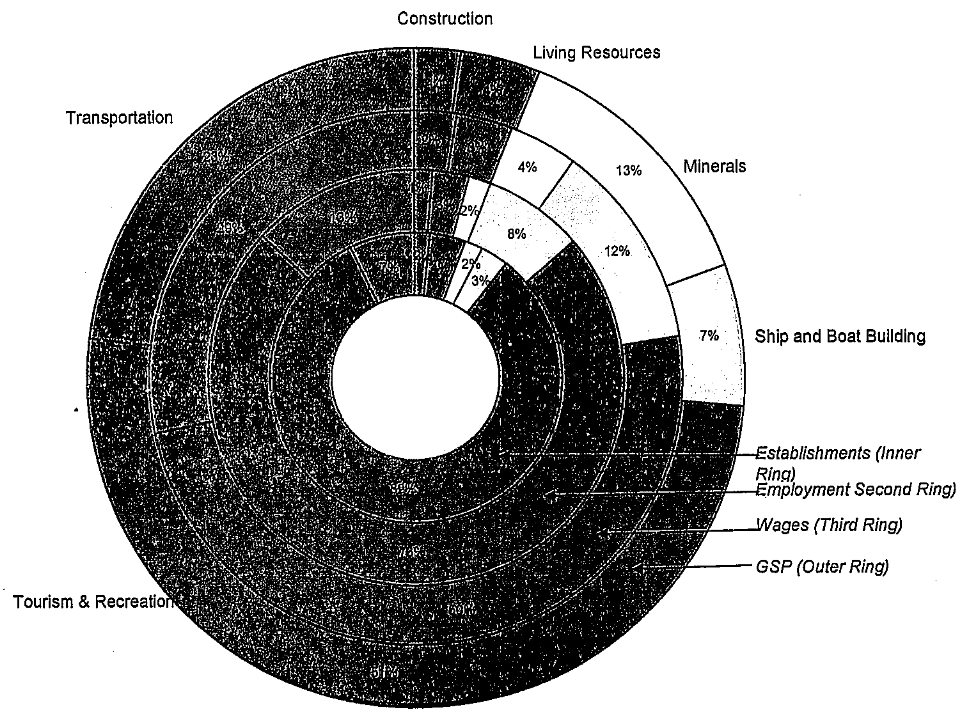


Figure 8: Illustrates the differing proportions of employment, wages, and gross state product that ocean economy sectors comprise.

This economic pattern presents states with a particular economic development challenge. The industries in the ocean economy that have been growing most rapidly are those that pay the lowest average wages (Figure 9). The average wage in 2000 in the tourism and recreation sector was $16,321, compared with over $60,000 in the minerals sector. Employment in the tourism and recreation sector is often highly seasonal, which distorts annual average figures to some extent. In fact, employment in ocean tourism is, on average, 10% higher in the summer than the annual average employment (except for Florida, which peaks in March). Maine leads the nation in the seasonal peak, with employment 35% higher in the summer.

The ocean economy has seen the most growth in the sectors and industries paying the least, and subject to a high degree of seasonality, while losing employment in the higher productivity, higher paying jobs. State economic development efforts will have to develop means to take advantage of tourism and recreation growth. As part of the larger shift towards a service economy, tourism and recreation industry growth is part of larger trends, including its tendency to use substantial amounts of increasingly scarce coastal lands. States will have to take advantage of the growth of ocean tourism while minimizing its impacts. At the same time, state economic development will have find ways to keep other ocean industries vibrant wherever possible, while transitioning people out of ocean industries experiencing resource scarcity, such as fisheries. [or improved productivity out of traditional ocean industries like fishing or oil and gas

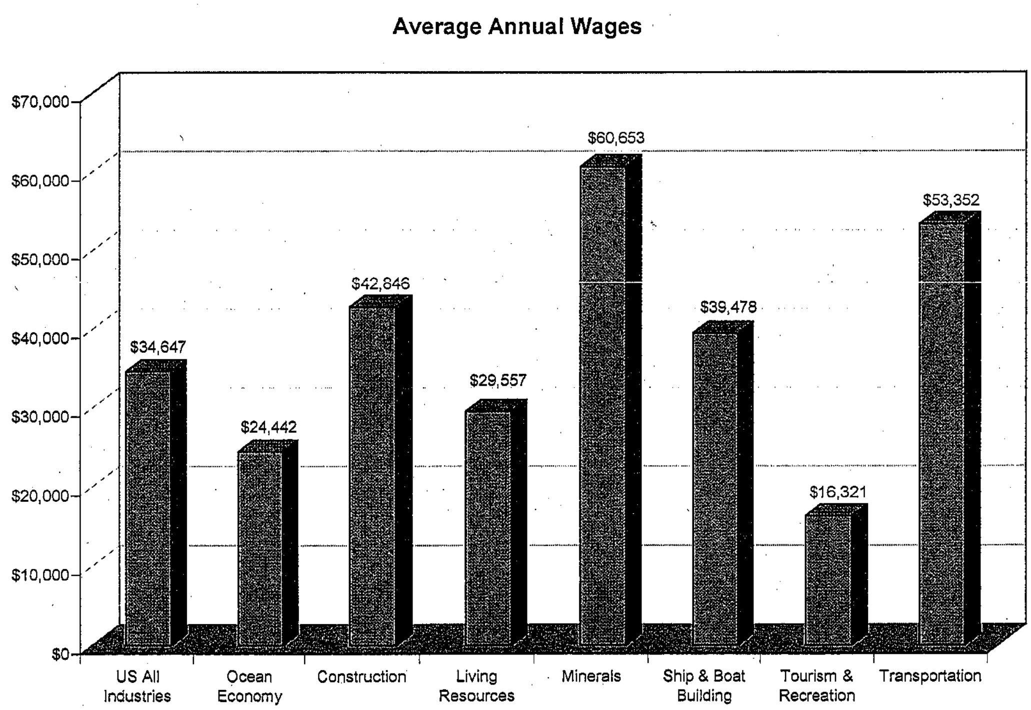


Figure 9: Illustrates the variation in average annual wage by sector of the ocean economy.

6. The Urban and Rural Distribution of the Ocean Economy

The ocean economy is overwhelmingly urban in location, but it is more important in rural areas.

Ninety-three percent of employment in the ocean economy is located in metropolitan areas. This is not surprising, since industries such as marine transportation, tourism and recreation, and even fishing tend to be found in the cities, where they are intimately connected to other industries and consumers in the region.

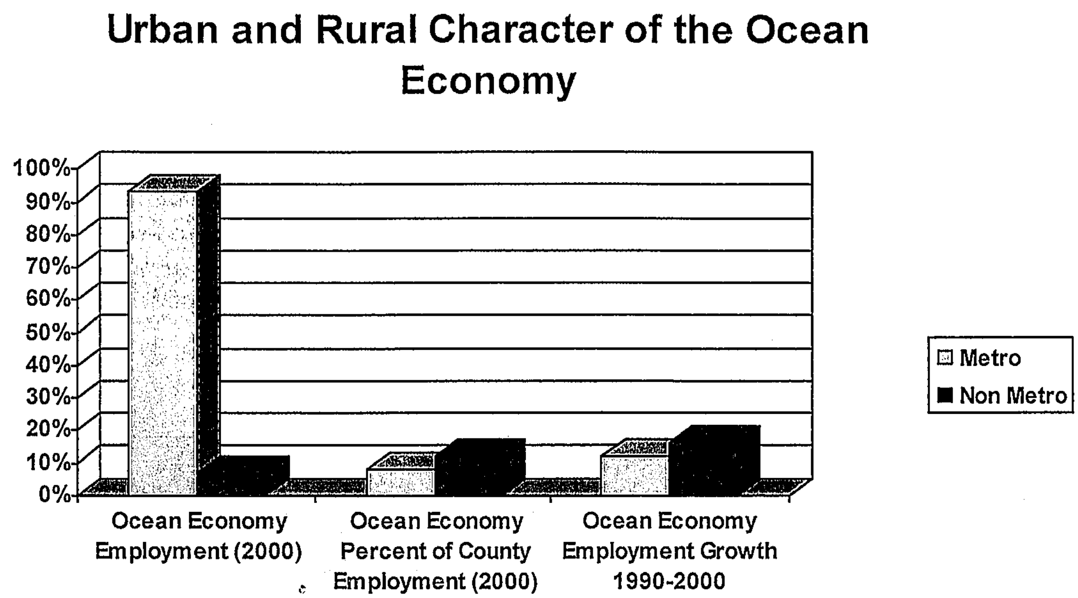


Figure 10: Illustrates the urban and rural (metro and non-metro) distribution of the ocean economy.

But, as Figure 10 shows, employment in the ocean economy is twice the share employment in non-metropolitan counties, and that ocean economy employment in the rural counties grew faster than in the urban counties. Recalling the growth trends in the ocean economy discussed above, it is likely that the changes in the ocean economy will have caused much greater stresses in rural economies, even while those economies showed growth, primarily related to tourism and recreation development. This stress arises from the declines of traditional- and often well paying- industries involved in natural resource use.

7. Measuring the Ocean and Coastal Economies

Less is known about the economy associated with the ocean than about any of the other major natural resources of the American economy (agriculture, forests, and minerals).

The information about the ocean and coastal economy presented here is the result of a research project which has only begun to develop the data and information needed to better understand how the economies of our coastal region and ocean industries are changing.

Currently, neither state nor federal governments invest resources to consistently measure the ocean economy. For example, there is no nationally consistent measure of employment in the fisheries harvesting industry, and most states, even those where commercial fishing is a major industry, do not regularly count those employed in commercial fishing. All of the changes over the past decade in commercial fishing have taken place without any systematic documentation of the number of people affected. The enormous contribution of the ocean to real estate values- and the tax base dependent on those values- is only sporadically measured. And the economic value of the states' investment in increasing access to the shore for recreation is not measured any where.

The collection and analysis of economic data is a cooperative endeavor of the state and federal governments. Much of the nation's key economic data is collected by the states with funding and guidelines provided by the federal government. The development of new and expanded data to better understand the ocean and coastal economies will have to follow this model, though the federal government will have to take the lead by setting national standards and providing funding. But state agencies, such as those with responsibilities for employment data, fisheries, and recreation will have to play their parts in developing the means to better measure and understand the coastal and ocean economy.

Notes

[i] The definition excludes the Mississippi-Missouri-Ohio river system.

[ii] Boundaries of coastal zone are provided by the Office of Coastal Resource Management, NOAA.

[iii] The four states which define the entire state as the coastal zone are Florida, Rhode Island, Delaware, and Hawaii.

[iv] Examples of states using county boundaries include Washington, South Carolina, Mississippi, and North Carolina. States using municipal boundaries include Maine and Connecticut. In New York, the coastal zone includes counties along the Hudson River as far north as Albany, as well as counties along both the Atlantic and Great Lakes coasts. Pennsylvania defines its coastal zone only along Lake Erie and not along the Delaware River. In this analysis, Cook County Illinois is included in the coastal zone county definition although Illinois does not participate in the CZM program to provide complete coverage of the nation.

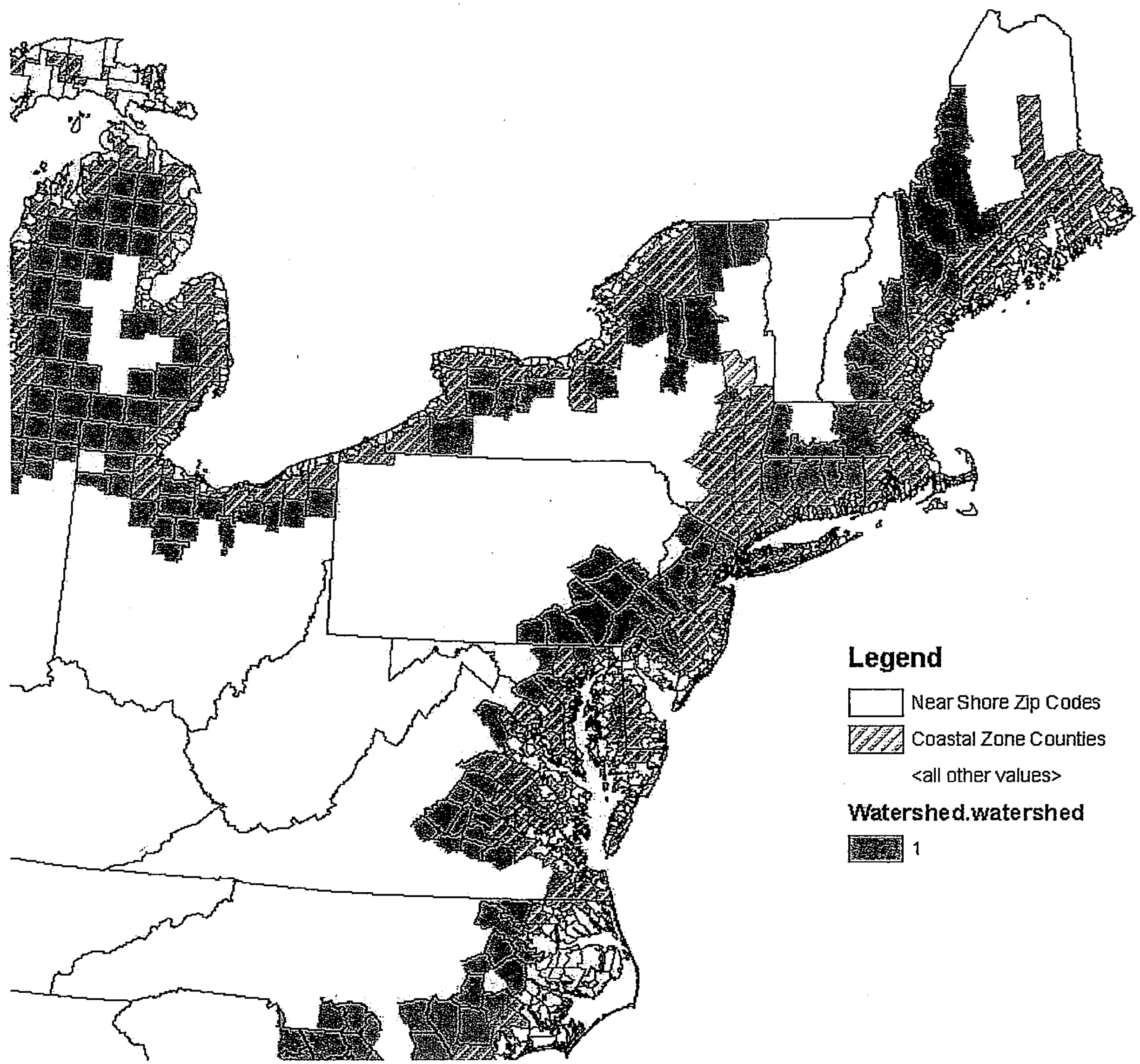
10 Things to Know About the US Ocean and Coastal economy

National Ocean Economics Project

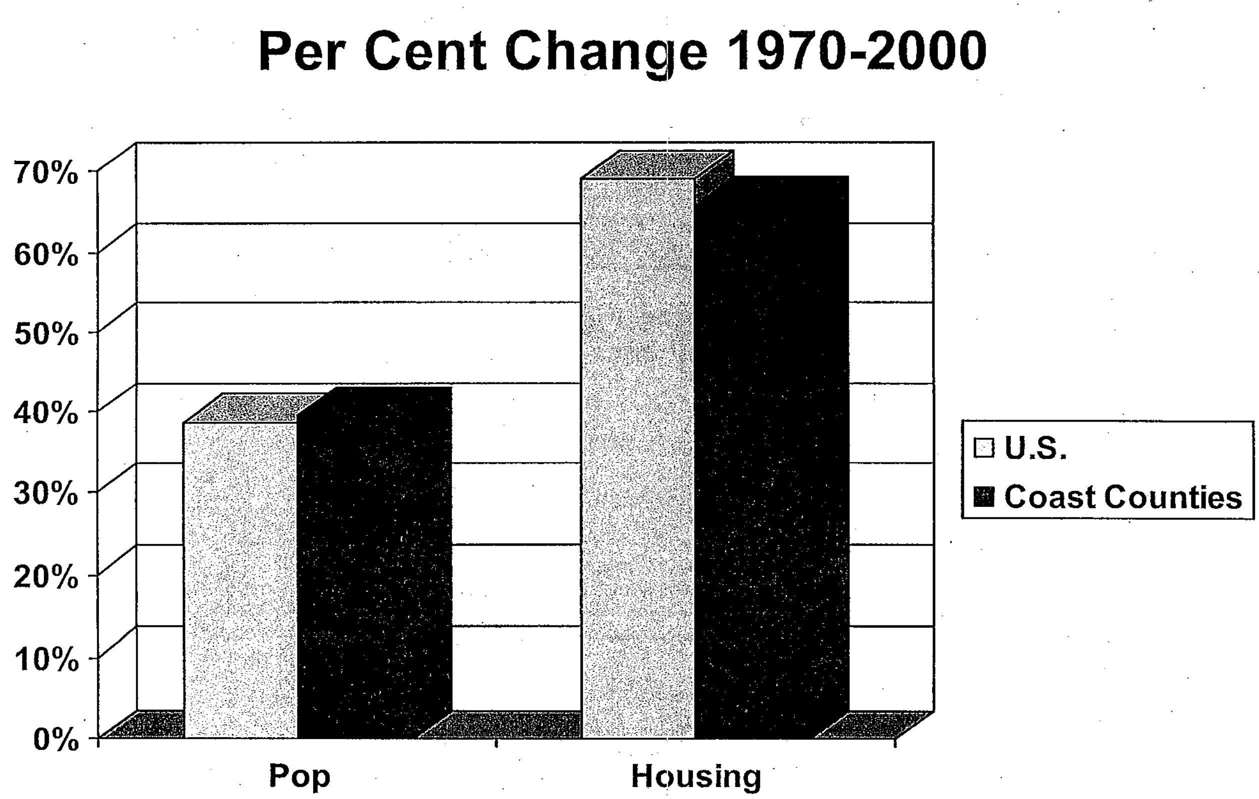
Charles S. Colgan
Muskie School of Public Service
University of Southern Maine

1. The “coast” is not one place but at least four

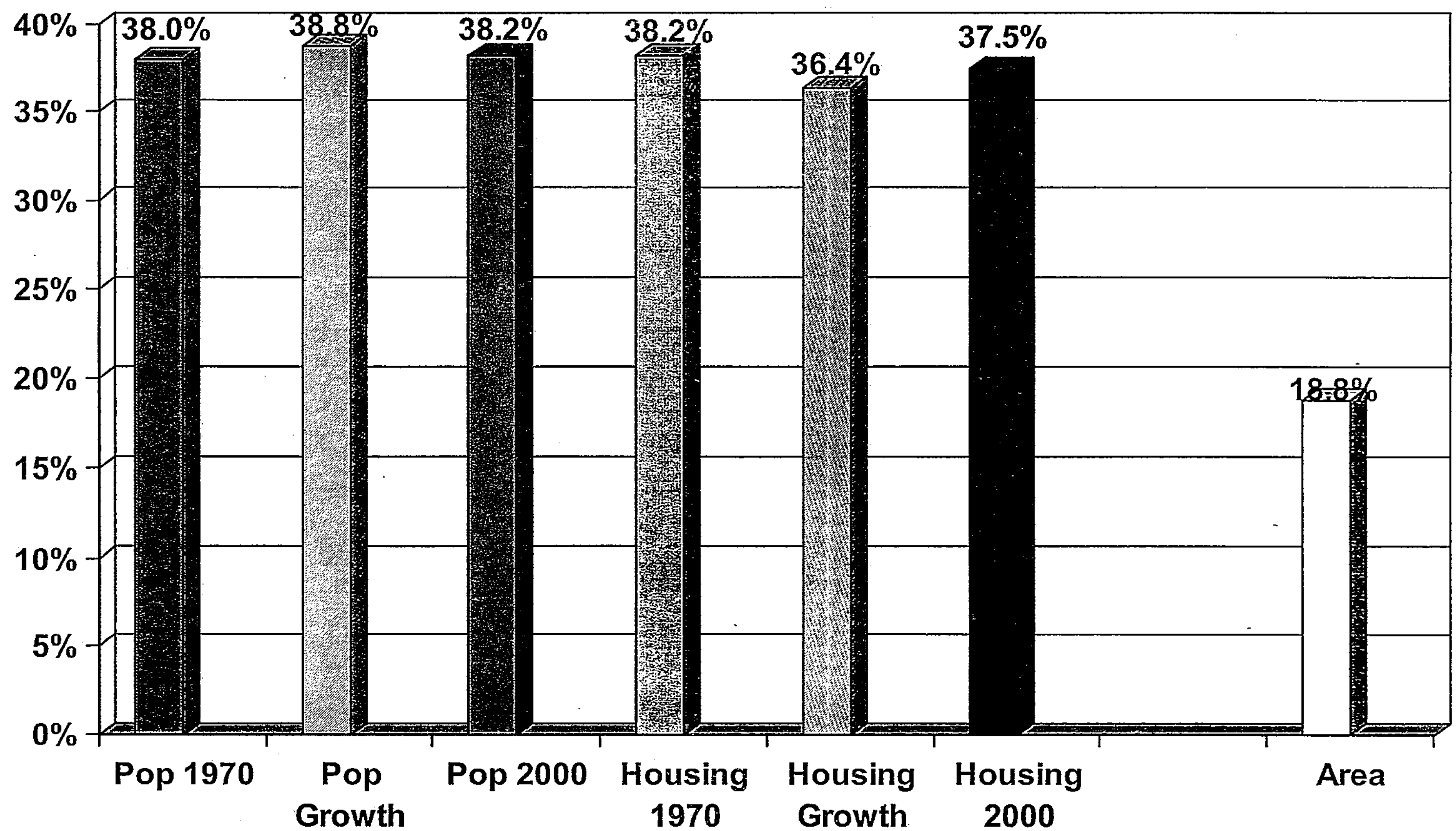
- Near Shore
  - Coastal Zip Codes
- Coastal Zone Counties
  - Touched by CZMA
- Coastal Watersheds
  - To headwaters of coastal rivers
- Coastal States
  - Bordering the Oceans and Great Lakes


Legend
Near Shore Zip Codes
Coastal Zone Counties
<all other values>
Watershed.watershed
1

2. Everybody is NOT moving to the coast…

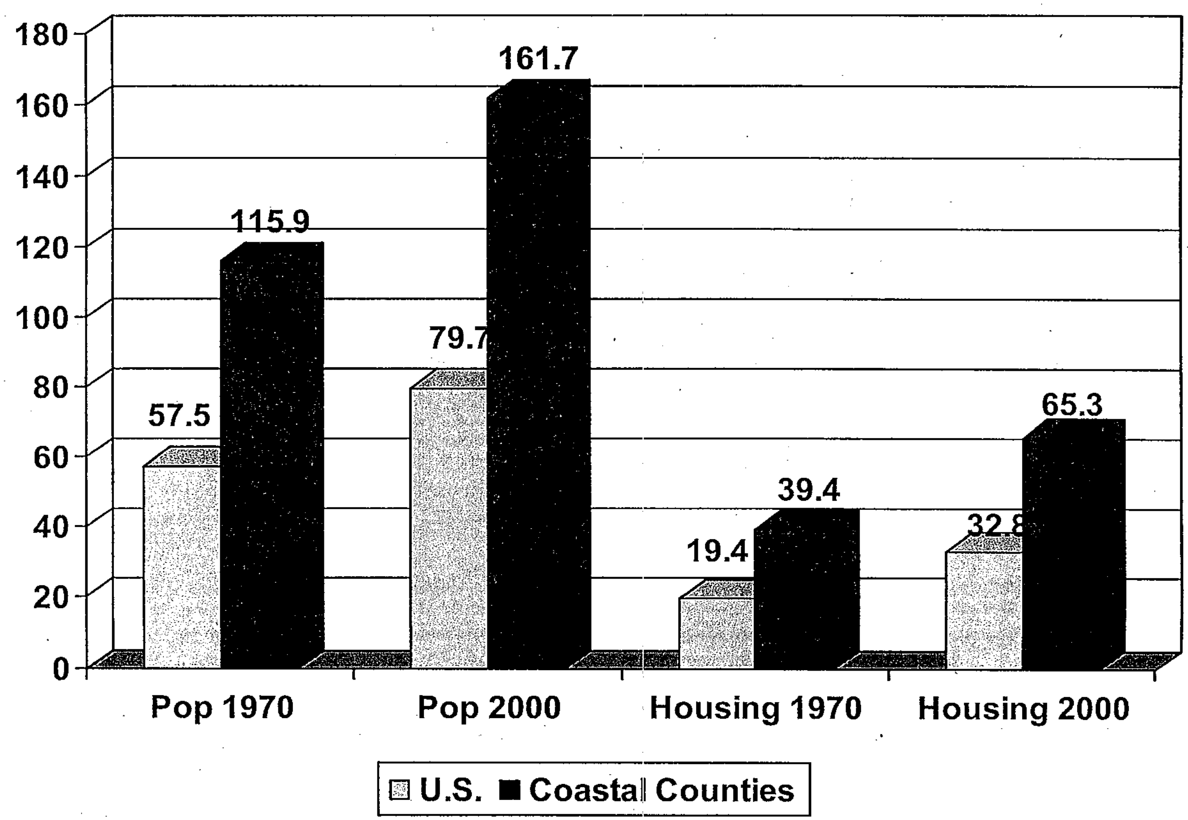


Coastal Zone Counties as Percent of U.S.



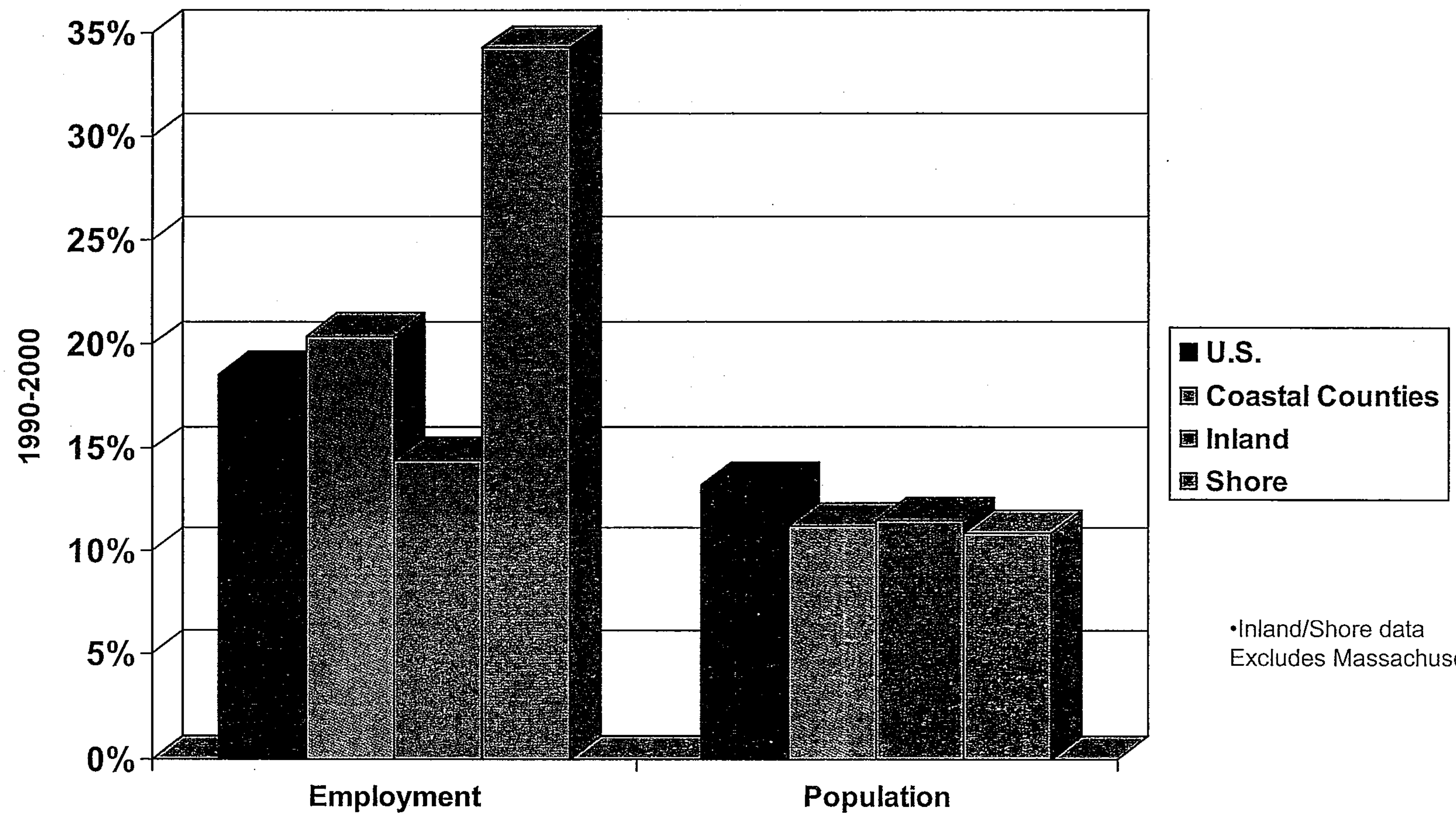
A004388

… but the Housing and Population Density Increases are still huge



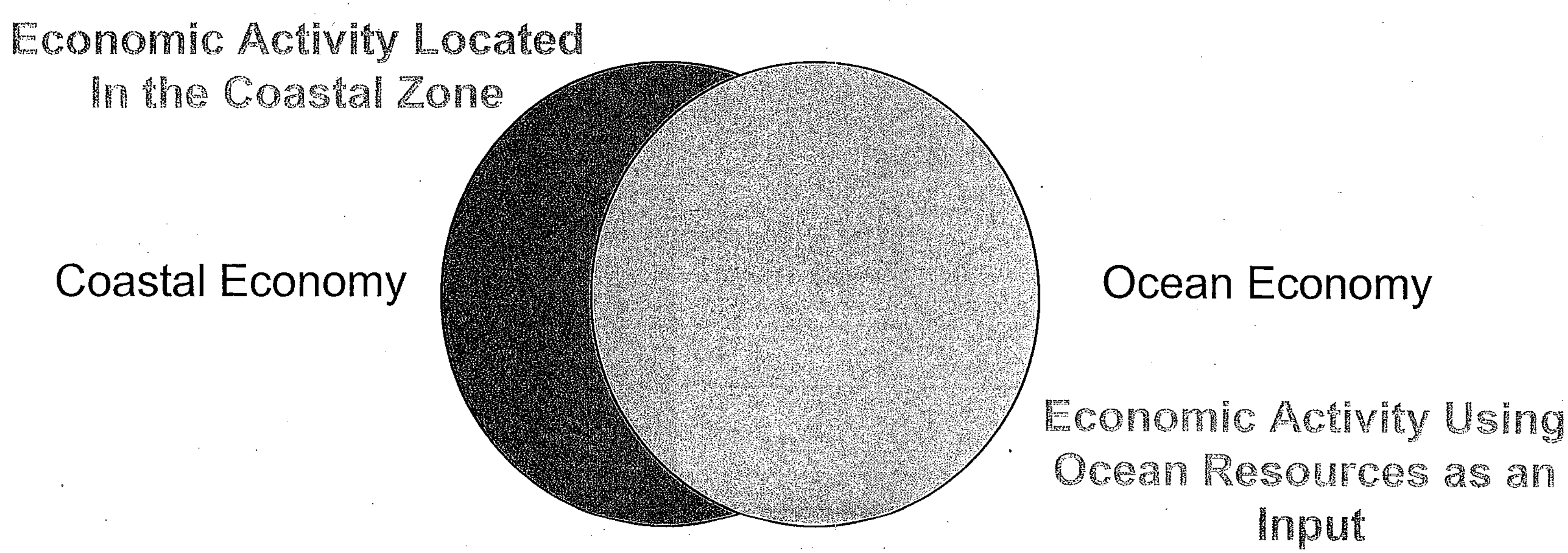
A004389

3. Employment growth is exceeding population growth on the coast, and the difference is greatest the closer to the shore

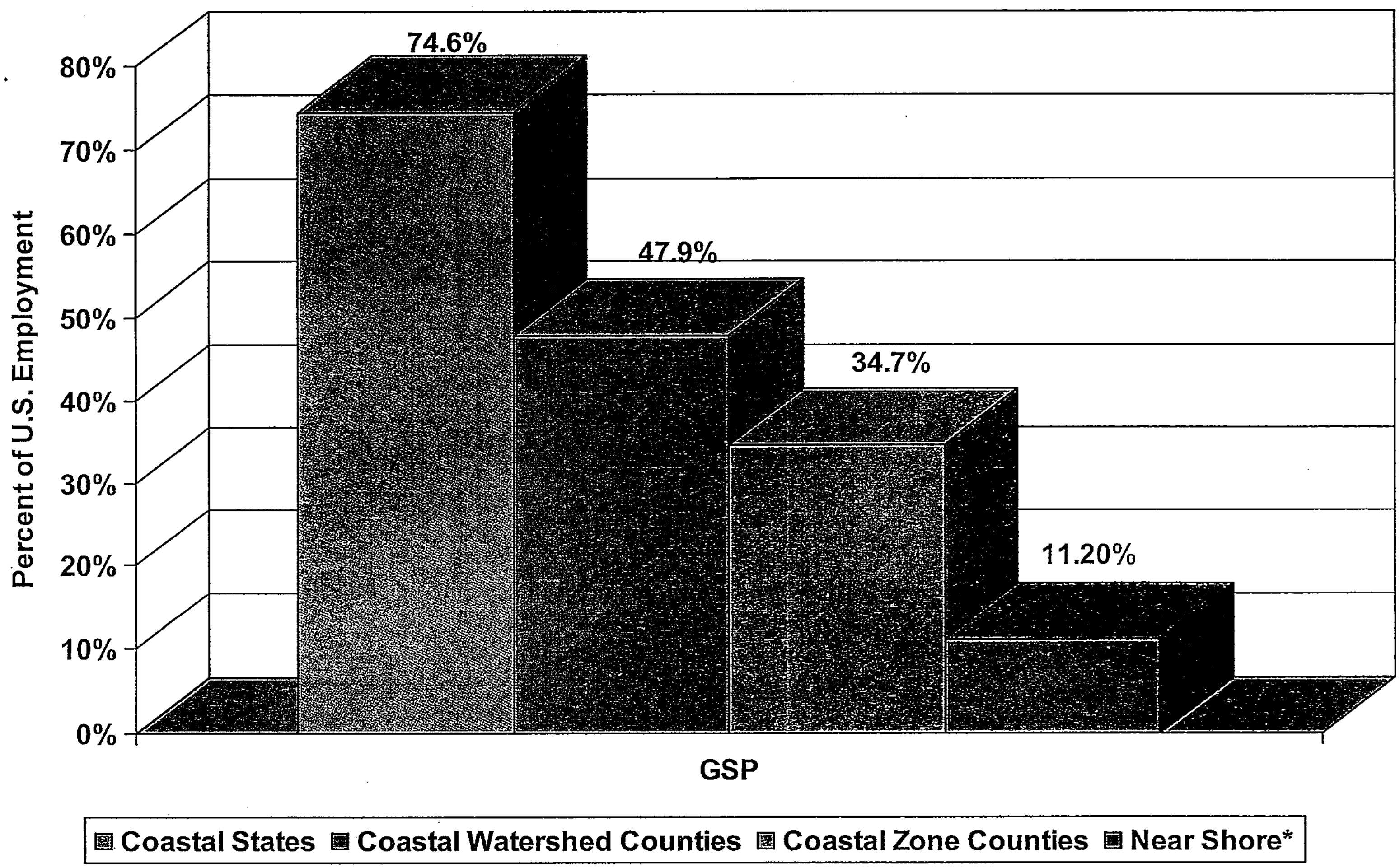


•Inland/Shore data
Excludes Massachusetts

4. The Coastal and Ocean Economies Aren't The Same Thing

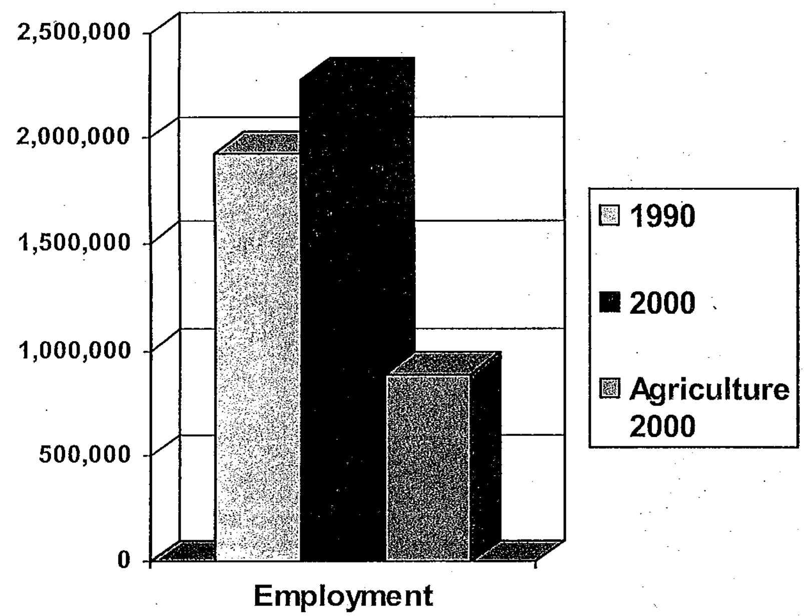


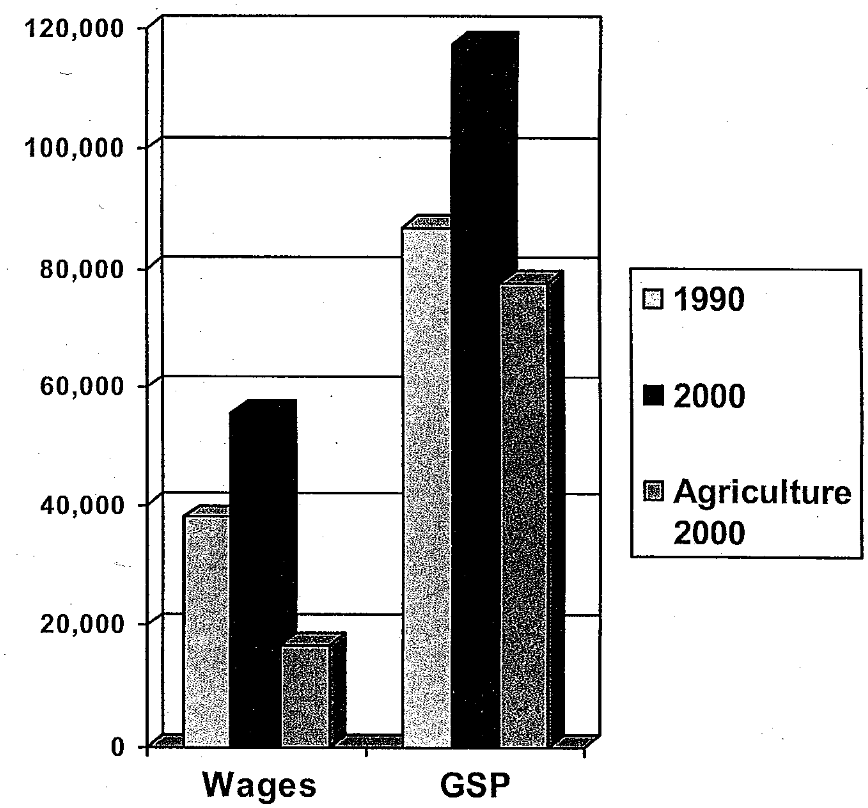
5. The coastal economy is where the action is

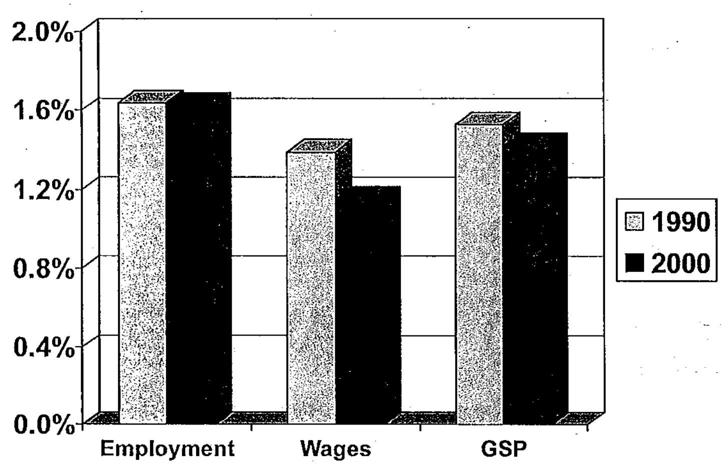


A004392

6. The ocean economy is large, but lost ground in the last decade







A004393

The Private Ocean Economy Industries

Construction

Heavy Construction

Living Resources

Aquaculture (part)

Seafood Processing

Minerals

Limestone, Sand, and Gravel

Oil and Gas Exploration

Oil and Gas Production

Ship & Boat Building

Boat Building

Ship Building

Tourism & Recreation

Amusement and Recreation Services NEC

Zoos and Aquaria

Boat Dealers

Eating and Drinking Places

Hotels and Motels

Marinas

Recreational Vehicle Parks and Campgrounds

Sporting Goods Retailers

Transportation

Deep Sea Freight Transportation

Marine Transportation Services

Petroleum and Natural Gas Pipelines

Search and Navigation Equipment

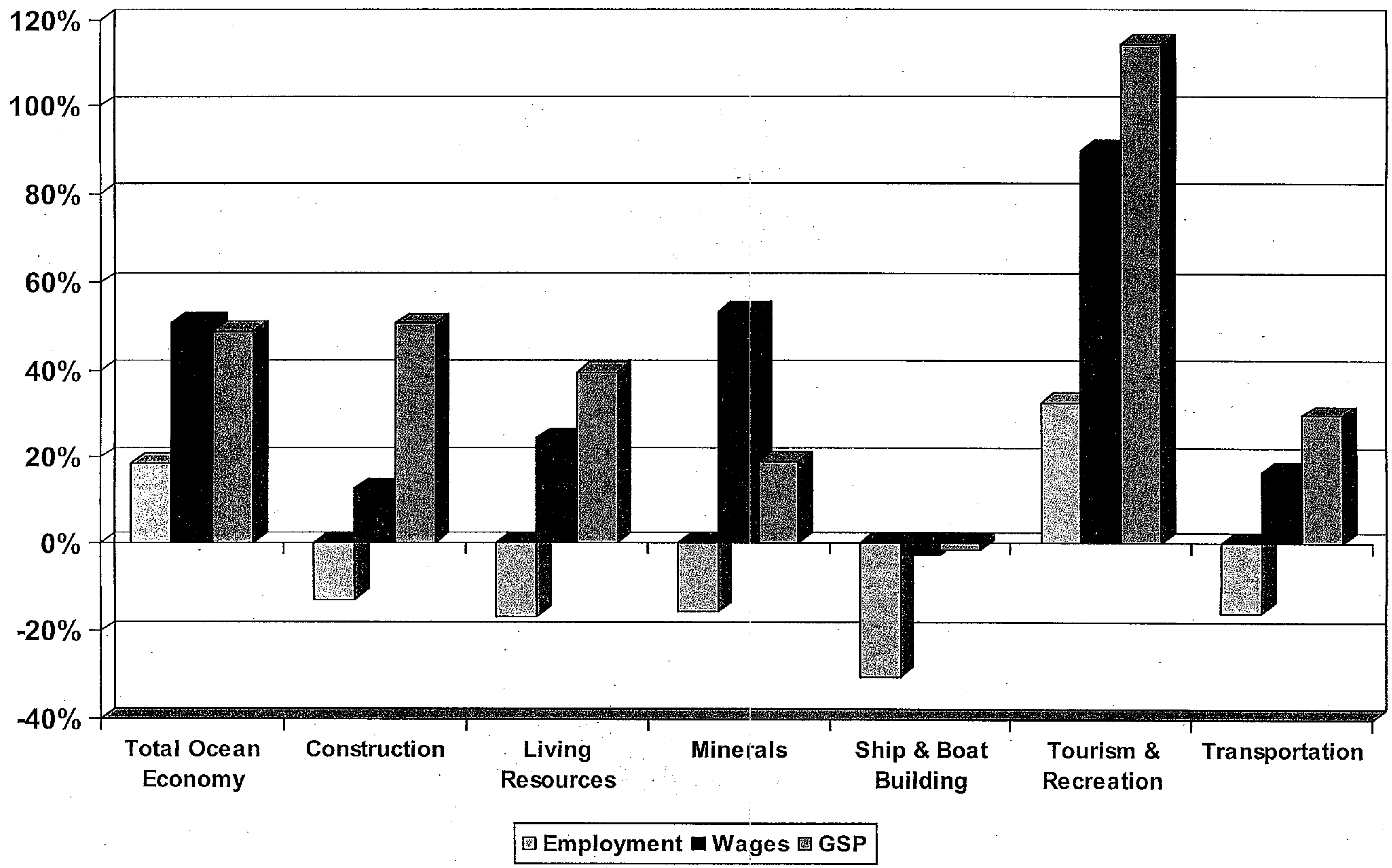
Warehousing

To be added:

Scientific Research
Government

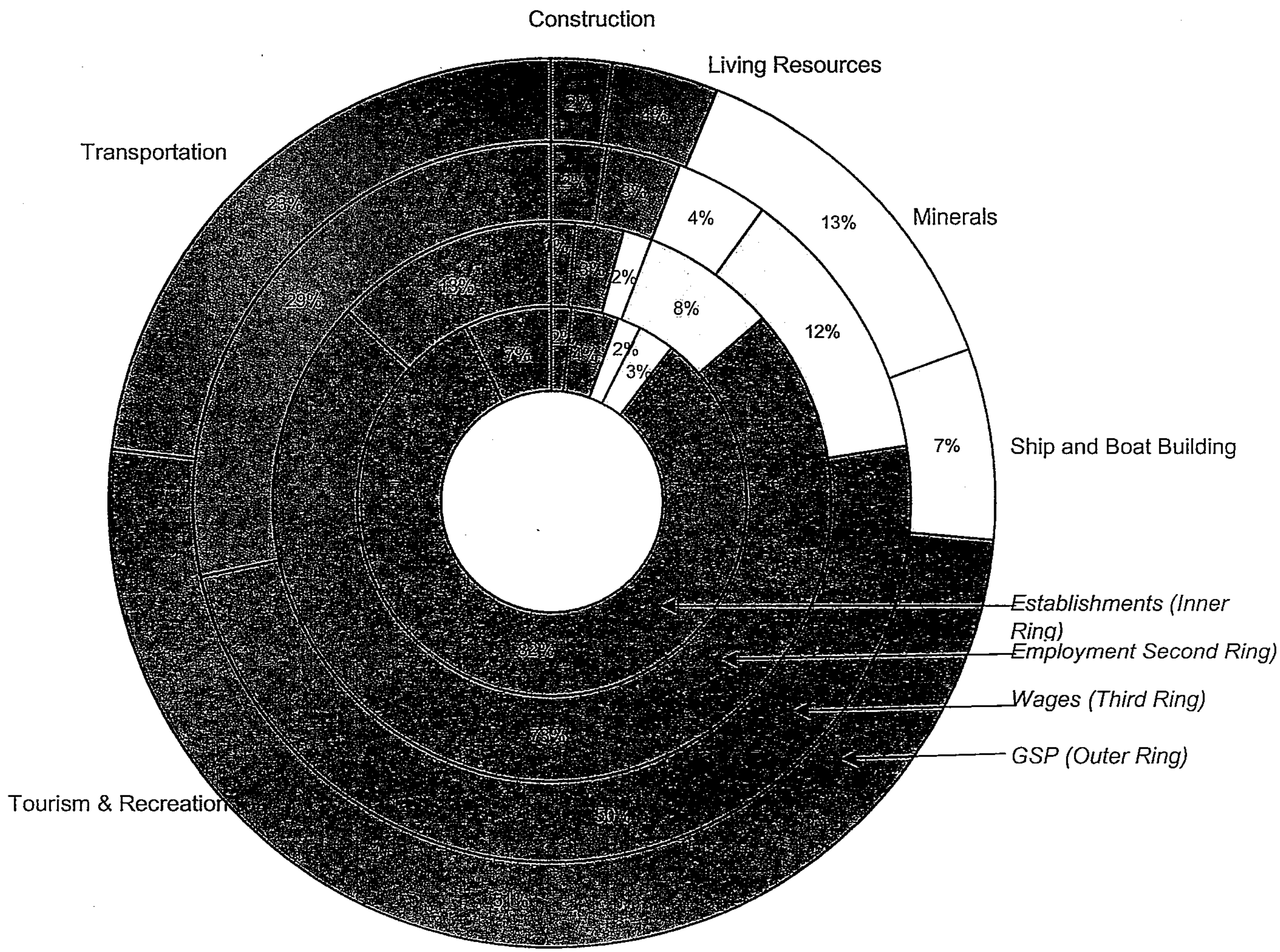
Industries in Red are Defined as Ocean if Located in Coastal Zip

7. The Ocean Economy is Becoming the Tourism & Recreation Economy



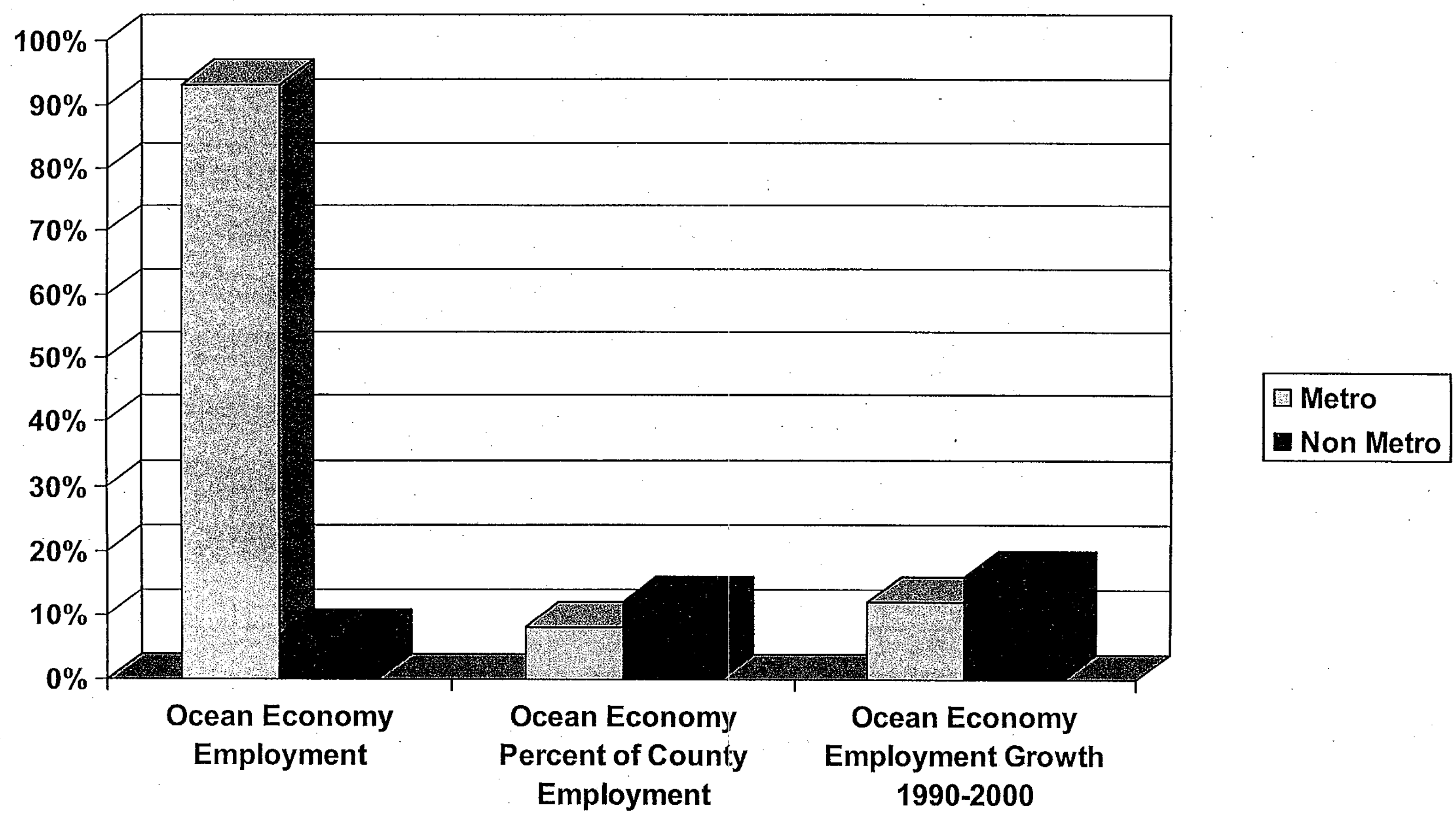
A004395

8. Tourism and Recreation is growing, but the other ocean sectors are more critical to the overall economy

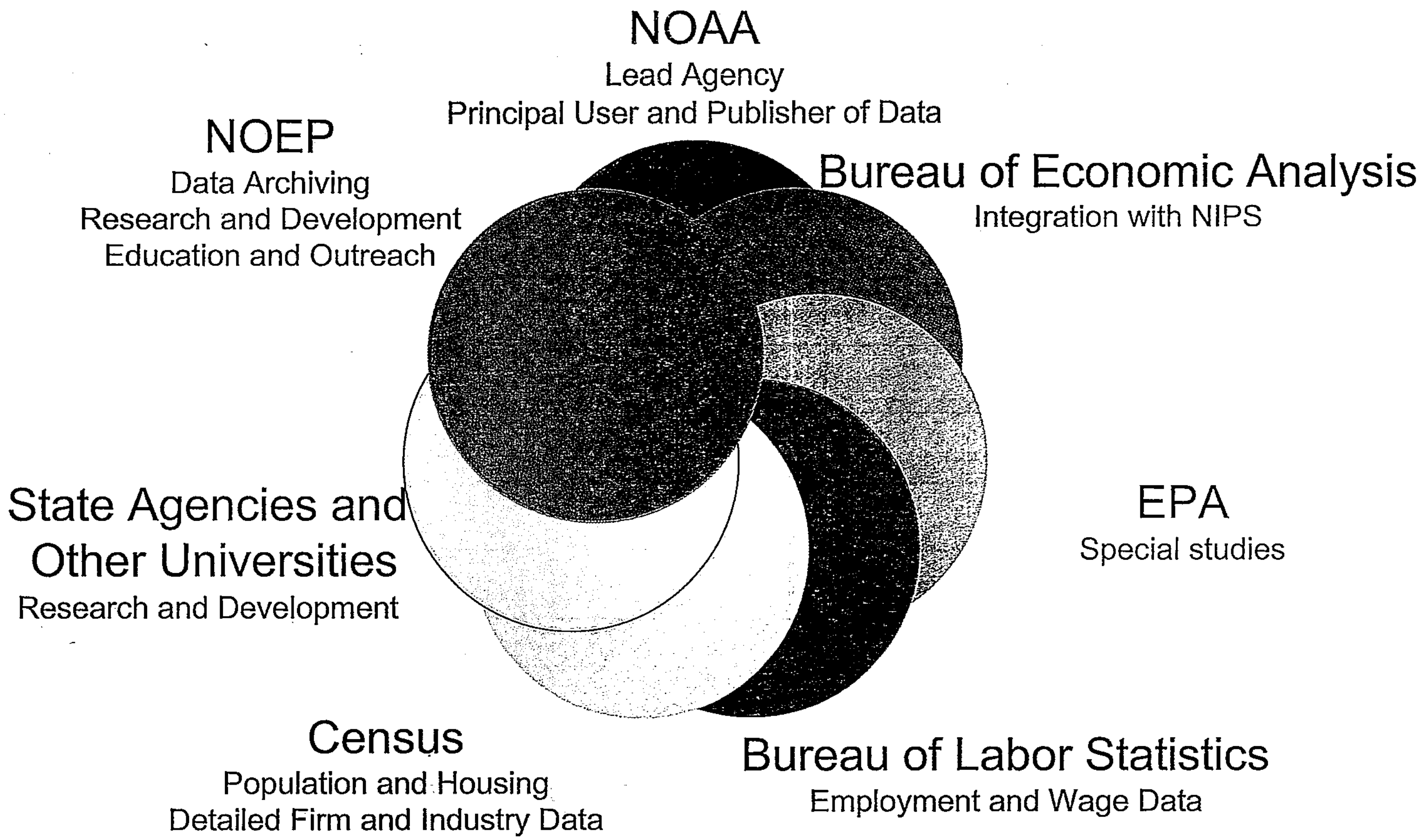


A004396

9. The Ocean Economy is *urban* in concentration but more important in *rural* areas



10. We Don't Know Nearly Enough- and Don't Spend Enough To Find Out



Some Implications

- Coastal sprawl
- Economic adjustment for fishing industry
- Managing the growth of tourism and recreation
- Transportation
- Economic Development

CALIFORNIA'S OCEAN ECONOMY

Report to the Resources Agency, State of California

Prepared by The National Ocean Economics Program

Professor Judith Kildow
Principal Investigator
California State University Monterey Bay

Professor Charles S. Colgan
Chief Economist
University of Southern Maine

National Ocean Economics Program

July 2005

Table of Contents

Index of Tables

Index of Charts and Figures

Executive Summary

California's Ocean Economy is the most expansive study of its kind in the nation and provides an update to the 1994 economic study conducted by the California Research Bureau and later released as part of the Resources Agency ocean strategy titled, *California's Ocean Resources: An Agenda for the Future.* This report from the National Ocean Economics Program (NOEP) provides a more comprehensive understanding of the economic role of California's ocean resources than has been available to date. It also provides California with strong evidence that its unique ocean and coastal resources are important to sustaining California's economy. This information highlights the economic importance of the ocean and coast to California and the nation and underscores the need for continued leadership in balancing resource protection and economic development.

Summary of Findings

California - Largest Ocean Economy in the Nation
California has the largest Ocean Economy in the United States, ranking number one overall for both employment and gross state product (GSP), an impressive position, because California was the 5th largest economy in the world in 2000.[1] The sectors of the Ocean Economy studied include: (1) coastal construction, (2) living resources, (3) offshore minerals, (4) ship and boat building and repair, (5) maritime transportation and ports, and (6) coastal tourism and recreation. The total GSP of California's Ocean Economy in 2000 was approximately $42.9 billion. California's Ocean Economy directly provided approximately 408,000 jobs in 2000, and almost 700,000 jobs when multiplier effects are included. It provided more than $11.4 billion in wages and salaries in 2000, and more than $24 billion when multiplier effects are included. The NOEP also evaluated the total value of all economic transactions within 19 coastal counties (mainland coast and four additional counties added within San Francisco Bay and the Sacramento River Delta) and identified approximately $ 1.15 trillion of economic activity,[2] (86% of total state economic activity), that is referred to as the "Coastal Economy." The natural resources of the coast and coastal ocean are a solid foundation for California's economy and these resources must be sustained to maintain the strength in the six sectors evaluated within the Ocean Economy and the much larger Coastal Economy.

California's Ocean Economy: Comparisons with the Nation
California provides a larger share of the national Ocean Economy than any other state. Overall, California made up nearly 19% of the US Ocean Economy in 2000 in both employment and GSP. A major reason for this was the increase in the Tourism & Recreation sector and the strength of the Transportation sector. California's Marine Transportation sector is more than a quarter of the national Marine Transportation sector with the Ports of Long Beach and Los Angeles among the largest in the nation.

---

[1] 2001 California Society of Certified Public Accountants, Gale Group.

[2] County shares of GSP computed as county share of wages from the BLS Quarterly Census of Employment and Wages applied to the estimate of GSP from the Bureau of Economic Analysis.

Coastal Tourism and Recreation – More Growth/Lower Wages

Coastal Tourism & Recreation dominated job growth with lower wages, while higher wage jobs in ocean-related sectors declined. This trend, which also took place nationally, represents a shift from goods-related economic activity towards services. It points to the need for California to continue to address housing and transportation issues to accommodate this workforce. In addition, California must continue its leadership efforts to protect and enhance the natural resources, which draw visitors from all over the world.

Coastal Population Density Is High – More Growth Inland

Not only are the oceans important economically to the state, they are much loved by the residents. In 2000, 77% of California's population lived in coastal counties, which represent 25% of the land. In fact, population density along the coast increased markedly over the decade to 671 people per square mile compared to population density for the entire state of 217 people per square mile. However, between 1990 and 2000, California's coastal population grew more slowly than the overall state population; 11.3% compared to the total state population growth of 13.7%, a difference of 2.4%. Areas of highest population growth were the inland areas immediately adjacent to the coast, where land was more available and less expensive at the time.

Coastal Economy: Employment and Gross State Product

Total Coastal County GSP in 2000 represented approximately 86% of California's GSP, estimated at $1.15 Trillion. Coastal employment in California increased by 13.2% from 1990 to 2000 compared to the state's overall employment growth of approximately 12%. In 2000, total employment in coastal counties represented 81% of the state's total employment or 11,994,814 salaried workers.

Regional Growth

Regionally, the largest growth occurred in the central region of California, which includes Monterey, San Mateo, and Santa Cruz counties. The growth rates on all three measures, employment, wages and GSP, were larger than any other region, and were driven primarily by growth in Tourism & Recreation. The largest Ocean Economy is in the Southern, most populous region. Rural areas indicated a higher proportion of jobs relating to the coastal and ocean economy than in urban areas. The Ocean Economy represented 2.7% of employment in the highly populated Southern California economy and nearly 10% of the jobs in the northern rural region of Humboldt, Del Norte, and Mendocino counties.

National Ocean Economics Program

This report was funded by a Coastal Impact Assistance Program (CIAP) Grant awarded by the California Resources Agency to the National Ocean Economics Program. The NOEP team, conducting a national investigation into the ocean based economy of the United States, has carried out this work using the most reliable available sources of information to prepare this report. The information and views expressed in this report are those of the authors and do not reflect any official views or position of the State of California. Professors Judith T. Kildow of California State University at Monterey Bay and Charles S. Colgan from the University of Southern Maine led the team.

Acknowledgements

The State of California Resources Agency sponsored this study with CIAP funds. The research team from the National Ocean Economics Program prepared this report from the most reliable, available sources. The information found in the following pages reflects the views and work of the staff of this project, and not necessarily those of the sponsor. Professor Judith Kildow led the team; Professor Charles Colgan was the Chief Economist; Professor Linwood Pendleton of UCLA participated in writing the beach valuation paper with Duan Zhuang and Shivendu Shivendu, research assistants at the University of Southern California, and Robin Tindall of the University of Vermont assisted with the project. Thanks to the Wrigley Institute for Environmental Studies at the University of Southern California for providing the offices and additional support for this work. Thanks are especially due to the NOEP staff at California State University at Monterey Bay for their enormous efforts in helping to complete the Final Report: Staff members, Pat Johnston and Bonnie Lockwood; student assistants, Lindsay Carr, Amy Lockwood, Eric Ensch, and Scott Norris.

Finally, our appreciation goes out to the many reviewers whose valuable suggestions and observations went into the final report. Karen Polenske, MIT; Giulio Pontecorvo, Columbia University; Robert Solow, MIT; Linwood Pendleton, UCLA; Phil King, San Francisco State University; Tim Tyrell, University of Rhode Island; Rosa Moller, State of California; Paul Kelly, Rowan Companies; Karen Garrison, Natural Resource Defense Council; Lesley Ewing, California Coastal Commission; Howard J. Shatz, Public Policy Institute of California; and others who volunteered comments and suggestions throughout the project.

NOEP

PART I BACKGROUND AND SUMMARY OF FINDINGS

Chapter 1 Introduction

1.1 California and the Sea

California has always been influenced by the sea. Unlike other western states, California was founded from the sea inward, first by the Spanish and then by the Americans. California retains close links to the Pacific and by utilizing its resources, was the fifth largest industrial economy in 2000.[3] Its connections to the ocean are evidenced by the economic activity of thousands of businesses, its burgeoning ports, and in the behavior of millions of people who flock to the shore.

Besides attracting millions of people, California is a fascinating place to examine and an important place to understand. California's coast has unique physical qualities. Geographically and geologically, California's coast is a mixture of broad sand beaches, enormous estuaries turned ports, and rocky cliff formations that make it conducive to differing economies and lifestyles. The varied climate along its coast contributes to differing patterns of living. Demographically, it is heavily urban in the Bay area and Southern Coastal areas, mixed rural and semi-urban along the Central Coast, and mostly rural along the Northern coast. In the past, it has been difficult to fully appreciate the magnitude of the connections to the ocean. Now, it is possible to measure the economic and demographic relationships as they change over time throughout the state as a whole, and in the different coastal regions of California.

Between 1990 and 2000, California's population grew from 29.8 million to approximately 33.9 million, an estimated annual growth rate of 13.7%. Seventy-seven percent of the population lives in or near the coast, and a faster growing population inhabits the inland areas immediately adjacent to the coast. Another important indicator of change, employment, is growing faster along the coast than inland, indicating a strong growth in the economy along the shore.

California holds a prominent political leadership position with respect to coastal zone and ocean management. For many years it has initiated innovative programs and policies to meet the challenges of balancing protection of it resources and development for its growing population and economy. As the first state to pass coastal management legislation in 1976[4], it continues as a model for other states by its responses to coastal issues. California's growing population and historic popularity as a tourist destination have brought it both economic wealth and the accompanying challenges of enormous pressure on all of its natural resources, particularly those along its more populated coastal areas.

Beaches are the top destination for its tourists and one of California's greatest assets. Its beaches stretch the length of the state, and are sought particularly in Southern California due

[3] 2001 California Society of Certified Public Accountants, Gale Group.
[4] Coastal Act of 1976, Coastal Resources Planning & Management Policies. <http://www.coastal.ca.gov/fedca/cach3.pdf>. The Act created policies for public access, recreation, marine environment, land resources, and development.

to its warmer climate. For this study the value of beaches and coastal areas has been calculated to demonstrate their importance to the California economy, and the significance of maintaining both. Protecting the beaches from pollution is only part of the challenge; they also are eroding because California, like other places, has damned up most of its coastal watersheds, thus preventing the fresh-running waters carrying essential nourishing sediments to the coast. As a result, California conducts some artificial beach nourishment to ensure its revenues from tourism continue, and to protect this unique and desirable asset.

Californians can boast a long list of challenges and activities that dominate the California coastal landscape. These activities require monitoring and management to ensure that the shores of California can sustain the pressures and deliver the amenities and goods the public seeks. To date, however, there has been little information about the value of the coast and ocean to the state of California, and even less information about how these values have changed over time. Likewise, there continues to be little understanding of the state's economic dependence on these natural resources. Uncovering California's relationships to the ocean and its economy is the purpose of this report.

1.2 About this Study

This report is an update of a study of California's Ocean Economy that was undertaken in 1994 by staff of the California Research Bureau,[5] and later published as part of a larger report in 1997 by the California Resources Agency.[6] A research team from the National Ocean Economics Program (NOEP), headquartered at the University of Southern California (1999-2003) and California State University at Monterey Bay (2003-present), has conducted a national investigation into the ocean-based economy of the United States.

The general outline and scope of the 1994 study were followed, but there are some differences. This report incorporates the latest data and analytic techniques developed by the NOEP to measure the Ocean Economy of all states, and thus yields somewhat different estimates. Data from the years 1990 and 2000 shows changes in the California Ocean Economy over time utilizing a single methodology in order to provide a nationally consistent approach to measuring the ocean and coastal economy of the US. The NOEP methodology permits greater precision in estimates, particularly in tourism and recreation, and also provides data that permits measurement over time. Appendix A contains a brief discussion of the methodological issues involved in preparing this report. More detailed information can be found in *Measurement of the Ocean and Coastal Economy: Theory and Methods* (Colgan 2003).[7]

NOEP developed its methodology because the data available to measure the Ocean Economy were imperfect for the following reasons: (1) standard economic data series available for this study were not designed to measure in detail the relationship between the

---

5 R. Moeller and J. Fitz, 1994. *An Economic Assessment of Ocean Dependent Activities*, Sacramento: California Research Bureau.
6 The Resources Agency, California, 1997. California's Ocean Resources: *An Agenda for the Future.*
7 C. Colgan, 2003. *Measurement of the Ocean and Coastal Economy: Theory and Methods* working paper, NOEP, <www.OceanEconomics.org/Download/NOEPMethodv8.pdf >.

ocean and economic activity, so a methodology has been devised that allows the data sets to be as compatible as possible with the realities of this particular slice of the economy; (2) other essential data are missing or irregularly available. Particularly, sector data at the county, and even regional level, in many cases cannot be publicly revealed because of federal rules of disclosure that protect proprietary information on firms; (3) standard economic data do not fully capture all of the economic value of the ocean. Recreational uses such as a day at the beach, or just enjoying a view of the sea do not appear in market data sets, but rather, are found in studies using a range of methodologies, and are thus not included in our estimates.

1.3 Definitions and Terminology

To avoid repetition and for clarification purposes, the following terms and definitions regarding economic indicators and valuation categories are found in the beginning of this report, so that the reader can fully understand what is intended.

Coastal Economy: the sum of all economic activity occurring in counties defined as part of a state's coastal zone management program, including four additional counties that are part of San Francisco Bay and the Sacramento River Delta areas. Most, but not all of the Ocean Economy is part of the Coastal Economy.

Ocean Economy: those activities that create goods and services, a portion of whose value is affected by the ocean and its resources. Economic statistics are grouped by a classification system known as the Standard Industrial Classification (SIC), which imperfectly reflects the relationship between economic activity and the ocean.[8] Only part of the Coastal Economy is part of the Ocean Economy.

Dollar Values: expressed in constant 2000 dollars (adjusted by the Consumer Price Index).

- Dollar values are estimated as direct and indirect values. Indirect values include induced values.
- Direct values: those activities associated only with the designated ocean industries such as travel and tourism and living resources (examples include labor and capital costs associated with hotel accommodations or labor and capital costs for fish processing).
- Multipliers: indirect and induced values. Multipliers affect the estimates of employment, wages, and output within the region. Indirect effects include both the change in economic activity in industries within the region that buy or sell from ocean industries (examples include sales of food to restaurants and hotels and the activities of travel agents booking trips) and the change in economic activity resulting from the spending of the wages earned by those employed by the ocean industries within the region. All indirect values or multiplier effects are based on IMPLAN, a standard and widely used economic impact model.

[8] After 2000, all industries are classified using the North American Industry Classification System (NAICS) rather than the Standard Industrial Classification (SIC by BLS). Both SIC and NAICS codes have been provided for 2001 as a benchmark leaving further calculations to the user. NAICS focuses on how products and services are created, as opposed to SIC which focuses on what is produced. Using NAICS yields significantly different industry groupings from those produced using SIC. These differences in NAICS and SIC structures, preclude direct comparison between NAICS data and SIC-based data for earlier years for historical series.

- Unless otherwise indicated, all measures are stated as direct values.

Employment: annual average wage and salary private employment excluding self-employment.

Gross State Product (GSP): measure of the contribution of the sector to the value of goods and services in the economy. The value-added, or net sales of a sector, minus the cost of inputs, e.g. the net output of a sector. Using this measure eliminates "double counting," among sectors.

Housing Patterns and Trends: include housing units both single and multi-family including seasonal and year round, owner occupied and rental.

National Ocean Economics Program (NOEP): federally funded program to understand and estimate the value of the ocean-based economy of the US.

Standard Industrial Classification System (SIC): The NOEP adopted the SIC system and identified eight major sections for its national study on the Ocean Economy. Six of these, selected for this study, are listed in alphabetical order (Table 1-1).

Table 1-1: The Sectors and Industries of the Ocean Economy

Construction Marine	**Tourism & Recreation - Coastal**
	Amusement and Recreation Services
Living Resources - Marine	*Boat Dealers*
Fish Harvesting	*Eating and Drinking Places*
Fish Hatcheries and Aquaculture	*Hotels and Motels*
Seafood Processing	*Marinas*
	Recreational Vehicle Parks and Campgrounds
Minerals - Offshore	*Sporting Goods Retailers*
Limestone, Sand, and Gravel	*Zoos and Aquaria*
Oil and Gas Exploration	**Transportation - Marine**
Oil and Gas Production	Deep Sea Freight Transportation
	Marine Passenger Transportation
	Marine Transportation Services
Ship & Boat Building	*Petroleum and Natural Gas Pipelines*
Boat Building and Repair	Search and Navigation Equipment
Ship Building and Repair	*Warehousing*

The sectors Construction, Living Resources, Minerals, Ship & Boat Building, Tourism & Recreation, and Transportation include specific industries that contribute to the Ocean Economy. Some industries, shown in *italics*, are considered ocean-related only when they are located in near-shore regions, and defined by location in a coast-adjacent zip code, which is the smallest unit of geography currently available for employment statistics.[9]

[9] The data source for the analysis is the Quarterly Census of Employment and Wages of the US Department of Labor, Bureau of Labor Statistics, which is derived from the ES-202 unemployment insurance data series supplied by the California Employment Development Department.

The use of SIC codes and geography provides the best means of measuring the Ocean Economy. This methodology is based on available data consistent across all states and can provide information from the national to the local level.

Wages and Salaries: the wages and salaries paid; all wages are shown in year 2000 dollars.

1.4 Limitations and Omissions

Although this report covers all categories found in the earlier California report, it does not capture the full value of the California Ocean Economy. This study omits some important segments of the California Ocean Economy:

- Ocean Economy is measured only in coastal counties at this time, although Ocean Economy activities extend throughout the country.
- The government sector is excluded; the SIC codes do not distinguish between coast and ocean-related sectors and non-ocean related activities of the federal, state, and local government agencies.
- Fisheries harvesting employment values are omitted because they are not included in the nation's employment database, and are not accurately and consistently available from any other source.
- Marine science and education are not included since data related to this field cannot be separated easily within larger organizations such as colleges and universities that undertake most marine scientific research. However, a list of California's marine science research and education institutions can be found in the Appendix. C.
- Real estate is not included because such information requires a different approach to valuation.
- Corporate investment estimates as well as consumptive values are missing because they require a different approach to valuation.

NOEP

Chapter 2 Summary of Findings

2.1 Introduction

This chapter has been separated into four categories highlighting the more interesting findings. The first two categories are (1) California's Coastal Economy, which includes the demographic patterns that define and drive it;[10] and (2) comparison of California's Ocean Economy with the nation that also includes other coastal states. These are added solely to provide context and a fuller understanding of the data generated for this report, yet are not analyzed or elaborated further. The second two categories, (3) comparison of California's Regional Ocean Economies with each other and with the state over time;[11] and (4) comparison of California's Ocean Economy by sectors, over time are further elaborated in the following chapters.

2.2 California's Coastal Economy

As explained in Chapter 1, California's Coastal Economy reflects all activities within either coastal zip codes or coastal counties, which are part of the California Coastal Zone Management Program. This includes all counties with ports and harbors in watersheds that host important maritime activities. Population and housing estimates are added to show important trends.

California's coastal population did not increase as rapidly as the state's population during the decade between 1990 and 2000, (11.3% compared to the total state population growth of 13.7%, a difference of 2.4%). However, density of California's coastal population continues to far exceed that of the state. In the year 2000, density along the coast was more than 623 people per square mile vs. 217people per square mile for the state.

- In 2000, 77% of California's population lived in coastal counties, which represent 25% of the land.

- According to US Census reports, the areas of highest population growth, however, were those found immediately adjacent to the coastal areas, inland along coastal watersheds, where property was less expensive and more available at the time.[12] While population density in coastal areas clearly exceeds these areas for now, inland areas merit close monitoring, because they are vulnerable to overexploitation of the natural landscape and the filling in of valuable and limited green space that could affect the quality of watersheds and ultimately the shoreline. See Table 2-1, Coastal County densities.

[10] California State Summary of Coastal and Ocean Social and Economic Trends, December 2004.
[11] The State has been divided into 5 regions, as was done in the previous CA study. However, due to changes in marine-based activities in watersheds, we have added the counties of Yolo, San Joaquin, and Sacramento to ensure that all significant activities were included.
12 Examples would be the "inland empire" in LA County, the Salinas Valley in Monterey County, the Inland areas of Sonoma county, the Sacramento Delta areas.

Table 2-1: Population and Housing Densities 1990-2000

Region	Near-Shore	Coastal Counties	California
Area (Square Miles)	7,747.3	39,094.0	155,959.3
Population 1990	4,481,996	23,546,687	29,785,857
Population 2000	4,828,228	26,215,856	33,871,648
Population Density 1990	578.5	602.3	191.0
Population Density 2000	623.2	670.6	217.2
Population Increase	7.7%	11.3%	13.7%
Housing 1990	1,858,485	8,750,629	11,182,882
Housing 2000	1,969,411	9,389,257	12,214,549
Housing Density 1990	239.9	223.8	71.7
Housing Density 2000	254.2	240.2	78.3
Housing Increase	6.0%	7.3%	9.2%

- Population across California coastal counties ranged in growth from 6.2% to 20% during the decade 1990 – 2000 (Table 2-2).

- Yolo County, adjacent to Sacramento, had the highest growth rate. Humboldt and San Francisco counties had the slowest growth rate.

Table 2-2: Regional Population and Housing Growth Rates

Region	2000 Population	Population 1990-2000 Growth Rate	2000 Housing	Housing 1990-2000 Growth Rate
North				
Del Norte	27,507	17.3%	10,434	14.8%
Humboldt	126,518	6.2%	55,912	9.3%
Mendocino	86,265	7.4%	36,937	9.8%
North Region Total	**240,290**	**7.8%**	**103,283**	**10.0%**
North Central				
Sonoma	458,614	18.1%	183,153	13.7%
Marin	247,289	7.5%	104,990	5.3%
Napa	124,279	12.2%	48,554	9.9%
Solano	394,542	16.2%	134,513	12.5%
Yolo	168,660	19.4%	61,587	16.2%
Sacramento	1,223,499	17.5%	474,814	13.7%
San Joaquin	563,598	17.3%	189,160	13.8%
San Francisco	776,733	7.3%	346,527	5.5%
Alameda	1,443,741	10.7%	540,183	7.2%
Contra Costa	948,816	18.1%	354,577	12.2%
Santa Clara	1,682,585	12.4%	579,329	7.2%
North Central Total	**8,032,356**	**13.8%**	**3,017,387**	**9.7%**
Central				
San Mateo	707,161	8.9%	260,576	3.5%
Santa Cruz	255,602	11.3%	98,873	7.6%
Monterey	401,762	13.0%	131,708	8.7%
Central Region Total	**1,364,525**	**10.5%**	**491,157**	**5.7%**
South Central				
San Luis Obispo	246,681	13.6%	102,275	13.4%
Santa Barbara	399,347	8.1%	142,901	3.4%
Ventura	753,197	12.6%	251,712	10.2%
South Central Total	**1,399,225**	**11.4%**	**496,888**	**8.8%**
South				
Los Angeles	9,519,338	7.4%	3,270,909	3.4%
Orange	2,846,289	18.1%	969,484	10.8%
San Diego	2,813,833	12.6%	1,040,149	9.9%
South Region Total	**15,179,460**	**10.2%**	**5,280,542**	**5.9%**
Total Coastal	**26,215,856**	**11.3%**	**9,389,257**	**7.3%**
California Total	**33,871,648**	**13.7%**	**12,214,549**	**9.2%**

The relative rate of increase over a decade for housing units in the three geographic areas of interest for this study: (1) total state housing; (2) coastal housing; and (3) near-shore[13] housing are reflected in Table 2-3. The near-shore's lower rate of increase in population compared to coastal zone counties and the state as a whole, suggests that limitations on building near the shore are having an influence. Regulatory limits, price, and land availability are the likely primary constraints. Although near-shore housing has the lowest rate of increase, it also represents a very narrow strip of land, so the lower rate can be misleading as a result. Density along the shore continues to increase far beyond either of the other two areas, indicating the need to monitor the development carefully.

Table 2-3: California Housing Comparisons

Year	Total State Housing	Coastal Housing	Near-shore Housing
1990	11,182,882	8,750,629	1,858,485
2000	12,214,549	9,389,257	1,969,411
Change	9.23%	7.30%	5.97%

- In 2000, total coastal county employment represented 80.7% of the state's total employment (Table 2-4).
- Coastal employment in California increased by 13.2% from 1990 to 2000.

Coastal counties in California, as well as the rest of the nation, represent a disproportionate size of the overall economy. While many of the nation's largest cities are located along the coast and account for some of this value, coastal location draws increasing numbers of people and a broad range of activities that represent vast sums of revenue, which no state can afford to overlook. The natural resources of the coast and coastal ocean are a solid foundation for California's economy and must be sustained to sustain the growth in the Coastal Economy.

Table 2-4: Comparison of California Coastal County Employment Growth with California Total Employment

Year	Total State Employment	Coastal County Employment	Coastal County % of State Employment
1990	13,262,696	10,497,161	79.2%
2000	14,867,006	11,994,814	80.7%
Change	12.1%	13.2%	1.5%

Coastal county population and employment in California are growing faster than housing (Table 2-5). This trend has several implications. Affordable housing for those working in the area may not available. This is particularly true in the lower paying tourism and recreation jobs. This trend has far reaching implications for social and physical infrastructure, such as adequate transportation and highways to carry those who must live far away from their employment.

[13] Near-shore housing consists of zip codes adjacent to the coastline.

Table 2-5: Growth Rates for Coastal County Housing, Population, and Employment

1990 - 2000 Housing Growth Rate	1990 - 2000 Population Growth Rate	1990 - 2000 Employment Growth Rate
7.30%	11.30%	13.2%

2.3 California's Ocean Economy: Comparisons with the Nation

- California's share of the national Ocean Economy is substantially larger than its share of the total US economy.

The nationally consistent measurements of the Ocean Economy, which have been developed by the NOEP, allow comparisons of California's Ocean Economy with other states and the nation.[14] Overall California made up nearly 19% of the US Ocean Economy in 2000 in both employment and GSP (Table 2-6). During that same year, California had 11.4% of total US employment and 13.4% of US GSP. California provided a larger portion of the national Ocean Economy than its contribution to the total economy. Major reasons for this were the increase in the Tourism & Recreation sector and the strength of the Transportation sector. California's Marine Transportation sector is more than a quarter of the national Marine Transportation sector with the Ports of Long Beach and Los Angeles being among the largest in the nation.

Table 2-6: California's Share in the US Ocean Economy 2000

California's share in the US Ocean Economy 2000		
	Employment	Gross State Product
Total Ocean Economy	**18.7%**	**18.9%**
Construction	9.6%	13.1%
Living Resources	10.6%	7.4%
Minerals	9.2%	6.7%
Ship & Boat Building	10.2%	9.6%
Tourism & Recreation	20.1%	22.1%
Transportation	26.1%	28.1%

Figures 2-1 and 2-2 compare the distribution of employment and GSP between the two areas in 2000. For employment, California has a larger proportion of its Ocean Economy in Ship & Boat Building, Living Resources, and Minerals than the US has as part of its economy. However, the value of GSP in the US is larger in Ship & Boat Building and Minerals, while the value of the Transportation sector's GSP is much larger in California. The value of Tourism & Recreation also is larger in California.

[14] All values reported in this part of the study are direct values, unless otherwise noted.

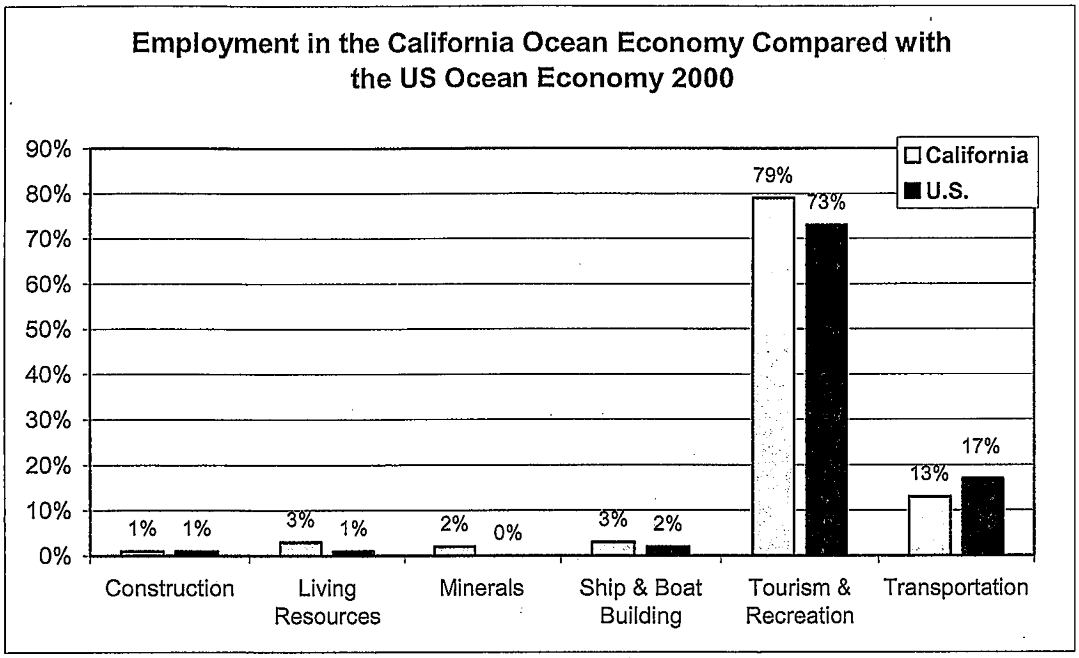


Figure 2-1: 2000 Employment, California vs. US Economy

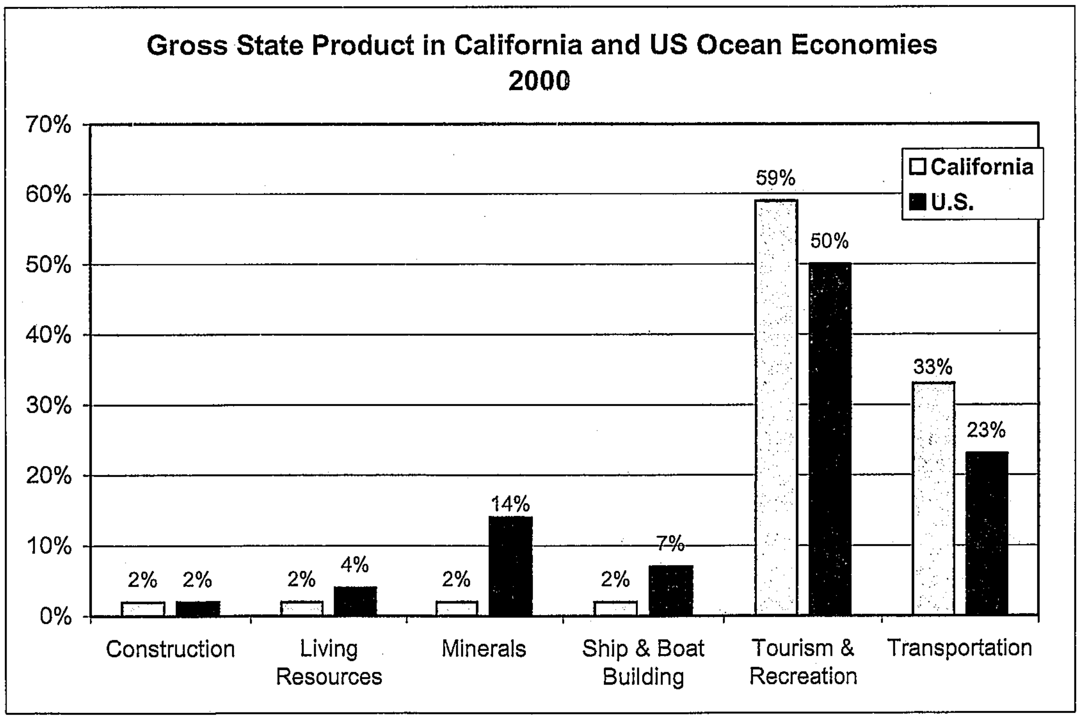


Figure 2-2: 2000 Ocean GSP, California vs. US Economy

2.4 California's Ocean Economy: Comparisons with Other States

- California has the largest Ocean Economy in the US, ranking number one overall in both employment and GSP from the ocean.

Table 2-7 shows California's ranking by sector among the 30 coastal and Great Lakes states. It is not surprising that California has the largest Ocean Economy among the coastal states, as well as in Tourism & Recreation and Transportation. It also ranks in the top five of all sectors except Ship & Boat Building, where it ranks sixth. It is noteworthy that in Construction, Living Resources, and Minerals, California's GSP ranks higher than in employment.

Table 2-7: California Rank by Sector Among Coastal States 2000

California Rank Among Coastal States 2000		
	Employment	**Gross State Product**
Total Ocean Economy	**1**	**1**
Construction	3	2
Living Resources	4	3
Minerals	4	3
Ship & Boat Building	6	6
Tourism & Recreation	1	1
Transportation	1	1

Table 2-8 shows California maintained its first place rank among all coastal and Great Lakes states in Ocean Economy GSP from 1990 to 2000.

Table 2-8: Ocean Economy GSP Rankings of Coastal States 1990 and 2000

Rank	State	1990	2000	State	Rank
1	California	14,703,784,251	21,434,428,141	California	1
2	Louisiana	14,599,213,346	15,248,432,508	Louisiana	2
3	New York	6,603,086,278	11,676,830,383	Florida	3
4	Florida	6,321,459,167	7,683,892,713	Washington	4
5	Alaska	5,296,007,820	6,848,544,553	New Jersey	5
6	Washington	5,260,776,080	6,446,339,764	Texas	6
7	New Jersey	4,885,639,675	5,239,162,298	Alaska	7
8	Texas	3,039,803,670	5,092,727,554	New York	8
9	Virginia	2,556,648,972	4,030,681,483	Hawaii	9
10	Hawaii	2,546,093,848	3,565,652,519	Virginia	10
11	Maryland	2,201,909,490	3,324,045,497	Illinois	11
12	Illinois	2,085,041,271	2,867,222,029	Pennsylvania	12
13	Connecticut	2,068,303,837	2,454,068,194	Connecticut	13
14	Michigan	1,210,080,844	2,363,494,739	Maryland	14
15	Maine	1,061,506,497	2,002,302,949	Michigan	15
16	Wisconsin	1,030,262,706	1,785,750,627	Mississippi	16
17	Mississippi	916,079,810	1,519,896,601	Maine	17
18	South Carolina	815,872,218	1,422,939,938	South Carolina	18
19	Rhode Island	711,994,326	1,241,080,165	Wisconsin	19
20	North Carolina	662,450,171	1,167,788,146	Georgia	20
21	Pennsylvania	622,336,827	1,097,149,561	North Carolina	21
22	Ohio	577,922,814	994,142,073	Indiana	22
23	New Hampshire	573,964,731	942,681,414	Ohio	23
24	Georgia	570,192,354	862,983,177	Rhode Island	24
25	Oregon	490,307,531	766,574,374	Alabama	25
26	Indiana	484,263,909	710,837,378	Oregon	26
27	Alabama	424,109,254	519,075,829	New Hampshire	27
28	Minnesota	281,665,137	454,283,828	Minnesota	28
29	Delaware	217,172,151	362,687,784	Delaware	29

2.5 California's Ocean Economy: Regional Comparisons

The size of the California economy necessitates that a regional perspective be used to investigate the Ocean Economy in greater detail. Five regions are defined in Table 2-9 and include the coastal counties following the categories used in the 1994 study (except for the caveat indicated in the Table).

Table 2-9: Ocean Economy Coastal Regions[15]

Region	County	Region	County
North	Del Norte	**Central**	Monterey
	Humboldt		San Mateo
	Mendocino		Santa Cruz
North Central	Alameda	**South Central**	San Luis Obispo
	Contra Costa		Santa Barbara
	Marin		Ventura
	Napa	**South**	Los Angeles
	Sacramento *		Orange
	San Francisco		San Diego
	San Joaquin *	** Sacramento, San Joaquin, and Yolo counties are included in this report for consistency with state level data and for their economic importance.*	
	Santa Clara		
	Solano		
	Sonoma		
	Yolo *		

The changes by region were significant. The fastest growth in regional Ocean Economy occurred in the Central region that includes Monterey, San Mateo, and Santa Cruz counties. The growth rates on all three measures, employment, wages and GSP, were larger than any other region, driven primarily by growth in Tourism & Recreation (see Figure 2-3).

15 Watershed regions determined by the original California study.

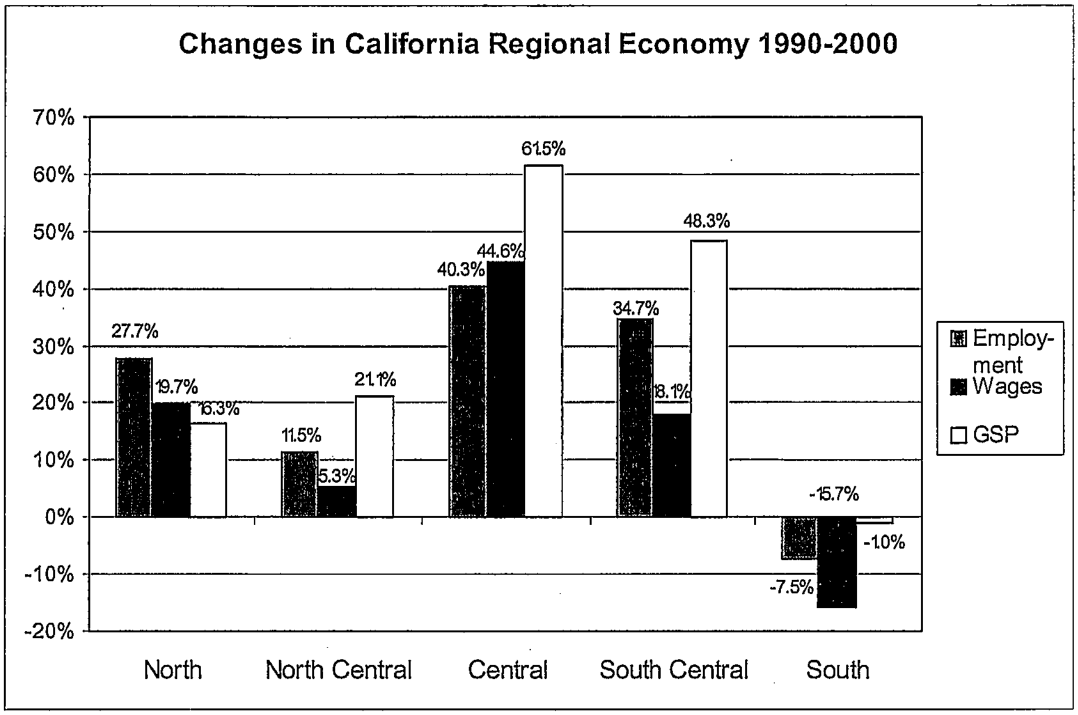


Figure 2-3: Changes in California's Regional Ocean Economy, 1990-2000

The North region's losses in the Marine Living Resources sector offset in part the growth in Tourism & Recreation, while the South Central region saw its GSP value climb faster than employment or wages, probably due to the increased value of the minerals sector, and the rise in the price of oil as discussed in Chapter 4 (see Table 4-9).

Slow growth in Southern California was probably caused by changes in the high-income sectors of Transportation and Ship Building that reduced the size of the Ocean Economy. In addition, the sharp drop in the high-value Search and Navigation Equipment industry overwhelmed modest growth in Tourism & Recreation (see Table 5-3 and Table 8-3).

Jobs in the California Ocean Economy are located primarily in the urban regions of the state. Eighty-five percent of the jobs are in Southern California coastal counties and Bay area counties (see Table 2-10).

- California's Ocean Economy reflects a higher proportion of jobs in the rural areas compared to other regions. The Ocean Economy represents 2.7% of employment in the highly populated Southern California economy and nearly 10% of the jobs in the northern rural region of Humboldt, Del Norte, and Mendocino counties.

Table 2-10: California Ocean Economy 2000 by Region with Multipliers

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	7,691	2,307	9,998	1.3
North Central	131,834	52,734	184,568	1.4
Central	46,874	14,062	60,936	1.3
South Central	29,774	14,887	44,661	1.5
South	187,045	187,045	374,090	2.0
Coastal Total *	**408,127**	**285,689**	**693,816**	**1.7**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	$95,569,934	$57,341,960	$152,911,894	1.6
North Central	$3,322,308,195	$2,990,077,376	$6,312,385,571	1.9
Central	$897,345,053	$628,141,537	$1,525,486,590	1.7
South Central	$540,692,752	$540,692,752	$1,081,385,504	2.0
South	$6,405,298,440	$7,686,358,128	$14,091,656,568	2.2
Coastal Total *	**$11,441,454,062**	**$12,585,599,468**	**$24,027,053,530**	**2.1**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	$214,950,623	$128,970,374	$343,920,997	1.6
North Central	$6,668,923,435	$6,002,031,092	$12,670,954,527	1.9
Central	$1,991,938,702	$1,394,357,091	$3,386,295,793	1.7
South Central	$1,242,271,083	$1,118,043,975	$2,360,315,058	1.9
South	$11,013,715,716	$13,216,458,859	$24,230,174,575	2.2
Coastal Total *	**$21,434,428,141**	**$21,434,428,141**	**$42,868,856,282**	**2.0**

* Coastal Totals are greater than the sum of the regional values due to data suppression at the county and regional levels.

Table 2-11 shows direct employment, wages, and GSP for the Ocean Economy in each of the coastal regions. The size of the Ocean Economy is proportionate to the size of the overall economy in each region.

Table 2-11: Changes in the Ocean Economy by Region 1990 - 2000

Region	Employment	Wages (millions)	GSP (millions)
North	1,670	$15.7	$30.2
North Central	13,579	$168.1	$1,160.3
Central	13,476	$276.7	$758.7
South Central	7,663	$82.9	$404.5
South	-15,078	-$1,190.5	-$116.9

The proportion of the Ocean Economy in each region's total economy changes from South to North. It remains unknown whether the size of the Ocean Economy is a cause or a result of the size of the rest of the economy in each region. Figure 2-4 compares the proportion of the California economy accounted for by employment in each of the regions. For example, the Southern region, with the largest and most urban population, provides 45.8% of California's ocean sector employment, while it represents 45% of California's total employment. The Northern region, far more rural with many fewer people, has only 2% of California's Ocean Economy jobs and less than 1% of California's total employment.

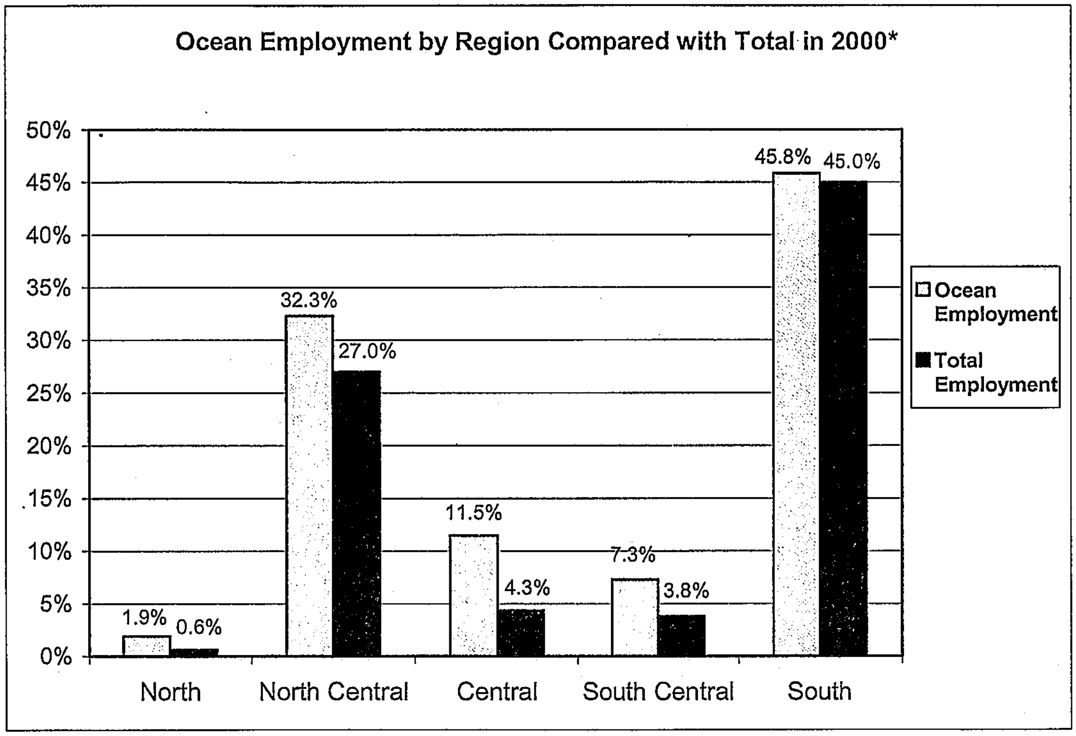


Figure 2-4: California Ocean Employment, Region vs. State

*Total employment represents all California employment and ocean employment represents ocean sectors.

A004430

Figure 2-5 shows that the proportion of Ocean Economy employment in each region is higher outside the major metropolitan areas. While the Ocean Economy is about 2.5% of the total California economy, and 2.6% of the Southern California economy, it is nearly 7.5% of the northern region. This mirrors a general pattern in the US Ocean Economy, in which employment is concentrated in urban areas, but the Ocean Economy plays a larger role in more rural areas.

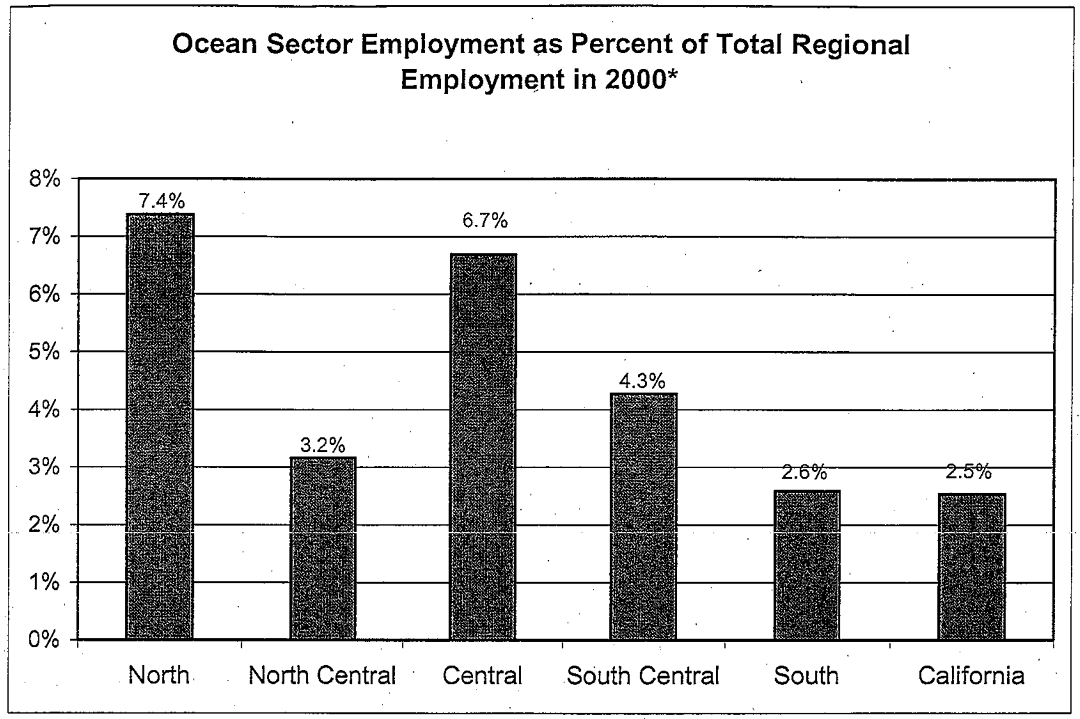


Figure 2-5: Regional Percentage of Ocean Employment
**The regions represent coastal counties only; California represents the entire state.*

A004431

2.6 California's Ocean Economy: Statewide Summaries by Sector

- The direct market value, or GSP, of California's Ocean Economy was $21.4 billion in 2000. Total market value, or GSP in 2000 was $42.9 billion.

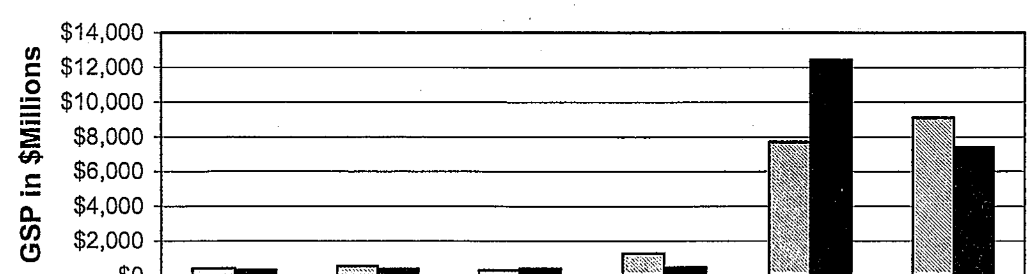
The ocean-related GSP grew by 10.64% in constant 2000 dollars between 1990 and 2000. This lagged behind California's overall economic growth. This lagging trend in growth was similar to the nation.

- The Marine Minerals and Coastal Recreation & Tourism sectors increased in GSP.

- California's Ocean Economy directly provided over 400,000 jobs in 2000, and more than 690,000 jobs when multiplier effects are considered.

- Employment in California's Ocean Economy grew more slowly than the state's overall economy. Wage and salary jobs in the Ocean Economy grew approximately 4.9%, compared with 13.8% overall growth in California. The increase was almost entirely due to growth in Tourism & Recreation jobs in the coastal regions.

- The coastal-related Tourism & Recreation sector dominated job growth in the Ocean Economy, during the past decade, while jobs in other ocean-related sectors declined. This trend, which also took place nationally, represents a profound shift in how the ocean relates to the economy, towards services and away from goods-related economic activity (see Figures 2-6 and 2-7).

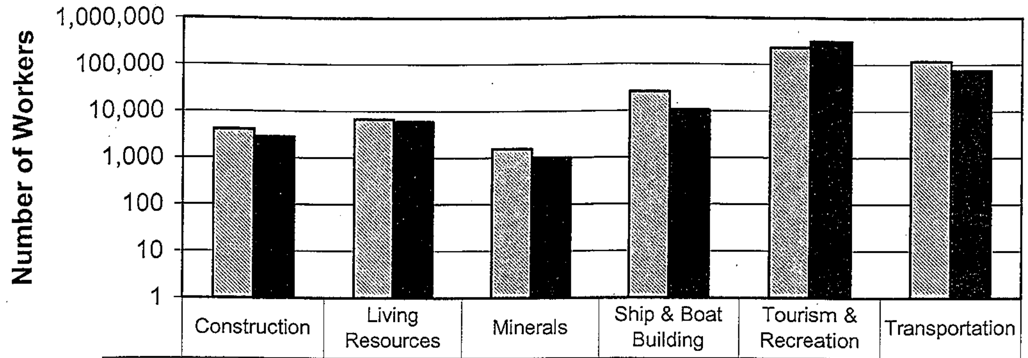


	Construction	Living Resources	Minerals	Ship & Boat Building	Tourism & Recreation	Transportation
1990	$414.25	$563.57	$317.44	$1,281.95	$7,689.70	$9,105.66
2000	$309.08	$403.28	$415.49	$493.14	$12,426.60	$7,386.84

Sector Values in $Millions

Figure 2-6: California Sectoral Comparisons by GSP

A004432



	Construction	Living Resources	Minerals	Ship & Boat Building	Tourism & Recreation	Transportation
1990	4,098	6,740	1,549	25,849	231,910	118,975
2000	2,833	6,015	1,014	10,557	313,417	74,289

Sector

Figure 2-7: California Sectoral Comparisons by Employment

Table 2-12: The Direct California Ocean Economy in 1990 and 2000

2000					
Sector	Employment	Wages (millions)	GSP (millions)	Average Wages	GSP/ Employee
Construction	2,833	$164.4	$309.1	$58,035	$109,100
Living Resources	6,015	$165.9	$403.3	$27,587	$67,046
Minerals	1,014	$67.1	$415.5	$66,165	$409,751
Ship & Boat Building	10,557	$377.6	$493.1	$35,772	$46,712
Tourism & Recreation	313,417	$5,545.0	$12,426.6	$17,692	$39,649
Transportation	74,289	$5,121.4	$7,386.8	$68,939	$99,434
TOTAL	408,127	$11,441.5	$21,434.4	$28,034	$52,519
1990					
Sector	Employment	Wages (millions)	GSP (millions)	Average Wage	GSP/ Employee
Construction	4,098	$219.3	$414.3	$53,522	$101,086
Living Resources	6,740	$206.4	$563.6	$30,626	$83,616
Minerals	1,549	$83.4	$317.4	$53,809	$204,932
Ship & Boat Building	25,849	$1,073.4	$1,282.0	$41,527	$49,594
Tourism & Recreation	231,910	$3,601.1	$7,689.7	$15,528	$33,158
Transportation	118,975	$6,988.2	$9,105.7	$58,737	$76,534
TOTAL	389,123	$12,171.8	$19,372.6	$31,280	$49,785

The Tourism & Recreation sector accounted for the largest proportion of employment and GSP with 76.8% of the former and 58% of the latter (Figure 2-8). However, it represented the lowest average wages and GSP per employee. The Transportation sector is the second largest in terms of employment and GSP, accounting for 18.2% of employment, but almost a third of GSP. And, the Transportation sector as well as the Minerals sector represented much higher average wages and GSP per employee. The Tourism & Recreation sector pays significantly lower wages and has significantly lower GSP per employee than all other sectors. These other sectors are the reason that the California Ocean Economy pays higher wages than the average wage for the state economy. The implication here is that the slower growth sectors contribute significantly to the California economy through higher wages, making up a critical element of the economy. More detailed discussions of these sectors, and the industries they include, are found in Part II The Sectors of the California Ocean Economy.

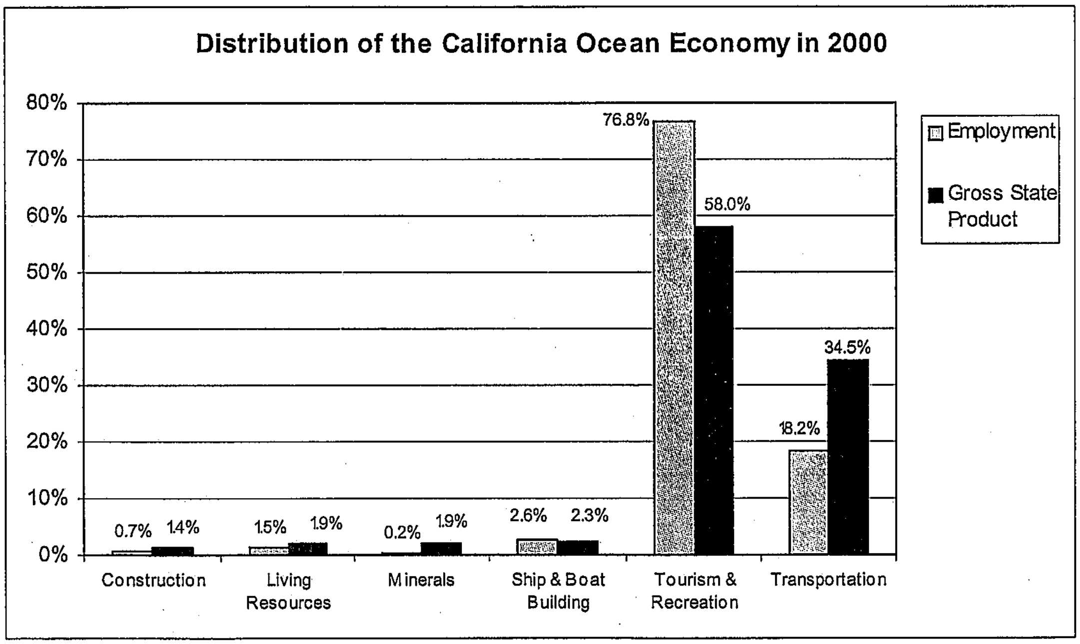


Figure 2-8: 2000 Distribution of the California Ocean Economy

A004434

2.7 Indirect and Induced Estimates of California's Ocean Economy

The data presented so far tells only part of the story of the Ocean Economy – the results of economic activity directly related to the ocean. This direct economic activity generates additional economic activity, which occurs in part because ocean-related industries purchase goods and services from other industries (indirect effects), and partly because the income earned in the ocean industries is spent by employees to purchase goods and services from other industries (induced). The multiplier estimates provide a measure of the total economic activity generated within California from the use of ocean and coastal resources. Estimates of these effects are shown in Table 2-13. The estimates were derived from a detailed analysis of the Ocean Economy industries in each of the coastal regions using IMPLAN, a standard and widely used economic impact model.

Table 2-13: Multiplier Effects of The California Ocean Economy 2000

Sector	Direct Employment	Indirect and Induced Employment	Total Employment	Multi-pliers
Construction	2,833	2,550	5,383	1.9
Living Resources	6,015	2,406	8,421	1.4
Minerals	1,014	2,028	3,042	3.0
Ship & Boat Building	10,557	8,446	19,003	1.8
Tourism & Recreation	313,417	94,025	407,442	1.3
Transportation	74,289	163,436	237,725	3.2
Total California	**408,127**	**285,689**	**693,816**	1.7
Sector	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multi-pliers**
Construction	$164,413,562	$164,413,562	$328,827,124	2.0
Living Resources	$165,933,760	$132,747,008	$298,680,768	1.8
Minerals	$67,091,107	$46,963,775	$114,054,882	1.7
Ship & Boat Building	$377,642,817	$302,114,254	$679,757,071	1.8
Tourism & Recreation	$5,544,976,307	$4,435,981,046	$9,980,957,353	1.8
Transportation	$5,121,396,509	$7,169,955,113	$12,291,351,622	2.4
Total California	**$11,441,454,062**	**$12,585,599,468**	**$24,027,053,530**	2.1
Sector	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multi-plier**
Construction	$309,081,043	$309,081,043	$618,162,086	2.0
Living Resources	$403,284,093	$322,627,274	$725,911,367	1.8
Minerals	$415,487,797	$290,841,458	$706,329,255	1.7
Ship & Boat Building	$493,135,966	$394,508,773	$887,644,739	1.8
Tourism & Recreation	$12,426,599,613	$9,941,279,690	$22,367,879,303	1.8
Transportation	$7,386,839,629	$10,341,575,481	$17,728,415,110	2.4
Total California	**$21,434,428,141**	**$21,434,428,141**	**$42,868,856,282**	**2.0**

The size of the Ocean Economy approximately doubles when the estimated multiplier effects are included. Employment almost doubles to over 690,000, while wages and the contribution to GSP more than double. With the multiplier effects included, the California Ocean Economy comprises 4.1% of California employment and 3.2% of California GSP.

The Transportation sector has the largest employment, wage, and GSP multiplier effects, while the Minerals sector also has a substantial employment multiplier.

2.8 Changes in the California Ocean Economy 1990-2000

The California Ocean Economy underwent profound changes during the decade 1990- 2000.

Table 2-14: Changes in the California Ocean Economy, 1990-2000 (Direct)

Sector	Employment		Wages		GSP	
	Change	% Change	Change (millions)	% Change	Change (millions)	% Change
Construction	-1,265	-30.9%	-$54.9	-25.04%	-$105.2	-25.39%
Living Resources	-725	-10.8%	-$40.5	-19.61%	-$160.3	-28.44%
Minerals	-535	-34.5%	-$16.3	-19.51%	$98.0	30.89%
Ship & Boat Building	-15,292	-59.2%	-$695.8	-64.82%	-$788.8	-61.53%
Tourism & Recreation	81,507	35.2%	$1,943.9	53.98%	$4,736.9	61.60%
Transportation	-44,686	-37.6%	-$1,866.8	-26.71%	-$1,718.8	-18.88%
All Ocean Sectors	**19,004**	**4.9%**	**-$730.4**	**-6.00%**	**$2,061.9**	**10.64%**

Only the Tourism & Recreation sector exhibited growth in employment, wages, and GSP as shown in Figure 2-9. Every other sector in the Ocean Economy declined in employment and real wages, and all except Minerals declined in direct GSP. This is a significant change toward services-oriented uses and away from goods-related uses related to the ocean.

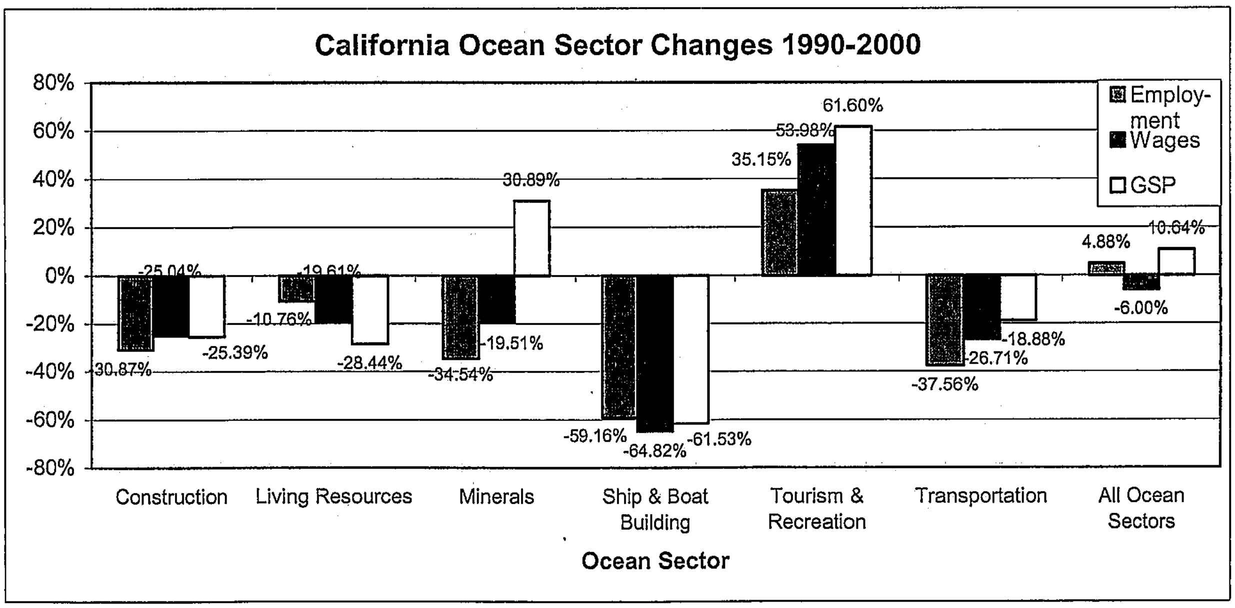


Figure 2-9: Changes in California's Ocean Economy by Sector, 1990-2000

Possible reasons for these changes follow:

- Construction trends in marine related Heavy Construction are very difficult to measure, in part because the industry is not measured well in the SIC system, and in part because the industry is highly cyclical and dependent, in particular on government spending for activities such as dredging, pier construction, etc. The declines shown were driven largely by changes in government spending over the decade, but detail on this spending is insufficient to measure accurately what activities have most changed.

- Living Resources declines are entirely related to declines in Fish Harvesting, which are explained in more detail in Part II.

- Minerals (mostly oil and gas) declined in employment and wages, but grew in GSP, reflecting two trends. First, the industry itself became more efficient, requiring fewer workers for output. Second, the real value of the oil increased. A 1989 federal moratorium on leasing additional offshore lands in California, combined with mostly older wells in place, could account for the decrease in oil and gas production volume.[16]

- Ship and Boat Building had the largest decline of all the ocean sectors on all three measures, GSP, employment, and wages. The decline is probably related to the end of the Cold War in 1990, and the peak in the Reagan era of seven-years of ship building expansion for the Navy, followed by the steady decline. This pattern occurred in all states where significant shipbuilding took place, and so California's experience reflected this national trend. In addition, "part of this decline could be due to the reduction in offshore minerals leasing over this period and the reduction in exploration and production activity. Offshore service/supply vessels, for example, were built in the San Diego shipyards, as were other service vessels and some production facilities".[17]

- Transportation exhibited the largest change in the Search and Navigation Equipment industry, which makes equipment for both military and civilian uses. This industry is the "high tech" segment of the Ocean Economy, in which California has been a national leader. The industry lost nearly 60,000 jobs, more than half of those employed, from 1990 to 2000, reflecting almost entirely the same military spending trends that resulted in the declines in the Ship & Boat Building sector. Also, the Deep-sea Freight Transportation industry lost approximately 40% of its employment (nearly 1,800 jobs)

---

[16] Paul Kelly, Sr. Vice-President, Rowan Companies, Communiqué 2004. "Another trend reflected in the decline in employment is the departure of pioneering companies from California once their base of operations in the State was impacted by offshore leasing moratoria. Longstanding State moratoria prohibiting new leasing and local opposition to federal leasing was expanded in 1989 with the first of Presidentially imposed new leasing moratoria. With their California bases of operations dealt this... blow to possible future work, most of these companies left the State [Orange and Ventura counties] for other... locations on the Texas and Louisiana Gulf Coast. Such companies included Santa Fe International (contract drilling and construction) to Dallas, Global Marine Drilling (contract drilling) to Houston, Varco International (technologically advanced drilling equipment) to Houston, Smith International (oilfield tubulars and equipment) to Houston, Oceaneering International (diving, underwater specialists and robotics) to Houston.... Also, earlier, in the 1980's, Armco Steel closed a plant in Southern California that manufactured pipe for petroleum operations. In addition, news stories in the Houston newspapers would indicate that California-based production companies such as UNOCAL and Chevron (now ChevronTexaco) have gradually been relocating jobs from California to Texas and Louisiana. In 1989, the National Ocean Industries Association determined in an informal survey that approximately 37,000 jobs had been moved out of California as the result of these relocations."

[17] Paul Kelly, Communiqué 2004.

despite large growth in the volume of cargo handled at California's ports. This job loss reflected the industry's increasing mechanization.

- Tourism & Recreation increased markedly over the decade consistent with national and local trends. California's beaches are among the most popular in the world.

2.9 References

US Department of Labor, Bureau of Labor Statistics. Quarterly Census of Employment and Wages.

Moeller, R, and J Fitz 1994. "*An Economic Assessment of Ocean-Dependent Activities.*" California Research Bureau. Sacramento.

The Resource Agency. March 1997. *California's Ocean Resources: An Agenda for the Future.* Sacramento. Available from Ocean Resources Management Program or on-line <http://resources.ca.gov/ocean/97Agenda/html_index.html>.

Economy.com. The World Economy in Real Time. <http://www.economy.com/default.asp>. Accessed 2004 December.

The National Ocean Economics Program. <http://www.OceanEconomics.org>. Accessed 2004 December.

PART II THE SECTORS OF THE CALIFORNIA OCEAN ECONOMY

Chapter 3 California Living Resources

Table 3-1: Summary of Direct Value of Living Resources Industry 2000

Industry	Employment	Wages	GSP
Fish Hatcheries & Aquaculture	488	$13,702,515	$35,350,869
Fishing *	976	$38,213,332	$98,585,880
Seafood Processing	4,551	$114,017,913	$269,347,344
Total	**6,015**	**$165,933,760**	**$403,284,093**

* Some fishing companies fall under the unemployment insurance laws and report their employment like other companies. Other people employed in fish harvesting, primarily the self-employed, are not counted. So these figures represent only the known portion of the harvesting sector.

Table 3-2: Summary of Living Resources Industry with Multipliers - 2000

	Direct	Indirect & Induced	Total	Multiplier
Employment	6,015	2,490	8,505	1.4
Wages	$165,933,760	$125,877,350	$291,811,110	1.8
GSP	$403,284,093	$309,722,183	$713,006,276	1.8

This chapter gives an overview of California's Living Resources sector. It includes a) a summary of the changes in the industry, b) the recent history of landings and landed value for the major fisheries; c) basic economic information – employment, wages and GSP or net output – about the three industries of the sector: Fish Harvesting, Seafood Processing, and Fish Hatcheries and Aquaculture; d) kelp industry production in California, (the economic indicators are included in the fish-harvesting industry); and e) summary estimates for the Sport and Recreational Fishing Industry in California.

We have tried to show estimated values by state and by region through this report, but this sector presented extra challenges because information at the county and regional levels was either not available at all or was suppressed in so many cases that the total estimates so under-represented the real value of the sector, we could not include them. This means that the industries comprising Fish Processing and Aquaculture and Fish Harvesting were too concentrated in a few companies to allow disclosure of information without violating confidentiality. This could be due in some cases to declines in fish catch and the consequent necessity for consolidation of the supporting industries, or to traditional dominance of particular regions by less then three companies. In addition, the employment and wage values are not available for Fish Harvesting. Hence, this chapter gives industry breakdowns by state only, and even these under-represent the actual value.

As the following tables indicate, the value of each category plummeted between 1990 and 2000. The last column in Table 3-3 indicates the actual changes.

Table 3-3: Direct Changes in California Living Resources 1990-2000

Industry	Employment 1990	Employment Change in 2000	Wages 1990	Wages Change in 2000	GSP 1990	GSP Change in 2000
Fish Hatcheries & Aquaculture	567	-79	$13,142,047	$560,468	$38,460,509	-$3,109,640
Fishing *	1,498	-522	$61,452,930	-$23,239,598	$179,843,437	-$81,257,557
Seafood Processing	4,674	-123	$131,824,548	-$17,806,635	$345,268,974	-$75,921,630
Total	**6,740**	-725	**$206,419,526**	-$40,485,766	**$563,572,921**	-$160,288,828

* Represents only the known portion of the harvesting sector.

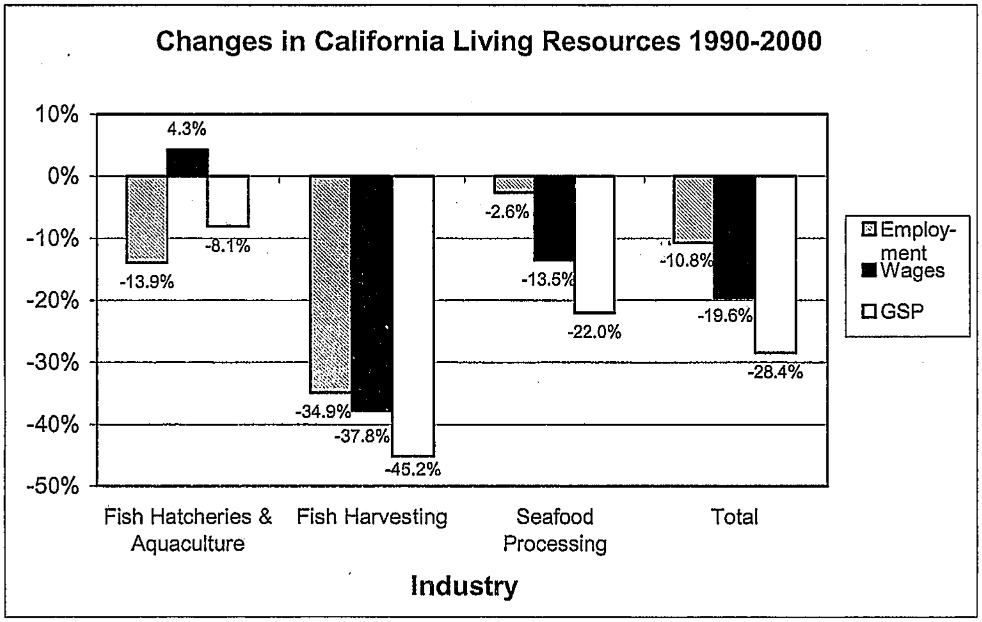


Figure 3-1: Changes in Living Resources Sector from 1990 to 2000

The demand for seafood in the US is large. Consumption of seafood is about 15.6 pounds per capita annually, which represents about $26.7 billion in revenue. Due to a higher degree of health-consciousness and the large portion of Asian immigrants in the state[18], the per capita demand for seafood in California is thought to be even larger than the national average. This has both national and international implications for California's economy, since a portion of California's fisheries is exported to foreign nations, and because the national and California markets are growing. The more California can effectively manage its fisheries for optimal sustainable productivity, the greater the opportunity for foreign trade as well as serving local and national markets. Of all the California Ocean Economy sectors, Living Resources is possibly the least understood and most controversial.

The Living Resources sector data suffers from large disclosure issues, and much uncertainty and presents a challenge to indicate its value. Several variables make this sector difficult to

[18] See <http://www.epa.gov/r10earth/offices/oea/risk/a&pi.pdf>.

assess: a) Landings and landed values have been unstable in the past and continue to be due to large declines in the catch of particular species; b) absence of mandated standardized employment and wage reporting for fish harvesting, preventing accurate accounting of the real value of fish harvesting to the state. Much of the fishing industry is considered "self-employed" and does not fall under the federal mandates for reporting wages and numbers of employees, as is the case in all other sectors with wages paid by companies. Hence, those "self-employed" vessels fall outside the reported data requirements. Only those fishing operations that report as regular private companies can be included in our dataset from the Federal Government. Hence, reporting wages, employment, and GSP for the entire Living Resources sector, when it is aggregated, and for the fish harvesting part of the sector, when that is reported separately, is under-reported. There is no way to accurately know how many fishermen there are in California nor how much they earn. The only amount that can be estimated is that amount of money that the owner of the boat receives for the catch at the dock, because legally, that must be reported by the buyer of the catch. This lack of standard reporting has several implications, not the least of which is that there can be no benchmark for regulators to determine the extent to which regulations or limits will impact the economy of the fishermen.

Only state aggregated estimates for the value of the Living Resources sector can be found in this chapter. Regional estimates have been left out. The evident domination of the Fish Processing and the Hatcheries and Aquaculture industries by only a few companies per region have resulted in the suppression of data at county and regional levels. This industry concentration may reflect the steep decline in catch over the past decades, or they could be the result of traditionally family-owned enterprises who captured the market long ago and have remained successful. In either case, we cannot report the numbers by region.

When compared with the larger Ocean Economy sectors in California such as Tourism & Transportation, the Living Resources market sector is relatively small. However, as a source of food and employment, the commercial fishing industry is very important to California's coastal economy. Many activities are dependent on this industry, such as boat construction and repair, brokerage, dock handling, trucking and other transportation, gear and rigging stores, fish processing, and commercial seafood trade. In addition, the health of California's fisheries is integrally related to the health of California's coastal waters, reflecting the strength of offshore ecosystems. The size of the catch and its contribution to California's economy is only a part of its value. These other values are not captured in the market place, but have far reaching effects on the sustainability of California's coastal resources, which fuels its flourishing coastal economy. The long-term sustainability of California's fisheries has additional values, or future values, because fisheries are a renewable resource that, if well-managed, could sustain a viable industry for years to come. Poor management of California's fisheries would be an opportunity lost, taking a major source of revenue and food from the citizens of California, costing Californians in future earnings and revenues.

While all Ocean Economy sectors but Tourism & Recreation declined during the decade 1990-2000, the Living Resources sector sustained the deepest cuts in relative terms. The real losses are not calculable from the market values published in this chapter. The additional values mentioned above need to be considered as well.

3.1 Overview of Activities: Fisheries Landings and Values

The US fishing industry has undergone massive changes during the past 25 years, but overall, landings have remained relatively steady at about 10 billion pounds a year and GSP at about $3.5 billion annually. In 1991 and 1994, the total US landings reached a peak, with more than 10 billion pounds in total landings each year (Figure 3-2). However, the overall national appearance is deceptive. Some states have increased their take with new species and others have seen their fisheries almost collapse. In California, the fisheries landings have shown the largest decline throughout the last 25 years, with the largest dip in the most recent years, showing a decrease from billions to millions in a 20-year time frame.

Each of the five regions in California showed a decrease in landings, with an increase in value. This was not true for the Central Coast, which showed an increase in both landings and value. The Central Coast includes Monterey County, Santa Cruz County, and San Mateo County. In California, there is also concern about other competitive uses of the land and water, other than for fisheries. As tourism continues to grow, it needs space, sometimes out-competing fisheries for limited dock and shoreline space. These changes have had major impacts on California's economy (Figure 3-2).

Although we usually use 2000 as our latest benchmark, we have included figures representing the years after 2000 because these numbers were readily available and told an even more complete story. Figure 3-3 reflects some of these losses.

- Between 1982 and 1999, California's fishing fleet declined by an estimated 4000 vessels, from approximately 6700 to 2700 boats.

- In 1976, California's fleet landed a peak of 1.3 billion pounds of fish and invertebrates, compared to landings of 650 million pounds in 2000.

- In 1980, the California fleet, at a peak since 1970, brought in more than $300 million in landed value, compared to $142 million in 2000 and $91 million in 2002 (NMFS) (See Figure 3-3). California's share of the US total commercial landings fell from approximately 19% in 1970 to about 7.1% of the US total, and 3.9% of total landed value in 2000 (See Figure 3-4).

- 1970 to 1990, total finfish and shellfish landings in California declined by more than half, while total US landings almost doubled. California experienced a dramatic drop in landings of tuna, ground fish, urchin, shark, swordfish, salmon, and abalone.[19]

[19] (NMFS site and www.OceanEconomics.org, which uses the data from that site)

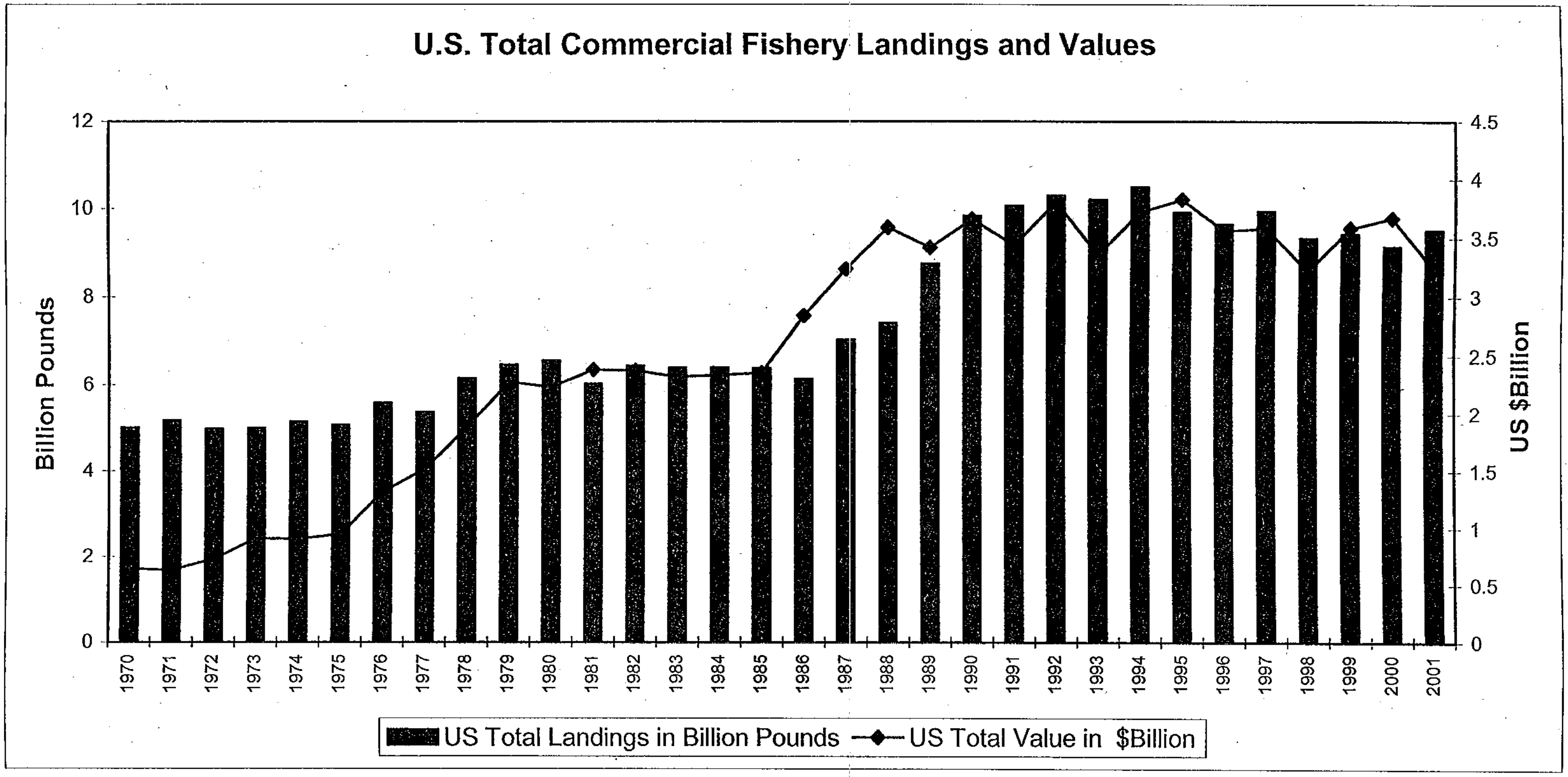


Figure 3-2: US Total Commercial Fishery Landings and Values
Source: Pacific Coast Fisheries Information Network (Pacfin)

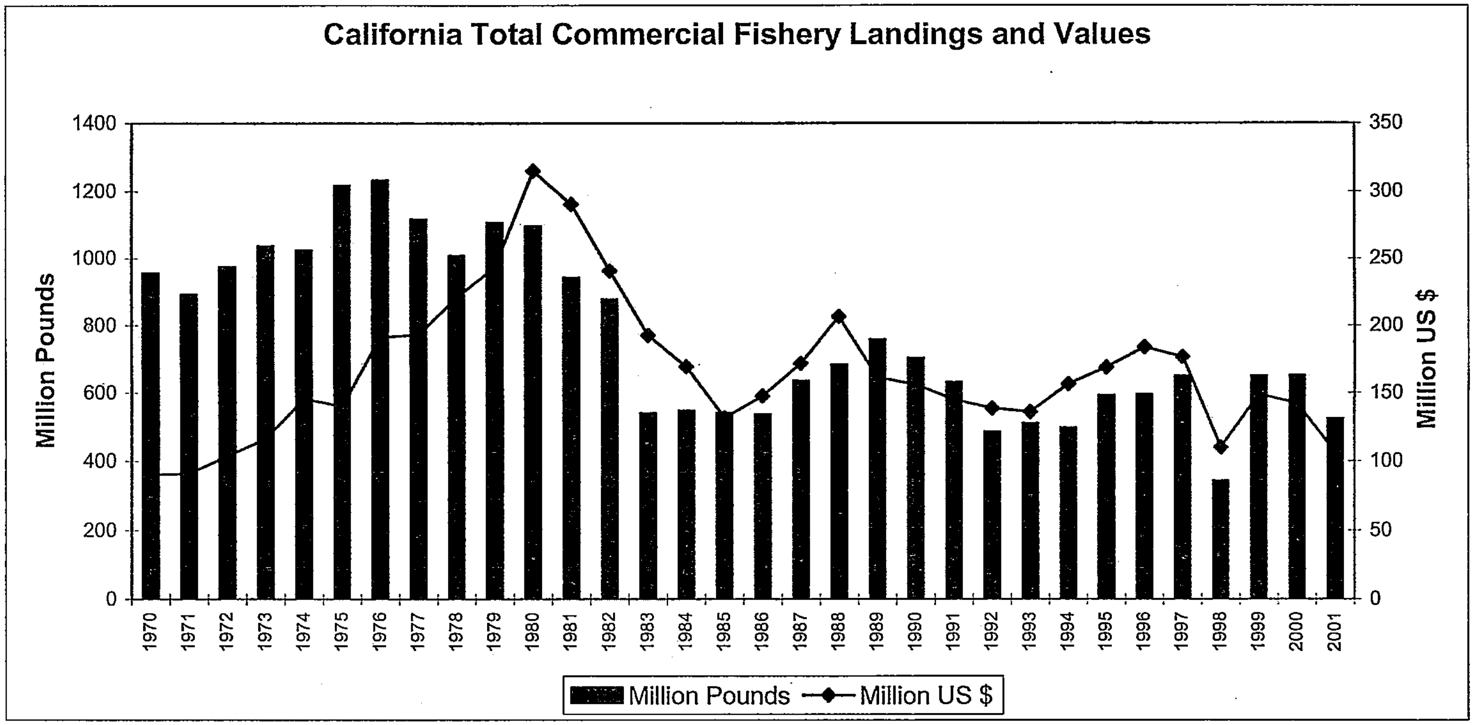


Figure 3-3: California Commercial Fishery Landings and Values
Source: Pacific Coast Fisheries Information Network (Pacfin)

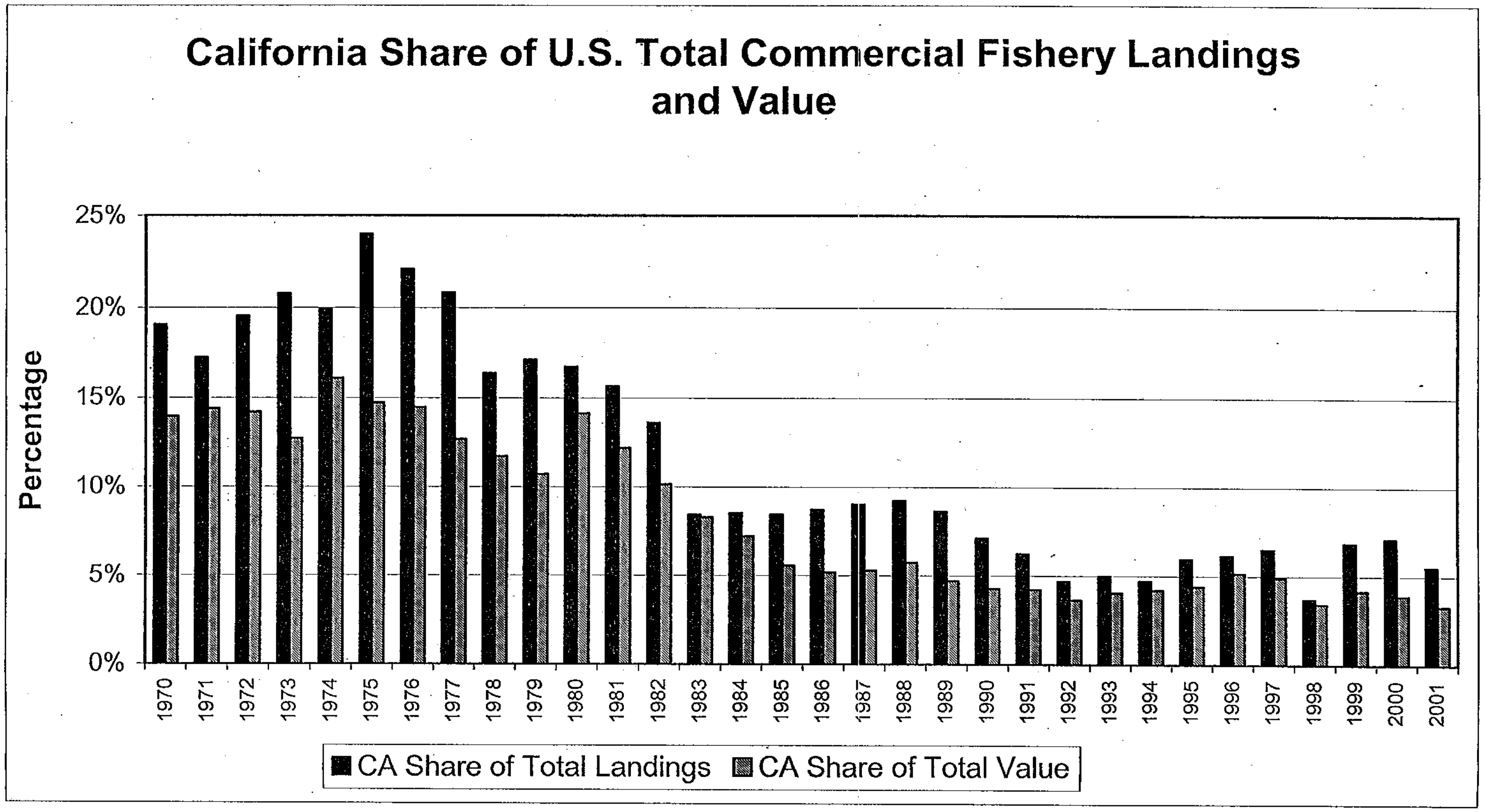


Figure 3-4: California Share of US commercial Fisheries
Source: Pacific Coast Fisheries Information Network (Pacfin)

3.1.1 Influences on California's Fishing Industry

According to *California Living Marine Resources: A Status Report* by the Department of Fish and Game (2001), the state's marine resources and its management have undergone continuous changes in part because of changes in the economics of fisheries and partly because of the need to restrict fishing effort in order to manage commercial fishery populations. The decline in tuna landings was primarily a result of the shift of landing ports from California to less costly cannery operations in Samoa and Puerto Rico. Because of severe decreases in abalone stock and concerns about the extinction of the white abalone, the total commercial fishing of abalone was closed south of San Francisco. Ground fish production was disrupted by seasonal area closures, quota reduction, and long-term stock-building plans. Salmon fishing has raised public concerns since five California salmon populations have been listed under the federal Endangered Species Act (ESA).

Additional regulations also played an important role in the development of California's commercial fishing industry. For example, rockfish and Cabezon were considered lucrative, and a major fishery dedicated to those near-shore species was established during the 1990s. According to the Department of Fish and Game, in 1994, California Constitutional Amendment (Prop. 132) prohibited fishing by gillnet in the near-shore areas of central and southern California. The 1998 Marine Life Management Act (MLMA), led to additional suspension of permits in the near-shore fishery, and a squid management plan is in place, which involves restrictions of access. The 1999 Marine Life Protection Act authorizes new protections for ocean habitats and wildlife. It also will create a new network of marine protected areas along the coast, setting aside zones in some cases, where preservation of certain species will be undertaken to revive some of the more depleted stocks.

Outside the industry, competing uses of waterfront for recreational boating, commercial cargo handling, and tourism, have confronted the California commercial fishing industry, and could limit the availability of shore-side space for support facilities.

Despite the decline of landings for certain species in California, some other species have exhibited growth patterns, and have become the targets of fishery expansion. For example, according to the California Department of Fish and Game, increased international demand for squid resulted in a dramatic increase in landings during non-El Nino years, which has attracted participation from former salmon fishermen in California. Growth of California fisheries also included the development of specialized fisheries for sea urchin, Pacific herring, and rockfish. However, restrictions on rockfish are now affecting these efforts.

3.1.2 Landings and Values by Species

Today, California's fishing industry no longer depends on tuna fisheries; other species have gained importance. Squid and red sea urchin were the top two revenue-generating species in 2002. The revenue from market squid reached 16.5 million tons in 2002. Along with Squid, Chinook salmon, Pacific sardine, and Albacore entered into the top ten commercial species in terms of revenue, replacing the positions of tuna, Pacific herring, shrimp, and Dover sole in the 1992 list (Figure 3-5).

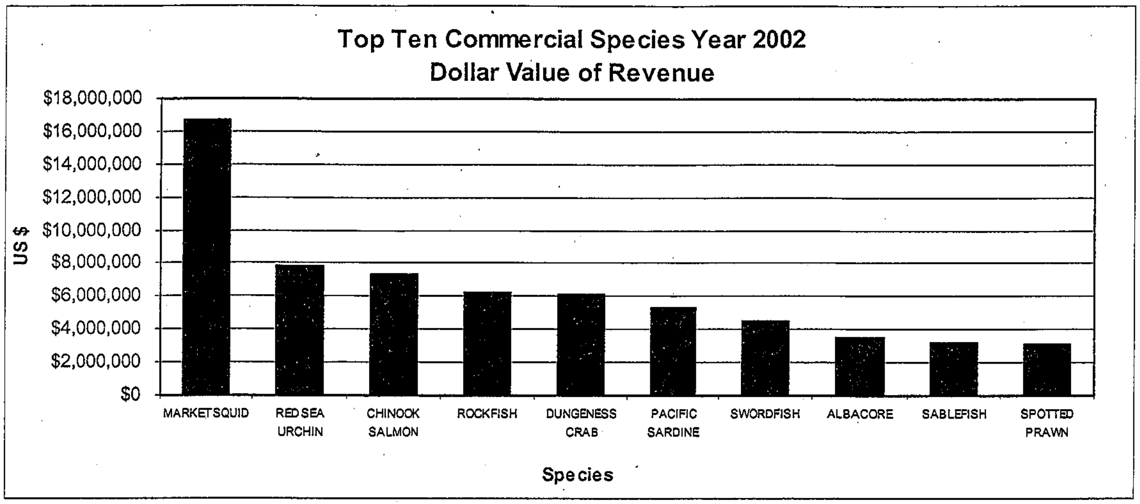


Figure 3-5: 2002 California's Top 10 Commercial Marine Species
Source: Pacific Coast Fisheries Information Network (Pacfin)

3.1.3 Landings and Values by Region and County 1990 to 2002

The total weight and value of landings have declined in California since 2000 (Table 3-4, Figure 3-6 and 3-7). Except for the Central Coast, all other regions have experienced loss of landings and value. Los Angeles County, accounting for more than 95% of the total landings and 90% of the total value, has experienced the greatest drop during the same period. The only county that experienced steady landing growth was San Diego, while the total value declined simultaneously (see NMFS site and www.OceanEconomics.org for detailed fisheries information on species).

Table 3-4: Regional Landings and Values 2000-2002

Region	2000		2001		2002	
	Weight of landings (lb)	Landed Value ($)	Weight of landings (lb)	Landed Value ($)	Weight of landings (lb)	Landed Value ($)
North Coast	**27,711,244**	**27,057,783**	**22,080,412**	**18,908,402**	**21,904,644**	**18,227,627**
Del Norte	8,114,071	9,779,518	6,533,578	5,856,040	4,496,855	4,430,281
Humboldt	10,102,830	8,410,836	7,209,487	5,690,285	7,853,514	6,380,523
Mendocino	9,494,343	8,867,429	8,337,347	7,362,084	9,554,275	7,146,823
North Central	**15,278,570**	**13,137,260**	**12,239,073**	**11,501,424**	**12,792,633**	**11,543,997**
Alameda	46,594	108,747	79,576	158,831	162,075	235,909
Contra Costa	10,737	27,564	6,747	19,394	13,138	33,038
Marin	1,919,644	1,672,380	2,986,961	2,137,359	364,236	629,607
San Francisco	10,204,780	7,313,606	6,491,229	5,889,007	8,751,549	6,625,709
Santa Clara	388,429	226,042	647,204	219,922	649,801	133,040
Solano					6,444	14,908
Sonoma	2,708,386	3,788,921	2,027,356	3,076,911	2,845,390	3,871,741
Central Coast	**65,054,096**	**14,809,023**	**66,674,419**	**12,041,962**	**99,208,364**	**16,571,474**
Monterey	61,339,436	9,813,590	63,450,017	8,260,265	94,186,314	12,450,017
San Mateo	3,029,606	3,925,871	2,885,194	3,256,384	4,651,711	3,609,970
Santa Cruz	685,054	1,069,562	339,208	525,313	370,339	553,173
South Central Coast	**174,848,867**	**33,230,847**	**113,480,611**	**22,341,361**	**60,231,135**	**19,225,417**
San Luis Obispo	3,661,918	5,718,773	3,469,567	4,604,807	2,848,307	3,773,916
Santa Barbara	7,005,508	6,728,900	5,263,908	5,382,993	5,658,833	6,125,507
Ventura	164,231,441	20,783,174	104,747,136	12,353,561	51,723,995	9,325,994
South Coast	**257,328,091**	**47,170,193**	**221,378,721**	**37,309,889**	**167,451,195**	**25,937,566**
Los Angeles	254,044,639	39,316,639	217,999,578	29,979,777	163,951,419	19,445,966
Orange	548,667	1,774,456	556,041	1,694,446	529,351	1,646,180
San Diego	2,734,785	6,078,956	2,823,102	5,635,666	2,970,425	4,845,180
All Coastal Counties	540,220,868	135,405,106	435,853,236	102,103,038	361,587,971	91,506,081

Figure 3-6 shows the landings by weight of commercial fish by coastal region and Figure 3-7 shows the landed value into California by region from 1993 to 2002. The weight and the total landed value in Southern California have greatly exceeded the rest of the state in recent years. This is in contrast to the results of the 1990s, when the highest total value of the landings was in the north coast.

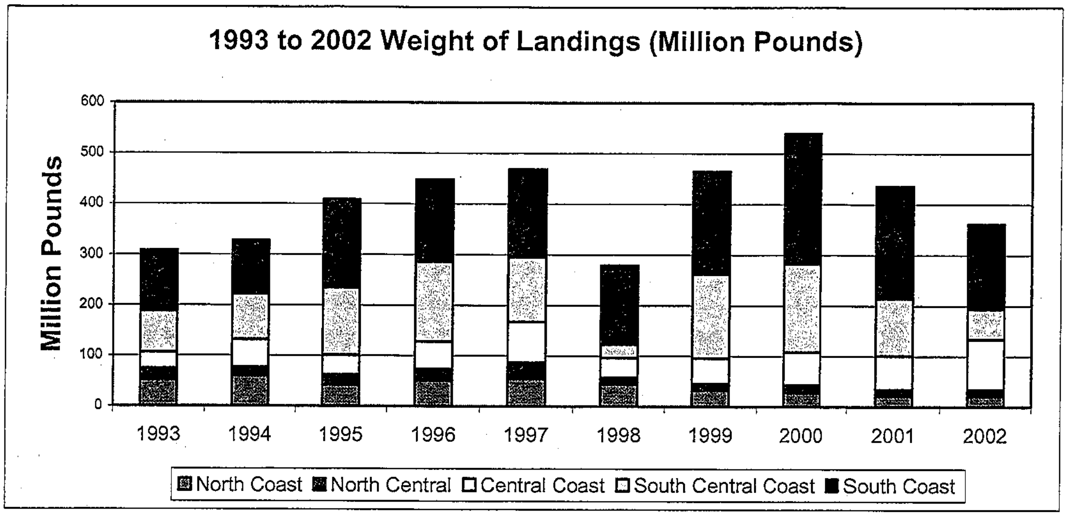


Figure 3-6: 1993 to 2002 Weight of Landings by Region
Source: Pacific Coast Fisheries Information Network (Pacfin)

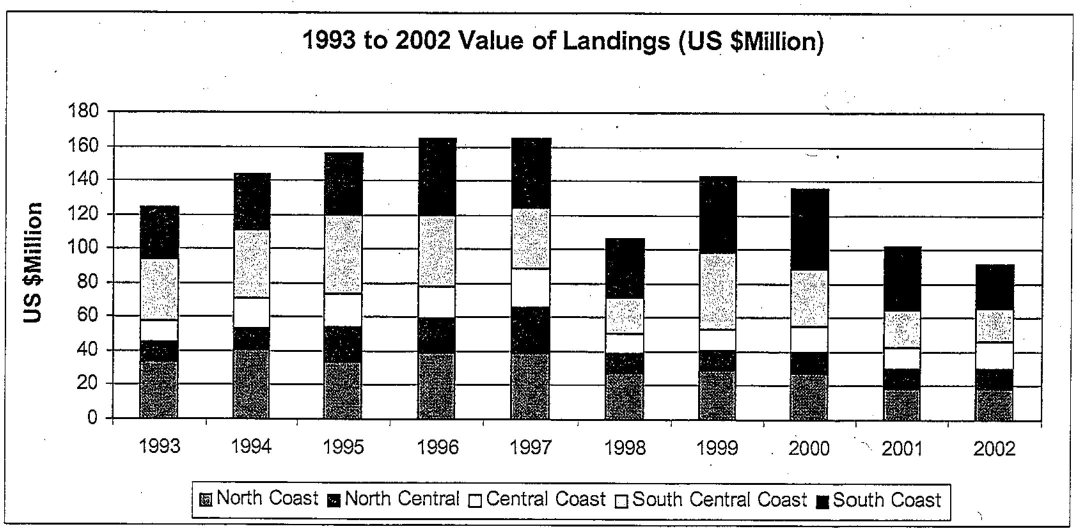


Figure 3-7: 1993 to 2002 Value of Landings by Region
Source: Pacific Coast Fisheries Information Network (Pacfin)

More recent information on California's Living Resources industry can be found in Appendix B to this report. The information reported in the body of this report reflects data from 1990 to 2000 and uses the SIC codes as the basis for classification of values, for consistency and comparability purposes. Appendix B contains estimates after 2000 done according to the newer NAICs codes, which give a more detailed accounting of the industry values. The charts found in the Appendix, however were taken from California state sources instead of the Federal Bureau of Labor Statistics source and so may represent a slightly different set of estimates.

3.3 Kelp and Sea Vegetable Harvesting

In addition to fisheries, California's Living Resources sector includes kelp farming offshore. Algin, an extract from kelp, is widely used in binding, stabilizing, and modeling pharmaceuticals, and in the cosmetics, hygiene, and food industries. Figure 3-8 presents the historical kelp production in wet tons in California. From 1970 to 1980, kelp harvest produced about 150,000 wet tons. As of 1980, the harvest of kelp was below 100,000 wet tons until 1989. The main reason for the low average was the 1982 to 1984 El Nino, which disturbed the environmental and climatic conditions of the Pacific Ocean. In 1990, kelp harvest reached its peak for the past 20 years with more than 150,000 wet tons. In 1998, 25,000 wet tons were harvested. From 1999 to 2001, the harvest was only around 40,000 tons annually. No separate data for employment and payroll in kelp and sea vegetable harvesting are available. They are included under the commercial fishing industry previously shown in Tables 3-1 and 3-2.

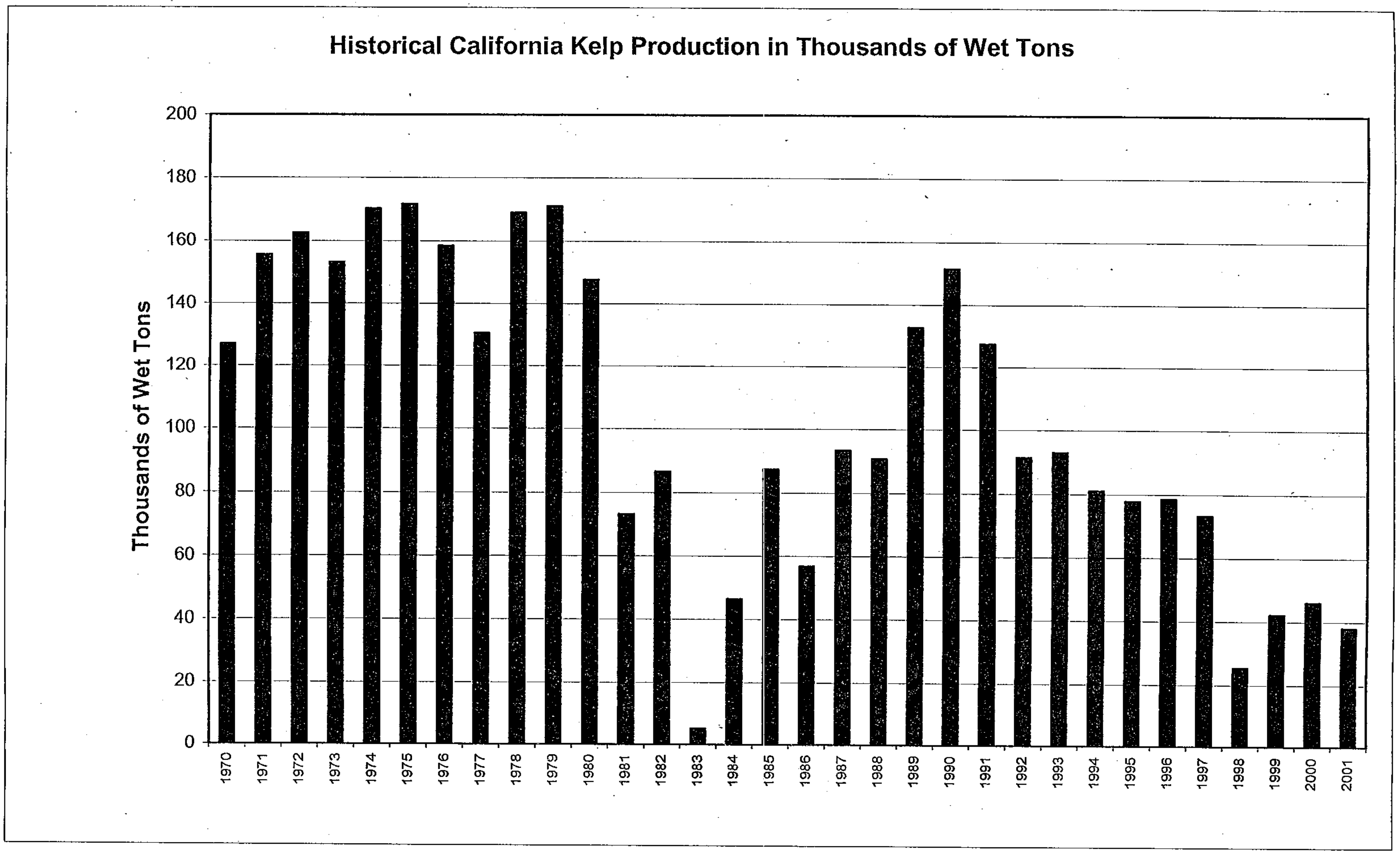


Figure 3-8: Historical California Kelp Production
Source: California Department of Fish and Game 2001

3.4 Recreational and Sport fishing

Recreational and Sport fishing in California is normally found in our Tourism and Recreation and Boat Building sectors, but it is included in this chapter because of the competitive nature of sport and commercial fishing for popularly sought after species. Since both industries are supported by California's fisheries, both parts of this sector often make claims of their value to the California economy to get a greater share of the limits. Sport and Recreational Fishing is an important part of the Living Resources sector and merits a separate consideration for readers to understand the contribution of this part of the fishing industry to the California economy. A major study of this sector was not undertaken for purposes of this report, because it was not part of the previous report. However, we sought official federal government numbers to provide an indication of the scale and scope of this enterprise. It must be noted that the two sets of data, ours for the commercial sector and those we used from NOAA, for the sport-fishing sector, are not comparable. Income and employment estimates are comparable to the wage and employment data for commercial fishing, and so can be compared. The Sales estimates for the sport-fishing industry found in Table 3-5 are gross values for the industry, and do not subtract the cost of doing business. The estimates used for commercial fishing, (GSP) are **net** output values and do deduct the cost of doing business. a very different set of values. Hence the sales data for the sport and recreational fishing industry found in Table 3-5, are a much-inflated estimate for sport fishing, when compared with our estimates for the GSP for the commercial fishing industry. Therefore, comparison of 2 billion dollars of sales from the Sport and Recreational Fishing industry has no relationship to the almost 800 million dollar estimate for the Commercial Fishing industry. Without a net estimate from the Sport and Recreational fishing industry, there is no basis for comparison.

Table 3-5: Total Economic Impacts Generated From Marine Recreational And Sport Fishing Expenditures in California - 2000

Total economic impacts from California marine recreational fishing in 2000*				
	Economic Impact			
	Direct	Indirect	Induced	Total
Sales ($1000)	$1,170,862	$288,216	$476,146	$1,935,224
Income ($1000)	$551,683	$125,383	$189,380	$866,446
Employment (jobs)	14,084	2,750	5,508	22,342

Source NOAA, "The Economic Importance of Marine Angler Expenditures in the United States", 2004

* Table 3-5 includes sport fishing related activities of the Tourism & Recreation, and Boat Building and Repair sectors, so they have already been counted in this report. We have merely separated them out for informational purposes. They should not be added to the commercial sector to get totals.

3.4 Conclusion

Living Resources contribute to the California economy through a range of activities. Commercial Fish Harvesting, including Kelp, Seafood Processing, Fish Hatcheries and Aquaculture, and Sport and Recreational Fishing represent a major source of revenue to the California economy. Fish Harvesting has suffered major declines over the past several decades. While there is not the evidence to indicate the loss in number of fishermen, nor in wages, the steep decline in catch, limitations on fishing, and loss of species has probably affected both the social and economic fabric of the coastal towns traditionally dependent on fishing. Estimates of the real value of the commercial sector are incomplete and under-estimated because of the lack of fishermen employment and wage data, and will not be able to become part of the record until the government requires regular and standard reporting of such information from the fishing industry. With escalating demand for fish throughout the world, California has much to gain from improving its circumstances. Future losses from mismanagement of this renewable resource have not been estimated here, because only reported market values have been considered. However, incalculable losses from over fishing and depletion of stocks have already occurred and will continue to occur into the future until California's fisheries have recovered. As of 2000, the fishing industry directly contributed a little more than $400 million to the California economy. That compares with a contribution of more than $560 million in 1990. The differences in landings is even more striking. Between 1980 and 2000, landings dropped from a value of $300 million to $142 million.

3.5 References

Moeller R, Fitz J. 1994. An Economic Assessment of Ocean-Dependent Activities. California Research Bureau. Sacramento.

National Marine Fisheries Service. Available at <http://www.nmfs.noaa.gov/>.

The National Ocean Economics Program. <http://www.oceaneconomics.org>. Accessed 2004 December.

Pacific Coast Fisheries Information Network. Available at <http://www.psmfc.org/pacfin/>.

Pacific Fishery Management Council. Available at <http://www.pcouncil.org/>.

The Resources Agency, California Department of Fish and Game. December 2001. California Living Marine Resources: A Status Report.

NOEP

Chapter 4 California Ocean Minerals

Table 4-1: Summary of Ocean Minerals with Multipliers in 2000

Indicator	Direct	Indirect & Induced	Total	Multiplier
Employment	1,014	2,052	3,066	3.0
Wages	$67,091,107	$46,963,775	$114,054,882	1.7
GSP	$415,487,797	$290,841,458	$706,329,255	1.7

Includes Limestone Sand & Gravel, Oil & Gas Exploration and Production, and Oil & Gas Exploration Services industries.

Table 4-2: Direct Changes in Ocean Minerals Sector 1990-2000

	Employment		Wages		GSP	
	1990	Change in 2000	1990	Change in 2000	1990	Change in 2000
Total Minerals *	1,549	-535	$83,350,066	-$16,258,959	$317,439,215	$98,048,582

* Separate industries are not shown due to data suppressions in 2000

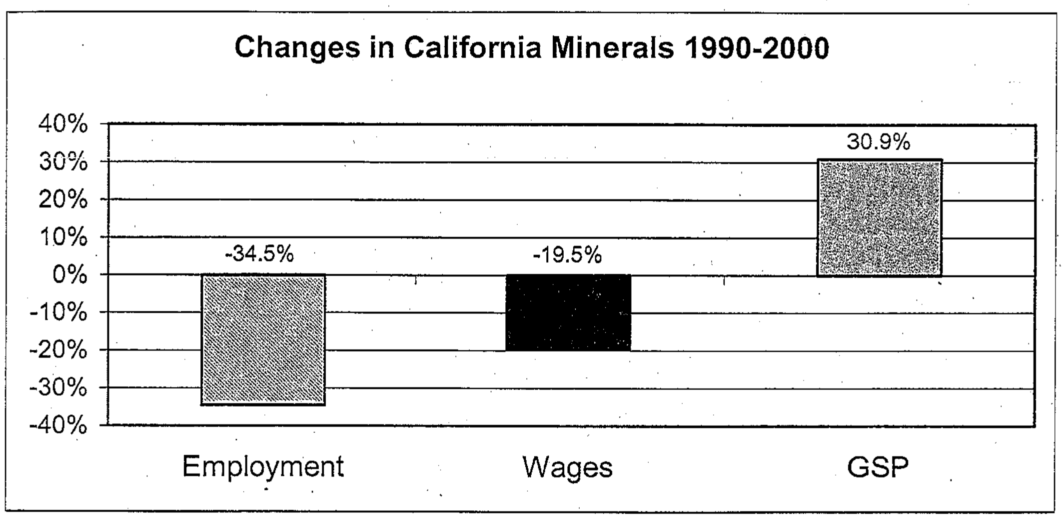


Figure 4-1: Changes in Ocean Minerals Industries from 1990 to 2000

4.1 Marine Minerals

The Offshore Ocean Minerals sector primarily includes oil and gas production from offshore and onshore wells that tap pools of oil and gas that extend under the ocean out to three miles, over which California has direct jurisdiction and thus derives state revenues. The NOEP has estimated the contribution of this industry to California, but has not estimated the revenues from Federal Outer Continental Shelf (OCS) lands, which lie beyond three miles, since those revenues go to federal coffers. However, the NOEP has included federal activities in our employment, wage and GSP data that generate revenue inside of California. Since this offshore part of the industry is found in four counties in California: Orange, Los Angeles, Ventura and Santa Barbara, most of the revenue generated from these activities come from the South Central and Southern part of the state. Also included in the

Offshore Minerals sector is a small hard minerals industry producing sand and gravel primarily for construction aggregate. However, offshore sand and gravel estimates are not separated from onshore, following the official federal economic statistics model.

The oil and gas industry has a deep-rooted history in California. With the first commercial oil production on land in 1876, California established itself as an integral part of the national petroleum industry. Petroleum is an important industry of the offshore minerals sector for both California's local and global economy.

4.1.1 Production and Revenue from Offshore Oil and Gas Production

In 2001, among the six US states[20] that produce offshore oil and gas on Federal lands, California ranked third behind Texas and Louisiana. California was the third largest manufacturer of petroleum products with the value of shipments just under $26 billion per year as of 2000. [21]

Offshore oil production has remained an important part of the overall oil industry for the state. Table 4-3 gives offshore oil production and Table 4-4 provides the proportion of offshore-onshore production of crude oil in California from 1992 to 2001.

Offshore oil and gas production is further segmented into state and federal offshore categories:[22] production facilities that are within 3 miles of the coast are taken as state offshore production and production beyond 3 miles is defined as the federal offshore. Federal oil production accounted for roughly two thirds of the total offshore production in recent years. Tables 4-4 and 4-5 give the composition of state and federal offshore oil production from 1992-2001.

[20] Alabama, Mississippi, Louisiana, Texas, California, and Alaska. Onshore production occurs in additional states.
[21] 2001 Annual Report of the State Oil and Gas Supervisor, California Department of Conservation, Division of Oil, Gas, and Geothermal Resources.
[22] In the US, the legal offshore boundary for state jurisdiction is 3 miles; land beyond 3 miles is under federal jurisdiction.

Table 4-3: California Offshore Oil Production in bbl *

Year	State Offshore Lands	State % of Total	Federal Offshore Lands	Federal % of Total	Total Offshore
1992	21,943,784	33.9	42,693,040	66.1	64,636,824
1993	20,843,516	29.2	50,642,865	70.8	71,486,381
1994	20,494,879	26.0	58,233,217	74.0	78,728,096
1995	19,825,993	21.5	72,421,115	78.5	92,247,108
1996	20,033,212	23.8	64,291,594	76.2	84,324,806
1997	21,515,445	28.2	54,685,468	71.8	76,200,913
1998	21,107,423	31.3	46,275,703	68.7	67,383,126
1999	18,137,762	31.6	39,271,068	68.4	57,408,830
2000	18,323,992	33.8	35,918,425	66.2	54,242,417
2001	16,972,359	33.8	33,190,678	66.2	50,163,037

Source: 2001 Annual Report of the State Oil & Gas Supervisor, California Department of Conservation, Division of Oil, Gas, and Geothermal Resources

* bbl or barrel of oil equals 42 gallons.

** OCS means Outer Continental Shelf, beyond the 3-mile state boundary.

Table 4-4: California Onshore and Offshore Oil Production in bbl

Year	Onshore	Onshore % of Total	Offshore	Offshore % of Total	Total Oil Production
1992	283,546,328	81.4	64,636,824	18.6	348,183,152
1993	272,173,413	79.2	71,486,381	20.8	343,659,794
1994	265,804,705	77.1	78,728,096	22.9	344,532,801
1995	259,072,589	73.7	92,247,108	26.3	351,319,697
1996	262,939,496	75.7	84,324,806	24.3	347,264,302
1997	264,161,530	77.6	76,200,913	22.4	340,362,443
1998	263,851,140	79.7	67,383,126	20.3	331,234,266
1999	254,125,730	81.6	57,408,830	18.4	311,534,560
2000	253,187,072	82.4	54,242,417	17.6	307,429,489
2001	243,582,065	82.9	50,163,037	17.1	293,745,102

Source: 2001 Annual Report of the State Oil & Gas Supervisor, California Department of Conservation, Division of Oil, Gas, and Geothermal Resources

Table 4-5: Share of Offshore Oil Production

Year	State Offshore % of Total	Federal Offshore % of Total	Total Offshore % of Total
1992	6.3	12.3	18.6
1993	6.1	14.7	20.8
1994	5.9	16.9	22.9
1995	5.6	20.6	26.3
1996	5.8	18.5	24.3
1997	6.3	16.1	22.4
1998	6.4	14.0	20.3
1999	5.8	12.6	18.4
2000	6.0	11.7	17.6
2001	5.8	11.3	17.1

Offshore oil production was highest in 1995 accounting for 92.3 million barrels and 26.3% of total oil production. Since 1995, oil production in general and offshore oil production in particular, has declined steadily. The offshore oil production on state and federal leases dropped 7.5%, a decline from 54.2 million barrels produced in 2000 to 50.2 million barrels. In 2001, offshore production accounted for 17.1% of the total state oil production.

In 2000, California, with 23 million registered automobiles, only produced one-half of the crude oil that it consumed; the other half was imported from other states or countries.

4.1.2 Geographic Location of Offshore Production

There are eleven sedimentary basins along the coast of California with favorable geologic structures for accumulation of oil and gas deposits. These basins are the Southern California Shelf; the San Diego Offshore Area; the Los Angeles Basin; the Santa Barbara-Ventura Basin; the Santa Maria, the Salinas, the Santa Cruz, the Bodega, the Point Arena, and the Eel River Basin; and Bear-Mattole Offshore Area. Of these eleven basins, only the Los Angeles, Santa Barbara-Ventura, and Santa Maria basins have been commercially exploited up to now.

Table 4-6 gives onshore and offshore oil production for all coastal counties of California in 2001. All of the coastal counties produced 30.9 million barrels of onshore oil and 17.0 million barrels of offshore oil. Offshore oil production is confined to Ventura, Santa Barbara, Los Angeles, and Orange counties. This production represents only state-owned lands. Los Angeles County alone accounts for approximately 50 percent of total onshore oil production of coastal counties and approximately 75 percent of the total offshore oil production for California. While Ventura County is a major onshore oil producer, its offshore oil production is only about 2 percent of California's offshore oil production. For further analysis only Santa Barbara, Ventura, Los Angeles, and Orange counties will be examined.

Table 4-6: Coastal Counties Onshore and Offshore Oil Production 2001

County	Number of Wells		Oil and Condensate (bbl)		Daily Production/Well(bbl)		Estimated Oil Reserve(Mbbl)	
	Onshore	Offshore	Onshore	Offshore	Onshore	Offshore	Onshore	Offshore
Del Norte	....	....	....	....	....	....	....	....
Humboldt	31	....	....	....	....	....	....	....
Mendocino	....	....	....	....	....	....	....	....
Yolo	74	....	....	....	....	....	....	....
Sonoma	....	....	....	....	....	....	....	....
Napa	....	....	....	....		....	....	....
Sacremento	70	....	7,273	....	0	....	....	....
Solano	185	....	36,931	....	1	....	35,873	....
San Joaquin	153	....	....	....	....	....	....	....
Marin	....	....	....	....	....	....	....	....
Contra Costa	46	....	489	....	0	....	....	....
Alameda	5	....	11,179	....	6	....	7	....
San Francisco	....	....	....	....	....	....	....	....
San Mateo	14	....	898	....	0	....	3	....
Santa Clara	7	....	28,880	....	11	....	114	....
Santa Cruz	....	....	....	....	....	....	....	....
Monterey	332	....	462,643	....	39	....	65,935	....
San Luis Obispo	154		717,190	....	13	....	6,433	....
Santa Barbara	677	27	2,521,649	1,203,743	10	122	36,873	10,340
Ventura	1,855	32	8,322,478	301,591	12	26	91,416	6,228
Los Angeles	2,586	835	15,700,887	12,488,554	18	41	304,890	111,269
Orange	1,150	160	3,084,371	2,978,471	7	51	22	47
San Deigo	....	....	....	....	....	....	....	....
Total	7,339	1,054	30,894,868	16,972,359	117	240	541,566	127,884

Table 4-7 gives the value of offshore oil production in California in 2001 dollars. The value of all offshore oil production in California was estimated at $1.4 billion in 2001, and state offshore oil production were valued at approximately $474 million.

Table 4-7: Value of Offshore Oil Production in 2001[23]

County	Oil & Condensate Production	Offshore Oil & Condensate Production(bbl)	% of Offshore Production	Price of Oil ($/bbl)	Gross Value of Offshore Oil ($)
Santa Barbara	3,725,392	1,203,743	32.31	$28	$33,620,542
Ventura	8,624,069	301,591	3.50	$28	$8,423,437
Los Angeles	28,189,441	12,488,554	44.30	$28	$348,805,313
Orange	6,062,842	2,978,471	49.13	$28	$83,188,695
All Coastal Counties	**46,601,744**	**16,972,359**	**36.42**	**$28**	**$474,037,987**
Federal		**33,190,678**		**$28**	**$927,015,637**
Total		**50,163,037**		**$28**	**$1,401,053,623**

[23] In order to estimate the value of offshore crude oil production, the average price of crude oil was estimated using Cushing, OKWTI spot price FOB($/bbl) from the Department of Energy.
Source: http://www.eia.doe.gov/oil_gas/petroleum/info_glance/prices.html

4.2 Offshore Natural Gas Production in California

Table 4-8 gives the physical production (in thousands of cubic feet, or Mcf) and value of offshore natural gas in California in 2001. The value of natural gas was estimated to be $277 million in 2001 dollars, while federal offshore natural gas production accounted for approximately 88 percent of total offshore gas production. Offshore natural gas production is relatively small in coastal counties.

Table 4-8: Offshore Natural Gas Production - 2001

County	Net Natural Gas (Mcf)		Total Natural Gas (Mcf)	% Offshore Production	Aver Price ($)/MCF	Total Value of Production ($)
	Onshore	Offshore				
Santa Barbara	... ...	... ...	... ...	... ...	6.4	$0
Ventura	8,839,190	203,790	9,042,980	2.3	6.4	$1,304,256
Los Angeles	0	3,384,455	3,384,455	100.0	6.4	$21,660,512
Orange	1,402,301	1,436,749	2,839,050	50.6	6.4	$9,195,194
All Coastal Counties		5,024,994				$32,159,962
Federal		38,310,447			6.4	$245,186,861
Total		43,335,441				$277,346,822

Source: Average gas price: http://www.eia.doe.gov/emeu/states/ngprices/ngprices_ca.html, in $per thousand cubic feet.

4.3 Estimate of the Economic Contribution of Ocean Minerals

Moller and Fitz (1994) used SIC codes 131, 132, 138 and 291 to estimate the total income and employment effect of the offshore oil and gas industry in the state. These SIC codes do not classify the industry in terms of onshore and offshore, but rather provide data for the industry including both. However, the authors of that study adjusted the SIC data taking into account that offshore production was just one part of these totals. They addressed this issue by multiplying total employment as reported in these SIC codes by the share of offshore oil production in total production. They multiplied the total employment in each region by the percentage of offshore oil production in total production in that region.

In this study the Quarterly Census of Employment and Wages of the US Department of Labor's Bureau of Labor Statistics was used, which is derived from the ES-202 unemployment insurance data series, supplied by the California Employment Development Department. This method uses both SIC codes and geography to measure the income and employment effects of the offshore oil and gas industry. Geography included the four counties where offshore minerals are produced, those areas onshore where oil is retrieved from under the ocean floor laterally, and those sites where oil and gas company offices are located. However, while this method allows more refined estimates for production, it does not separate offshore from onshore sources for refining. Thus, the following industry estimates do not include the petroleum refining industry in California, because there was no legitimate or accurate way to estimate offshore oil and gas inputs or even in-state and out-of-state oil refining. Hence, the industry totals with multipliers are underestimates.

In addition, detailed data on the offshore Oil and Gas, and offshore Sand and Gravel industries is not available, because federal rules dictate suppression of data when activities are concentrated in less than three companies per measured geographic unit. Hence we have consolidated the two into offshore minerals to provide our estimates.

Table 4-9: Employment, Wages and GSP of Ocean Mineral Industries - 2000[24]

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	D	D	D	D
North Central	382	764	1,146	3.0
Central	D	D	D	D
South Central	382	764	1,147	3.0
South	228	478	706	3.1
Total	**992**	**2,007**	**2,999**	**3.2**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	D	D	D	D
North Central	$20,484,304	$14,339,013	$34,823,317	1.7
Central	D	D	D	D
South Central	$30,512,821	$21,358,975	$51,871,796	1.7
South	$15,512,982	$10,859,087	$26,372,069	1.7
Total	**$66,510,107**	**$46,557,075**	**$113,067,182**	**1.7**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	D	D	D	D
North Central	$109,163,335	$76,414,334	$185,577,669	1.7
Central	D	D	D	D
South Central	$197,124,933	$137,987,453	$335,112,386	1.7
South	$106,385,984	$74,470,188	$180,856,172	1.7
Total	**$412,674,251**	**$288,871,976**	**$701,546,227**	**1.7**

While the Oil and Gas industry forms a relatively small part of the California Ocean Economy in terms of employment, its contribution in terms of wages and GSP was substantial, contributing approximately $66 million in direct wages ($113 million with multipliers) and $412 million in direct GSP ($701 million with multipliers) to California's economy in 2000.[25] However the number of jobs declined by an estimated 34.5% during the 1990-2000 period, and total wages declined by an estimated 19.5%. GSP, on the other hand, increased by approximately 30.9% in constant 2000 dollars, possibly due to the increase in the price of oil and gas. Although California experienced a total decline in employment for this sector, the South Central region employment grew.[26]

---

[24] The industries in the oil and gas industry do not include petroleum refining, as was done in the 1994 CRB report. The refining industry was excluded for lack of key data. The offshore/coastal component of oil refined in California comprises only a portion of the oil refined in California. Onshore production from California, Alaskan oil, and foreign oil also is refined. The precise mix of offshore/coastal supply to the refining industry is not known, and can vary substantially over time.

[25] Because refining is not included in these estimates, the estimates are low.

[26] See footnote 20, chapter 2 of this report

4.4 References

2001 Annual Report of the State Oil and Gas Supervisor, California Department of Conservation, Division of Oil, Gas, and Geothermal Resources.

Department of Energy. Available at <http://www.eia.doe.gov/oil_gas/petroleum/info_glance/prices.html>.

US Department of Labor, Bureau of Labor Statistics. "Quarterly Census of Employment and Wages.

Chapter 5 California Marine Transportation

Table 5-1: Summary of Direct Values for Marine Transportation 2000

Industry	Employment	Wages	GSP
Deep Sea Freight	3,521	$305,661,201	$503,856,683
Marine Passenger Transportation	2,449	$68,840,957	$113,478,506
Marine Transportation Services	17,251	$1,082,763,879	$1,784,844,839
Petroleum and Natural Gas Pipelines	21	$1,270,234	$3,865,805
Search and Navigation Equipment	48,116	$3,580,391,768	$4,788,474,162
Warehousing	2,928	$82,468,470	$192,319,634
Total	**74,289**	**$5,121,396,509**	**$7,386,839,629**

Source: BLS/IMPLAN

Table 5-2: Summary of Marine Transportation with Multipliers - 2000

Indicator	Direct	Indirect & Induced	Total	Multiplier
Employment	74,289	160,986	235,275	3.2
Wages	$5,121,396,509	$7,322,744,342	$12,444,140,851	2.4
GSP	$7,386,839,629	$10,566,697,930	$17,953,537,559	2.4

Table 5-3: Direct Changes in California Marine Transportation 1990-2000

	Employment		Wages		GSP	
Industry	1990	Change in 2000	1990 (millions)	Change in 2000 (millions)	1990 (millions)	Change in 2000 (millions)
Deep Sea Freight	5,421	-1,900	$418.56	-$112.89	$686.69	-$182.84
Marine Passenger Transportation	1,429	1,020	$42.57	$26.27	$69.85	$43.63
Marine Transportation Services	12,549	4,702	$766.89	$315.87	$1,258.18	$526.66
Petroleum and Natural Gas Pipelines	D	D	---	---	D	---
Search and Navigation Equipment	97,604	-49,488	$5,696.33	-$2,115.94	$6,962.74	-$2,174.27
Warehousing	D	D	---	---	D	---
Total	**118,975**	**-44,686**	**$6,988.20**	**-$1,866.80**	**$9,105.66**	**-$1,718.82**

D = Disclosure, 1990 values not available

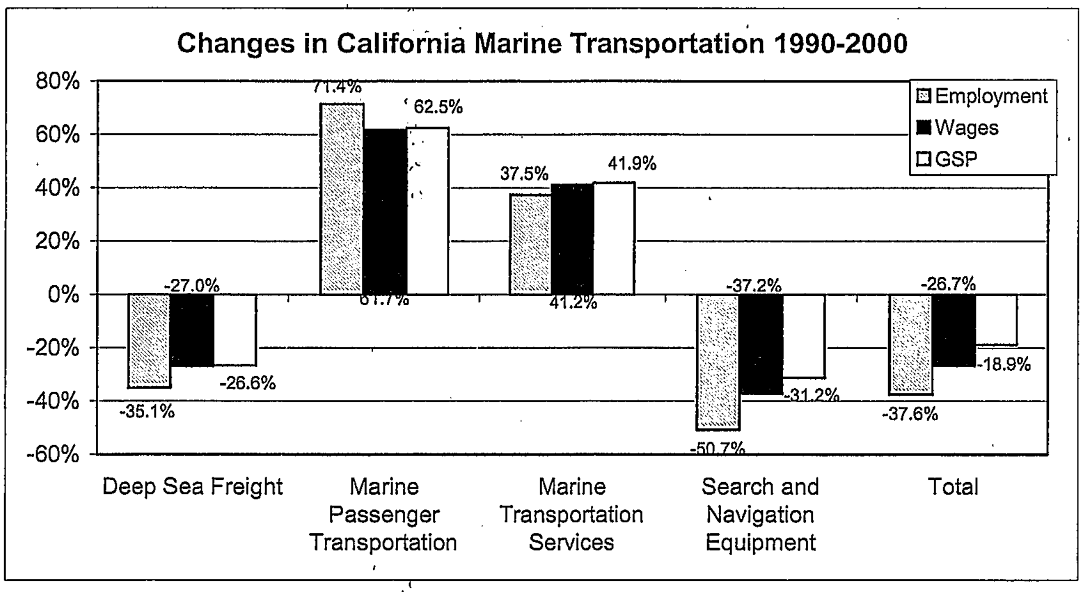


Figure 5-1: Changes in California Marine Transportation 1990-2000

5.1 Marine Transportation

California is the largest single gateway services state in the US. In 2000, the value of trade through the Los Angeles, Long Beach, and Oakland Customs Districts was $392 billion. Ideally situated in the global trading network, waterborne commerce through California's ports accounted for 40% of the national total in 2000. [27]

Located on the central West Coast of North America, California ports provide direct access to the entire continent and Asia. In the state, there are 20 ports, including seven major commercial seaports covering 98 percent of the state's total waterborne cargo value in 2000. They are: Los Angeles, Long Beach, Oakland, Richmond, Port Hueneme, San Diego, and San Francisco. Among them, Los Angeles, Long Beach, and Oakland were three of the four largest container ports in the country in terms of cargo volume in 2000.

5.1.1 Overview of Activities

California's seaports and the cargo handled are of great economic significance. They support industrial, retail and agricultural sectors throughout the nation.

The following two figures present the composition of waterborne tonnages for major California ports in 2001 and 2000. In 2001, the eight major ports carried approximately 161.7 million tons of cargo, of which 36 million metric tons were domestic, and 125.7 million tons were foreign.(see figure 5-3.) In 2000, 36.3 million tons of domestic and 124.9

[27] US Army Corps of Engineers, Waterborne Commerce Statistics Center, State to State and Region to Region Commodity Tonnage, Public Domain database, available at http://www.Usacoe.amry.mil. As of Oct.30, 2001.

million tons of foreign cargo went through nine major ports in California. In both years, about 90% of the foreign cargos were imports, and only 10% were exports.

After Long Beach and Los Angeles, in 2000, Richmond was the third largest port in California in terms of cargo volume and about half of that volume was domestic in 2000. In comparison, more than half of the cargo volume through Long Beach and Los Angeles was imports, while more than half of the volume through the Port of Oakland was exports.

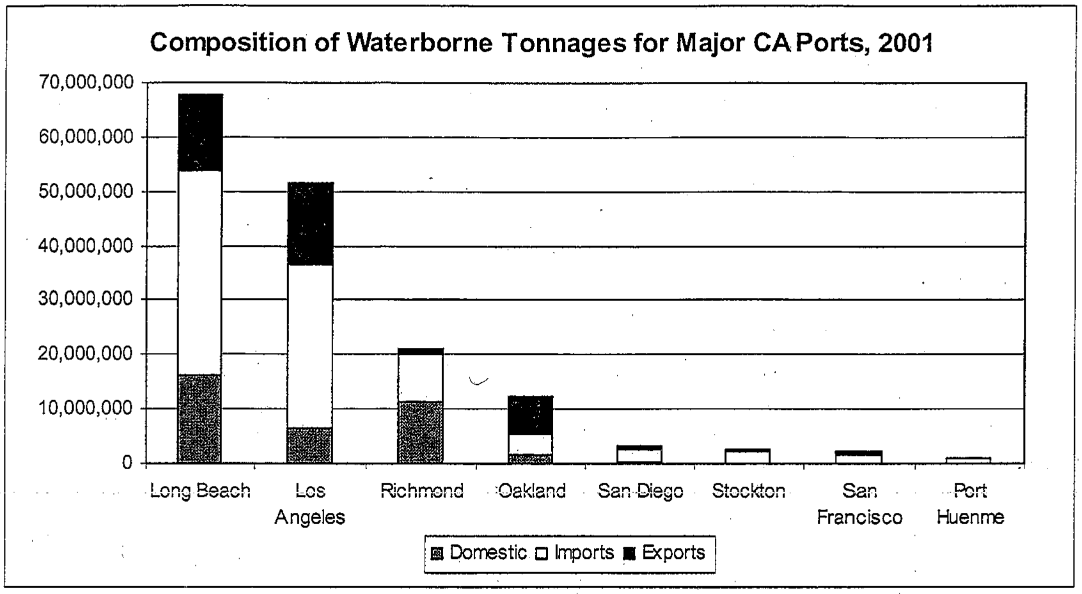


Figure 5-2: 2001 Major California Ports, Composition of Tonnage
Source: US Army Corps of Engineers

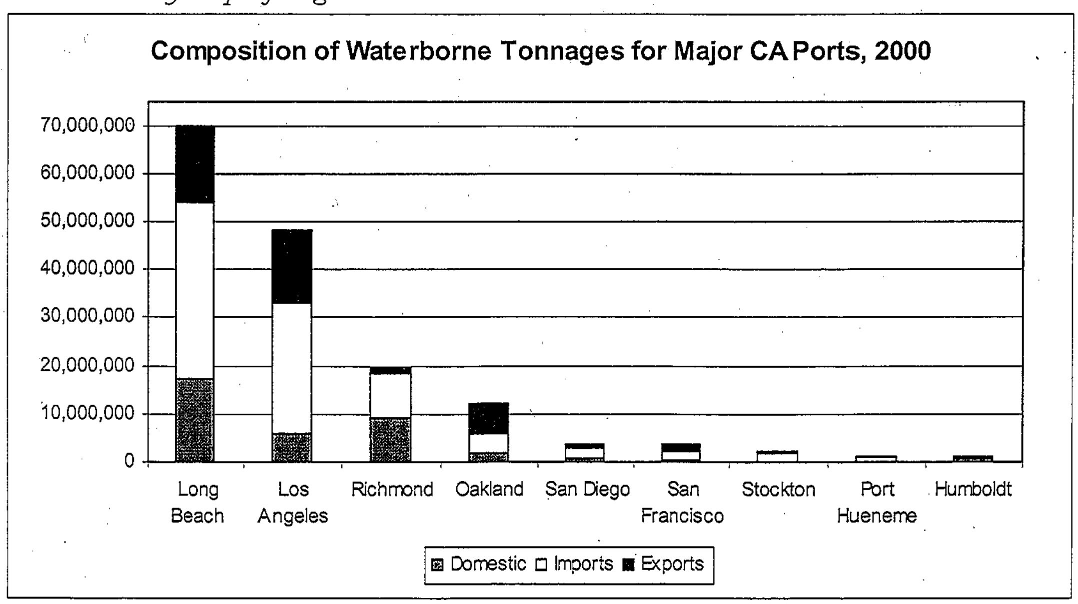


Figure 5-3: 2000 Major California Ports, Composition of Tonnage
Source: US Army Corps of Engineers

In recent years, California ports have become more and more significant as service providers to promote international commerce. Figure 5-4 shows the composition of waterborne tonnage for combined California ports from 1997 to 2001. The total volume of cargo through all ports grew 8.5% from 1997 to 2001. The most significant growth occurred from 1999-2000. with a 7.7% increase. From 1997 to 2001, total imports increased 85.8%.

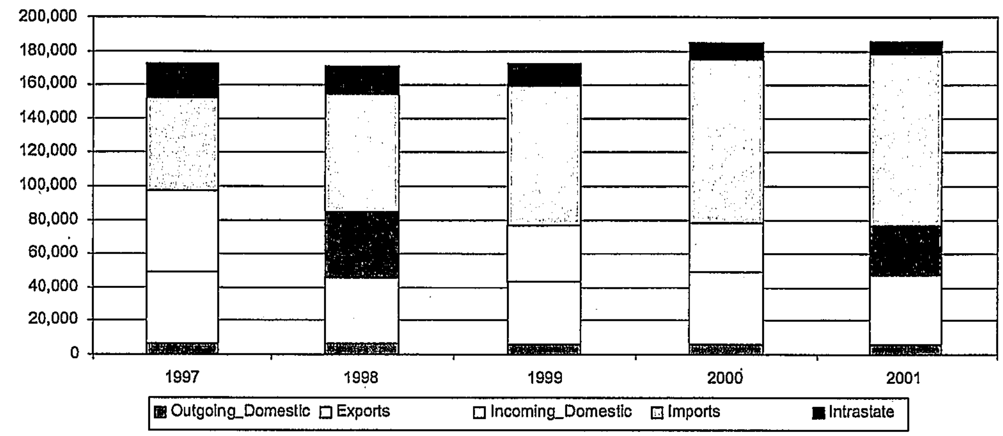


Figure 5-4: 1997-2001 Combined California Ports, Composition of Tonnage
Source: US Army Corps of Engineers

Figure 5-5 presents the composition of waterborne tonnage for combined Long Beach and Los Angeles Ports from 1997 to 2001. The Ports of Los Angeles and Long Beach, the two most active container ports in the nation. Combined, they represented the third largest container port in the world, only after Hong Kong and Singapore. In 2000, more than one third of all US waterborne containers moved through the Los Angeles and Long Beach ports. Approximately two millions jobs nationwide were linked to the activities of the Ports of Los Angeles and Long Beach at that time.

According to the California Marine and Inter-modal Transportation System Advisory Council, containerized cargo through the Ports of Los Angeles and Long Beach is expected to grow three times its current size between 2001 and 2020. The economic benefits of trade through the ports will be accompanied by major challenges of congestion and growth management. [28]

[28] For additional information on expected growth for California ports, see Jon Haveman, *California Seaports, California Global Gateways: Trends and Issues.*

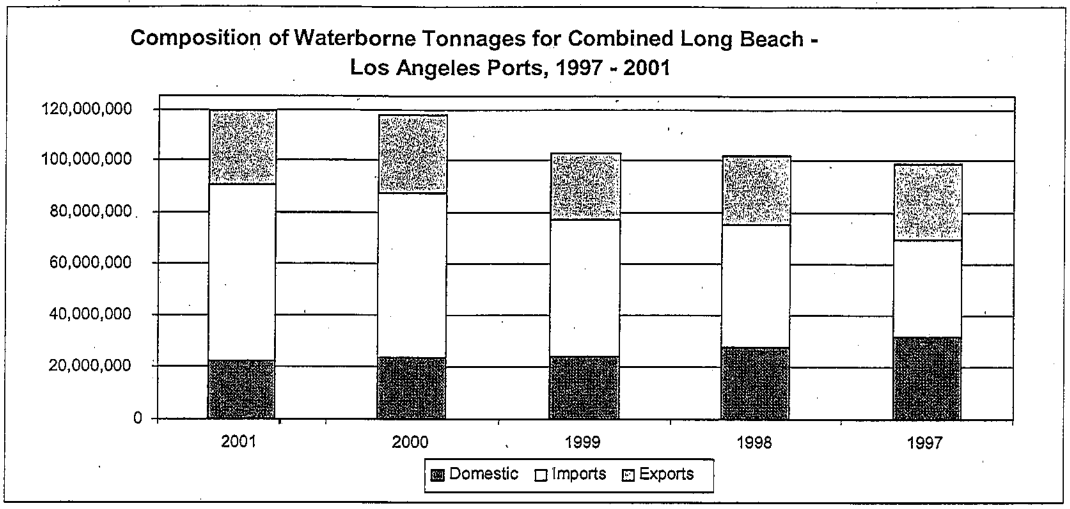


Figure 5-5: 1997-2001 Long Beach – Los Angeles Ports, Composition of Tonnage
Source: US Army Corps of Engineers

5.1.2 Composition of Cargo for all California Ports by Commodity

The highest-value cargo through California ports includes a large portion of the nation's imported consumer goods. By value, California is the nation's largest freight destination. By tonnage, it is the second highest in freight movements.

The following two graphs show the waterborne tonnage from and to major California ports by types of commodity respectively. In 2000, approximately 59.7 million tons of shipments originated from California ports. Petroleum exceeds all other commodities by tonnage. Food products exports are the second largest commodity by weight.[29] California appears to import more than double what it exports in petroleum. About 136.9 million tons of cargo entered California through its ports in 2000. The major cargoes were petroleum, manufactured goods, and petroleum products, which constituted about 70% of the total cargo volume.

[29] Of interest relative to the chapter on Offshore Minerals in this report,

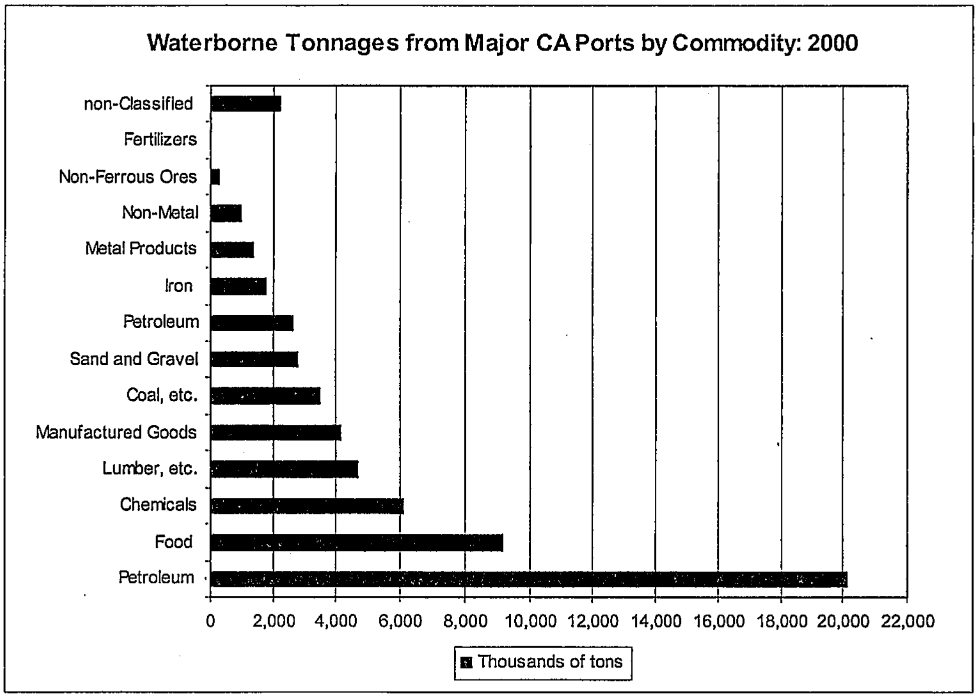


Figure 5-6: 2000 Major California Ports, Tonnage by Commodity
Source: US Army Corps of Engineers

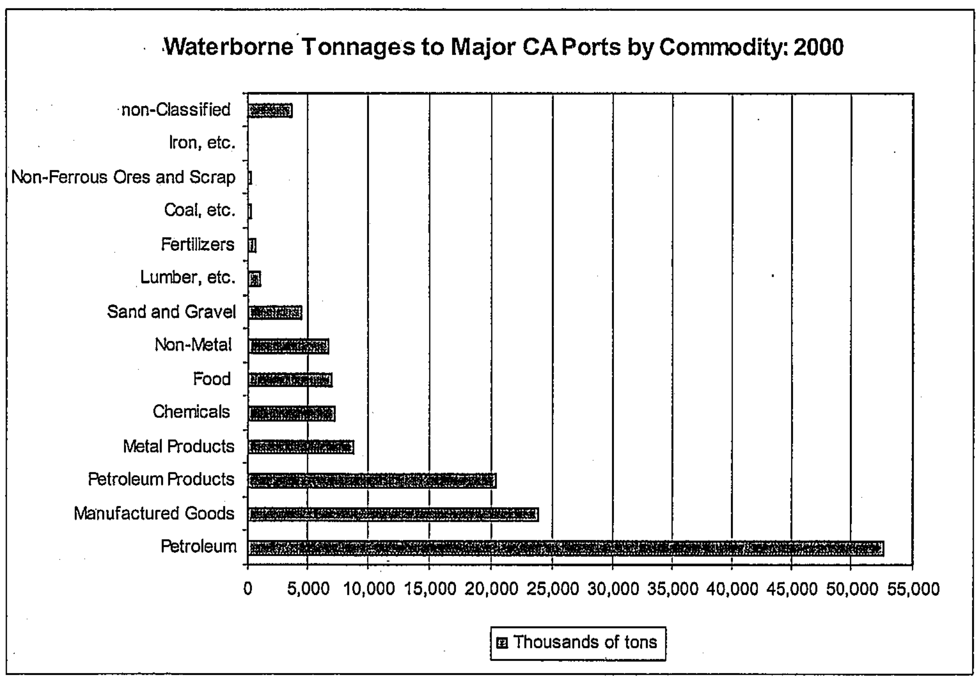


Figure 5-7: 2000 Combined California Ports, Tonnage by Commodity
Source for data on the above pages: US Army Corps of Engineers, Waterborne Commerce Statistics Center, State to State and Region to Region Commodity Tonnages, Public Domain database, available at http://www.iwr.usace.army.mil as of Oct. 30, 2001.

From 1992 to 2001, total value of imports and exports from major California ports increased by 74.6% and 17.3% respectively. In 2001, total imports were worth more than $195 billion, and total exports reached $44.6 billion. The Figure 5-8 shows the estimated value of imports and exports for major California ports from 1992 to 2001.

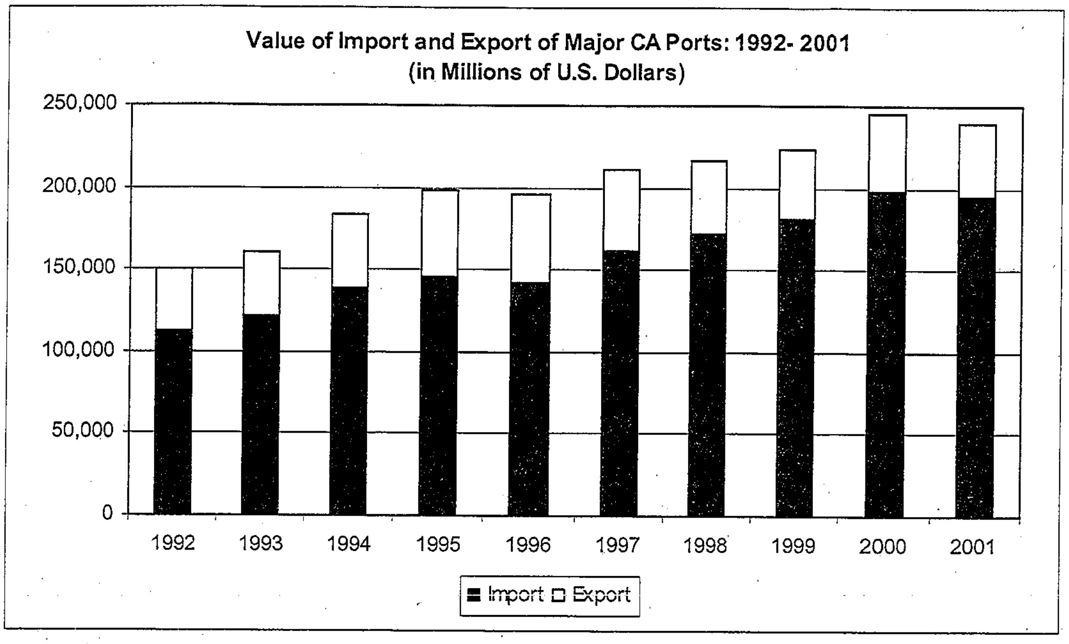


Figure 5-8: Major California Ports, 1992-2001 Values of Imports and Exports
Source: US Maritime Administration and US Army Corps of Engineers

From the Ports of Los Angeles and Long Beach, cargo is distributed to and from all other locations in the US and major ports all over the world, with an estimated cargo value of $200 billion in 2001. The estimated value of imports and exports of combined Los Angeles and Long Beach ports from 1992 to 2001 is shown in Figure 5-9.

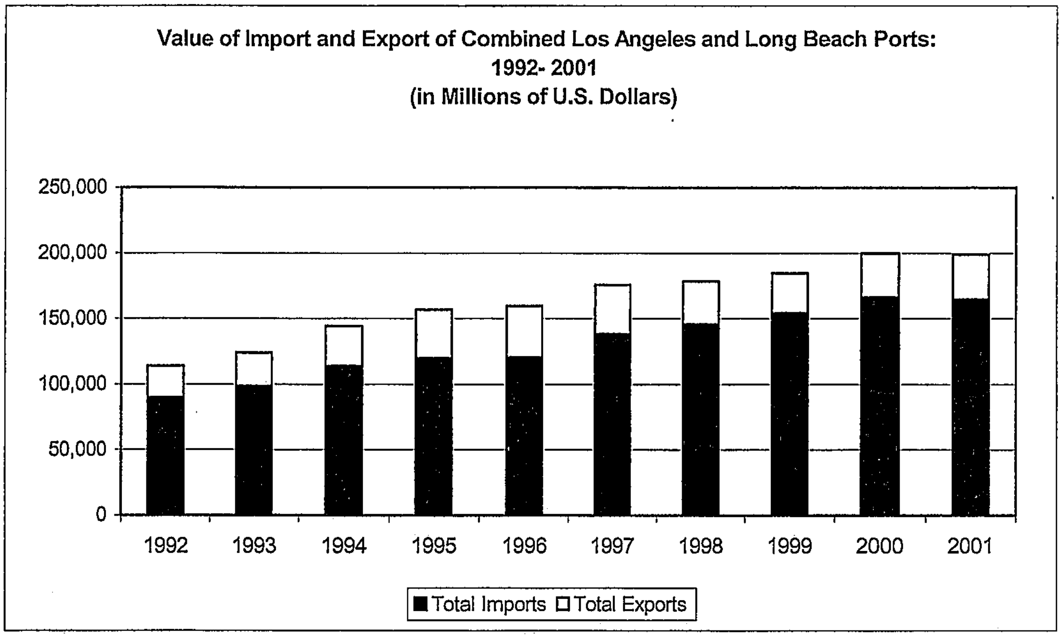


Figure 5-9: Los Angeles and Long Beach Ports, 1992-2001 Import and Export Values
Source: US Maritime Administration and US Army Corps of Engineers

5.1.3 Estimated Value of Imports and Exports for Major California Ports

Table 5-4 presents historical ranking of California ports by total, imports, and exports of cargo value for 2001. Besides Long Beach and Los Angeles, other ports have also experienced significant growth during the past decade. Situated in the center of the San Francisco area, the Port of Oakland is the primary deepwater port in Northern California and the gateway to the Silicon Valley, although much of the goods from Silicon Valley travels by air through Los Angeles and San Francisco Airports, making these airports among the two largest export terminals by value in the country.[30] Connected with high-capacity rail, freeway, and aviation services, the Port of Oakland is the hub of Northern California's transportation network and the center of trade across the coast to the Rocky Mountains. Oakland is the fourth busiest marine port in the US, and the cargo volume through it is expected to triple from 2001 to 2020.

[30] Review comment by H. Schatz

Table 5-4: Port Rankings 2001 by Total, Import and Export Cargo Value (in Millions of US dollars)

Ranking	Ports	Total	Ranking	Ports	Imports	Ranking	Ports	Exports
1	Los Angeles, CA	$104,193	1	Los Angeles, CA	$86,757	1	Los Angeles, CA	$17,436
2	Long Beach, CA	$94,699	2	Long Beach, CA	$77,984	2	Long Beach, CA	$16,716
3	Oakland, CA	$24,985	3	Oakland, CA	$17,245	3	Oakland, CA	$7,739
4	Port Hueneme, CA	$4,822	4	Port Hueneme, CA	$4,691	4	San Francisco, CA	$1,723
5	San Diego, CA	$4,257	5	San Diego, CA	$4,008	5	San Diego, CA	$249
6	San Francisco, CA	$3,044	6	El Segundo, CA	$1,458	6	Richmond, CA	$167
7	El Segundo, CA	$1,459	7	San Francisco, CA	$1,321	7	Port Hueneme	$132
8	Richmond, CA	$760	8	Carquinez Strait	$675	8	Martinez, CA	$118
9	Carquinez Strait, CA	$730	9	Richmond, CA	$593	9	Sacramento, CA	$89
10	Martinez, CA	$314	10	Martinez, CA	$196	10	Eureka, CA	$73
11	Stockton, CA	$173	11	Stockton, CA	$124	11	Carquinez Strait	$54
12	San Pablo Bay, CA	$151	12	San Pablo Bay, CA	$106	12	Stockton, CA	$49
13	Sacramento, CA	$115	13	San Joaquin River	$90	13	San Pablo Bay	$45
14	San Joaquin River	$106	14	Crockett, CA	$57	14	San Joaquin River	$15
15	Eureka, CA	$93	15	Suisan Bay, CA	$34	15	Redwood City	$15
16	Crockett, CA	$57	16	Selby, CA	$29	16	Suisan Bay, CA	$4
17	Suisan Bay, CA	$39	17	Sacramento, CA	$27			
18	Selby, CA	$29	18	Eureka, CA	$21			
19	Redwood City, CA	$24	19	Alameda, CA	$13			
20	Alameda, CA	$13	20	Redwood City, CA	$9			

Source: US Maritime Administration and US Army Corps of Engineers

Figure 5-10 presents the top ten California ports in terms of combined cargo value from 1992 to 2001.

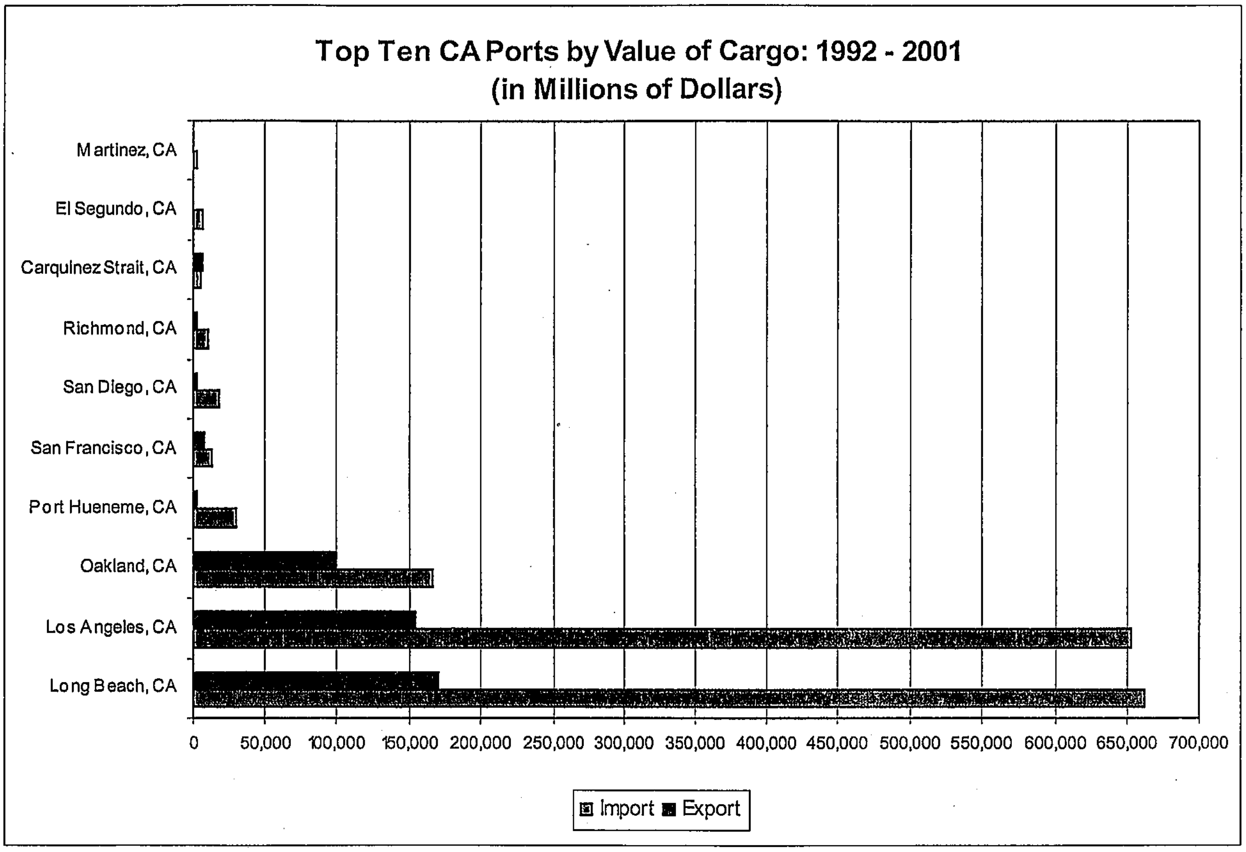


Figure 5-10: Top Ten California Ports by Cargo Value, 1992-2001
Source: US Maritime Administration and US Army Corps of Engineers

A004472

5.2 CA Water Transportation: Regional and State Employment and Income

Direct Economic Impact [31]
The following tables show 1990 and 2000 direct employment, wages and GSP for selected SIC codes of water transportation by region.

Table 5-5: Deep Sea Foreign Freight (SIC code 4412, 4424)

	1990				2000			
Region	Number of Establish-ments	Employ-ment	Wages (millions)	GSP (millions)	Number of Establish-ments	Employ-ment	Wages (millions)	GSP (millions)
North	D	D	D	D	D	D	D	D
North Central	24	3,243	$175.24	$287.50	25	1,747	$171.23	$282.25
Central	D	D	D	D	D	D	D	D
South Central	D	D	D	D	D	D	D	D
South	D	D	D	D	D	941	$61.43	101.3
Total	**24**	**3,343**	**$175.24**	**$287.50**	**25**	**2,688**	**$232.66**	**$383.52**

Source: BLS
Note: *For data disclosure reasons, numbers in cells with "D"s are not presented.*

Employment dropped almost 20% over the decade, yet wages and GSP increased 32.8% and 33.4%, respectively for Deep Sea Foreign Freight.

Table 5-6: Water Transportation for Passengers (SIC code 4481, 4482, and 4489)

	1990				2000			
Region	Number of Establish-ments	Employ-ment	Wages (millions)	GSP (millions)	Number of Establish-ments	Employ-ment	Wages (millions)	GSP (millions)
North	D	D	D	D	D	D	D	D
North Central	D	D	D	D	D	D	D	D
Central	D	D	D	D	D	D	D	D
South Central	D	D	D	D	D	D	D	D
South	D	D	D	D	36	1,394	$39.18	$64.59
Total	**36**	**1,310**	**$30.45**	**$49.96**	**36**	**1,394**	**$39.18**	**$64.59**

Source: BLS

For Water Transportation for Passengers, wages increased 28.7% and GSP increased 29.3%.

[31] The estimated totals found in this section on regional economies differ from the summary totals at the beginning of the chapter due to the suppressions of data at this level that do not get included in the totals. The state summary totals at the beginning of the chapter include all relevant data because suppressions are not an issue at that level of aggregate.

Table 5-7: Marine Transportation Services (SIC code 4491, 4492, and 4499)

Region	1990 Number of Establish-ments	1990 Employ ment	1990 Wages (millions)	1990 GSP (millions)	2000 Number of Establish-ments	2000 Employ ment	2000 Wages (millions)	2000 GSP (millions)
North	D	D	D	D	16	38	$1.85	$3.06
North Central	79	4,130	$183.95	$301.79	89	3,557	$224.97	$370.85
Central	D	D	D	D	4	25	$.85	$1.40
South Central	17	496	$11.62	$19.07	25	646	$24.81	$40.90
South	139	7,027	$361.98	$593.86	128	12,539	$809.69	$1,334.71
Total	**235**	**11,653**	**$557.55**	**$914.72**	**262**	**16,804**	**$1,062.18**	**$1,750.91**

Source: BLS

For Marine Transportation Services all estimated values increased significantly.

Table 5-8: Search and Navigation Equipment (SIC code 3812)[32]

Region	1990 Number of Establish-ments	1990 Employ ment	1990 Wages (millions)	1990 GSP (millions)	2000 Number of Establish-ments	2000 Employ ment	2000 Wages (millions)	2000 GSP (millions)
North	D	D	D	D	D	D	D	D
North Central	D	D	D	D	15	951	$47.31	$63.28
Central	D	D	D	D	5	41	$2.62	$3.51
South Central	17	3,110	$129.84	$158.71	21	1,612	$90.99	$4,121.68
South	89	82,267	$3,651.64	$4,463.47	173	38,835	$2,921.57	$43,907.36
Total	**106**	**85,377**	**$3,781.48**	**$4,622.18**	**214**	**41,440**	**$3,062.49**	**$4,095.83**

Source: BLS
Note: For data disclosure reasons, numbers in cells with "D"s are not presented.

Search and Navigation Equipment fell in all categories, probably as a result of the large decline in the Ship Building sector.

32 The search and navigation equipment industry produces primarily electronic equipment such as radar, sonar, geographic positioning systems, etc. These products all have applications in marine transportation (and increasingly in recreational boating) but also in aviation. No information exists to separate the applications to which the products of this industry may be put. All of the output is counted in marine transportation, which probably overstates the actual marine component of the output.

Table 5-9: Warehousing (SIC code 4222 and 4225)

Region	1990 Number of Establish-ments	1990 Employ ment	1990 Wages (millions)	1990 GSP (millions)	2000 Number of Establish-ments	2000 Employ ment	2000 Wages (millions)	2000 GSP (millions)
North	6	22	$.30	$.54	12	32	$.41	$.94
North Central	76	795	$16.08	$28.79	152	1,940	$56.61	$132.02
Central	D	D	D	D	D	245	$6.14	$20.35
South Central	14	131	$2.27	$4.06	D	227	$7.00	$16.31
South	45	449	$10.32	$18.48	D	D	D	D
Total	**141**	**1,397**	**$28.97**	**$51.87**	**164**	**2,444**	**$70.15**	**$169.62**

Source: BLS
Note: For data disclosure reasons, numbers in cells with "D"s are not presented.

The Warehousing industry grew significantly in every category of measurement during the decade, reflecting the large increase in trade volume.

5.2.1 Regional and State Indirect Employment and Income from IMPLAN Model[33]

The above data show the results of economic activity directly related to the ocean, but this direct economic activity generates additional economic activity as employees spend their salaries and ocean-related firms purchase inputs from other California firms. These indirect and induced, or multiplier effects, must also be accounted for. Estimates of these effects are shown in the following Tables[34].

[33] These estimates do not include the values that are suppressed, so they are underestimates and don't match the state summary totals at the beginning of the chapter.
[34] The estimates were derived by a detailed analysis of the Ocean Economy industries in each of the coastal regions using IMPLAN, a standard and widely used economic impact model

The following tables show direct and indirect income, employment and GSP effects by region, derived from the deep-sea freight, marine passenger transportation, marine transportation services, search and navigation equipment, and warehousing industries.

Table 5-10: Deep Sea Freight

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	D	D	D	D
North Central	1,747	3,302	5049	2.9
Central	D	D	D	D
South Central	D	D	D	D
South	941	1,779	2720	2.9
Total	**2,688**	**5,081**	**7,769**	**3.2**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	D	D	D	D
North Central	$171,225,591	$226,017,780	$397,243,371	2.3
Central	D	D	D	D
South Central	D	D	D	D
South	$61,434,989	$88,466,384	$149,901,373	2.4
Total	**$232,660,580**	**$314,484,164**	**$547,144,744**	**2.8**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	D	D	D	D
North Central	$282,250,931	$373,969,445	$656,220,376	2.3
Central	D	D	D	D
South Central	D	D	D	D
South	$101,270,393	$145,829,365	$247,099,758	2.4
Total	**$383,521,324**	**$519,798,810**	**$903,320,134**	**2.8**

Note: For data disclosure reasons, numbers in cells with "D"s are not presented.

Table 5-11: Marine Passenger Transportation

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	D	D	D	D
North Central	D	D	D	D
Central	D	D	D	D
South Central	D	D	D	D
South	1394	3178	4572	3.3
Total	**1,394**	**3,178**	**4,572**	**3.3**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	D	D	D	D
North Central	D	D	D	D
Central	D	D	D	D
South Central	D	D	D	D
South	$39,181,979	$56,422,050	$95,604,029	2.4
Total	**$39,181,979**	**$56,422,050**	**$95,604,029**	**2.8**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	D	D	D	D
North Central	D	D	D	D
Central	D	D	D	D
South Central	D	D	D	D
South	$64,588,184	$93,266,191	$157,854,376	2.4
Total	**$64,588,184**	**$93,266,191**	**$157,854,376**	**2.4**

Table 5-12: Marine Transportation Services

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	38	51	89	2.3
North Central	3,557	6,723	10,280	2.9
Central	25	22	47	1.9
South Central	646	1,201	1,847	2.9
South	12,539	28,588	41,126	3.3
Total	**16,804**	**36,584**	**53,388**	**3.2**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	$1,853,537	$1,668,183	$3,521,720	1.9
North Central	$224,971,658	$296,962,589	$521,934,247	2.3
Central	$848,899	$993,212	$1,842,111	2.2
South Central	$24,808,763	$39,445,933	$64,254,696	2.6
South	$809,694,290	$1,165,959,778	$1,975,654,068	2.4
Total	**$1,062,177,147**	**$1,505,029,694**	**$2,567,206,841**	**2.8**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	$3,055,399	$2,753,939	$5,809,339	1.9
North Central	$370,846,784	$491,354,859	$862,201,643	2.3
Central	$1,399,338	$1,637,367	$3,036,706	2.2
South Central	$40,895,151	$65,108,710	$106,003,862	2.6
South	$1,334,712,676	$1,927,342,736	$3,262,055,412	2.4
Total	**$1,750,909,348**	**$2,488,197,611**	**$4,239,106,962**	**2.8**

Table 5-13: Search and Navigation Equipment

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	D	D	D	2.3
North Central	951	1,797	2,748	2.9
Central	41	37	78	1.9
South Central	1,612	2,994	4,607	2.9
South	38,835	88,637	127,472	3.3
Total	**41,440**	**91,168**	**132,607**	**3.2**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	D	D	D	D
North Central	$47,311,908	$62,451,719	$109,763,627	2.3
Central	$2,624,164	$3,070,272	$5,694,436	2.2
South Central	$90,983,119	$144,663,159	$235,646,278	2.6
South	$2,921,571,678	$4,207,063,216	$7,128,634,894	2.4
Total	**$3,062,490,869**	**$4,417,248,366**	**$7,479,739,235**	**2.8**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	D	D	D	D
North Central	$63,275,715	$83,837,400	$147,113,114	2.3
Central	$3,509,600	$4,106,586	$7,616,186	2.2
South Central	$121,682,303	$193,729,025	$315,411,328	2.6
South	$3,907,357,462	$5,642,275,792	$9,549,633,254	2.4
Total	**$4,095,825,080**	**$5,923,948,803**	**$10,019,773,882**	**2.8**

Table 5-14: Warehousing

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	32	42	73	2.3
North Central	1,940	3,664	5,604	2.9
Central	245	221	466	1.9
South Central	227	422	649	2.9
South	D	D	D	3.3
Total	**2,444**	**4,349**	**6,792**	**3.2**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	$405,138	$364,624	$769,762	1.9
North Central	$56,610,049	$74,725,265	$131,335,314	2.3
Central	$6,135,788	$7,178,872	$13,314,660	2.2
South Central	$6,995,772	$11,123,277	$18,119,049	2.6
South	D	D	D	2.4
Total	**$70,146,747**	**$93,392,038**	**$163,538,785**	**2.8**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	$944,797	$851,579	$1,796,377	1.9
North Central	$132,016,805	$174,916,168	$306,932,973	2.3
Central	$20,347,633	$20,347,633	$40,695,266	2.0
South Central	$16,314,409	$25,939,910	$42,254,319	2.6
South	D	D	D	D
Total	**$169,623,644**	**$222,055,291**	**$391,678,936**	**2.8**

Note.[35]

The total effect on California income from water transportation was estimated at $17,953,537,559 for 2000. These industries provided employment (direct and indirect) to approximately 235,275 workers with total wages of $12,444,140,851. (See summary Table 5-2 at the beginning of the chapter.)

[35] : The data source for table 5-10 through table 5-14 is BLS. For data disclosure reasons, numbers in cells with "D"s are not presented but are included in the state summaries in Table 5-1 and 5-2.

5.2 References

California Marine and Inter-modal Transportation System Advisory Council, 2001.

US Maritime Administration, Department of Transportation, and Army Corps of Engineers, Waterborne Commerce Statistics Center, State to State and Region to Region Commodity Tonnage, Public Domain database. Available at <http://www.Usacoe.amry.mil>.

Bureau of Labor Statistics, US Department of Labor.

NOEP

Chapter 6 California Marine Construction

Table 6-1: Sum Of 2000 Marine Construction With Multipliers

Indicator	Direct	Indirect & Induced	Total	Multiplier
Employment	2,833	2,662	5,495	1.9
Wages	$164,413,562	$162,336,362	$326,749,924	2.0
GSP	$309,081,043	$304,298,814	$613,379,857	2.0

Table 6-2: Changes in Marine Construction 1990-2000

Employment		Wages		GSP	
1990	Change in 2000	1990	Change in 2000	1990	Change in 2000
4,098	-1,265	$219,334,254	-$54,920,692	$414,250,590	-$105,169,547

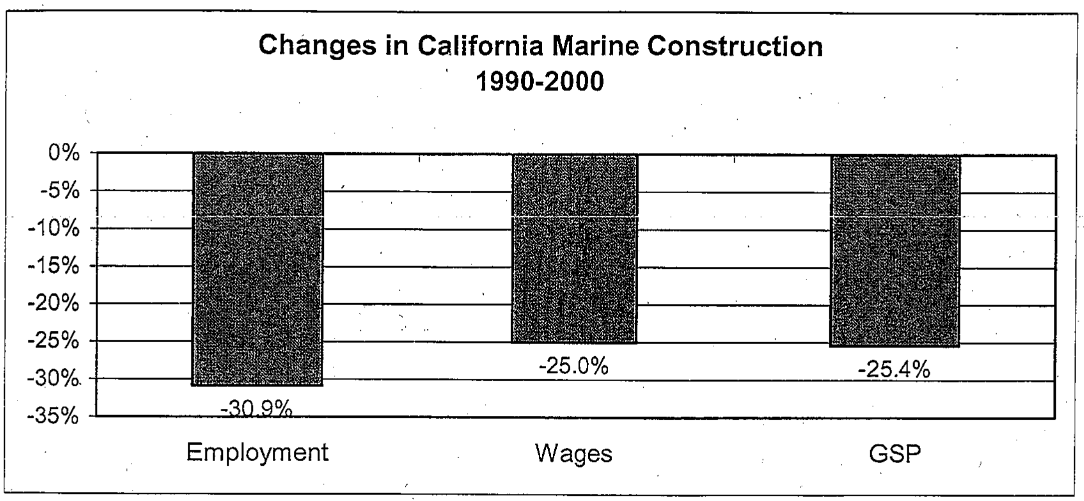


Figure 6-1: Changes in Marine Construction from 1990 to 2000

6.1 Marine Construction (maintenance, repair and restoration)

The category "marine construction" was created by the NOEP research team as one of its ocean sector categories. It was not derived from the standard government set of industry categories, and it was not included in the former California study. For purposes of the full national study, the NOEP will include a broad range of economic activities under this category. They include all of the marine construction categories found in the SIC and NAICs federal datasets such as port construction and dredging. [36] In its final version, it will also include beach nourishment, coastal armoring activities such as jetties and seawalls; environmental restoration and maintenance activities for wetlands and estuaries, and other large construction activities that relate to the shore and coastal ocean.

[36] Some sand and gravel mining activity is probably also reported under this category, since most of the companies that do that mining are dredging companies.

For purposes of this study we include only those categories found in the federal datasets for SIC and NAICs codes, primarily connected to port construction and maintenance. We have also included data from other sources to estimate the values associated with beach nourishment, a significant economic activity in California. Beach nourishment represents a large expenditure by federal, state, and local authorities, which could be interpreted to be a negative payment to compensate for the external costs of beach loss resulting from diversion of water from coastal watersheds or offshore mining of sand and gravel for example. Yet, beach nourishment expenditures also have a positive face. The provide jobs and revenue for local and state entities, in addition to stabilizing California's valuable beaches, which are themselves a source of much revenue to the state. In most instances the benefits derived from enhancing an eroding beach are far greater than the costs of the enhancement.

As for the other activities, which should be included here, but are not because of lack of reliable and consistent data, California has a number of important wetland and estuarine restoration projects underway, which contribute markedly to California's economy, both through market and non-market values.

The data on port developments and beach nourishment follow.

6.2 Port Development

Port development includes construction of new facilities, modernization of existing ones, and rehabilitation of old ones. According to the US Port Development Expenditure Report, from 1946 to 2001, a total of more than $23.6 billion were spent in capital improvements to port facilities and related infrastructure across the nation.

6.2.1 Historical Capital Expenditures for California Public Port Development

From 1946 to 2001, approximately $7.6 billion were invested in port construction in California (South Pacific region), which ranked first in the nation for individual expenditures.

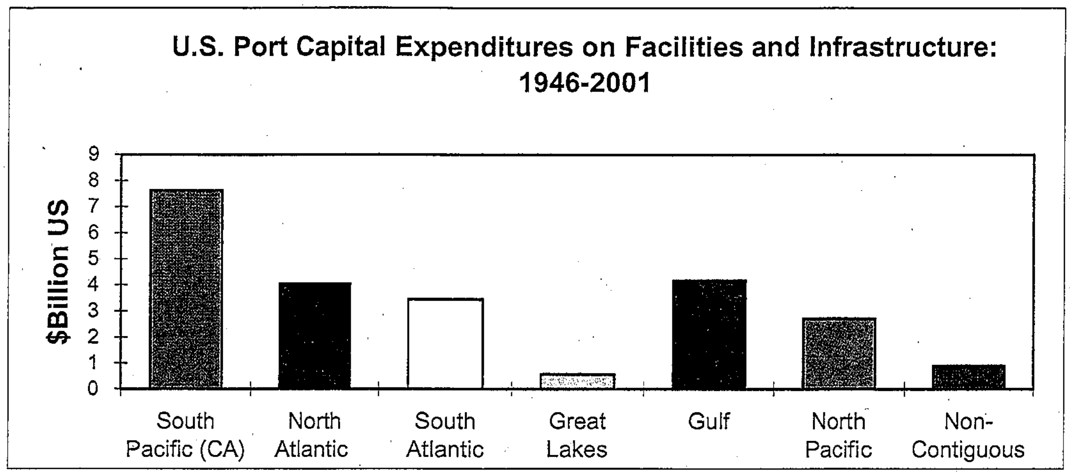
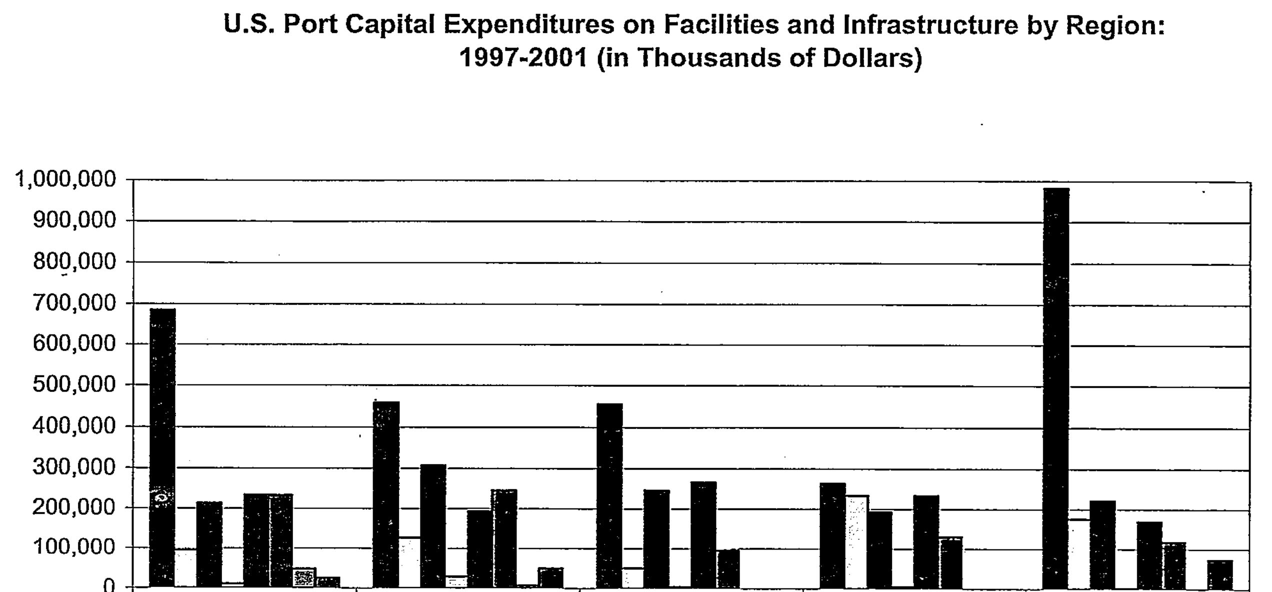


Figure 6-2: Port Development Expenditure Overview[37]
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

In 2001, California continued as the leading region spending $981.5 million on port development, which was 56.4% of all port expenditures across the nation. The following graph shows the actual port spending on facilities and infrastructure by region from 1997 to 2001.

[37] Regions: South Pacific in California; North Atlantic is Maine to Virginia; South Atlantic is from Virginia to the tip of Florida; Great Lakes are all those states bordering on a Great Lake, Gulf are states from the tip of Florida to Texas, N. Pacific is Oregon and Washington. The rest are self-explanatory.



	1997	1998	1999	2000	2001
South Pacific (CA)	$683,749	$457,309	$454,614	$263,030	$981,534
North Atlantic	$95,151	$126,486	$50,893	$233,186	$176,351
South Atlantic	$212,721	$306,620	$245,634	$192,567	$220,027
Great Lakes	$10,792	$28,871	$4,325	$5,046	$1,000
Gulf	$233,462	$193,101	$265,054	$233,160	$169,823
North Pacific	$231,937	$244,612	$95,160	$130,461	$117,967
Guam, Saipan	$49,113	$7,092	$0	$203	$0
AK, HI, PR, and VI	$25,529	$50,306	$0	$0	$73,468

Figure 6-3: Capital Expenditures for US Port Facilities and Infrastructure by Region
Source: US Port Development Expenditure Report <u>*http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf*</u>

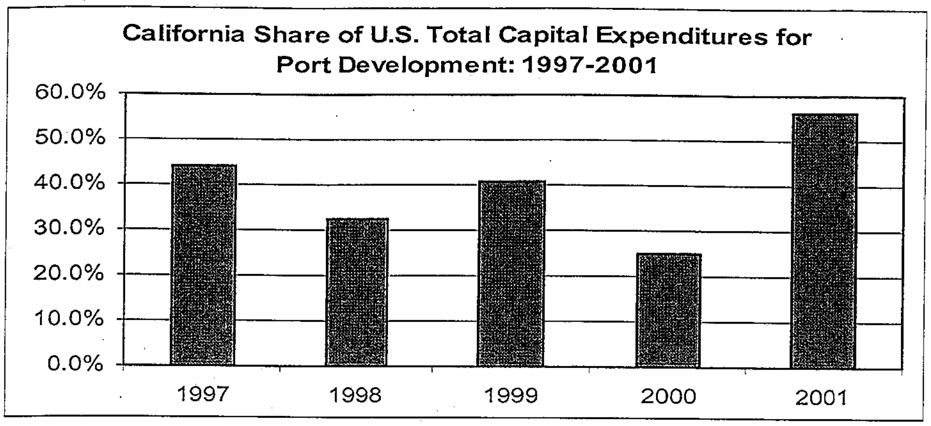


Figure 6-4: California' Share of Port Development Expenditures, 1997-2001
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

California has lead in total capital expenditure for port development across the nation. In 2001, the capital expenditure for the Port of Los Angeles alone reached $550 million. Besides Los Angeles, the Port of Long Beach and Port of Oakland invested an estimated $200 million each, which made the three California ports the three leading port authorities in terms of capital expenditure in 2001. Expansion of facilities to accommodate increasing trade with Asia, and advancing technologies to make ports more efficient have been primary drivers for these investments.

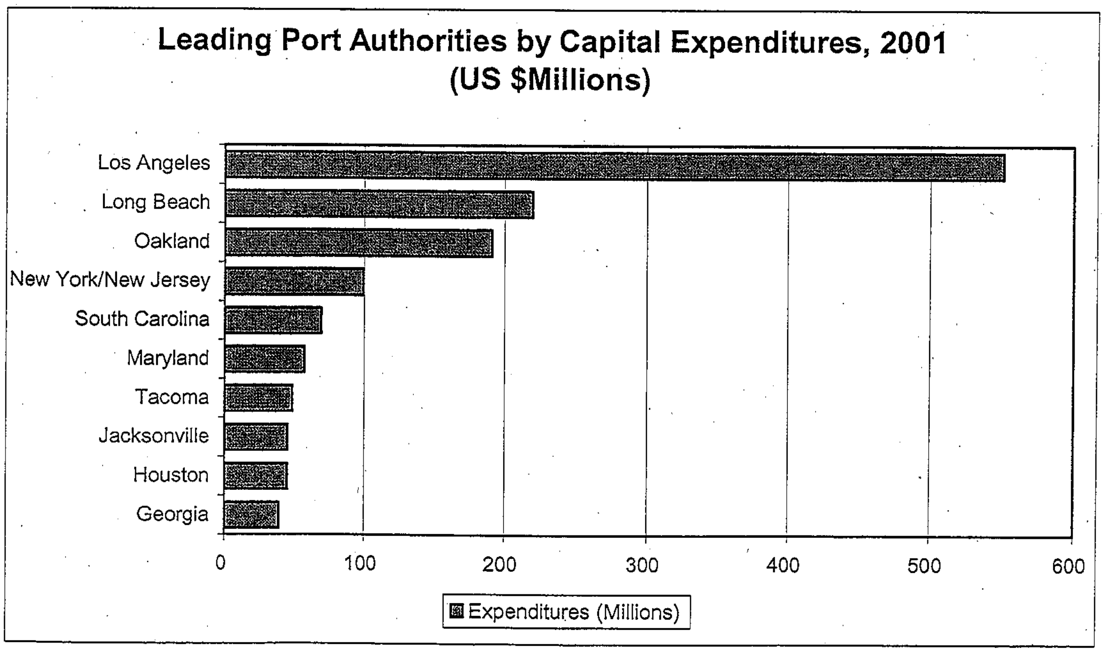


Figure 6-5: Leading US Port Authorities by Capital Expenditures, 2001
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

Expenditure by Facility Type

Figure 6-6 shows the capital expenditure by types of facilities. Specialized cargo handling (mostly for containers) is the leading expenditure category, and California accounted for nearly 80% of the total investment in this category. California represented one third of the expenditure in dry and liquid bulk. Investment on general cargo and passengers in California is not very significant.

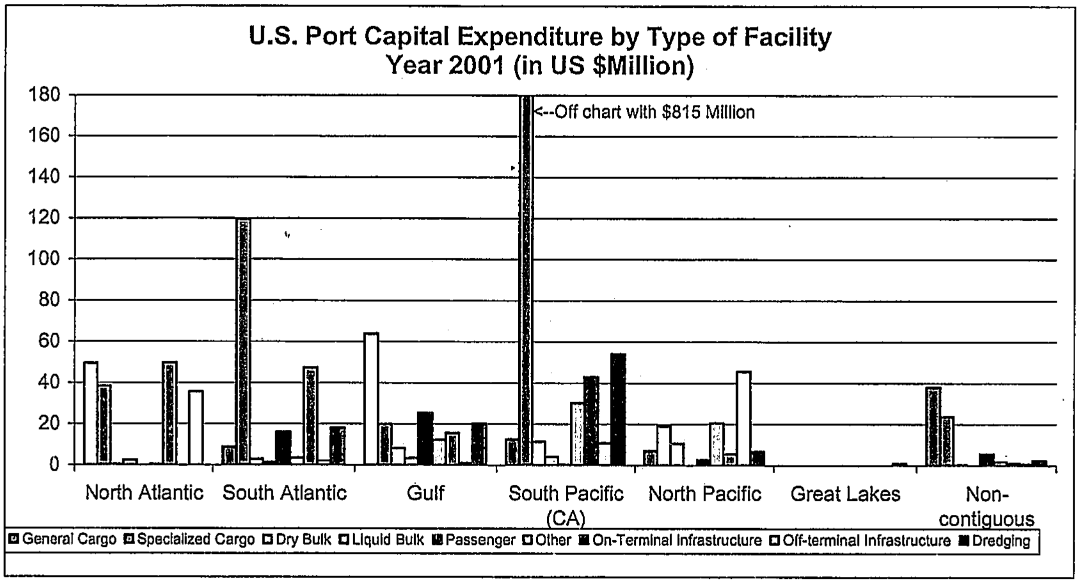


Figure 6-6: Expenditures on US Ports by Type of Facility, 2001
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

Figure 6-7 gives a more detailed picture of California's share of total port development expenditure by facility type in 2001. More than 55% of total port investment by all US ports was spent on California ports in 2001. California expenditures on specialized cargo, dredging, and other facilities such as administrative and maintenance buildings, as well as dry and liquid bulk facilities, represented over 30% of the total spent by US ports.

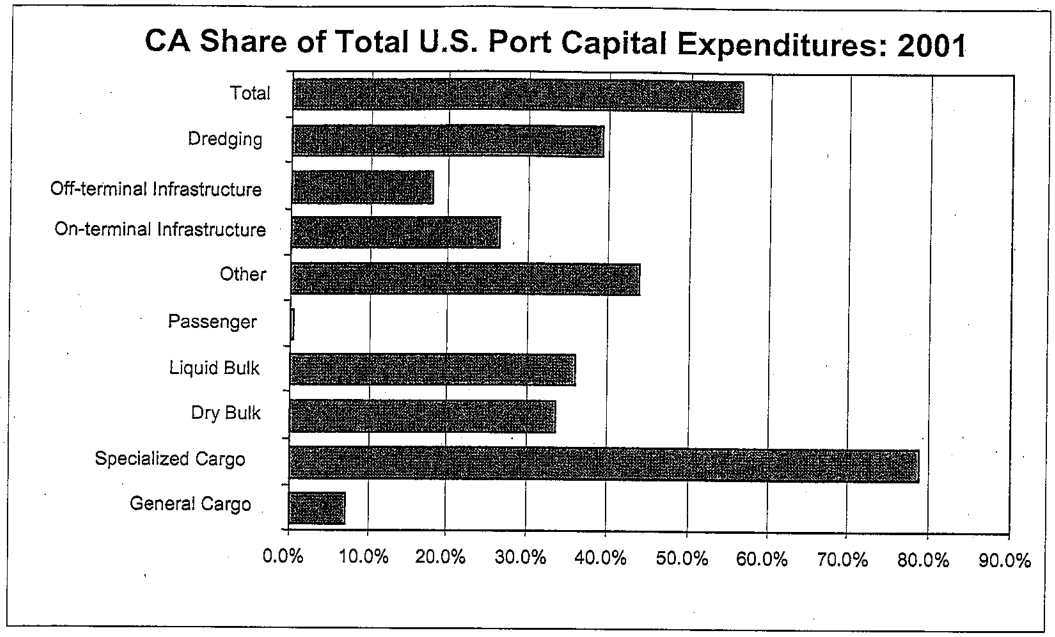


Figure 6-7: California's Share of US Expenditures on Ports, 2001
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

Expenditure by Construction Type[38]

The following three graphs, Figures 6-8, 6-9, and 6-10, show details of capital expenditure on new construction and modernization/rehabilitation by facility type in 2001, as well as California's portion of total expenditure by all US ports by construction type.

Nearly 60% of the nation's ports' spending on new construction was on California ports in 2001, an estimated $586.8 million. Of this California expenditure, $541.9 million was spent on specialized cargo. In addition, California ports invested in more than 45% of the dredging activities across the nation that year.

For modernization and rehabilitation expenditures, California led the total with $203.3 million (39.7%) in 2001. The investments on specialized cargo and other facilities stand out as the most significant.

[38] In most cases, investment decisions for construction and expansion of port facilities are made by individual ports and their governing boards. While large amounts of federal monies are made available to port authorities, much of their construction money is raised through bonds, revenues and other mechanisms. Most ports operate as separate private or private-public entities.

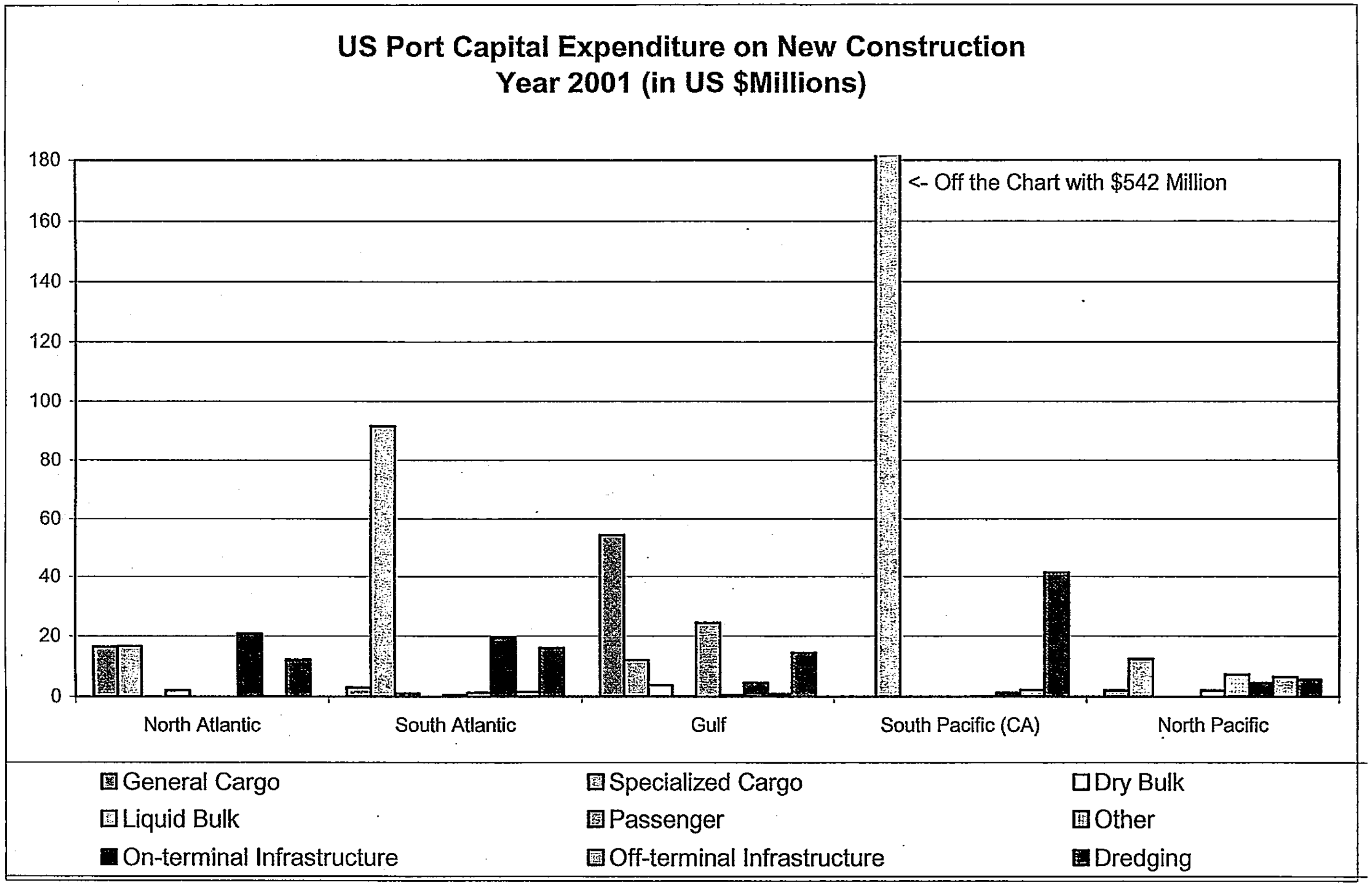


Figure 6-8: US Expenditures on New Port Construction, 2001
Source: US Port Development Expenditure Report

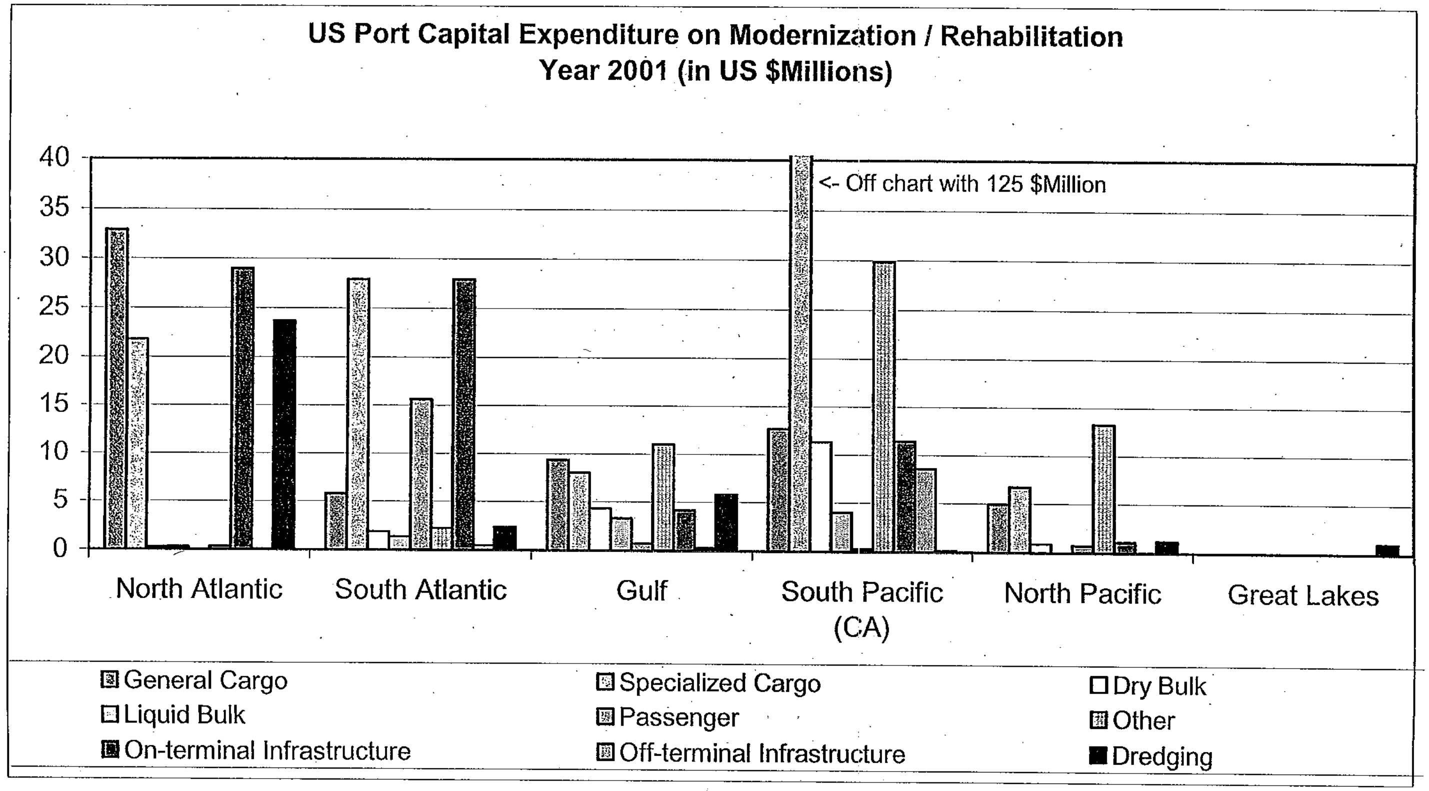


Figure 6-9: US Expenditures on Port Modernization and Rehabilitation, 2001

Source: US Port Development Expenditure Report *http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf*

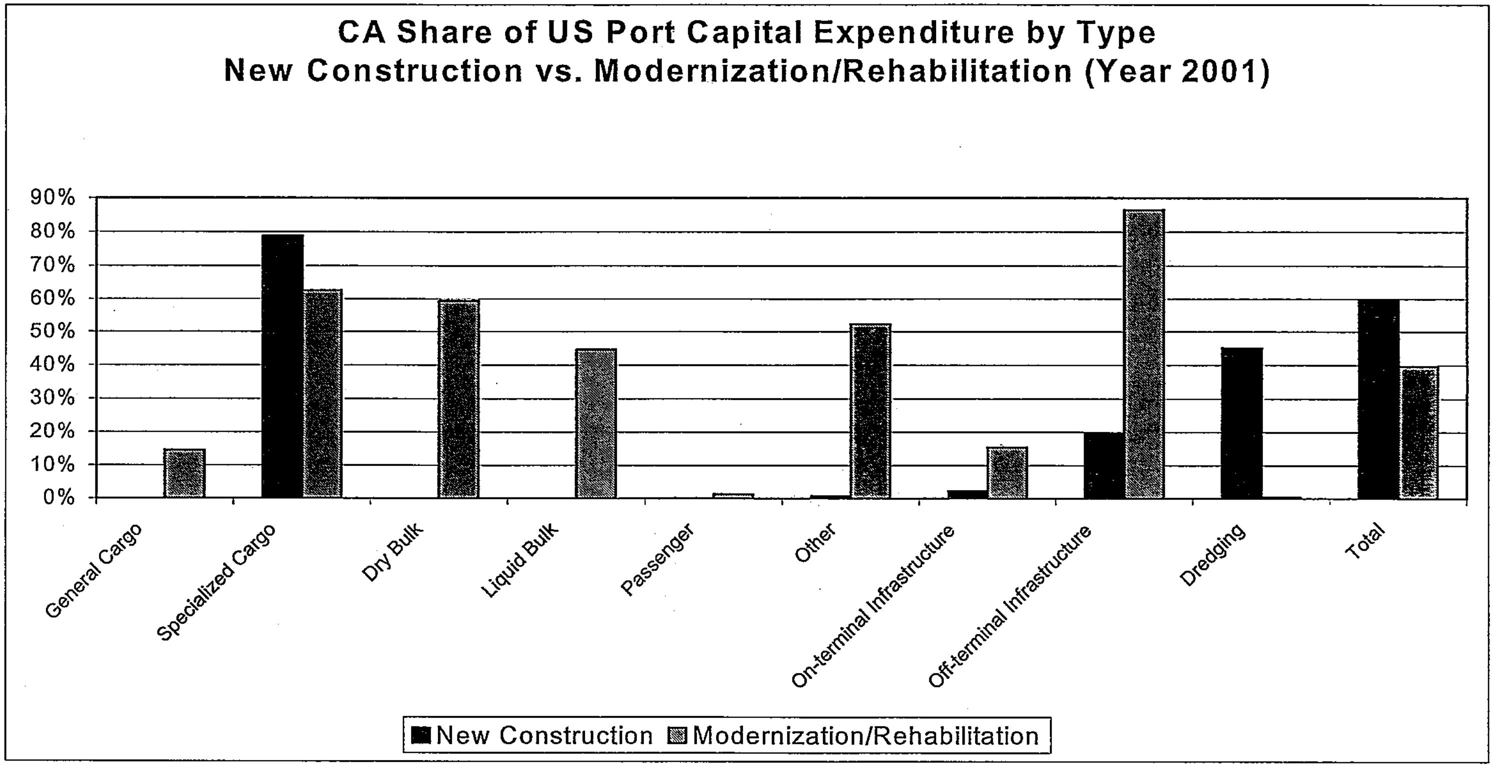


Figure 6-10: California's Share of US Port Expenditures by Construction Type, 2001
Source: US Port Development Expenditure Report http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

6.2.2 Proposed Capital Expenditure for California Public Port Development: Total US vs. CA 2002-2006

California also leads for planned investments with proposed spending of $3 billion for the five-year period 2002-2006, which constitutes 28.6% of the proposed investment by all US ports.

Proposed Port Development Expenditure 2002-2006

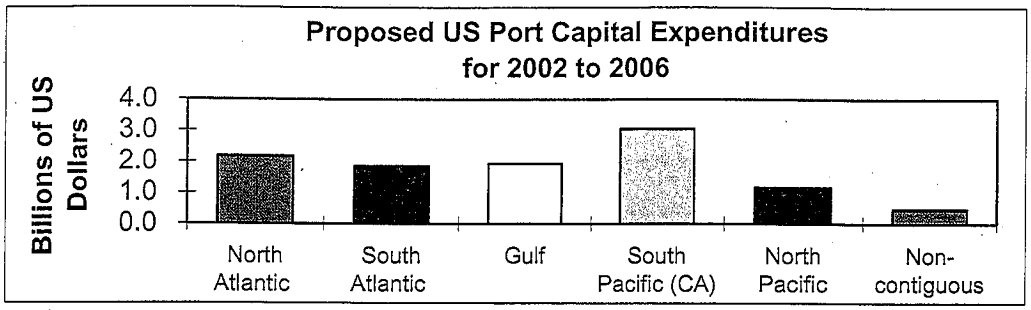


Figure 6-11: Proposed US Port Construction Expenditures, 2002-2006
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

Figure 6-12 lists the top ten ports in the US in terms of future capital expenditure. Among them, three are located in California. More than $1.5 billion and more than $1 billion are proposed to be spent on the development of Long Beach and Los Angeles ports respectively, in the period of 2002 to 2006. In addition, the Port of Oakland anticipates $0.44 billion in capital expenditures.

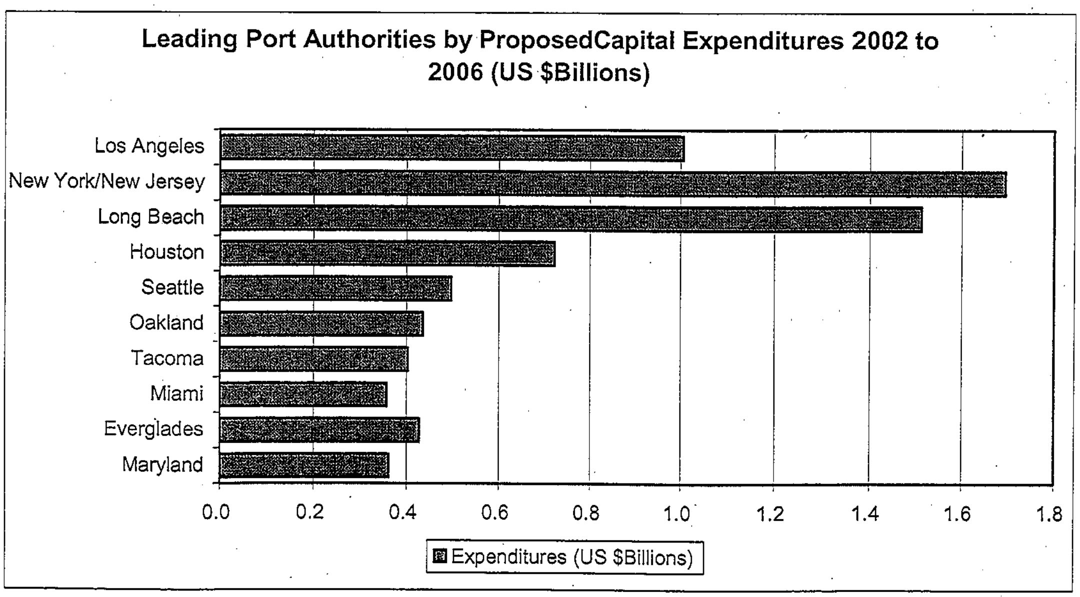


Figure 6-12: Leading Port Authorities by Proposed Expenditures, 2002-2006
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

Proposed Expenditure by Facility Type 2002-2006

California is expected to account for 39.2% of the proposed expenditures in specialized cargo with proposed spending of $1.9 billion for the five-year period. California will also make significant investments in off-terminal infrastructure, such as underground traffic corridors to warehouses and other essential facilities that are more efficiently located away from the port terminal. Figures 6-13 and 6-14 exhibit the trends in detail.

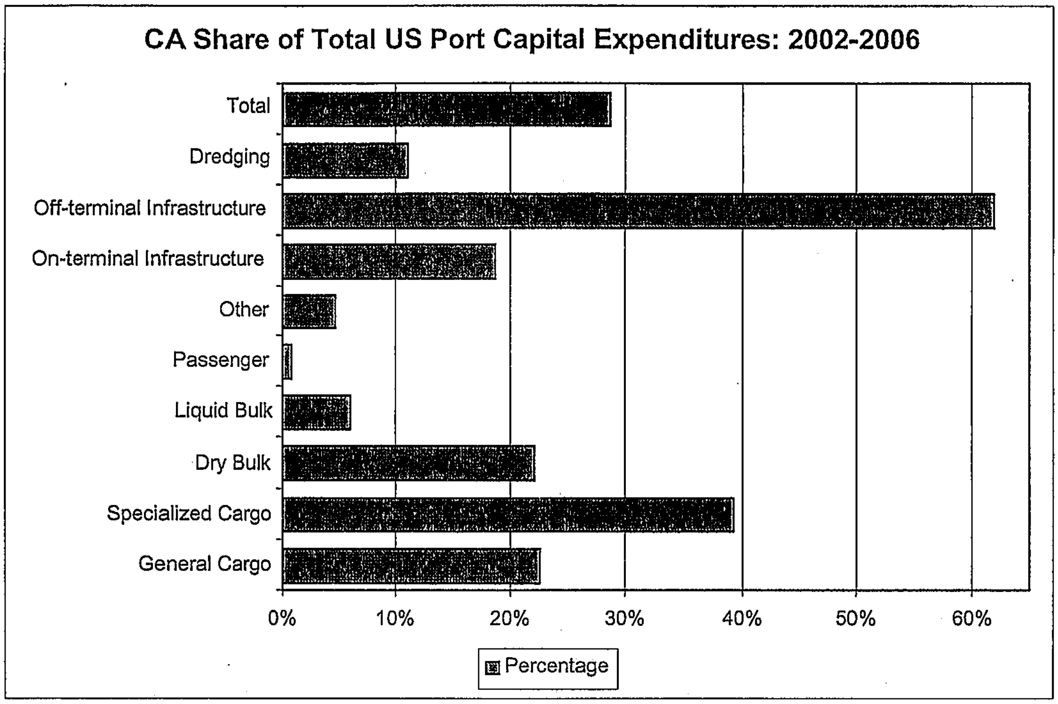


Figure 6-13: California's Share of US Port Construction Expenditures, 2002-2006
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

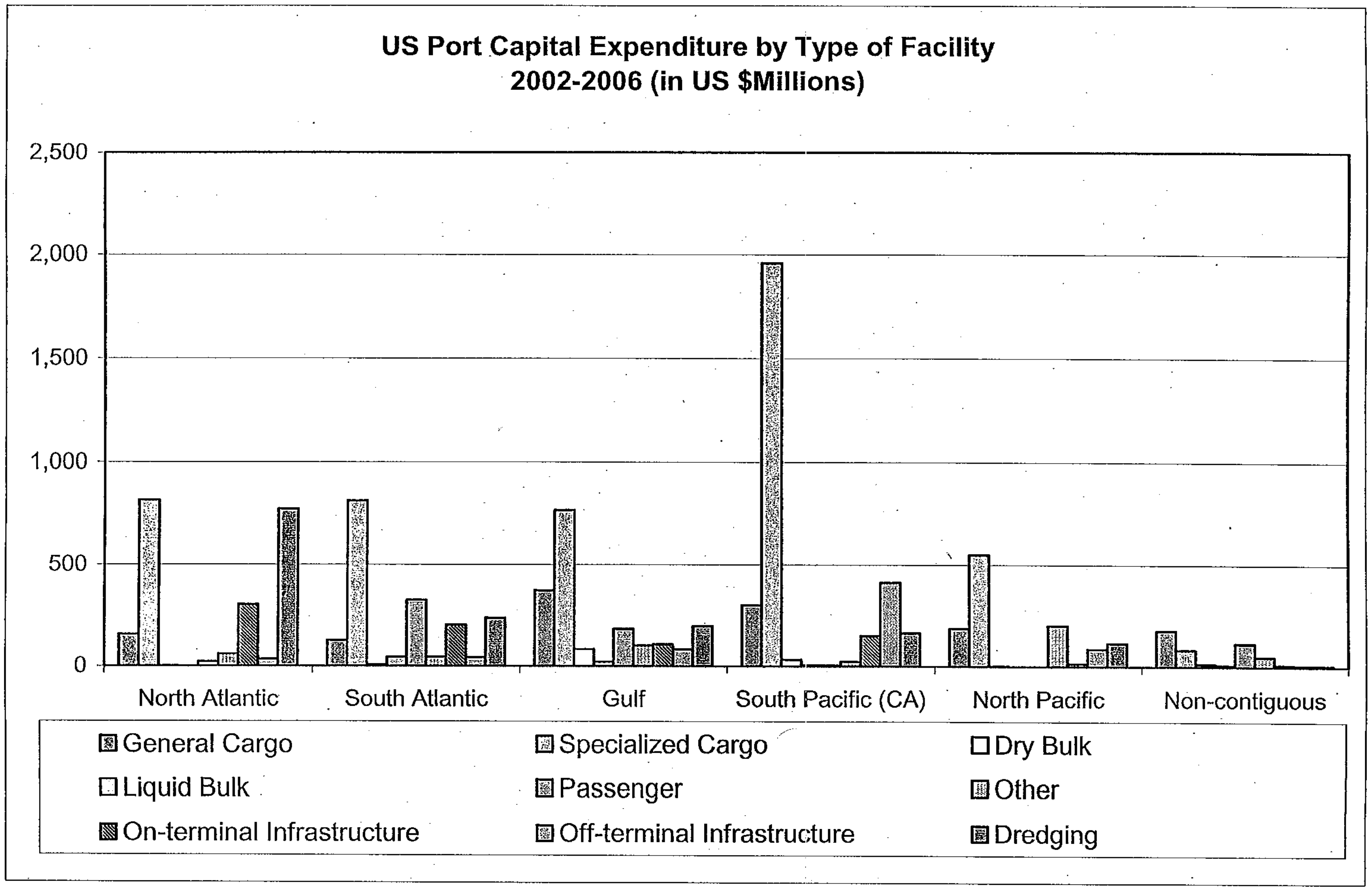


Figure 6-14: US Port Construction Expenditures by Type of Facility, 2002-2006
Source: US Port Development Expenditure Report . *http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf*

6.2.3 Funding Resources for Port Development

Figures 6-15 and 6-16 show California's past and future projections for income generation using various types of financing vehicles relative to other US ports. For example, in 2001, California's offerings represented just under 85% of the revenue bonds issued by other US ports for port construction. California ports are among the most active issuers of revenue bonds.

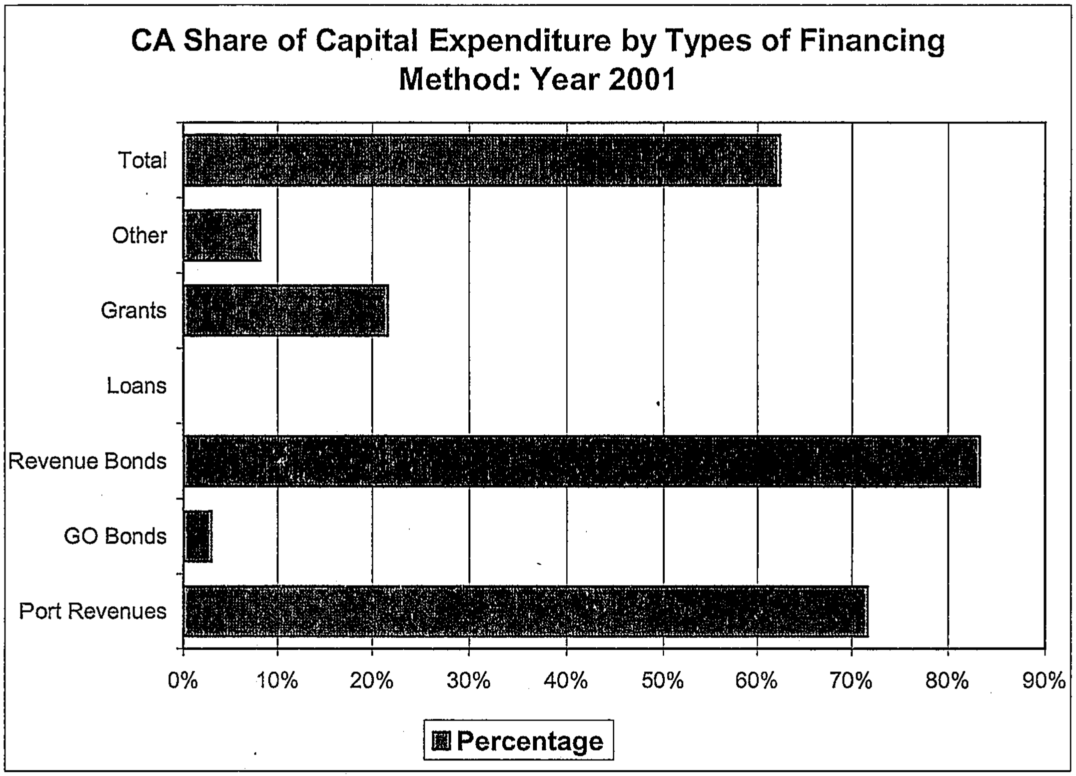


Figure 6-15: California's Share of Port Expenditures by Types of Financing, 2001

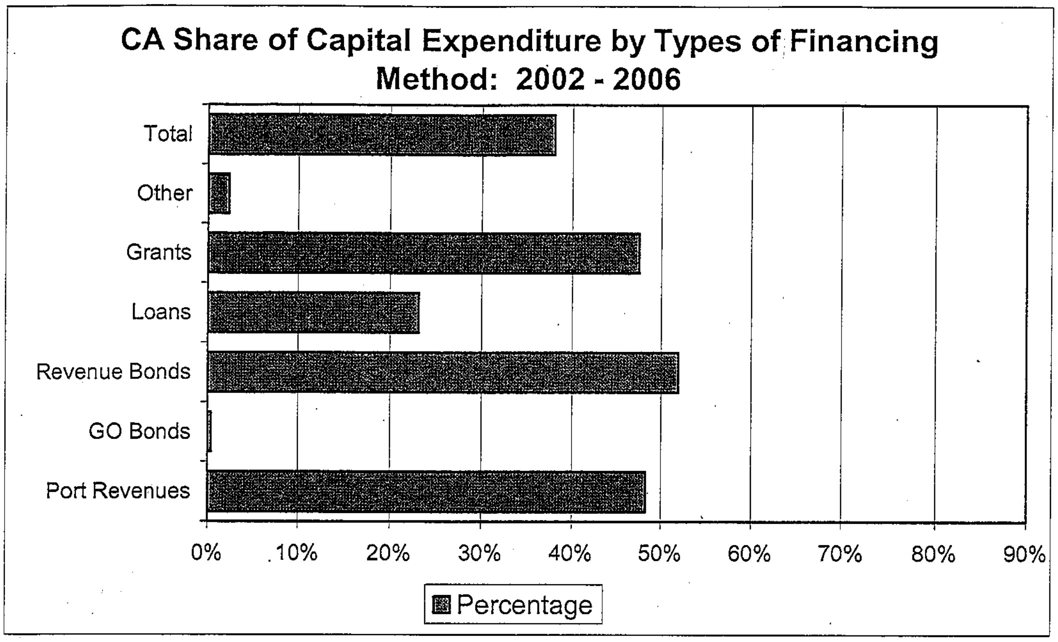


Figure 6-16: California's Share of Port Expenditures by Types of Financing, 2002-2006
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

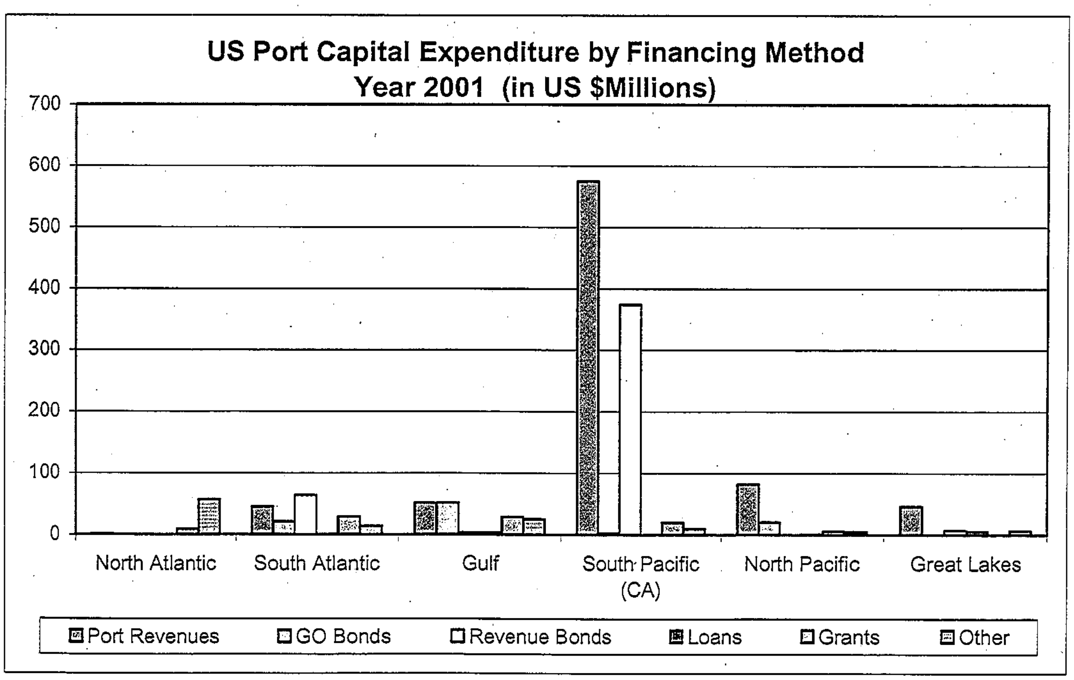


Figure 6-17: US Port Expenditures by Financing Methods, 2001
Source: US Port Development Expenditure Report

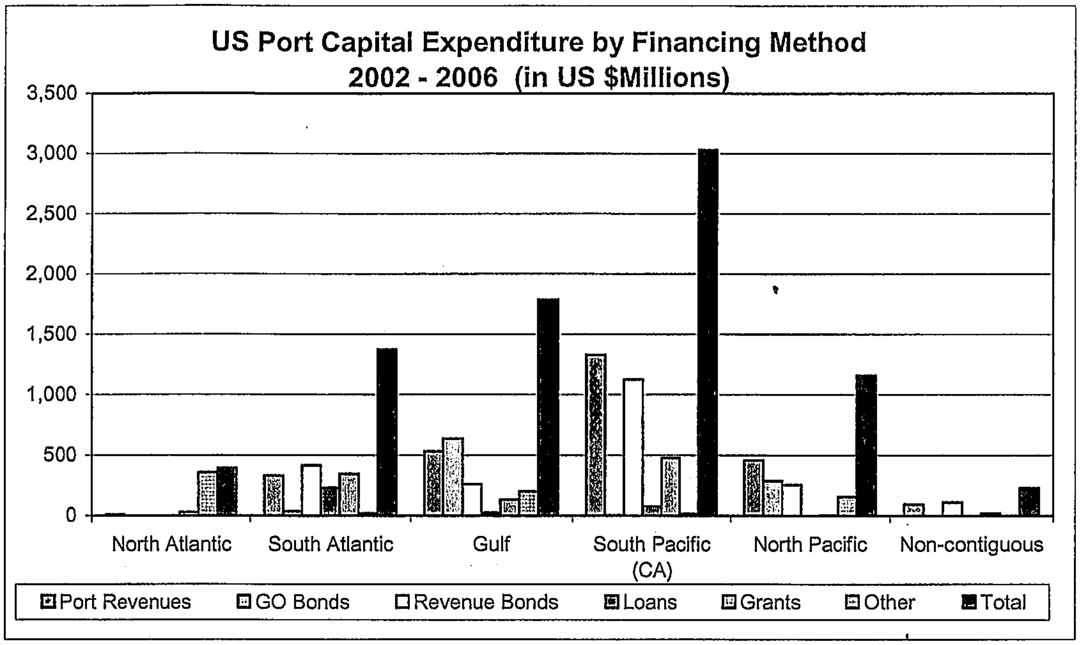


Figure 6-18: US Port Expenditures by Financing Methods, 2002-2006
Source: US Port Development Expenditure Report
http://www.marad.dot.gov/publications/PDF/Exp2001rpt.pdf

In 2001, California was the principal user of port revenue for development with $574.7 million. California's port revenues expenditures accounted for 71.6% of the all port investment from revenue for the nation. It was also the major user of revenue bonds with $374 million, or 83.3% of the national total. California also captured 21.4% of grants, far more than any other region, worth $20.1 million.

Looking ahead, California will remain the primary user of port revenue with $1.3 billion from 2002 to 2006. Over half of the proposed issuance of revenue bonds by all ports will be issued by California ports with $1.1 billion worth. Nearly half of all loans taken out by US ports, $477.8 million, will be spent on the development of California ports.

6.2.4 Economic Impact

The following table shows 1990 and 2000 economic indicators by region for the Marine Construction sector in California.

Table 6-3: Direct Regional Economic Impact of Marine Construction, 1990 and 2000

Region	1990			2000		
	Employ-ment	Wages ($Million)	GSP ($Million)	Employ-ment	Wages ($Million)	GSP ($Million)
North	384	$20.00	$37.77	62	$1.50	$2.81
North Central	4,429	$231.84	$437.87	2,446	$139.10	$261.50
Central	979	$54.37	$102.68	167	$8.00	$15.05
South Central	2,158	$82.94	$156.64	661	$30.77	$57.85
South	7,581	$413.06	$780.13	4,907	$245.93	$462.33
Total	**15,531**	**$802.20**	**$1,515.10**	**8,243**	**$425.31**	**$799.54**

Source: BLS

Regionally, the Southern part of California, with the Ports of Long Beach and Los Angeles, represents a major portion of the value of the Marine Construction sector in the state. The urban area of North Central is the other major source of value, with the range of activities associated with San Francisco Bay and the Delta.

Table 6-3 shows the results of economic activity directly related to the ocean, but this direct economic activity generates additional economic activity as employees spend salaries and ocean-related firms purchase inputs from other California firms. These indirect and induced, or multiplier effects, must also be accounted for. Estimates of these effects are shown in the following tables. The estimates were derived by a detailed analysis of the Ocean Economy industries in each of the coastal regions using IMPLAN, a standard and widely used economic impact model.

Table 6-4 shows the estimated impact on regional total wages, income and employment brought about by Marine Construction sector from the IMPLAN Model.

Table 6-4: 2000 Employment, Wages and GSP: Impact of Marine Construction Industry from IMPLAN Model

Region	Direct Employment	Indirect and Induced Employment	Total Employment	Multiplier
North	62	50	112	1.8
North Central	2,446	2,201	4,647	1.9
Central	167	134	301	1.8
South Central	661	595	1,256	1.9
South	4,907	4,907	9,814	2
Total	**8,243**	**7,419**	**15,662**	**1.9**
Region	Direct Wages	Indirect and Induced Wages	Total Wages	Multiplier
North	$1,495,567	$1,046,897	$2,542,464	1.7
North Central	$139,103,215	$139,103,215	$278,206,430	2
Central	$8,004,930	$6,403,944	$14,408,874	1.8
South Central	$30,772,559	$21,540,791	$52,313,350	1.7
South	$245,933,772	$295,120,526	$541,054,298	2.2
Total	**$425,310,043**	**$425,310,043**	**$850,620,086**	**2**
Region	Direct GSP	Indirect and Induced GSP	Total GSP	Multiplier
North	$2,811,516	$1,968,061	$4,779,577	1.7
North Central	$261,500,123	$261,500,123	$523,000,246	2
Central	$15,048,467	$12,038,774	$27,087,241	1.8
South Central	$57,849,332	$40,494,532	$98,343,864	1.7
South	$462,330,880	$554,797,056	$1,017,127,936	2.2
Total	**$799,540,318**	**$799,540,318**	**$1,599,080,636**	**2**

Source: BLS

The total effect of the marine construction industry on California income is estimated as $609.1 million. This industry provides employment (direct and indirect) to 5,452 workers.

6.3 Beach Nourishment[39]

In California, both intense use of coastal resources and near-shore development have significantly impacted the state's beaches. Some beaches naturally erode, but many public beaches erode due to human activities that affect sediment supply. Dams, construction of harbor structures, coastal armoring, and offshore sand and gravel mining are among the human activities that impact sediment supply to beaches.

The loss of public beaches will continue without beach restoration efforts. Environmentally, beach nourishment preserves both certain animal species and threatened plants by restoring and enhancing habitat. It also provides public safety benefits to residents and visitors by providing safer access to the water, especially for recreational swimmers and surfers.

In 2000, a study of the economic benefit of specific beach projects across California was released by the Department of Boating and Waterways and the State Coastal Conservancy. A survey was conducted to collect information in the following categories:

- attendance numbers and corresponding methodology used to estimate;
- characteristics and duration of trips;
- recreational activities and amenities involved in trips;
- assessment of coastal protection and estimate of erosion and damages;
- assessment of public infrastructure threatened and likelihood of damages.

A summary of the costs and benefits estimated for a number of beach projects in California by the California Department of Boating and Waterways is shown in Table 6-5. The data indicate that there is substantial variation in the benefits and costs of such projects, but that benefits based on the basis of beach visits and visitor expenditures often substantially exceed costs.

39. The process of replenishing a beach by artificial means; e.g., by the depositions of dredged materials, also called beach replenishment or beach feeding. For this study, we also include additional activities for stabilization of beaches and natural beach systems.

Table 6-5: Benefit of Beach Restorations in California[40]

Location	Conceptual Project	Cost	Net Benefit	Benefit/Cost Ratio
Venice Beach	Groin repair	$2,000,000	$130,270,670	65.14
Leo Carrillo State Beach	Retention structure/dune	$170,000	$8,310,900	48.89
Dockweiler Beach	Groin repair	$1,350,000	$42,520,220	31.50
Topanga Beach	Seawall	$630,000	$8,798,226	13.97
East Beach	Groin repair	$1,500,000	$17,379,719	11.59
Will Rogers Beach	Groin repair	$3,900,000	$43,060,455	11.04
Pierpont Beach	Groin repair	$820,000	$13,432,299	16.38
Hueneme Beach	Seawall	$850,000	$12,382,432	14.57
El Granda	Revetment	$1,000,000	$13,843,292	13.84
Beach Boulevard	Repair Rock toe	$824,000	$10,328,642	12.53
Carpinteria State Beach	Cobble berm	$6,500,000	$44,106,263	6.79
Pismo Beach	Nourishment/retention structure	$4,000,000	$26,059,465	6.51
San Buenaventura	Groin repair	$3,800,000	$14,945,698	3.93
Beach Access way	Revetment	$50,000	$187,382	3.75
El Capitan State Beach	Nourishment/retention	$3,600,000	$10,301,836	2.86
Ashby Interchange	Revetment	$275,000	$735,491	2.67
The Hook	Shore retention wall	$2,000,000	$4,896,221	2.45
Regugio State Beach	Nourishment/retention	$2,600,000	$5,518,840	2.12
Coyote Point	Nourishment/retention	$5,500,000	$8,579,945	1.56
Twin Lakes Beach	Seawall	$5,000,000	$7,632,443	1.53
Surfers Point	Cobble berm/retention	$7,700,000	$10,820,353	1.41
Carlsbad State Beach	Nourishment	$21,000,000	$28,516,254	1.36
Hobson	Nourishment/retention	$12,300,000	$12,752,134	1.04
La Conchita	Nourishment/retention	$12,300,000	$12,608,042	1.03
Dan Blocker Beach	Nourishment/retention	$5,700,000	$5,748,354	1.01
Leadbetter Beach	Seawall	$2,360,000	$1,474,537	0.62
Isla Vista	Nourishment/retention	$13,700,000	$6,781,239	0.49
Cayucos Beach	Seawall	$820,000	$372,877	0.45

Source: California Beach Restoration Study, Department of Boating and Waterway

6.3.1 Funding Sources

In 1999, the Public Beach Restoration Program (PBRP) was created under the administration of the Department of Boating and Waterway. The program was motivated by the loss of public beaches due to man's activities in upland watersheds and along the shoreline. The following table lists the projects and funding for the program, which was funded for $10 million in grants for fiscal year 2000-2001.

[40] Definitions to help understand chart: groins and jetties are walls built perpendicular to the shoreline. They are designed to trap sand that is moving along the shore due to the long shore current. A groin usually extends to the end of the surf zone while a jetty extends further into an inlet to stabilize a navigation channel. The construction of both groins and jetties severely affects the flow of sand moved by the long shore currents.

Table 6-6: Funding for California Beach Restoration Projects

Recipient	Project	Funding
City of San Francisco	Nourishment at Ocean Beach	$1,000,000
BEACON	Nourishment at Goleta County Beach	$650,000
City of Port Hueneme	Dune restoration and vegetation at city beach park	$129,500
Surfside-Sunset Project	Nourishment at Surfside-Sunset feeder beach	$3,850,000
SANDAG Regional Beach Restoration Project	Nourishment at 12 beaches in San Diego County	$1,236,500
Cities and Individual projects	Feasibility study of beach nourishment alternatives at various beaches	Approx. $3,134,000

Source: California Beach Restoration Study, Department of Boating and Waterway

The funding allocation for the above projects is exhibited in Table 6.7 below.

Table 6-7: Total Beach Restoration Funding by Category

Project Category	Number of Projects	Total Funding (00-01)	Percentage of Program Budget
Beach Nourishment and Restoration	5	$6,866,000	69%
Corps of Engineers Projects	9	$2,594,000	26%
Research and Other Studies	2	$540,000	5%
Total	**16**	**$10,000,000**	**100%**

6.4 References

US Army Corps of Engineers <http://www.usace.army.mil/>.

CA Department of Boating and Waterway: *California Beach Restoration Study* <http://dbw.ca.gov/PDF/BeachReport/Ch4_Nourishment.pdf>.
<http://dbw.ca.gov/PDF/BeachReport/Ch2_Setting.pdf>.

NOEP

Chapter 7: California Ship & Boat Building

Table 7-1 Summary of California Ship & Boat Building and Repair Industry in 2000

Industry	Employment	Wages	GSP
Boat Building & Repair	4,033	$126,378,329	$165,028,160
Ship Building & Repair	6,523	$251,264,488	$328,107,805
Total	**10,557**	**$377,642,817**	**$493,135,966**

Table 7-2 Summary of Ship and Boat Building & Repair with Multipliers for 2000

Indicator	Direct	Indirect & Induced	Total	Multiplier
Employment	10,557	8,639	**19,196**	1.8
Wages	$377,642,817	$308,890,473	**$686,533,290**	1.8
GSP	$493,135,966	$403,357,340	**$896,493,306**	1.8

Table 7-3: Changes in Direct Economy of California Ship & Boat Building and Repair 1990-2000

Industry	Employment		Wages (millions)		GSP (millions)	
	1990	Change in 2000	1990	Change in 2000	1990	Change in 2000
Boat Building and Repair	3,256	777	$97.71	$28.67	$116.68	$48.34
Ship Building and Repair	22,593	-16,070	$975.73	-$724.46	$1,165.27	-$837.16
Total	**25,849**	**-15,292**	**$1,073.43**	**-$695.79**	**$1,281.95**	**-$788.81**

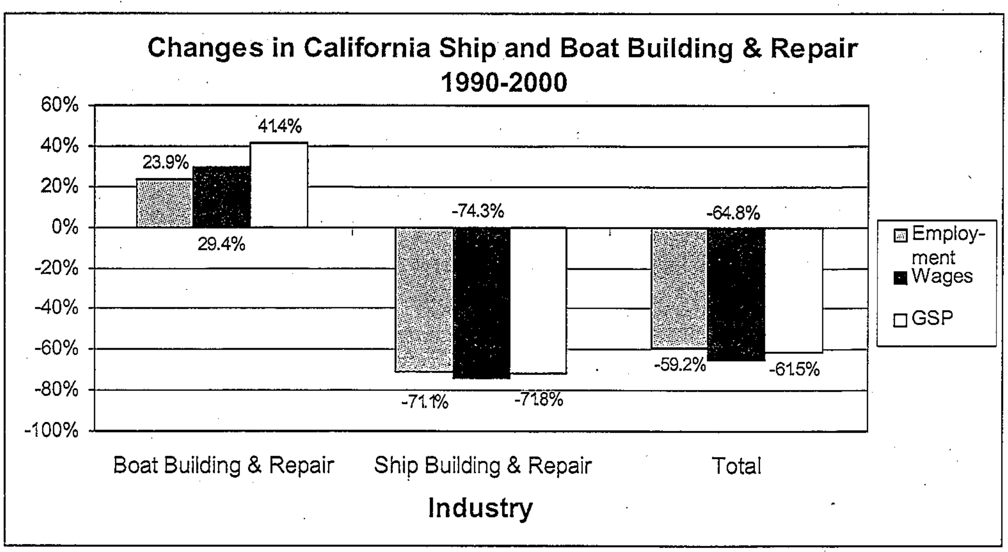


Figure 7-1: Change in Ship & Boat Building and Repair from 1990 to 2000

7.1 Ship & Boat Building and Repair: Description of the Sector

The shipbuilding and repair industry builds and repairs ships, barges and other large vessels, whether self-propelled or towed by other craft. This industry also includes the conversion and alteration of ships and a portion of the manufacture of offshore oil and gas drilling and production platforms. The boat building and repair industry is engaged in the manufacturing and repairing of smaller non-ocean going vessels primarily used for recreation, fishing, and personal transport

Unlike most other industries, only a small number of orders for large ships are received each year, and these often take years to fill. The orders for shipbuilding and repairs are primarily placed by large shipping, passenger and cruise, ferry, petrochemical, commercial fishing, and towing and tugboat companies, or the federal government. The principal federal government agencies placing ship building and repair orders include the Naval Sea System Command, the Military Sealift Command, the Army Corps of Engineers, the US Coast Guard, the National Oceanic and Atmospheric Administration, the National Science Foundation and the Maritime Administration. The boat building and repair industry is almost entirely privately owned and is characterized by a very large number of buyers with varied tastes and a larger number of producers with varied product ranges.

The US ship building and repair industry is primarily devoted to building ships for the US Navy and a small number of commercial shipping companies. The industry reached its peak output in the mid-1970s, when it held a significant portion of the international commercial market while maintaining its ability to supply military orders. Since then, new ship construction, the number of ship building and repair yards, and overall industry employment have decreased sharply, particularly since the end of the major naval buildup of the 1980's. This decline came on top of a severe drop in the construction of new vessels, which fell from about 77 ships (1,000 gross tons or more) per year in the mid-1970s to only about eight ships through the late 1980s and 1990s. Smaller shipyards have been able to keep much of their mainly commercial market share, since these shipyards build vessels used on the inland and coastal waterways, which, by law, must be built in the US.

7.2 Ship & Boat Building in California

California was a major ship builder during World War II, when the Richmond and other shipyards were flourishing.[41] The ship building industry in California is heavily dependent on the federal government as its primary market. The Navy's new ship procurement has declined since the accelerated Navy ship construction in the 1980s. First tier shipyards may face the possibility of closure. The General Dynamics National Steel and Shipbuilding Co. (NASSCO) in San Diego CA is the biggest private shipyard on the West coast and employed more than 3000 people in 2000. Over the last four decades, NASSCO has delivered over 100 ships to the world's fleets -- 53 ships to commercial customers, becoming America's leading commercial shipbuilder during that period; and 53 auxiliary and support ships for the US Navy. These have included oil tankers, ferries, containerships, and oceanographic

[41] Comments by G. Pontecorvo for review of this document.

research ships for commercial customers; and hospital ships, fast combat support ships, tank landing ships, and roll-on/roll-off ships for the US Navy. NASSCO as of 2000, had contracts to build six commercial ships and three Navy ships. Because of its location, expertise and full-service capabilities, the Navy relies on NASSCO as a repair facility for its Pacific Fleet ships. The company also performs maintenance and repair for commercial operators[42]. Since California has a large ship building capacity, changes in national policies that might drive increased shipbuilding for the Navy could have a positive influence on California's economy.

The Boat Building and Repair industry in California includes a large number of products, manufacturers and dealers. Table 7-4 gives the 1990 direct estimates for this industry.

Table 7-4: Direct Employment, Wages, and GSP for Ship and Boat Building and Repair Industry 1990

	SIC4 Name	Employment 1990	Wages 1990	GSP 1990
California	Boat Building & Repair	3,256	$97,705,470	$116,684,864
	Ship Building & Repair	22,593	$975,728,866	$1,165,265,257
	TOTAL	**25,849**	**$1,073,434,336**	**$1,281,950,121**

Comparisons drawn in Table 7-3 and Figure 7-1 clearly reflect the difficulties in the industry in the last decade. The major decline has come from the shipbuilding industry, while the Boat Building and Repair industry has remained stable. The Ship Building and Repair industry employed more than 22,500 people in 1990, but that number declined to less than 6,500 in 2000. The employment in the Boat Building and Repair industry remained relatively constant at approximately 2,700. The sharp decline in the Ship Building and Repair industry also led to a significant drop in wages; they declined from around $800 million in 1990 to around $331 million in 2000 in constant 2000 dollars. Similarly the industry's contribution to GSP also contracted to less than half of its value: from $958 million in 1990 to around $433 million.

[42] http://www.nassco.com/

Table 7-5: Total Regional Employment, Wages, and GSP for CA. Shipbuilding and Repair Industry for 2000

Region	Employment	Indirect Employment	Total Employment	Multiplier
North	D	D	D	1.7
North Central	1,056	782	1,838	1.6
Central	73	50	122	1.5
South Central	D	D	D	1.6
South	7,907	6,563	14,470	1.7
Total	**9,036**	**7,394**	**16,430**	**1.7**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Multiplier**
North	D	D	D	1.6
North Central	$40,835,602	$30,218,345	$71,053,947	1.7
Central	$2,154,988	$1,465,392	$3,620,380	1.7
South Central	D	D	D	2.0
South	$288,651,239	$239,580,528	$528,231,767	1.8
Total	**$331,641,829**	**$271,264,266**	**$602,906,095**	**1.8**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**Multiplier**
North	D	D	D	1.6
North Central	$53,324,208	$39,459,914	$92,784,121	1.7
Central	$2,814,040	$1,913,547	$4,727,588	1.7
South Central	D	D	D	2.0
South	$376,928,412	$312,850,582	$689,778,995	1.8
Total	**$433,066,660**	**$354,224,043**	**$787,290,704**	**1.8**

7.3 References

CA Employment Development Department
http://www.calmis.ca.gov/

CA Department of Boating and Waterway
http://dbw.ca.gov/PDF/BeachReport/Ch4_Nourishment.pdf

Maritime Administration, US Department of Transportation
<http://www.marad.dot.gov/publications/index.html>.

National Steel and Shipbuilding Co
<http://www.nassco.com/>.

US Army Corps of Engineers, Navigation Data Center
<http://www.iwr.usace.army.mil/ndc/wcsc/wcsc.htm>.

California Research Bureau 1994 Report: Economic Assessment of Ocean-Dependent Activities.

NOEP

Chapter 8 Coastal Tourism & Recreation

8.0 Estimated Economic Summaries of the California Coastal Tourism & Recreation Sector

Table 8-1: California Coastal Tourism & Recreation Direct Values 2000

Industry	Employment	Wages	GSP
Amusement and Recreation Services	17,783	$410,474,527	$688,823,549
Amusement and Recreation Services NEC	488	$7,889,632	$17,896,189
Boat Dealers	1,702	$61,022,843	$139,818,073
Eating and Drinking Places	216,533	$3,207,978,118	$7,350,252,717
Hotels and Lodging	70,489	$1,612,618,217	$3,657,929,867
Marinas	833	$24,329,879	$40,105,751
Sporting Goods Retailers	4,679	$199,345,181	$501,688,464
Zoos, Aquaria	906	$21,317,910	$30,085,003
Total	**313,417**	**$5,544,976,307**	**$12,426,599,613**

Source: BLS Quarterly Census using SIC code categories.

Table 8-2: California Coastal Tourism & Recreation Sector with Multipliers for 2000

Indicators	Direct	Indirect & Induced	Total	Multiplier
Employment	313,417	94,025	407,442	1.3
Wages	$5,544,976,307	$4,435,981,046	$9,980,957,353	1.8
GSP	$12,426,599,613	$9,941,279,690	$22,367,879,303	1.8

Source: BLS and IMPLAN

Table 8-3: Changes in California Coastal Tourism & Recreation Direct Values between 1990 and 2000

Industry	Employment		Wages (millions)		GSP (millions)	
	1990	Changes in 2000	1990	Changes in 2000	1990	Changes in 2000
Amusement and Recreation Services	16,908	875	$375.85	$34.62	$648.71	$40.11
Amusement and Recreation Services NEC	455	33	$7.94	-$0.05	$17.38	$0.52
Boat Dealers	1,473	229	$42.08	$18.94	$92.00	$47.81
Eating and Drinking Places	157,489	59,044	$2,097.83	$1,110.15	$4,586.39	$2,763.86
Hotels and Lodging	52,373	18,116	$985.87	$626.75	$2,157.26	$1,500.67
Marinas	724	109	$19.97	$4.36	$32.76	$7.34
Sporting Goods Retailers	1,807	2,872	$53.88	$145.47	$128.99	$372.70
Zoos and Aquaria	677	229	$17.67	$3.65	$26.20	$3.88
Total	**231,910**	**81,507**	**$3,601.08**	**$1,943.89**	**$7,689.70**	**$4,736.90**

Source: BLS Quarterly Census using SIC codes.

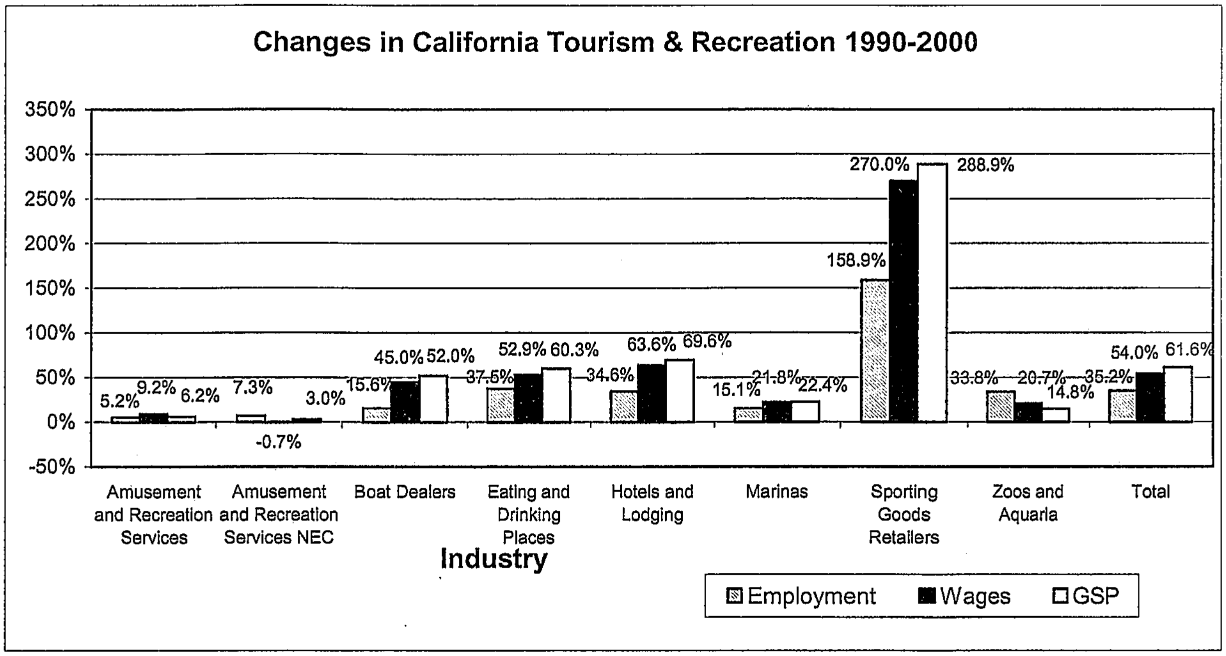


Figure 8-1: Changes in California Coastal Tourism & Recreation from 1990 to 2000
Source: BLS

8.1 California Coastal Tourism & Recreation: Scope, Scale and Definition

In this report, the "Coastal Tourism & Recreation" sector includes the full range of tourism, leisure, and recreational activities that take place in coastal areas and in offshore coastal waters. These include the hotel and restaurant industry, marinas, the coastal water sports industry, recreational boating harbors, recreational fishing facilities and stores, beaches, and retail businesses. We also include ecotourism and recreational activities such as recreational boating, swimming, recreational fishing, surfing, kayaking, diving and snorkeling. This chapter reveals estimates of the market and non-market use value of ocean related tourism and recreational activities in California. (See Appendix A, "Methodology" non-market section for more detail on the methodology used to derive market and non-market values.)

California is the number one travel destination in the US. The total California tourism industry annually generates more than $75 billion in direct travel spending for the state economy, and supports more than 1 million jobs, which makes it the 3rd largest employer and 5th largest contributor to the state's GSP[43]. World famous sandy beaches and favorable weather conditions of Southern California make Coastal Tourism & Recreation an important component of California's economy in general, and the overall tourism industry of the state in particular. Coastal Tourism & Recreation has been the fastest growing activity, both in

---

[43] *California Tourism's Contribution to the California Economy: 1998-2002,*
<http://www.gocalif.gov/state/tourism/tour_html>

volume and diversity, along the coastal zone[44]. As of 2000, it was one of the major growth engines not only for the coastal counties, but also for the entire state. Tourism and recreation-related economic activities are shaping development patterns in the coastal zone, which account for a major share of population and economic activities. [45] Coastal tourism also makes California's position competitive in international tourism as studies have shown that beaches are the leading international tourist destination. [46]

Summary Tables 8-1, 8-2, and 8-3 show what a large influence California's Coastal Tourism & Recreation sector has had on the state. While its economic contribution was quite significant in 2000, its growth in the decade 1990-2000 was even more significant - far larger than any other Ocean Economy sector in California with a GSP increase of almost 62%, a wage increase of 55%, and an employment increase of more than 35%. In fact, its decadal growth kept the California Ocean Economy sector in positive numbers during that decade. Without Tourism & Recreation, there would have been a large net loss in all columns.

Understanding the role that California's ocean and coasts play in Tourism & Recreation, and estimating its value to the state is not a simple task. The NOEP has divided this chapter into three sections to untangle some of this complexity. First, we define coastal recreation and its scope and scale. This data is not captured in the market data, and so could be added with some degree of reliability. Within this section, the reader will find a brief paper estimating both market and non-market values for all of California's beaches, a number that is as high as $5 billion a year, again measured in a different way and so cannot be added directly to the market data, but in many ways is added value to the estimated market totals. Second, travel spending is defined, described, and estimated for both California and the coast, since economic data for tourism is not easily separated, except by coastal counties. The travel spending data is actually included in the market data. Finally, we provide regional estimates of market values for employment, wages, and GSP to show geographic areas of largest and slowest sector growth between 1990-2000.

California Coastal Recreation - Definition and Measurement

Coastal recreation is undertaken by local residents, by residents of California who travel to the coast, and by residents of other states and countries. Recreation may impact the California economy by as much as spending at a luxury hotel in Santa Barbara or as little as a hot dog on the beach in Santa Monica. Data is not available for all expenditures by those who recreate along the California shore, but a comprehensive national survey undertaken in 2000 does measure the number of people and activity levels involved in California ocean recreation.[47] This data, combined with state data on use of key coastal recreation resources, provide a picture of the magnitude of coastal recreation resource use. This data is presented in the next part of this chapter.

Travel in California Coastal Counties - Definition, Description and Spending Estimates

---

[44] *1998 Year of the Ocean: Coastal Tourism and Recreation.* http://www.yoto98.noaa.gov/yoto/meeting/tour_rec_316.html

[45] C. Cunningham, and Walker, K. 1996. "Enhancing Public Access to the Coast through the CZMA." *The Journal of Marine Education,* Volume 14, No.1. pp 8-11.

[46] J.R. Houston, 1996. "International Tourism and U.S. beaches". *Shore and Beach.*

[47] National Survey on Recreation and Environment, 2000.

The travel economy is generally defined as activity associated with travel away from home. Travel may be undertaken for many purposes, including business, visiting friends and relatives, and for recreation. Trips may be single or multi-purpose. Travel to coastal counties in California may include coastal recreation or use of a coastal facility in whole or part. To get a sense of the entire travel industry affecting coastal California, we examined travel and tourism in the state as a whole and in the coastal counties. A portion of the economic value reported under travel and tourism is ocean related, but we do not know what that portion is precisely.

Regional Estimates of Economic Impact of California Tourism and Recreation
The NOEP team separated employment, wages, and contribution to GSP for those establishments located in shore-adjacent zip codes and defined this as ocean-related tourism and recreation. This is a smaller proportion of total travel activity in coastal counties, but it includes those activities most likely to be affected by ocean and coastal resources. It also includes the activities of both those who travel or spend money for recreation and for other purposes such as business.

The next sections of this chapter present data for each of these aspects of Tourism & Recreation in coastal California.

8.2 Coastal Recreational Activities

All economic activities relating to coastal recreation are affected by the quality of the environment. Coastal land, beaches, watersheds, and coastal waters each provide a link between the travel and tourism industry and coastal recreational industries such as swimming, surfing, boating and fishing. The level of participation in coastal water/nature-related industries affects several other industries and sectors of the economy. Increased demand for coastal recreation will result in increased demand for the hotel, restaurant, and service industry. This will also, indirectly, increase the construction activity along the coast as more hotels and vacation homes are built. For example, an increase in water-skiing will increase the manufacture and sale of boats used for these activities. Similarly, an improvement in a beach will lead to more beach visitors leading to increased beach-wear demand, which will lead to increased manufacturing and retailing business. Increased demand will also affect infrastructure construction activities. Roads, parking lots, water and waste water systems and the like will also be necessary. Therefore, it is important to define and measure the scale and scope of coastal recreational activities along the California coast before estimating market or non-market values for coastal tourism.

The National Survey of Recreation and Environment (NSRE) in 2000 was the first national survey that included an assessment of public participation in marine recreation. This survey defined nineteen activities as part of marine recreation. These nineteen activities can be divided into four major subgroups: beach activities, recreational fishing, recreational boating, and other marine recreational activities. Table 8-4 provides the estimates for California[48] for each of these subgroups. Figure 8-2 depicts the proportion of different marine recreational activities. The NRSE estimation method captures the number of California residents who

[48] Source NSRE 2000.

participated in marine recreation activities anywhere in the US. We assumed that the number of California residents who participated in marine recreation in other states is likely to be smaller than the number of other states' residents who participated in marine recreation in California. Additionally, a significant number of foreign tourists visit California beaches.[49] Therefore, the NSRE numbers are likely to underestimate marine recreation participation in California.

Table 8-4: Measure of Participation in Marine Recreational Activities

Recreational Activity	Number of Participants
Beach Activities	14,789,653
Recreational Fishing	2,727,286
Recreational Boating	4,221,775
Other Marine Recreation	2,321,265

The numbers in Table 8-4 cannot be added together, because one person may have participated in more than one activity.

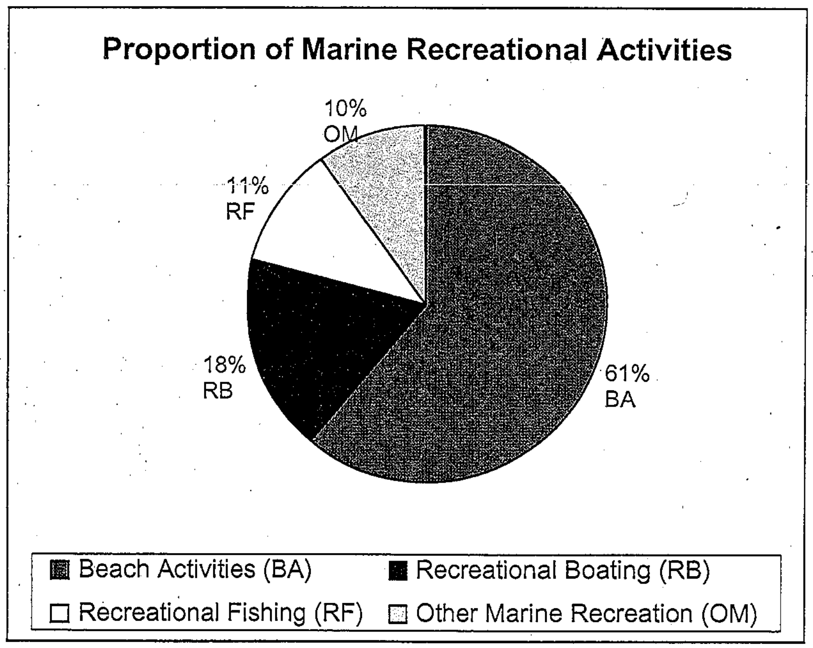


Figure 8-2: Proportion of Different Marine Recreational Activities

8.2.1 Beach Activities

Table 8-5 gives the estimates for the number of participants and number of activity days for different beach related recreational activities in California. More than 12 million people visited different beaches in California during the year 2000 and, on average, each person made slightly more than 12 trips per year. Beach visitation activity includes multiple recreational activities at a beach on a given day such as swimming, sunbathing, viewing

[49] More than 6.36 million foreign visitors came to California in 2000. California Fast Facts 2002.

wildlife, or collecting seashells. So the beach visitation numbers should not be added to other activity numbers.

Table 8-5: Participation in Beach Related Recreational Activities

Recreational Activity	Number of Participants	Number of Days	Average Days Per Person
Visit Beaches	12,598,069	151,429,000	12.02
Swimming	8,398,997	94,573,000	11.26
Scuba Diving	288,023	1,383,000	4.80
Surfing	1,114,372	22,633,000	20.31
Wind Surfing	82,201	n/a	n/a
Snorkeling	706,998	3,818,000	5.40

Source: National Survey of Recreation and the Environment (NRSE) 2000, Preliminary Estimates from Versions 1-6: Coastal Recreation Participation, Table A-3

The average number of activity days per participant (participation rate) gives a measure of intensity of participation and it varies from activity to activity, being as low as 4.8 days for scuba diving and as high as 20 days for surfing. California accounts for approximately 35% of all surfers in the US in terms of the number of participants and 30% in terms of the number of surfing activity days[50] in the US.

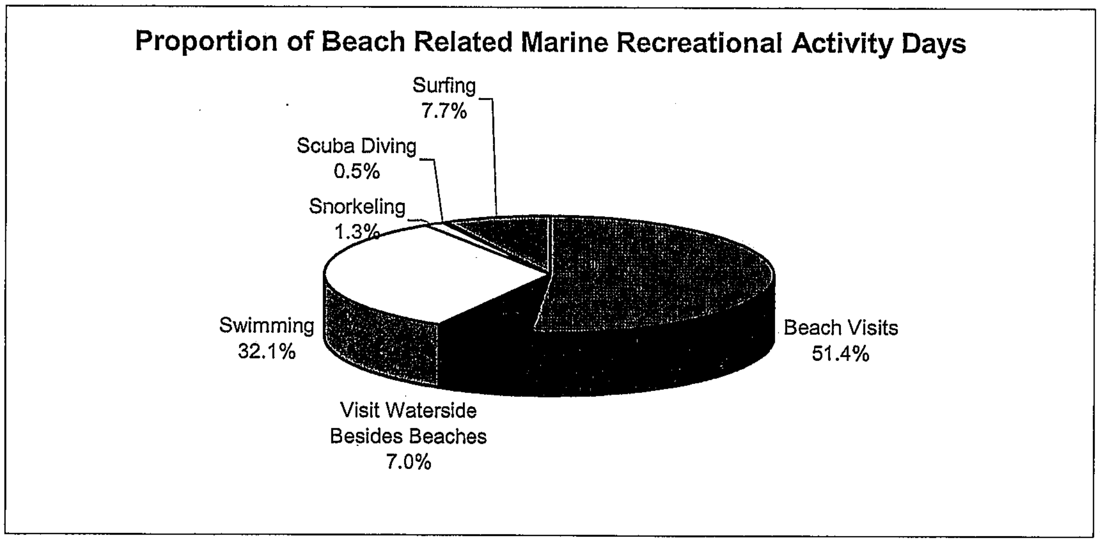


Figure 8-3: Proportion of Beach Related Marine Recreation Activity Days

[50] Hawaii pushes California to 2nd place in terms of number of activity days as it has a participation rate of 35.

8.2.2 California Beach Valuation: The Non-market Value of California Beaches[51]

Beach recreation is a cornerstone of the California coastal economy and even California culture. For at least four decades, Hollywood has carefully documented the California beach life. A more complete and accurate assessment of the number of actual beach users and the economic value of beach use, however, has only just begun. Nevertheless, the emerging picture of beach visitation and the potential value of market and non-market economic impacts of beach use in California corroborate the obvious importance of beach visitation for the California coastal economy.

The California Coastal Act protects access to public beaches throughout California. As a result, beaches are an important source of recreational open space for Californians with as many as 63.4% of all Californians making at least one visit to a California beach each year – 2.5 times the national average (California Department of Boating and Waterways, CDBW, 2002).

Day trips to beaches generate two distinct sources of economic value for the Coastal and Ocean Economy: market expenditures and non-market consumer surplus values. To begin, day visitors to beaches spend money locally on food, beverages, parking, and beach-related activities and rentals (e.g., body boards, umbrellas, etc.). These expenditures partially represent a transfer of expenditures that may have been made elsewhere in the state (e.g., gas and auto), but are largely expenditures that would not have been made in the absence of the beach trip. King (1999) estimated the fiscal impact of beaches in California and reported that in 1998, California's beaches generated $14 billion dollars in direct revenue (King, 1999).[52] In two other studies, the average expenditures per person per day trip ($/trip/person) were estimated for visits to California beaches. A survey of beach goers in Southern California (Hanemann et al. 2002) found that per person per trip expenditures on beach related items and services were $23.19 for beach goers that took at least one trip in the summer of 2000. In another study by King (California Department of Boating and Waterways 2002), average beach related expenditures (excluding gas and automobile costs) were $29.66.

Visitors to beaches also place a value on beach visits above and beyond what they spend at the beach – the consumer surplus of beach visits. Unlike many marketed goods, access to the beach is largely free (aside from parking fees) in California. Because of the low cost of beach access and the importance of beach recreation to Californians, numerous studies have estimated the consumer surplus of beach going in California to better measure the true value of beaches and beach management in the state. Yet, no study has attempted to compile these values to find an estimate for the total non-market value of beaches in California. As we show below, the value of non-market beach uses is substantial and may even be within an order of magnitude of the market values of beach recreation. Failure to fully account for both the market and non-market values of beaches in California could lead to explicit and implicit benefit-cost assessments of beach policies that significantly undervalue beach recreation.

---

51 Linwood Pendleton, Judith Kildow, and S. Shivendu authored this section on beaches.
52 Direct Revenue is the direct expenditure from people making beach trips for items such as gas and parking, food and drinks from stores, restaurants, equipment rentals, beach sporting goods, beach related lodging and incidentals.

8.2.2.1 Methodology

The total non-market value of beaches in California was estimated using a two-step process. First, we estimated the total beach visitation activity days. This is the total number of days people spent on the beaches of California in one year. If a visitor went to the same beach or different California beaches ten times in one year then it was counted as ten beach visitation activity days. Second, we drew from the literature to find what we believed to be the most appropriate estimate of value for one day of beach visitation to find the total non-market value of beach visitation for California. The people who visit a beach on a given day may engage in multiple outdoor recreation activities. They swim, sunbath, walk, jog, view birds/wildlife, or just watch sunsets. Our estimates included beach visits for any recreational activity.

8.2.2.2 Estimating Total Beach Visitation Days

A number of different sources estimate beach visitation days for California. Philip King of the San Francisco State University estimates that as many as 378.5 million day trips were made to California beaches by Californians in 2001 (CDBW 2002, Chapter 3). Leeworthy (2001) uses data from the National Survey on Recreation and the Environment to estimate that 151,429,000 beach visits were made to California beaches in 2000. The United States Life Saving Association estimates that as many as 146 million visitor days were made to Southern California beaches alone (USLA 2002). In another study, Morton and Pendleton (2001) estimate that total beach attendance in Los Angeles and Orange County in 2000 exceeded 79 million visits. Morton and Pendleton's estimates, detailed in a report to the State Water Resources Control Board, are taken directly from lifeguard records.

Kildow and Shivendu (2001), use data from the US Environmental Protection Agency's BEACH Watch Program (EPA BEACH)[53] to estimate beach visitation in California. The authors estimate the attendance per mile of beach using US EPA's BEACH attendance estimates for four different regions of California, i.e., Northern California, North Central (San Francisco Bay area), Central California and Southern California and then extrapolate to get the estimates of attendance for those beaches for which only length is known. The EPA BEACH covers only 224 beaches, but the authors supplement the data with other sources including guidebooks and the Coastal Commission's Beach Access Guide. In all, the authors identify at least 417 California beaches (see Appendix D for a complete list of beaches) and estimate the attendance at these beaches to be 153.1 million activity days. The estimates of Kildow and Shivendu are in line with those of the NSRE (2000) estimates, the United States Lifeguard Agency (2002) data, and the estimates for beach attendance given by Morton and Pendleton (2001), but are significantly lower than those of King's estimates for the California Department of Boating and Waterways (2001).

8.2.2.3 Estimating the Value of a Day at the Beach

[53] This data collection has been discontinued because data methods were non-uniform.

No attempt has been made to estimate the aggregate non-market value of beaches for large areas, in general, and for California in particular. Aggregating non-market values studies can be complicated if the studies examined estimate the value of different types of uses (e.g. surfing, swimming, or just sunbathing) and the value of uses at different seasons. Fortunately, most studies that have estimated non-market values for beach use in California have estimated the value of a general beach day, usually during the summer. Unfortunately, nearly all of the studies cited estimate values for Southern California beaches. As a result, the potential for extrapolation error in our estimates lies in the degree to which non-market beach values for Southern California beaches may not be representative of the values placed on beaches elsewhere in California. Nevertheless, because more than 85% of all beach visits in California are made to beaches in Los Angeles, Orange, and San Diego Counties, the sensitivity of our results to this geographical extrapolation error are likely to be relatively small.

Two primary methods have been used to value consumer surplus estimates: the travel cost method and the contingent valuation method. Chapman and Hanemann (2001) argue that to date contingent valuation estimates of California beach visits have been flawed and generate unreliable estimates of beach values, largely because the contingent valuation surveys often are not site specific and fail to account for varying travel costs to beaches around the state.

We employed travel cost estimates of consumer surplus for beach visits to estimate the value of visits to beaches, largely along the Central and Southern California coast. Table 8-6 provides estimates of consumer surplus values for visits to beaches in California. Consumer surplus estimates range from a low of $10.98 (in 2001 dollars) for visits to Cabrillo Beach in Los Angeles County (Leeworthy and Wiley 1993) to a high of greater than $70 (in 2001 dollars) per person per trip for visits to San Diego beaches (Lew 2002). In 1997, Michael Hanemann estimated the value of the consumer surplus of beach visits to Huntington Beach at $15/visit (Hanemann 1997). Hanemann's estimate of beach-related consumer surplus was later discounted by ten percent and used as the basis for a jury award regarding lost beach recreation due to the American Trader oil spill (Chapman and Hanemann 2001).

Hanemann's conservative estimate of the value of a beach day ($15) is used to find the total non-market value of beach days in all of California. Based on a conservative estimate of beach attendance of 150 million beach days annually, we estimate the non-market value of beach visits in California to be approximately $2.25 billion dollars annually. (Using similar attendance figures and the expenditure results reported earlier, we estimate that beach-related expenditures, i.e. the market value of beach going, would be $3.75 billion.)

Table 8-6: Estimates of the Consumer Surplus Value of Beach Visits in Southern California

Consumer Surplus/Trip	US$(1990)	US$ (2000)
Cabrillo-Long Beach[1]	$8.16	$10.98
Santa Monica[1]	$18.36	$24.71
Pismo State Beach[2]	$26.20	$35.26
Leo Carillo State Beach[1]	$51.94	$69.91
San Onofre State Beach[2]	$57.31	$77.14
San Diego[2]	$60.79	$81.82

Source: Environmental Damages in Court: The American Trader Case, published in The Law and Economics of the Environment, 2001, Anthony Heyes, Editor, pp. 319-367. The data are extracted from 1) Leeworthy and Wiley (1993) and 2) Leeworthy (1995).

Consumer Surplus/Day	**US$ (2001)**			
Individual Surplus/Day	Carpinteria	Encinitas	San Clemente	Solana Beach
Method 1	$20.48	$18.84	$25.70	$14.58
Method 2	$24.43	$22.17	$30.58	$17.35

Source: Philip King, The Economic Analysis of Beach Spending and the Recreational Benefits of Beaches in the City of San Clemente, 2001. Note: Method 1 - dependent variable is a discrete random variable, Consumer Surplus (CS) calculated as the sum of a series of rectangles, each one day wide, touching the demand curve at its upper right corner. Method 2 - CS calculated as the sum of a rectangle for the area under the curve between zero and one, and the definite integral for the area between one and the average number of trips.

Total Value of Beach Trip (San Diego)		**US$(2002)**		
Statistic	Two-step Heckman	Two-step HFS	Joint Heckman	Joint HFS
Mean	$71.43	$74.86	$43.97	$33.70
Median	$74.03	$77.33	$46.31	$36.13
Standard Deviation	$10.57	$10.79	$9.70	$9.77

Source: Dissertation by Daniel Kevin Lew, 2002, University of California Davis. Valuing Recreation, Time, and Water Quality Improvements Using Non-Market Valuation: An Application to San Diego Beaches.

8.2.2.4 Value of California's Beaches

Beach going is more than just an idle past time in California. Beach going represents a major economic use of the California coast and ocean. Concession stands, paid parking lots, and waterfront restaurants reveal that beach goers contribute to a thriving coastal market economy. In fact, we estimate that market expenditures by beach goers in California could substantially exceed $3 billion. Less obvious, however, is the economic magnitude of beach values that never enter the market. Beaches in California represent a recreational and open space resource that provides a level of public access rarely matched elsewhere in the US. Thanks in part to the protection afforded by the California Coastal Act, beaches in California continue to produce non-market economic benefits that are on the order of $2 billion or more. These values are real and affect a beach-going public that includes more than half of all Californians. Combined, the total value of beach going, including market and non-market values, may exceed $5 billion annually.

8.2.3 Recreational Fishing and Boating

Table 8-7 gives the estimates for recreational fishing and boating activities. In 2000, more than 2.7 million fishers participated in more than 20.3 million recreational fishing activity days along the California coast, while more than 4 million people participated in marine boating related activities. Participation rates in different boating related activities varied in a narrow band around 6 days. California had the largest number of marine fishers and sailors, while it was ranked second, behind Florida, in motor boating in the US. The proportions of different boating and fishing related activities are given in Figure 8-4.

Table 8-7: Participation in Recreational Fishing and Boating Activities

Recreational Activity	Number of Participants	Number of Days	Average Days Per Person
Recreational Fishing	**2,727,286**	**20,318,000**	**7.45**
Motorboating	1,549,289	11,589,000	7.48
Sailing	1,087,755	6,755,000	6.21
Personal Watercraft	680,309	2,925,000	4.30
Canoeing	190,948	n/a	
Kayaking	433,209	n/a	
Rowing	280,265	n/a	
Total for Recreational Boating	**4,221,775**		**6.41**

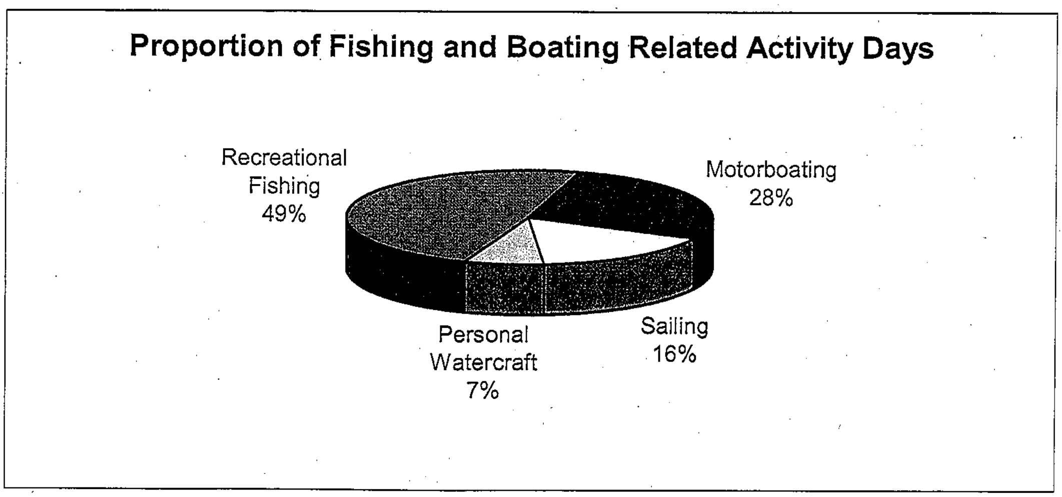


Figure 8-4: Fishing and Boating Related Activity Days

8.2.4 Marinas

In 2000 marinas accounted for a substantial economic activity in marine recreation in California, especially in Central and Southern California. Table 8-8 and Table 8-9 give the marina recreators' characteristics and use pattern.

Table 8-8: Marina Recreators' Characteristics by Use

Visitor Characteristics	Day Users	Overnight Users
Total trips using boat	36.16	36.08
Nights away from home	0	2.52
Days use boat	1	2.68
People on boat	3.79	3.88

Table 8-9: Marina Recreators' Characteristics by Boat Length Segment

Visitor Characteristics	20' and smaller	21' - 30'	31' and larger
Total trips using boat	49.72	28.14	43
Nights away from home	1.17	1.47	2.27
Days use boat	1.73	1.98	2.59
People on boat	3.36	3.87	4.44

8.2.5 State parks and recreational areas along the coast

Table 8-10 provides the attendance estimates of the national parks and state parks along the coast, including the state beaches. Santa Monica State Beach attracts more than 7.3 million visitors per year, while Golden Gate National Recreation Area accounts for more than 13.4 million visitors. The total attendance exceeds 40 million visitor days or activity days per year, which is approximately 23% of gross beach visit activity days for California.

Table 8-10: California's Top Beach/Coastal Park Attendance

Golden Gate National Recreation Area *	13,459,000
Santa Monica State Park	7,342,250
Light House Field State Beach	3,977,600
Dockweiler State Beach	3,855,700
Huntington State Beach	2,780,400
Seacliff State Beach	2,424,400
Bolsa Chica State Beach	2,289,300
Doheny State Beach	2,145,100
Sonoma Coast State Beach	201,600
San Clemente State Beach	495,100

Source: California Fast Facts. (Based on 2000/2001 fiscal year visitation)
** US Park Service*

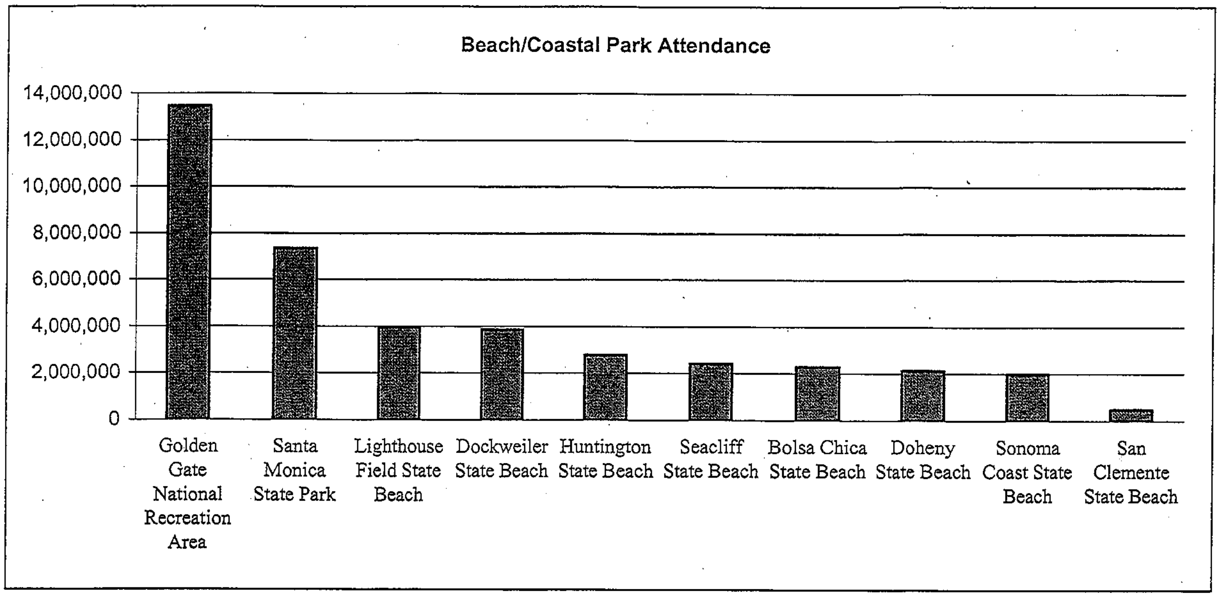


Figure 8-5: Attendance at Top 10 California Beach/Coastal Parks

8.2.6 Other marine recreational activities

Table 8-11 gives the estimates of participants and number of activity days for all other marine recreational activities along the California coast, such as wild life viewing, photography, viewing scenery, or water fowl hunting in the saltwater surrounding.

Table 8-11: Participation in Other Marine Related Recreation

Recreation Activity	Number of Participants	Number of Days	Average Days Per Person
Visit Waterside Besides Beaches	1,500,965	20,683,000	13.78
Snorkeling	706,998	3,818,000	5.40
Bird Watching in Saltwater Surrounding	2,581,958	65,762,000	25.47
Viewing or Photographing Scenery in Saltwater Surroundings	4,175,372	n/a	n/a
Hunting Waterfowl in Saltwater Surroundings	113,302	n/a	n/a

8.3 The Travel and Tourism Industry in California Coastal Counties: Description and Expenditures

Unlike the Tourism & Recreation sector, the state of California aggregates information into a Travel and Tourism industry. Travel and Tourism is the third largest employer in California, following business and health services.[54] Beach and waterfront activities are the second most popular recreational pursuits of travelers to California. Coastal tourism plays an important role in attracting recreators to California and generating significant economic. The California Travel and Tourism industry reflected the following highlights for the entire state for 2001.[55]

- The destination for an estimated 287 million domestic travelers and approximately 9 million international travelers.
- The most visited state with an 11.1% share of the domestic travel market.
- Expenditures amounted to $75.4 billion, or 6% of California's GSP. [56]
- Los Angeles County received the most domestic tourists in California. More than 45 million person-trips took place in and through Los Angeles County.
- Generated over $4.8 billion in tax revenues in 2001.

8.3.1 Travel Spending Estimates

The Travel and Tourism industry is a major part of California's economy and is a primary industry in many local communities. Travel spending by domestic and international travelers generates sales and employment for many different types of businesses in the state. Table 8-12 provides the estimates of the economic impact of the California travel industry from 1991 to 2001.

Table 8-12: Economic Impact of the Travel Industry of California

Year	Destination Spending ($Billion)	Total Travel Spending ($Billion)	Employment (1,000 jobs)	Wages ($Billion)	Tax Receipts ($Billion)
1991	37.9	44.6	852	15.2	2.6
1992	40.1	47.1	878	16.0	2.9
1993	40.9	48.4	882	16.2	3.0
1994	42.2	50.0	914	16.8	3.1
1995	44.2	52.7	935	17.5	3.2
1996	48.6	57.6	990	19.0	3.6
1997	53.7	62.6	1,054	20.8	3.9
1998	56.5	64.9	1,045	21.9	4.1
1999	61.1	69.8	1,087	23.4	4.5
2000	66.0	75.4	1,100	24.9	4.8
2001p*	66.1	75.4	1,051	25.0	4.8
**Annual Change					
2000-2001p	0.2%	0.0%	-4.4%	0.2%	-0.6%
1991-2001p	5.7%	5.4%	2.1%	5.1%	6.2%

Source: California Fast Facts 2002.
** 2001 numbers are provisional.*
*** Annual Change for 1991-2001p is the average annual percentage change.*

[54] California fast Facts 2002.
[55] California Fast Facts 2002.
[56] Expenditure includes accommodations, meals, ground and air transportation, travel arrangements by travel agents, spending in retail stores while on the trip, and the recreational spending such as equipment rental or admissions to amusement parks. The Office of Tourism defines travel as either spending at least one night away from home or traveling at least 50 miles from home.

The travel industry supported more than one million jobs in 2001 in California and earnings grew at an average rate of 5.1% over the last decade.

Figures 8-6 and 8-7 reflect travel spending and employment in the travel industry. Both show declines in 2001, which may be traced to the September 2001 events and a downturn in the economy. One interesting characteristic of these patterns is that travel spending increased by approximately 4% in 1998, though employment remained about the same.

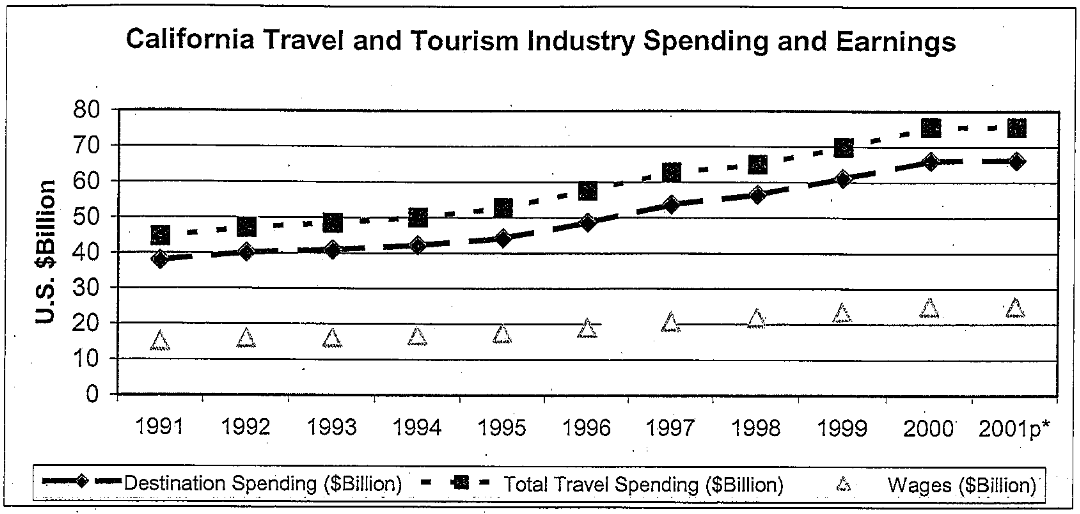


Figure 8-6: Travel and Tourism Industry Spending and Earnings in California

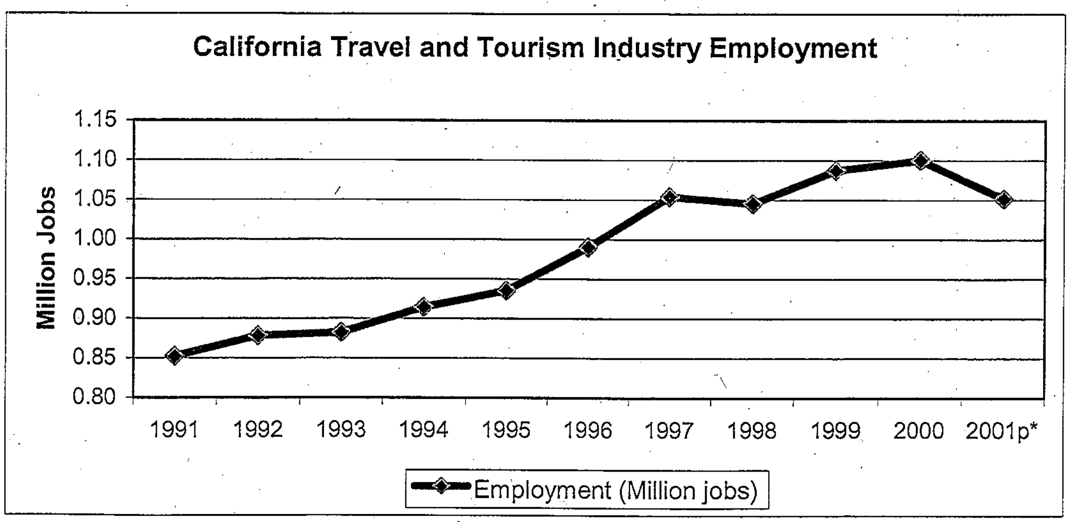


Figure 8-7: Travel and Tourism Industry Employment in California

Table 8-13 provides the travel spending by type of business service and Table 8-14 the estimates of employment generated by travel spending in different types of businesses. Accommodations account for around 20% of the total spending, while eating and drinking accounts for approximately 15%. Recreation accounts for about 12% to 15% of spending.

In terms of employment, recreation accounts for from 22% to 25% of the total employment generated by the travel industry in California.

Table 8-13: Travel Spending by Type of Business Service ($ Billion)

Type of Business	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Destination Spending	37.9	40.1	40.9	42.2	44.2	48.6	53.7	56.7	61.1	66.0	66.1
Accommodations	6.8	7.0	7.2	7.4	7.9	8.9	10.0	10.7	11.7	12.9	12.7
Eating, Drinking	9.9	10.2	10.3	10.6	11.1	12.0	13.4	14.3	15.3	16.0	16.2
Food Stores	1.4	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3
Ground Transport	5.1	5.4	5.4	5.5	5.7	6.3	6.8	6.5	7.4	8.8	8.6
Recreation	6.8	7.4	7.6	7.9	8.3	9.1	10.0	10.7	11.5	12.1	12.2
Retail Sales	7.9	8.7	8.9	9.2	9.7	10.6	11.6	12.3	13.2	13.9	14.1
Air Transportation	6.4	6.7	7.2	7.5	8.0	8.6	8.5	7.9	8.2	8.8	8.7
Travel Arrangement	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.5
Total Spending	**44.6**	**47.1**	**48.4**	**50.0**	**52.7**	**57.6**	**62.6**	**64.9**	**69.8**	**75.4**	**75.4**

Table 8-14: Employment Generated by Travel Spending (1,000 Jobs)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Accommodations	141	144	142	150	154	165	183	181	194	201	187
Eating, Drinking	324	322	328	332	341	362	379	181	393	398	387
Food Stores	11	10	10	11	11	12	13	12	12	12	12
Ground Transport	35	34	34	37	38	41	44	40	43	47	45
Recreation	171	195	194	206	210	222	241	236	248	248	236
Retail Sales	92	95	97	99	103	111	116	117	118	114	106
Air Transportation	52	51	51	51	50	51	51	50	51	52	51
Travel Arrangement	27	27	26	28	28	27	28	28	28	28	27
Total Employment	**852**	**878**	**882**	**914**	**935**	**990**	**1,054**	**1,045**	**1,087**	**1,100**	**1,051**

Source: "California Travel Impacts by County, 1992-2000," California Travel and Tourism Commission and Division of Tourism, 2002.

8.4 Regional Estimates of California Coastal Tourism & Recreation

Coastal tourism is an important and pivotal component of the Travel and Tourism industry of California. There are twenty-one coastal counties in California. Before estimating the economic impact of the Coastal Tourism industry, a measure of tourism activity in these coastal counties is instructive. Table 8-15 gives the estimates of visitor volume since 1998 for all the coastal counties, except those noted.

Table 8-15: Visitor Volumes in Coastal Counties of California*(Millions of person-trips)

Table 8-15: Visitor Volumes in Coastal Counties of California*(Millions of person-trips)

County	1998			1999			2000			2001		
	Total	Leisure	%	Total	Leisure	%	Total	Leisure	%	Total	Leisure	%
Mendocino	1.8	1.5	83.3	1.4	0.9	64.3	2.3	2.2	95.7	3.6	3.5	97.2
Sonoma	5.4	4.1	75.9	6.0	4.5	75.0	6.3	4.9	77.8	6.9	5.3	76.8
Napa	2.2	1.7	77.3	3.3	2.5	75.8	3.9	3.0	76.9	3.4	2.4	70.6
Sacremento	11.7	6.9	59.0	12.0	7.9	65.8	14.2	9.0	63.4	15.1	9.6	63.6
Marin	1.1	1.0	90.9	2.1	1.8	85.7	1.8	1.7	94.4	1.2	1.1	91.7
Contra Costa	2.9	1.7	58.6	3.2	2.1	65.6	3.5	2.5	71.4	3.2	2.2	68.8
Alameda	6.0	3.3	55.0	6.3	3.5	55.6	6.4	3.5	54.7	7.8	4.2	53.8
San Francisco	16.8	11.1	66.1	17.9	12.0	67.0	18.7	12.0	64.2	21.3	14.6	68.5
San Mateo	1.9	1.4	73.7	1.8	1.4	77.8	2.6	2.1	80.8	2.6	2.2	84.6
Santa Clara	9.3	5.7	61.3	10.3	6.4	62.1	10.8	6.7	62.0	11.9	7.3	61.3
Santa Cruz	3.7	3.2	86.5	3.7	3.2	86.5	4.3	3.7	86.0	4.5	3.9	86.7
Monterey	6.1	4.9	80.3	6.7	5.6	83.6	7.2	5.8	80.6	7.7	6.3	81.8
Santa Barbara	8.4	5.8	69.0	9.0	6.7	74.4	9.7	6.7	69.1	9.6	7.2	75.0
Ventura	2.7	2.1	77.8	3.2	2.8	87.5	3.4	2.9	85.3	3.6	3.5	97.2
Los Angeles	37.4	23.3	62.3	42.2	27.0	64.0	45.4	28.6	63.0	49.0	30.9	63.1
Orange	20.3	16.0	78.8	22.2	17.9	80.6	23.8	19.3	81.1	25.5	21.1	82.7
San Deigo	28.3	20.0	70.7	31.9	23.1	72.4	35.2	25.1	71.3	38.0	27.1	71.3

*Data for Del Norte, Humboldt,Yolo, Solano, San Joaquin,and San Luis Obispo coastal counties are not available.

Table 8-16 tells the story of the large increase in the direct contribution of the Tourism & Recreation industry to California between 1990 and 2000. Table 8-16 also gives detailed activity information on the direct impacts on the California economy by region.

Table 8-16: Employment, wages and GSP: Coastal Tourism & Recreation Sector

Region	SIC name	Employ 1990	Wages 1990	GSP 1990	Employ 2000	Wages 2000	GSP 2000
North	Amusement and Recreation Services	237	$1,904,465	$3,287,060	548	$8,241,712	$13,830,542
	Boat Dealers	17	$278,781	$609,487	D	D	D
	Eating and Drinking Places	2,984	$23,088,454	$50,477,293	4,074	$40,991,235	$93,920,820
	Hotels & Lodging Places	1,466	$13,317,529	$29,141,245	1,936	$23,427,349	$53,140,662
	Marinas	D	D	D	D	D	D
	Recreational Vehicle Parks and Campgrounds	D	D	D	D	D	D
	Zoos and Aquaria	D	D	D	D	D	D
	TOURISM & RECREATION	**4,765**	**$39,289,773**	**$84,976,861**	**6,674**	**$74,372,905**	**$164,581,624**
North Central	Amusement and Recreation Services	7,114	$141,427,734	$244,100,822	9,163	$225,582,798	$378,553,925
	Boat Dealers	759	$15,665,485	$34,248,775	363	$10,789,365	$24,721,041
	Eating and Drinking Places	64,554	$689,685,228	$1,507,829,108	92,365	$1,482,888,549	$3,397,655,840
	Hotels and Lodging Places	18,579	$303,401,347	$663,898,905	26,177	$691,246,163	$1,567,965,659
	Marinas	233	$4,883,247	$8,011,566	241	$7,443,259	$12,269,584
	Recreational Vehicle Parks and Campgrounds	D	D	D	77	$1,150,123	$2,608,844
	Sporting Goods	191	$4,733,845	$11,333,930	331	$13,156,663	$33,111,139
	Zoos and Aquaria	D	D	D	454	$10,480,821	$14,791,109
	TOURISM & RECREATION	**91,623**	**$1,162,470,431**	**$2,474,425,311**	**129,171**	**$2,442,737,741**	**$5,431,677,142**

Table 8-16 Cont.

Region	SIC4 Name	Employ 1990	Wages 1990	GSP 1990	Employ 2000	Wages 2000	GSP 2000
Central	Amusement and Recreation Services	614	$7,298,675	$12,597,335	810	$12,271,768	$20,593,441
	Boat Dealers	58	$1,531,126	$3,347,435	D	D	D
	Eating and Drinking Places	11,137	$104,030,476	$227,437,349	15,707	$203,759,487	$466,862,200
	Hotels and Lodging Places	4,725	$56,904,914	$124,518,597	8,519	$186,206,452	$422,375,324
	Marinas	98	$1,755,085	$2,879,432	90	$2,376,608	$3,917,638
	Recreational Vehicle Parks and Campgrounds	D	D	D	103	$1,769,615	$4,014,048
	Sporting Goods	D	D	D	77	$1,393,704	$3,507,510
	Zoos and Aquaria	D	D	D	D	D	D
	TOURISM & RECREATION	**17,121**	**$182,297,420**	**$387,817,811**	**25,862**	**$431,081,904**	**$974,607,724**
South Central	Amusement and Recreation Services	823	$9,594,725	$16,560,262	805	$14,207,296	$23,841,480
	Boat Dealers	89	$1,586,375	$3,468,223	58	$809,319	$1,854,345
	Eating and Drinking Places	9,434	$82,125,709	$179,547,900	14,390	$174,141,504	$399,000,247
	Hotels and Lodging Places	3,273	$39,220,696	$85,822,220	3,993	$75,743,437	$171,810,152
	Marinas	38	$1,292,914	$2,121,184	D	D	D
	Recreational Vehicle Parks and Campgrounds	41	$813,396	$1,779,863	D	D	D
	Sporting Goods	214	$5,085,171	$12,175,087	529	$15,031,491	$37,829,486
	Zoos and Aquaria	147	$2,278,765	$3,379,960	204	$4,346,474	$6,133,982
	TOURISM & RECREATION	**14,058**	**$141,997,751**	**$304,854,699**	**20,020**	**$285,660,011**	**$642,767,752**

Table 8-16 Cont.

Region	SIC name	Employ 1990	Wages 1990	GSP 1990	Employ 2000	Wages 2000	GSP 2000
South	Amusement and Recreation Services	7,267	$114,955,182	$198,409,843	5,944	$138,870,920	$233,041,404
	Boat Dealers	506	$12,010,953	$26,259,029	643	$23,958,054	$54,893,688
	Eating and Drinking Places	58,424	$585,090,288	$1,279,157,696	81,191	$1,154,471,234	$2,645,172,446
	Hotels and Lodging Places	22,470	$313,689,743	$686,411,840	28,527	$608,954,167	$1,381,301,297
	Marinas	314	$6,478,733	$10,629,157	421	$12,330,780	$20,326,250
	Recreational Vehicle Parks and Campgrounds	127	$1,491,051	$3,262,699	D	D	D
	Sporting Goods	1,377	$30,767,014	$73,663,417	3,722	$169,131,582	$425,650,438
	Zoos and Aquaria	52	$468,373	$694,710	D	D	D
	TOURISM & RECREATION	**90,537**	**$1,064,951,337**	**$2,278,488,391**	**120,863**	**$2,117,233,382**	**$4,776,667,273**
Total of Regions	Amusement and Recreation Services	16,054	$275,180,781	$474,955,322	17,270	$399,174,494	$669,860,792
	Boat Dealers	1,428	$31,072,720	$67,932,949	D	D	D
	Eating and Drinking Places	146,532	$1,484,020,155	$3,244,449,346	207,728	$3,056,252,009	$7,002,611,554
	Hotels and Lodging Places	50,514	$726,534,229	$1,589,792,808	69,152	$1,585,577,568	$3,596,593,094
	Marinas	D	D	D	D	D	D
	Recreational Vehicle Parks and Campgrounds	D	D	D	D	D	D
	Sporting Goods	D	D	D	D	D	D
	Zoos and Aquaria	D	D	D	D	D	D
	TOURISM & RECREATION	**218,103**	**$2,591,006,712**	**$5,530,563,073**	**302,591**	**$5,351,085,943**	**$11,990,301,515**

Source: BLS

Note: Regional totals contain data suppressions and are slightly lower than the state level aggregates of Table 8-1 and 8-3.

Table 8-17 summarizes the total economic impact of the California Coastal Tourism and Recreation sector by region.

Table 8-17: Regional Summary of Coastal Tourism & Recreation Total Employment, Wages and GSP 2000

Region	Direct Employment	Indirect and Induced Employment	Total Employment	Employment multiplier
North	6,672	2,002	8,674	1.3
North Central	112,856	33,857	146,713	1.3
Central	45,155	13,547	58,702	1.3
South Central	26,231	10,492	36,723	1.4
South	120,861	36,258	157,119	1.3
Total	**311,775**	**93,533**	**405,308**	**1.3**
Region	**Direct Wages**	**Indirect and Induced Wages**	**Total Wages**	**Wages Multiplier**
North	$74,372,905	$44,623,743	$118,996,648	1.6
North Central	$2,122,346,352	$1,697,877,082	$3,820,223,434	1.8
Central	$843,387,471	$590,371,230	$1,433,758,701	1.7
South Central	$365,505,566	$292,404,453	$657,910,019	1.8
South	$2,117,233,382	$1,905,510,044	$4,022,743,426	1.9
Total	**$5,522,845,676**	**$4,418,276,541**	**$9,941,122,217**	**1.8**
Region	**Direct GSP**	**Indirect and Induced GSP**	**Total GSP**	**GSP Multipliers**
North	$164,581,623	$115,207,136	$279,788,759	1.7
North Central	$4,724,735,090	$2,834,841,054	$7,559,576,144	1.6
Central	$1,886,575,918	$1,509,260,734	$3,395,836,652	1.8
South Central	$823,712,612	$741,341,351	$1,565,053,963	1.9
South	$4,776,667,271	$3,821,333,817	$8,598,001,088	1.8
Total	**$12,376,272,514**	**$9,901,018,011**	**$22,277,290,525**	**1.8**

Source: BLS

Note: Regional totals contain data suppressions and are slightly lower than the state level aggregates of Table 8-1 and 8-3.

The Tourism & Recreation sector component of the California Ocean Economy grew significantly in the 1990s. The growth in the Central region was highest in terms of employment, wages, and contribution to GSP, followed by the San Francisco Bay, or North Central area. The growth in wages and contribution to GSP are relatively high compared to employment growth using constant 2000 dollars. The estimates that follow include data suppressions, and therefore are slightly higher than those found in Table 8-17.

- The total economic impact of the Tourism & Recreation sector of the Ocean Economy in California was estimated to be $22,367,879,303 in 2000.
- Total employment generated more than 400,000 jobs.

- Direct wages were estimated at $5,544,976,307. Including indirect estimates, wages totaled $9,980,957,353.
- The Coastal Tourism & Recreation sector accounts for around 72% of the jobs that can be attributed to the Ocean Economy and approximately 55% in terms of wages and contribution to GSP.

8.5 References

California Fast Facts 2002.

"California Travel Impacts by County, 1992-2000," *California Travel and Tourism Commission and Division of Tourism*, 2002.

Cunningham, C. and Walker, K. 1996. "Enhancing Public Access to the Coast through the CZMA." *The Journal of Marine Education*, Volume 14, No.1. pp 8-11.

Houston, J.R. 1996. "International Tourism and US beaches". *Shore and Beach.*

US Department of Interior, US Department of Commerce, NOAA. National Survey on Recreation and Environment, 2000.

US Department of Labor, Bureau of Labor Statistics.

8.5.1 References for Beach Valuation Section

California Coastal Commission, Beach Access Guide

California Department of Boating and Waterways (CDBW) and State Coastal Conservancy, 2002, California Beach Restoration Study. Sacramento California (references in the text as CDBW 2002)

Chapman, David and Michael Hanemann. 2001. Environmental damages in court: the American Trader case, in The Law and Economics of the Environment, Anthony Heyes, Editor, pp. 319-367

Deacon, R.T. and Kolstad, C. D., 2000. "Valuing Beach Recreation Lost in Environmental Accidents", *Journal of Water Resources Planning and Management*, **126**: 374-81.

Hanemann, M. 1997. " Final Conclusions of Professor Michael Hanemann Regarding Lost Recreational Damages Resulting from the *American Trader* Oil Spill"

Hanemann, M., Pendleton, L., Hilger, J., and D. Layton. 2002. Expenditure Report for the Southern California Beach Valuation Project. Prepared for the National Ocean and Atmospheric Administration, Minerals Management Service (Department of the Interior), The California State Water Resources Control Board, and The California Department of Fish and Game.

Hanemann, M., Pendleton, L., Mohn, C., Hilger, J., Kurisawa, K., Layton, D. and Felipe Vasquez. 2003. Interim Report on the Southern California Beach Valuation Project. Prepared for the National Ocean and Atmospheric Administration, Minerals Management Service (Department of the Interior), The California State Water Resources Control Board, and The California Department of Fish and Game.

Hanemann, M., Pendleton, L., Mohn, C., Hilger, J., Kurisawa, K., Layton, D. and Felipe Vasquez. 2004. Using revealed preference models to estimate the affect of coastal water quality on beach choice in Southern California. Prepared for the National Ocean and Atmospheric Administration, Minerals Management Service (Department of the Interior), The California State Water Resources Control Board, and The California Department of Fish and Game.

Hanemann, W. Michael. 1997. Final conclusions of Professor Michael Hanemann regarding lost recreational damages resulting from the *American Trader* Oil Spill. Report submitted to the State of California Attorney General's Office. August 15, 1997.

Kildow, J. and S. Shivendu. 2001. Valuing California Beaches. Presented at the Beach Economics Workshop, University of Southern California.

King, Philip. 1999. "The Fiscal Impact of Beaches in California." *Public Research Institute*, San Francisco University, Report Commissioned by California Department of Boating and Waterways.

King, Philip. 2001. The Economic Analysis of Beach Spending and the Recreational Benefits of Beaches in the City of San Clemente, mimeo, San Francisco State University.

Leeworthy, V. R. and Wiley, P. C. 1993. "Recreational Use Value for Three Southern California Beaches." *Strategic Environmental Assessments Division*, Office of Ocean Resource Conservation and Assessment, National Oceanic and Atmospheric Administration, Rockville Maryland.

Leeworthy, Vernon R. 1995. Transferability of Bell and Leeworthy Beach study to Southern California Beaches. Memo to David Chapman, June 22 (Exhibited 939) reported in Chapman, David and Michael Hanemann 2001. Environmental damages in court: the American Trader case, in The Law and Economics of the Environment, Anthony Heyes, Editor, pp. 319-367.

Leeworthy, Vernon R. and Peter C. Wiley. 1993. Recreational use value for three southern California beaches. Rockville, MD. NOAA Strategic Environmental Assessments Division. Office of Ocean Resources and Conservation, March.

Leeworthy, V. R. and P.C. Wiley. 2001. Current Participation Patterns in Marine Recreation. National Oceanic and Atmospheric Administration.

Lew, Daniel Kevin. 2002. Valuing recreation, time, and water quality improvements using non-market valuation: an application to San Diego beaches. Doctoral Dissertation. University of California Davis.

Morton, J. and L. Pendleton. 2001. A Database of Beach Closures and Historical Water Quality. Prepared for the State Water Resources Control Board. Sacramento, California.

Pendleton, L., Martin, N. and D.G. Webster. 2001. "Public Perceptions of Environmental Quality: A Survey Study of Beach Use and Perceptions in Los Angeles County." Marine Pollution Bulletin 42: 1155-1160.

Report on Phase I Beach Valuation Analysis. Southern California Beach Valuation Project: http://marineeconomics.noaa.gov/SCBeach/welcome.html#background

United States Lifesaving Association, 2002, (USLA) http://www.usla.org/PublicInfo/

United States EPA BEACH Watch, http://www.epa.gov/waterscience/beaches/2001surveyfs.pdf

PART III CONCLUSION

Future Directions in Understanding the Ocean Economy of California

This report has provided a detailed overview of important trends in the California Ocean Economy. It has relied on both published data sources and analysis of unpublished data undertaken specifically for analysis of the Ocean Economy. The ocean and coast make vital contributions to the welfare and economy of Californians, but it also is clear that the nature of those contributions is changing over time, as the ocean and coast become more and more a center of tourism and recreation.

This analysis is incomplete due to inadequate time and resources and because multiple aspects of the California Ocean Economy data are unavailable. Given the importance of the Ocean Economy, additional investments are warranted in improving the measurement and tracking of this segment of California's overall economy. We suggest the following:

1. The Government Sector of the Ocean Economy: This report has concentrated on the private sector Ocean Economy because the relationship to the ocean can be directly or indirectly inferred from industrial definitions and geographic locations. Federal, state, and local governments also are a key part of the Ocean Economy and provide a variety of services such as parks and resource management, as well as key roles in defense and homeland security. Because data sources do not permit a separation of function and geography for government activities, it is difficult to determine the employment levels needed to maintain the federal, state, and local parks along the ocean, or the size of the US Navy's presence in California. Determining the employment levels needed requires detailed analysis of budgetary and other internal government documents and specific surveys of local and county governments. The addition of these data would provide a more complete picture of the Ocean Economy.

2. Improved measurement of ocean recreation values: The Tourism & Recreation sector now is the single most important part of the Ocean Economy in California. However, as the analysis in this report shows, the measurement of this key sector is still imprecise. It is possible to measure the activity that takes place near the shore in industries such as hotels or restaurants, a large (but unknown) portion of which is related directly to the use of ocean resources like beaches, boating, or whale watching. There also is a large (and also unknown) portion of the activity in hotels away from the shore that uses the ocean resources for at least some portion of recreational activity. Measurement of the number of people who use beaches (whether tourists or residents) in California is best at state parks and very uneven through the rest of the coast. There is little measurement at all of recreational boating except for counting the number of boats. Moreover, these limitations apply only to market-related economic activity. While studies of the non-market values of California's beaches have been undertaken, little has been done with the non-market values of other ocean related resources, such as wildlife viewing. For all the data available, ocean-based tourism and recreation in California remains a poorly understood activity from an economic perspective.

3. Employment in fisheries harvesting: A major gap in the measurement of the Ocean Economy in the US and in California is the absence of reliable, consistent figures on employment in the fisheries harvesting sector. By law this sector is exempt from the unemployment insurance laws that require reporting by almost all other industries (including all governments). However, the use of license data for commercial fish harvesters does provide a means to measure employment. Because it is possible to hold multiple licenses, changes in the licensing system are required to add statistical measurement capabilities to what is fundamentally an administrative system designed for other purposes. It is not clear the extent to which such changes are feasible in California, but a review of procedures to assess feasibility might lead to an important addition to the capacity to measure this important industry.

For all these reasons, the data in this report represent an under estimate of the value of the ocean to California. However, the size of the ocean's contribution documented here should spur additional efforts to measure more accurately both that contribution and its change over time.

PART IV APPENDIX

Appendix A: The NOEP Ocean Economy: The Methodology

The NOEP is sponsored by NOAA to develop new methods to measure the Ocean Economy of the US in a way that is consistent across the entire country.

A.1 Market Data

The methodology developed to estimate market values is based on using the ES-202 employment data, which are collected monthly by each state's department of labor and reported to the US Department of Labor. The ES-202 data are used as the basis for administering the nation's unemployment insurance laws, and covers about 90 percent of all employees. The data series excludes farm and self-employment.

A.1.1 NOEP Methodology

ES-202 data are at the establishment level. Any single place of business is an establishment, regardless of who owns it. A business firm may have many establishments or only one. Nonprofit organizations and government also report its employment through this system. For purposes of the NOEP methodology, establishments (see table A-2) are defined as ocean-related based on SIC codes and, for certain industries, by the location of a given establishment in a zip code adjacent to the shore.

Most of the industries defined in this table are single 4-digit SIC codes. Some 4-digit SIC industries have been combined to create the industries as shown in order to minimize the disclosure of data for single firms, which is prohibited. Table A-1 shows the industries and corresponding SIC codes (1987 Revision)

Table A-1: NOEP Industries and Related SIC Codes

SECTOR/INDUSTRY	SIC CODE
LIVING RESOURCES	
Fishing	0912 0913 0919
Fish Hatcheries & Aquaculture	0921 0273
Seafood Processing	2077 2091 2092
MINERALS	
Oil & Gas Exploration and Production	1311 1321 1381 1382
Oil & Gas Exploration Services	1382
Limestone, Sand & Gravel	1422 1442
CONSTRUCTION	
Marine Related Construction	1629
SHIP AND BOAT BUILDING	
Ship Building & Repair	3731
Boat Building & Repair	3732
TRANSPORTATION	
Search and Navigation Equipment	3812
Warehousing	4222 4225
Deep Sea Freight	4412 4424
Marine Passenger Transportation'	4481 4489 4482
Marine Transportation Services	4491 4492 4499
Petroleum and Natural Gas Pipelines	4612 4922
TOURISM AND RECREATION	
Sporting Goods	3949
Marinas	4493
Boat Dealers	5551
Eating & Drinking Places	5810 5812
Hotels & Lodging Places	7011
Recreational Vehicle Parks & Campsites	7033
Amusement and Recreation services	7999 7990

In California, all zip codes adjacent to the Pacific Ocean or San Francisco Bay in the coastal counties defined by the state were included based on analysis using geographic information systems. Arc Map® was used, combining zip code polygons from ESRI with Census boundary files from the Bureau of the Census.

The zip codes of the physical address of the establishment as recorded in the ES-202 were used to determine location where available on the record. If not available, the zip code of the mailing address was used.

All ES-202 data are reported to the Bureau of Labor Statistics of the US Department of Labor, which compiles the state reports into a longitudinal database (LDB) of all reporting establishments in the US. This database was used to access California's information. Because of differences in revisions of the data between the LDB and California's own records, there may be minor differences between totals reported here and those available from the California Employment Development Department.

Except where noted, all reported data are annual average data from monthly reports. All wage data are annual totals from monthly reports.

ES-202 data include only wage and salary employment. It excludes self-employment and farm employment. While the latter is not relevant to the Ocean Economy, self-employment can be significant in the tourism and recreation sector. Thus the figures reported here understate employment and wages in that sector.

Fisheries harvesting employment is also excluded from this analysis, since the fish harvesting industry is not covered by the federal law requiring reporting of employment. Estimates of fisheries harvesting derived using IMPLAN are included in the living resources sector for 2000. These should be treated cautiously as they are derived, not reported data.

All data derived from the ES-202 data series are subject to confidentiality screening. Federal law prohibits the release of data at any level of aggregation, which could reveal the employment or wages of a single firm. The estimates for employment and wages were developed using the original non-public data series, which includes all establishments. However, all reported data in this report were screened for confidentiality by the Bureau of Labor Statistics before being released. This screening included comparing the released data with other published data sources to be certain that no confidential data could be imputed based on combining this data series with any other data.

In all tables, totals of the sectors, regions, and the state include all data from all establishments selected as above. Industry level totals are suppressed to prevent disclosure of confidential data. In any sector where one industry's data is suppressed, a second industry's data also are suppressed to prevent complimentary disclosure.

The ES-202 data are the basis for all information regarding employment, wages, and the number of establishments in this report. GSP for each sector is estimated using Equation A-1*, which states that an establishment's share of the state's GSP is based on the establishment's share of the 2-digit SIC code's wages as reported by the Bureau of Economic Analysis multiplied by the GSP for that two digit industry, and then summed across all establishments in that industry. This method assures that the sum of wages and GSP for the ocean sector is consistent with the total GSP as reported by BEA. Wage percentages were also cross-checked against the totals reported in the BLS LDB for the state to assure consistency in proportions.

Equation A-1

$$GSP_r^i = \sum_{i=1}^{n}\left(\frac{W_e^i}{W_S^I}\right)GSP_S^I$$

Where:

GSP_r^i = the Gross State Product for industry i in region r

W_e^i = the wages for a given establishment in industry i

W_S^I = the total wages in industry i in state S (from BLS data)

GSP_S^I = the total gross state product for industry I in state S from BEA.

A.1.2 Strengths and Weaknesses of the NOEP methodology.

The NOEP methodology was developed to overcome the limitations of other approaches to measuring the Ocean Economy. The methodology may be considered to have the following strengths:

- Use of primary data. The use of the ES-202 data permits all estimates to be based on primary reporting data from almost all establishments in the US. The data are verified by both the state and US Departments of Labor and is the basis for all employer-related government employment statistics in the US.

- Consistency and comparability. The data are collected using consistent methodologies across all fifty states. It can be aggregated by industry and geography (although small area geographies do have limitations discussed below). The data are also consistent over time, at least until the implementation of the new North American Industrial Classification System in 2001, which created a break in the industrial data series.

- Estimates are derived from the bottom up. Employment and wage estimates are the sum of actual reported data and, except where limited by confidentiality restrictions, are the sum of firm-level reports.

- Using the zip codes permits a much finer geographic level of detail than the county level at which employment data are normally released. This is especially important in California, where large urban counties such as in Southern California seriously distort the picture of ocean related activities measured at the county level only.

At the same time, this data series does have some weaknesses:

- Zip code geography is imperfect. Zip codes change over time, and available GIS files on zip codes (from Environmental Systems Research Institute) do not always contain correct historical or recent revisions. The zip code data used here are for 1999. It matches very closely with 2000 data, but there may be unknown errors in the 1990 data since zip code information in GIS format for that year was not available.

- There are errors in the original employment reports. Firms make errors in reporting SIC codes and may make errors in reporting addresses. For example, while required to give the physical location of each establishment, not every record contains this information. In such cases, alternative mailing addresses on the record were used. If no address was given, the record was omitted. These reporting errors introduce biases in the data of unknown directions and sizes that may be amplified in the fine-level geographic detail examined here.

- Industry definitions related to the ocean are imperfect. Some industries, such as those in SIC 44 (Water Transportation) are reasonably well related to the oceans. Others such as restaurants and hotels always will present problems in determining the degree to which they are related to the ocean.

- Still others, such as SIC 1629 (Heavy Construction) and SIC 3999 (Sporting Goods not elsewhere classified) do not separate a marine from a non-marine component. In these cases, the assumption is that the marine component (dredging and pier construction companies or surfboard manufacturers) are most likely located near the shore and so may be captured in a shore-adjacent zip code. But in both cases it is likely that other non-marine related firms may be located in a near shore zip code and thus over-counted in the data.

- A somewhat similar problem occurs with search and navigation equipment. This industry produces primarily electronic equipment such as radar, sonar, geographic positioning systems, etc. These products all have applications in marine transportation (and increasingly in recreational boating) but also in aviation. No information exists to separate the applications to which the products of this industry may be put. All of the output is counted in marine transportation, which probably overstates the actual marine component of the output.

- Industries might be included in more than one ocean sector. The example of search and navigation equipment just discussed indicates that the products of the industry may be used both in marine transportation of goods and people but also in recreational boating. It has been assigned to transportation since the largest dollar volume of marine related products is in the commercial side of the business.

- Marinas are another example of possible sectoral confusion. Marinas are the home to both recreational boats and some commercial boats, primarily in the fishing industry. However, the vast majority of boats in marinas are recreational boats and so this sector is assigned to tourism and recreation.

- Where data for the individual industries are available, users may adjust the sector totals to suit specific preferences, if desired.

On balance, the strengths of the methodology outweigh the weaknesses. For the most part, the weaknesses are inherent to either the original data sources used or to the nature of any taxonomic process or to data availability limitations that cannot easily be overcome. The NOEP methodology is still under development, and ways must be found to control for both the upward and downward biases in the data in order to improve the estimates.

A.2 Market and Non-Market Valuation

The ocean, like other environmental assets, may be viewed as a set of natural resources that provide a stream of valuable services over a period of time (Freeman, 2003). These services can be direct, like swimming or sunbathing on a beach, boating or recreational fishing. Or they can be indirect, like ecological preservation or influencing climates. Moreover, these services may be traded in markets with prices, like overnight camping fees, or fishing permits. These services can also be available outside traditional markets, like the recreational value of a day at the beach, or day of recreational fishing. Much of what a beach visitor values in a "day at a beach" or a surfer values in a "day of surfing" is not bought and sold in markets, and therefore, the value of these added services is often omitted in traditional economic valuation/impact studies, or is not directly linked to the natural asset that provides these services.

The process of determining the economic value of those activities that are not traded in the market is not the same as calculating the value of something that is traded in the market place such as purchasing a boat or buying a swim suit. These activities have non-market use values to those who partake in them, which must be estimated indirectly and somewhat less precisely than a market activity. Non-market valuation methods have been increasingly used to estimate that "value "of recreational activities that are not captured by market transactions, although the methods for determining these values are less precise and still becoming more sophisticated. Non-market valuation methods can be broadly divided into two groups: surrogate market techniques and simulated market techniques. Surrogate market techniques attempt to estimate implicit (substitute) values for environmental goods and services by means of the price of another good or service that is marketed. These techniques use actual market prices to value an environmental quality or resource that is not marketed. The idea behind these methods is that prices for many marketed goods and services differ across seemingly equal units due to different environmental qualities, scale or setting, and these price differentials reflect a purchaser's valuation of the environmental effects associated with any particular unit. Hedonic Pricing and Travel Cost are the two most widely used methods under this category. Simulated market techniques are not based on observed behavior, but on a user's responses to survey questions, which try to mimic the actual market. These experimental situations ask users to choose between things, to give information about the value they place on certain costs or benefits. Contingent Valuation methods are the most commonly used simulated market techniques.

Estimates of non-market values of ocean-related recreational activities in California are imprecise and subject to a range of biases. The users' valuation of beaches, recreational fishing, or boating will not only depend on the ocean/water/beach/fish stock characteristics, it will also be a function of the users' characteristics and situation. Even assuming that the appropriate non-market valuation methods were available to determine the exact price which the users would be willing to pay for the use of these ocean-related environmental assets, each recreational activity in each area will have different dollar values. For example, while a surfer may value a beach by its surf, a sunbather may value it by the quality of the sand. In order to get willingness to pay for a day at a particular beach, the valuation of these different uses is aggregated, which may create aggregation error. To get the overall non-market value of ocean-related recreational activities in California, gross aggregations were used to get the total number of users and then again aggregated different types of uses in three broad categories, namely, beach visitation, recreational fishing and recreational boating; leading to additional estimation errors. Therefore, the reader must keep in mind, that the estimated non-market values are not precise, but only give gross estimates.

Table B-2: California's Seafood Product Preparation and Packaging (NAICS Code 3117) 2001 Employment and Total Effects on Income by County and Region

County and Region	Number of Establishments	Average Monthly Employment	Average Annual Pay ($)	Total Annual Payroll ($1,000)	Proportion of Labor Costs in Total Costs	Estimated Total Costs ($1,000)
North Coast						
Mendocino	5	204	$14,129	$2,875	40%	$7,188
North Central						
San Francisco	4	26	$34,837	$906	40%	$2,265
South Central Coast						
Ventura	4	52	$14,737	$766	40%	$1,915
South Coast						
Los Angeles	31	1,468	$24,310	$35,688	40%	$89,220
All Coastal	44	1750	$22,991	$40,235	40%	$100,588

Source: CA Employment Development Department: http://www.calmis.ca.gov/file/es202/cew-select.htm

Table B-3: Aquaculture (NAICS Code 11251) 2001 Employment and Total Effects on Income in California.

NAICS Codes	Detailed Industry Title	Number of Establishments	Average Monthly Employment	Average Annual Pay	Total Annual Payroll ($1,000)	Proportion of Labor Costs in Total Costs	Estimated Total Costs ($1,000)
11251	**Total Animal aquaculture**	**84**	**564**	**$26,534**	**$14,965**	**40%**	**$37,413**
112511	Finfish farming and fish hatcheries	64	415	$25,068	$10,405	40%	$26,013
112512	Shellfish farming	14	135	$31,951	$4,303	40%	$10,758
112519	Other animal aquaculture	7	14	$18,024	$257	40%	$643

Source: CA Employment Development Department: http://www.calmis.ca.gov/file/es202/cew-select.htm

Appendix C: California Marine Research Institutions

Telonicher Marine Laboratory (Humboldt State University)
Trinidad, CA 95570
< http://www.humboldt.edu/~marinelb/>

Bodega Marine Laboratory (cooperative program UC Davis and UC Berkeley)
Bodega Bay, CA 94923-0247
< http://www-bml.ucdavis.edu/>

Romberg Tiburon Center (San Francisco State University)
Tiburon, CA 94920
< http://www.rtc.sfsu.edu/>

Institute of Marine Science (UC Santa Cruz)
Long Marine Lab (UC Santa Cruz)
Santa Cruz, CA 95064
< http://ims.ucsc.edu/>

Elkhorn Slough National Estuarine Research Reserve
Moss Landing, CA 95039
<http://www.elkhornslough.org/>

Moss Landing Marine Laboratories (California State University)
Moss Landing, CA 95039
< http://arkeia.mlml.calstate.edu/>

Monterey Bay Aquarium Research Institute (MBARI)
Moss Landing, CA 95039-9644
< http://www.mbari.org/default.htm>

Naval Postgraduate School
Monterey, CA 93943
< http://www.nps.navy.mil/>

Hopkins Marine Station (Stanford University)
Pacific Grove, CA 93950-3094
< http://www.marine.stanford.edu/>

Santa Barbara Marine Science Institute (UC Santa Barbara)
< http://www.msi.ucsb.edu/>
Santa Barbara, CA 93106-6150

Santa Cruz Laboratory
Santa Cruz, CA 95060
< http://santacruz.nmfs.noaa.gov/index.php>

Wrigley Institute for Environmental Studies (University of Southern California)
Los Angeles, California 90089-0371
< http://wrigley.usc.edu/>
and
Wrigley Marine Science Center
Avalon, California 90704

Marine Science Center (UC Los Angeles)
Los Angeles, CA 90095-1606
< http://www.msc.ucla.edu/>

Southern California Marine Institute in Long Beach (cooperative program California State University, University of Southern California, and Occidental College)
Long Beach, CA 90803
<http://www.longbeachmarineinst.com/>

Marine Conservation Research Institute (MCRI) (Aquarium of the Pacific)
Long Beach, CA 90802
< http://www.aquariumofpacific.org/MCRI/>

Kerckhoff Marine Lab, California Institute of Technology
Corona Del Mar, CA 92625
<http://www.cco.caltech.edu/~mirsky/kml.htm>

Pacific Marine Mammal Center
Laguna Beach, CA 92651
http://www.pacificmmc.org/

The Ocean Institute
Dana Point, CA 92629
< http://www.ocean-institute.org/>

Scripps Institution of Oceanography-UC San Diego
La Jolla, CA 92093-0233
< http://sio.ucsd.edu/>

Hubbs Sea World Research Institute (San Diego State University)
San Diego, CA 92109
< http://www.hswri.org/>

Cetacean Behavior Laboratory (San Diego State University)
San Diego, CA 92182
< http://www.sci.sdsu.edu/CBL/CBLHome.html>

Appendix D: California Beaches

Table D-1: Regional Beaches and Locations

County Name	Name of the Beach	Water Body	Nearest city	Length of Beach
Humboldt	Clam Beach	Pacific Ocean	Trinidad	1
	Freshwater Lagoon Beach	Pacific Ocean	Orick	1
	Samoa Beach	Pacific Ocean	Samoa	5
Mendocino	Pudding Creek Beach	Pacific Ocean	Fort Bragg	1
	Virgin Creek Beach	Pacific Ocean	Fort Bragg	0.5
Sonoma	Black Point	Pacific Ocean	Sea Ranch	0.5
	Campbell Cove State Beach	Pacific Ocean	Bodega Bay	0.1
	Doran Park County Regional Park	Pacific Ocean	Bodega Bay	1
	Goat Rock State Beach	Pacific Ocean	Jenner	1
	Gualala Regional Park	Pacific Ocean	Gualala	0.5
	Salal	Pacific Ocean	Sea Ranch	
	Salmon Creek State	Pacific Ocean	Bodega Bay	1
	Shell Beach	Pacific Ocean	Sea Ranch	
	Stengel Beach	Pacific Ocean	Sea Ranch	
	Stillwater Cove Regional Park	Pacific Ocean	Timber Cove	0.05
	Walk-On	Pacific Ocean	Sea Ranch	
San Francisco	Aquatic Park	San Francisco Bay	San Francisco	1
	Baker Beach	San Francisco Bay	San Francisco	1
	Candlestick Park Recreation Area	San Francisco Bay	San Francisco	1
	China/Phelan Beach	San Francisco Bay	San Francisco	1
	Fort Funston	San Francisco Bay	San Francisco	
	Ocean Beach	San Francisco Bay	San Francisco	3
Marin	Ayala Cove	San Francisco Bay	Tiburon	0.33
	China Cove	San Francisco Bay	Tiburon	0.25
	Hearts Desire Beach	Tomales Bay	Point Reyes	0.33
	Perles Beach	San Francisco Bay	San Francisco	0.25
	Quarry Beach	San Francisco Bay	San Francisco	0.5
	Shell Beach	Tomales Bay	Point Reyes	0.33
	West Garrison Beach	San Francisco Bay	Tiburon	0.25
Solano				
Alameda	Crown Memorial State Beach	San Francisco Bay	Alameda	2
San Mateo	Bean Hollow State Beach	Pacific Ocean	Pescadero	
	Capistrano Beach	Pacific Ocean	Princeton	0.25
	Dunes Beach	Pacific Ocean	Half Moon Bay	1
	Elmar Beach	Pacific Ocean	Half Moon Bay	1
	Erckenbrack Park	Lagoon	Foster City	
	Fitzgerald Marine Reserve	Pacific Ocean	Moss Beach	2
	Francis Beach	Pacific Ocean	Half Moon Bay	2
	Gazos Creek Beach Access	Pacific Ocean	Gazos	
	Gull Park	Lagoon	Foster City	
	Linda Mar Beach	Pacific Ocean	Pacifica	

Table D-1: Regional Beaches and Locations (Cont.)

County Name	Name of the Beach	Water Body	Nearest city	Length of Beach
San Mateo	Marlin Park - Foster City	Lagoon	Foster City	
	Marlin Park - Redwood City	Lagoon	Redwood City	
	Miramar	Pacific Ocean	Half Moon Bay	1
	Montara Beach	Pacific Ocean	Montara	2
	Naples Beach	Pacific Ocean		1
	Pacifica State Beach (San Pedro Beach)	Pacific Ocean	Pacifica	2
	Pescadero State Beach	Pacific Ocean	Pescadero	
	Pillar Point Beach	Pacific Ocean	Princeton	
	Pomponio State Beach	Pacific Ocean	San Gregorio	
	Poplar Beach	Pacific Ocean	Half Moon Bay	1
	Rockaway Beach	Pacific Ocean	Pacifica	1
	Roosevelt Beach	Pacific Ocean	Half Moon Bay	
	San Gregorio State Beach	Pacific Ocean	San Gregorio	
	Sharp Park	Pacific Ocean	Pacifica	1
	Surfer's Beach	Pacific Ocean	El Granada	
	Venice Beach	Pacific Ocean	Half Moon Bay	1
Santa Cruz	Capitola Beach	Monterey Bay	Capitola	1
	Corcoran Lagoon Beach	Monterey Bay	Santa Cruz	1
	Cowell Beach	Monterey Bay	Santa Cruz	1
	Lighthouse Beach	Monterey Bay	Santa Cruz	
	Manresa State Beach	Monterey Bay	Watsonville	3
	Mitchell's Cove Beach	Monterey Bay	Santa Cruz	
	Moran Lake Beach	Monterey Bay	Santa Cruz	0.5
	Natural Bridges State Beach	Monterey Bay	Santa Cruz	0.5
	New Brighton State Beach	Monterey Bay	Santa Cruz	2
	Pajaro Dunes State Beach	Monterey Bay	Watsonville	
	Palm Beach/Pajaro Dunes Beach	Monterey Bay	Watsonville	1
	Rio del Mar Beach	Monterey Bay	Rio del Mar	1
	Santa Cruz Main Beach at the Boardwalk	Monterey Bay	Santa Cruz	1
	Seabright State Beach	Monterey Bay	Santa Cruz	1
	Seacliff State Beach	Monterey Bay	Rio del Mar	3
	Sunset State Beach	Monterey Bay	Watsonville	2
	Trestle Beach	Monterey Bay	Watsonville	
	Twin Lakes State Beach	Monterey Bay	Santa Cruz	0.5
Monterey	Carmel Beach	Monterey Bay	Carmel	1
	Del Monte Beach	Monterey Bay	Monterey	
	Garrapata State Beach	Pacific Ocean	Big Sur	
	Heritage Harbor	Pacific Ocean	Monterey	0.1
	Lover's Point	Monterey Bay	Pacific Grove	0.25
	Monastery Beach	Monterey Bay	Carmel	0.5
	Monterey Beach Hotel	Monterey Bay	Monterey	0.25
	Moss Landing Beach	Monterey Bay	Moss Landing	

Table D-1: Regional Beaches and Locations (Cont.)

County Name	Name of the Beach	Water Body	Nearest city	Length of Beach
Monterey	Oceanview Avenue	Pacific Ocean	Pacific Grove	1
	Pfeiffer Beach	Pacific Ocean	Big Sur	
	San Carlos Beach	Monterey Bay	Monterey	0.25
	Spanish Bay Beach	Monterey Bay	Pebble Beach	
	Stillwater Cove	Monterey Bay	Pebble Beach	0.25
	Sunset Drive Beach	Monterey Bay	Pacific Grove	2
	Zmudowski State Beach	Monterey Bay	Pajaro	
San Luis Obispo	Avila Beach	Avila Bay	Avila Beach	1
	Cayucos		Cayucos	
	Moonstone Beach	Pacific Ocean	Cambria	
	Morro Bay City Beach	Morro Bay	Morro Bay	2
	Olde Port Beach	Port San Luis	Avila Beach	0.5
	Pismo Beach	Pacific Ocean	Pismo Beach	2
	Pismo State Beach	Pacific Ocean	Oceano	5
	Shell Beach	Pacific Ocean	Pismo Beach	
Santa Barbara	Arroyo Burro Beach	Pacific Ocean	Santa Barbara	1
	Arroyo Quemada Beach	Pacific Ocean	Santa Barbara	1
	Butterfly Beach	Pacific Ocean	Montecito	1
	Carpinteria City Beach	Pacific Ocean	Carpinteria	1
	Carpinteria State Beach	Pacific Ocean	Carpinteria	1
	East Beach at Mission Creek	Pacific Ocean	Santa Barbara	1
	East Beach at Sycamore Creek	Pacific Ocean	Santa Barbara	1
	El Capitan State Beach	Pacific Ocean	Santa Barbara	1
	Gaviota State Beach	Pacific Ocean	Santa Barbara	1
	Goleta Beach	Pacific Ocean	Goleta	1
	Guadalupe Dunes	Pacific Ocean	Santa Maria	1
	Hammond's Beach	Pacific Ocean	Montecito	1
	Hope Ranch Beach	Pacific Ocean	Santa Barbara	1
	Jalama Beach	Pacific Ocean	Lompoc	1
	Leadbetter Beach	Pacific Ocean	Santa Barbara	1
	Ocean Beach	Pacific Ocean	Lompoc	1
	Refugio State Beach	Pacific Ocean	Santa Barbara	1
	Rincon Beach	Pacific Ocean	Carpinteria	1
	Sands Beach at Coal Oil Point	Pacific Ocean	Santa Barbara	1
	Surf Beach	Pacific Ocean	Surf	1
Ventura	Channel Islands Harbor Beach Park	Channel Islands Harbor	Oxnard	
	County Line Beach	Pacific Ocean		
	Deer Creek Beach	Pacific Ocean		
	Emma Wood State Beach	Pacific Ocean	Ventura	2

Table D-1: Regional Beaches and Locations (Cont.)

County Name	Name of the Beach	Water Body	Nearest city	Length of Beach
Ventura	Faria County Park	Pacific Ocean		
	Hobie Beach	Channel Islands Harbor	Oxnard	
	Hobson County Park	Pacific Ocean		
	Hollywood Beach	Pacific Ocean	Oxnard	
	La Conchita Beach	Pacific Ocean		
	Mandalay County Park	Pacific Ocean	Oxnard	
	Mandos Cove Beach	Pacific Ocean		
	Marina Park Beach	Pacific Ocean	Ventura	
	McGrath State Beach	Pacific Ocean	Oxnard	2.5
	Mussel Shoals Beach	Pacific Ocean		
	Oil Piers Beach	Pacific Ocean		
	Ormond Beach	Pacific Ocean	Oxnard	
	Oxnard Shores Beach	Pacific Ocean	Oxnard	
	Oxnard State Beach	Pacific Ocean	Oxnard	
	Peninsula Beach	Pacific Ocean	Ventura	
	Point Mugu State Beach	Pacific Ocean	Port Hueneme	5
	Port Hueneme Beach Park	Pacific Ocean	Port Hueneme	2.5
	Promenade Park	Pacific Ocean	Ventura	
	Rincon Beach	Pacific Ocean		
	San Buenaventura State Beach	Pacific Ocean	Ventura	2
	Seaside Wilderness Park	Pacific Ocean	Ventura	
	Silverstrand Beach	Pacific Ocean		
	Solimar Beach	Pacific Ocean		
Los Angeles	10th Place Beach	Pacific Ocean	Long Beach	0.3
	16th Place Beach	Pacific Ocean	Long Beach	0.3
	1st and Bayshore	Alamitos Bay	Long Beach	0.4
	2nd Street Bridge and Bayshore	Alamitos Bay	Long Beach	0.4
	36th Place Beach	Pacific Ocean	Long Beach	0.3
	3rd Place Beach	Pacific Ocean	Long Beach	0.3
	54th Place Beach	Pacific Ocean	Long Beach	0.3
	55th Place Beach	Pacific Ocean	Long Beach	0.3
	56th Place Beach	Alamitos Bay	Long Beach	0.4
	5th Place Beach	Pacific Ocean	Long Beach	0.3
	62nd Place Beach	Pacific Ocean	Long Beach	0.3
	72nd Place Beach	Pacific Ocean	Long Beach	0.3
	Abalone Cove	Pacific Ocean	Rancho Palos Verdes	1
	Alamitos Bay Shore Float	Pacific Ocean	Long Beach	0.3
	Avalon Beach	Pacific Ocean	Avalon	1
	Basin H	Pacific Ocean	Marina Del Ray	1
	Belmont Pier	Pacific Ocean	Long Beach	0.6

Table D-1: Regional Beaches and Locations (Cont.)

County Name	Name of the Beach	Water Body	Nearest city	Length of Beach
Los Angeles	Big Rock Beach	Pacific Ocean	Malibu	0.3
	Bluff Cove	Pacific Ocean	Palos Verde Estates	
	Broad Beach	Pacific Ocean	Malibu	1
	Cabrillo Beach	Pacific Ocean	Los Angeles	1
	Colorado Lagoon-Center	Alamitos Bay	Los Angeles	0.4
	Colorado Lagoon-North	Alamitos Bay	Los Angeles	0.4
	Colorado Lagoon-South	Alamitos Bay	Los Angeles	0.4
	Coronado Avenue Beach	Pacific Ocean	Los Angeles	0.3
	Corral Beach	Pacific Ocean	Malibu	1
	Dan Blocker Beach	Pacific Ocean	Malibu	1
Orange	Aliso County Beach Park	Pacific Ocean	Laguna Beach	
	Bolsa Chica State Beach Park	Pacific Ocean	Huntington Beach	3
	Capistrano Bay District	Pacific Ocean	Dana Point	1
	Capistrano County Beach	Pacific Ocean	Dana Point	1
	Corona Del Mar State Beach	Pacific Ocean	Newport Beach	0.5
	Crystal Cove State Beach Park	Pacific Ocean	Newport Beach	3.2
	Dana Point Harbor	Pacific Ocean	Dana Point	3
	Doheny State Beach Park	Pacific Ocean	Dana Point	1
	Emerald Bay	Pacific Ocean	Laguna Beach	0.4
	Huntington City Beach	Pacific Ocean	Huntington Beach	2
	Huntington Harbour	Pacific Ocean	Huntington Beach	38??
	Huntington State Beach	Pacific Ocean	Huntington Beach	2
	Laguna Beach	Pacific Ocean	Laguna Beach	4
	Little Corona - Cameo Shores	Pacific Ocean	Newport Beach	0.5
	Monarch Beach	Pacific Ocean	Dana Point	1
	Newport Bay	Pacific Ocean	Newport Beach	39??
	Newport Beach	Pacific Ocean	Newport Beach	6
	Poche County Beach	Pacific Ocean	San Clemente	0.2
	Salt Creek Beach Park	Pacific Ocean	Dana Point	0.2
	San Clemente City Beach	Pacific Ocean	San Clemente	2
	San Clemente State Beach	Pacific Ocean	San Clemente	1
	Seal Beach	Pacific Ocean	Seal Beach	
	South Laguna Beach	Pacific Ocean	Laguna Beach	
	Sunset Beach	Pacific Ocean	Sunset Beach	1
	Surfside	Pacific Ocean	Seal Beach	

Table D-1: Regional Beaches and Locations (Cont.)

County Name	Name of the Beach	Water Body	Nearest city	Length of Beach
San Diego	Border Field State Park	Pacific Ocean	Otay Mesa	1.2
	Camp Del Mar (USMC Camp Pendleton)	Pacific Ocean	Camp Pendelton	0.75
	Cardiff State Beach	Pacific Ocean	Encinitas	2.94
	Carlsbad City Beach	Pacific Ocean	Carlsbad	0.6
	Carlsbad State Beach	Pacific Ocean	Carlsbad	3.4
	Coronado Municipal Beach	Pacific Ocean	Coronado	1.7
	Del Mar City Beach	Pacific Ocean	Del Mar	2.5
	Encinitas City Beach	Pacific Ocean	Encinitas	2
	Fletcher Cove	Pacific Ocean	Solana Beach	1.3
	Imperial Beach City Beach	Pacific Ocean	Imperial Beach	1.5
	La Jolla Community Beach	Pacific Ocean	San Diego	2
	La Jolla Shores Beach	Pacific Ocean	San Diego	0.6
	Leucadia State Beach	Pacific Ocean	Encinitas	1.3
	Mission Bay	Pacific Ocean	San Diego	2
	Mission Beach	Pacific Ocean	San Diego	2.5
	Moonlight State Beach	Pacific Ocean	Encinitas	0.4
	North Pacific Beach	Pacific Ocean	Pacific Beach	0.55
	Ocean Beach	Pacific Ocean	San Diego	0.7
	Oceanside City Beach	Pacific Ocean	Oceanside	3.7
	Pacific Beach	Pacific Ocean	San Diego	1
	San Diego Bay	Pacific Ocean	San Diego, Coronado, Chula Vista, Pt. Loma	1
	San Elijo State Beach	Pacific Ocean	Encinitas	1.1
	San Onofre State Beach	Pacific Ocean	San Clemente	0.75
	Seascape Beach Park	Pacific Ocean	Solana Beach	1.3
	Shell Beach	Pacific Ocean	La Jolla	0.2
	Silver Strand State Beach	Pacific Ocean	Coronado	2
	Solana Beach	Pacific Ocean	Solana Beach	

Source: California Coastal Commission, Beach Access Guide

Table D-2: Regional Beaches from EPA

Region	County	Beach
North	Del Norte	High Bluff Beach
		Wilson Creek Beach
		Enderts Beach
		Crescent Beach
		South Beach
		Beachfront Park
		Pebble Beach
		Point St. George
		Lake Earl Wildlife
		Area Beaches
		Kellogg Beach
		Clifford Kamph Memorial Park
		Pelican State Beach
	Humboldt	Dead Man's Beach
		Shelter Cove
		Little Black Sands Beach
		Black Sands Beach
		Mattole River Beach
		Centerville Beach Co. Park
		Crab County Park
		South Spit & Jetty
		Samoa Dunes Rec. Area
		Mad River Beach C. Park
		Clam Beach County Park
		Little River Beach Co. Park
		Moonstone Beach
		Luffenholtz Beach
		Baker Beach
		Indian Beach
		Trinidad Head
		Trinidad State Beach
		College Cove
		Agate Beach
		Big Lagoon County Park
		Dry Lagoon
		Stone Lagoon
		Freshwater Lagoon
		Redwood Creek Beach
		Orick Fishing Access
		Gold Bluffs Beach
		Carruthers Cove Beach

Table D-2: Regional Beaches from EPA (Cont.)

Region	County	Beach
North	Mendocino	Gualala River
		Fish Rock Beach
		Schooner Gulch Beach
		Bowling Ball Beach
		Moat Creek Beach
		Arena Cove Beach
		Manchester State Beach
		Greenwood Creek State Beach
		Navarro River Beach Access
		Albion Flat
		Van Damme State Park
		12. Mendocino Headlands State Park
		Russian Gulch State Park
		Caspar Headlands State Reserve
		Caspar State Beach
		16. Jug Handle State Reserve
		Noyo Harbor
		Glass Beach
		Pudding Creek Beach
		Virgin Creek Beach
		MacKerricher State Park
		Seaside Creek Beach
		Chadbourne Gulch
		Wages Creek Beach
		Westport-Union Landing State Beach
		Usal Beach
		Little Jackass Creek Beach
		Bear Harbor Beach
		Needle Rock Beach
		Jones Beach
North Central	Sonoma	Doran Beach Regional Park
		Campbell Cove
		Westside Regional Park
		Bodega Head
		Bodega Dunes
		South Salmon Creek Beach
		North Salmon Creek Beach
		Miwok Beach
		Coleman Beach
		Arched Rock Beach
		Carmet Beach
		Schoolhouse Beach

Table D-2: Regional Beaches from EPA (Cont.)

Region	County	Beach
North Central	Sonoma	Portuguese Beach
		Gleason Beach
		Duncan's Landing
		Wright's Beach
		Shell Beach
		Blind Beach
		Goat Rock Beach
		North Jenner Beaches
		Russian Gulch
		Vista Point
		Fort Ross Reef
		Fort Ross Cove
		Timber Cove
		Stillwater Cove Regional Park
		Ocean Cove
		Gerstle Cove
		Stump Beach
		Fisk Mill Cove
		North Horseshoe Cove
		Black Point Beach
		Pebble Beach
		Stengel Beach
		Shell Beach
		Walk-On Beach
		Gualala Point Regional Park
	Marin	Kirby Cove
		Bonita Cove
		Rodeo Beach
		Tennessee Cove
		Muir Beach
		Steep Ravine Beach
		Red Rock Beach
		Stinson Beach
		Bolinas Beach
		Agate Beach
		Palomarin Beach
		Wildcat Beach
		Kelham Beach
		Sculptured Beach
		Santa Maria Beach
		Limantour Beach
		Drakes Beach
		Point Reyes Beach South

Table D-2: Regional Beaches from EPA (Cont.)

Region	County	Beach
North Central	Marin	19. Point Reyes Beach North
		20. Abbotts Lagoon
		Kehoe Beach
		McClures Beach
		Marshall Beach
		Hearts Desire Beach
		Shell Beach
		Alan Sieroty Beach
		Lawson's Landing
		Dillon Beach
	San Francisco	Burton Memorial Beach
		Fort Funston Beach
		Ocean Beach
		Lands End Beach
		China Beach
		6. Baker Beach
		7. North Baker Beach
		8. Crissy Field
		9. Marina Green
		Aquatic Park
Central	San Mateo	Ano Nuevo State Reserve
		The Fist
		Gazos Creek Access
		Pigeon Point
		Bean Hollow State Beach
		Pebble Beach
		Pescadero State Beach
		The Gulch
		Pomponio State Beach
		San Gregorio State Beach
		San Gregorio Private Beach
		Martin's Beach
		Cowell Ranch Beach
		Pelican Point Beach
		Francis Beach
		Venice Beach
		Dunes Beach
		Miramar Beach
		El Granada Beach
		Pillar Point Harbor
		Mavericks
		James V. Fitzgerald Marine Reserve
		Montara State Beach

NOEP

Region	County	Beach
Central	San Mateo	Gray Whale Cove State Beach 25. Pacifica State Beach
		Rockaway Beach
		Sharp Park State Beach
		Esplanade Beach
		Thornton State Beach
	Santa Cruz	Palm Beach
		Sunset State Beach
		Manresa Uplands
		4. Manresa State Beach
		5. Lundborgh Beach
		Rio Del Mar Beach
		Seacliff State Beach
		New Brighton State Beach
		Capitola City Beach
		Hooper Beach
		Key Beach
		Pleasure Point Beach
		Moran Lake Beach
		Corcoran Lagoon Beach
		Sunny Cove
		Lincoln Beach
		Twin Lakes State Beach
		Seabright Beach
		Main Beach
		Cowell Beach
		Steamer Lane
		22. Lighthouse Field State Beach
		Its Beach
		Mitchell's Cove
		25. Natural Bridges State Beach
		Wilder Ranch State Park
		Four Mile Beach
		Red, White, and Blue Beach
		Laguna Creek Beach
		Yellowbank Beach
		Bonny Doon Beach
		Panther Beach
		Davenport Beach
		Davenport Landing Beach
		Scott Creek Beach
		Greyhound Rock Fishing Access
		Waddell Creek Beach

Region	County	Beach
Central	Monterey	Willow Creek Picnic Area
		Jade Cove
		Sand Dollar Picnic Area and Beach
		Mill Creek Picnic Area
		Kirk Creek Campground
		Limekiln State Park
		Julia Pfeiffer Burns State Park
		Partington Cove
		Pfeiffer Beach
		Andrew Molera State Park
		Garrapata State Park
		Point Lobos State Reserve
		Carmel River State Beach
		Carmel City Beach
		Fanshell Beach
		Moss Beach
		Spanish Bay
		Asilomar State Beach
		Lover's Point
		Shoreline Park
		Macabee Beach
		San Carlos Beach Park
		Monterey State Beach ("Willows on the Bay" unit)
		Del Monte Beach
		Monterey State Beach (Sand Dunes Drive unit)
		Monterey State Beach (Seaside unit)
		Marina State Beach
		Salinas River State Beach
		Moss Landing State Beach
		Zmudowski State Beach
South Central	San Luis Obispo	Pismo Dunes State Vehicular Recreation Area
		Pismo State Beach
		Avila State Beach
		Montana de Oro State Park
		Moro Dunes Natural Area
		Bayshore Bluffs Park
		Morro Bay State Park
		Morro Rock and Beach
		Morrow Strand State Beach (South)
		Morrow Strand State Beach (North)
		Cayucos Beach
		Cayucos State Beach
		Moonstone State Beach

Region	County	Beach
South Central	San Luis Obispo	San Simeon State Beach
		W. R. Hearst Mem. State Beach
	Santa Barbara	Rincon Point
		Rincon Beach County Park
		Carpinteria State Beach
		Carpinteria City Beach
		Lookout County Park
		Miramar Beach
		Hammonds Beach
		Butterfly Beach
		East Beach
		West Beach
		Leadbetter Beach
		Mesa Lane Beach
		Arroyo Burro Beach County Park
		Goleta Beach County Park
		Isla Vista Beach
		Coal Oil Point Natural Reserve
		El Capitan State Beach
		Refugio State Beach
		Jalama Beach County Park
		Vandenberg Air Force Base Fishing Access
		Ocean Beach County Park
		Point Sal State Beach
		Guadalupe-Nipomo Dunes Preserve
	Ventura	Sycamore Cove Beach
		Thornhill Broome Beach
		Point Mugu Beach
		Ormond Beach
		Port Hueneme Beach Park
		Silver Strand Beach
		Channel Inds. Harbor Beach
		Hollywood Beach
		Oxnard State Beach
		Mandalay County Park
		McGrath State Beach
		Marina Cove Beach
		Marina Park
		San Buenaventura State Beach
		Promenade Park
		Surfer's Point
		Emma Wood State Beach
		Solimar Beach

NOEP

Region	County	Beach
South Central	Ventura	Faria Beach County Park
		Rincon Parkway North
		Hobson County Park
		Oil Piers Beach
		Mussel Shoals Beach
		La Conchita Beach
South	Los Angeles	Descanso Beach
		Crescent Beach
		Pebbly Beach
		Ben Weston Beach
		Little Harbor Beach
		Little Fisherman's Cove
		Alamitos Bay Beach
		Belmont Shore
		Long Beach City Beach
		Cabrillo City Beach
		Point Fermin Park
		White Point County Park
		Royal Palms County Beach
		Abalone Cove Beach
		Malaga Cove
		Torrance County Beach
		Redondo County Beach
		Hermosa City Beach
		Manhattan County Beach
		El Porto Beach
		El Segundo Beach
		Mother's Beach
		Dockweiler State Beach
		Venice City Beach
		Santa Monica State Beach
		Will Rogers State Beach
		Topanga County Beach
		Las Tunas County Beach
		Surfrider Beach
		Malibu Lagoon County Beach
		Dan Blocker County Beach
		Escondido Beach
		Paradise Cove
		Point Dume County Beach
		Zuma County Beach
		Broad Beach
		El Matador State Beach

NOEP

Region	County	Beach
South	Los Angeles	La Piedra State Beach
		El Pescador State Beach
		Nicholas Canyon County Beach
		Leo Carillo State Beach
		County Line Beach
	Orange	San Clemente State Beach
		San Clemente City Beach
		Poche Beach
		Capistrano Beach
		Doheny State Beach
		Salt Creek County Beach
		1,000 Steps Beach
		West Street Beach
		Aliso Creek County Beach
		Victoria Beach
		Brooks Beach
		Main Beach
		Picnic Beach
		Rockpile Beach
		Diver's Cove
		Shaw's Cove
		Crescent Bay Point Park
		Crystal Cove State Park
		Little Corona del Mar Beach
		Corona del Mar State Beach
		Rocky Point
		China Cove Beach
		Bayside Drive County Beach
		West Jetty View Park
		Balboa Beach
		Newport Beach Municipal Beach
		Santa Ana River County Beach
		Huntington State Beach
		Huntington City Beach
		Bolsa Chica State Beach
		Sunset Beach
		Surfside Beach
		Seal Beach
	San Diego	Border Field State Park
		Imperial Beach
		Silver Strand State Beach
		Coronado Shores Beach
		Corondao City Beach

Region	County	Beach
South	San Diego	Ocean Beach City Beach
		Ocean Beach Park
		Mission Beach
		Pacific Beach
		Tourmaline Surfing Park
		La Jolla Strand Park
		Windansea Beach
		Marine Street Beach
		Children's Pool Beach
		La Jolla Cove
		La Jolla Shores Beach
		Black's Beach
		Torrey Pines State Beach
		Del Mar City Beach
		Seascape Shores
		Fletcher Cove Park
		Tide Beach Park
		Cardiff State Beach
		San Elijo State Beach
		Swami's
		Boneyard Beach
		D Street Viewpoint
		Moonlight Beach
		Stone Steps Beach
		Encinitas Beach
		Beacon's Beach
		Ponto Beach
		South Carlsbad State Beach
		Carlsbad State Beach
		Carlsbad City Beach
		South Oceanside Beach
		Oceanside City Beach 38. Harbor Beach
		San Onofre State Beach

Source: EPA BEACH Watch Program

COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

An Introduction to Life Cycle Costing Involving Structural Stormwater Quality Management Measures

André Taylor
Research Fellow, Urban Stormwater Quality Program
Cooperative Research Centre for Catchment Hydrology
andretaylor@iprimus.com.au

5 June 2003

INTRODUCTION

The primary purpose of this paper is to provide a simple data recording sheet to collect life cycle costing information for structural measures that aim to improve stormwater quality, such as gross pollutant traps and constructed wetlands.

The data recording sheet has been prepared to:

- Help stormwater management agencies who manage such assets (e.g. small to medium sized local authorities) to ensure that critical costing-related information is gathered at the start of an asset's life cycle.
- Help funding and research bodies to gather basic life cycle costing information in a consistent manner, and make it simpler for agencies supplying the information.
- Minimise the risk of common mistakes occurring during the collection of costing data which make subsequent life cycle costing difficult.

In addition, the paper provides a brief overview of the Australian Standard for life cycle costing (AS/NZS 4536:1999). This standard provides the theoretical framework for the life cycle costing data recording sheet.

BACKGROUND

The focus on urban stormwater as an important source of water pollution has led to the increased use of infrastructure to improve urban stormwater quality in all Australian states. For example, a recent survey by the Cooperative Research Centre for Catchment Hydrology (Taylor and Wong, 2002) involving 25 stormwater managers from across Australia found that the majority of respondents to the survey reported an increasing trend in use for 10 of 25 structural best management practices (BMPs). The survey also found that none of the 25 BMPs were associated with a widespread decreasing trend in use.

Such infrastructure however comes at a cost. Costs typically include those associated with:

- Site selection processes.
- Grant application costs (i.e. to obtain State or Commonwealth funding for capital works).
- Feasibility studies.

- Conceptual, preliminary and detail designs.
- Project and contract management costs.
- Construction/purchase costs, including *related* costs such as the cost of environmental impact assessment, gaining environmental permits and subsequent environmental management (e.g. erosion and sediment control).[1]
- Routine maintenance costs (including related costs such as disposal of wastes, health and safety training of staff, etc.).
- Renewal and adaptation costs (e.g. unusual costs associated with reconstruction of the asset or adding new features).
- Decommissioning costs.

Developers and stormwater management agencies are now closely examining these costs as they can represent a significant financial investment and long-term financial commitment. Developers particularly want to minimise acquisition costs. Stormwater management agencies want to minimise life cycle costs, and in particular maintenance costs.

In response to the concerns about the cost of this infrastructure, relevant costing data are now being collected by stormwater managers, funding and research agencies. The Cooperative Research Centre for Catchment Hydrology is one of these agencies. Our most recent experience from surveying approximately 60 agencies across all Australian states found that:

- There is little or no consistency in the way that agencies record basic life cycle costing data for structural stormwater quality best management practices.
- Many agencies have recently installed structural measures to improve urban stormwater quality, but have not yet established management systems that clearly record all of the important life cycle costing details. This is particularly the case for small to medium-sized local government authorities.
- It is very difficult to collect some critical life cycle costing details in retrospect, if the data have not been recorded at the start of the asset's life cycle.
- Data that has been recorded often suffers from simple sources of uncertainty which severely compromises its usefulness. Common examples include whether or not GST has been included in the cost estimates (this is particularly relevant to assets that have been 'donated' by the private sector), whether cost estimates include 'on-costs' such as project management/administration, and the dates that expenditure occurred (so that costs can be adjusted for inflation).

The simple data recording sheet presented in this paper aims to help overcome these drawbacks. It could be used by agencies that build and/or maintain these assets as a:

- simple paper-based system for collecting important life cycle costing data;
- framework for an electronic database;
- framework for a simple spreadsheet with expenditure notes; or
- checklist to ensure existing asset/financial management systems record the necessary information.

[1] It is acknowledged that costs associated with environmental impact assessment and gaining environmental permits could be incurred during feasibility studies or design work. However, for the sake of consistency and simplicity, it is recommended that such environmental costs be recorded as part of the cost of "construction".

The work currently being undertaken by the Cooperative Research Centre for Catchment Hydrology involving life cycle costing will produce two outputs:

- In the short-medium term, costing data from around Australia will be analysed to derive relationships between BMP size and cost for a variety of BMP types using 'parametric cost estimating' techniques. These relationships will be used to build a 'life cycle costing module' into the CRC's MUSIC model[2]. This module will allow life cycle costs of BMPs to be estimated during the planning stage of projects, when MUSIC is commonly used as a tool to run scenarios of different stormwater treatment options and configurations.
- Over the next two years, the CRC will also be developing triple-bottom-line assessment methodologies for selecting suitable structural BMPs for a given site. The resulting assessment tools will be developed primarily for use by stormwater management agencies, and will enable financial, social and ecological costs and benefits to be considered in the decision making process. Traditional life cycle costing analysis will be one of the financial inputs to the recommended processes.

SCOPE

This paper addresses life cycle costing as defined in the Australian Standard titled *'AS/NZS 4536:1999 Life Cycle Costing – An Application Guide'*, namely "the process of assessing the cost of a product over its life cycle or portion thereof" (p. 6).

The costs being considered in this paper are traditional costs that have a market (e.g. construction expenses) not environmental costs/benefits (e.g. the environmental costs associated with production of the structure's raw materials, or the benefits to ecosystem services due to the structure's role in minimising stormwater pollution).

Other methods can be used to identify and assess the significance of these externalities[3]. Such methods include:

- Life cycle assessment. Such assessment is defined as the "compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle" (AS/NZS ISO 14040:1998, p. 2).
- Cost-benefit analysis that attempts to place an approximate monetary value on environment and social costs/benefits through a variety of valuation methods (see www.ecosystemvaluation.org for a description of these).
- Multi-criteria analysis within a 'triple-bottom-line' assessment framework, where traditional costs, environmental costs/benefits and social costs/benefits are considered.

It is important to realise that traditional life cycle costing as outlined in this paper is only one input to decision making process of siting and design of structural measures to improve urban stormwater quality. Social and environmental inputs should also be considered to gain optimal outcomes for the community. This approach is summarised in Figure 1.

2 'Model for Urban Stormwater Improvement Conceptualisation'. A model developed by the CRC which is widely used across Australia to develop stormwater management plans involving structural BMPs. For more information see: www.catchment.crc.org.au.

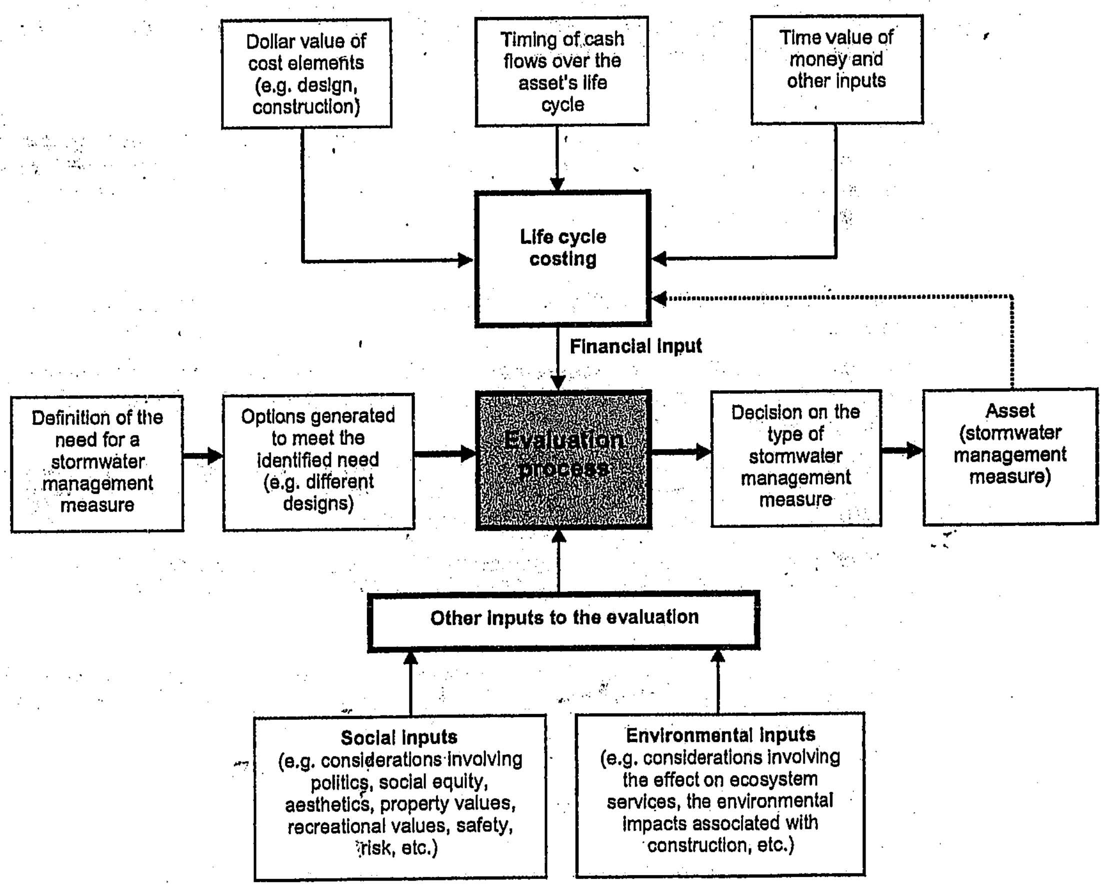
3 An 'externality' can be defined as a cost or benefit that arises from an economic transaction (e.g. the construction of a wetland) and falls on people who don't participate in the transaction (e.g. people living next to the wetland). These costs/benefits may be positive or negative and the assets affected may be tangible (i.e. have markets) or intangible.

AUSTRALIAN STANDARD FOR LIFE CYCLE COSTING

Standards Australia have published a guideline on life cycle costing titled *"AS/NZS 4536:1999 Life Cycle Costing – An Application Guide"*. Key elements of this document are summarised here to provide the theoretical framework for the data recording sheet for the collection of critical life cycle costing details.

Life cycle costing is defined in the standard as a "process to determine the sum of all expenses associated with a product or project, including acquisition, installation, operation, maintenance, refurbishment, discarding and disposal costs" (Standards Australia, 1999, p. 4). As described in Figure 1, it often provides one important input into an evaluation process. Such an evaluation process may involve the selection of the best stormwater management measure (or combination of measures) for a particular site.

Figure 1 - Use of Life Cycle Costing In an Evaluation Process Such as the Design of a Stormwater Quality Management Measure



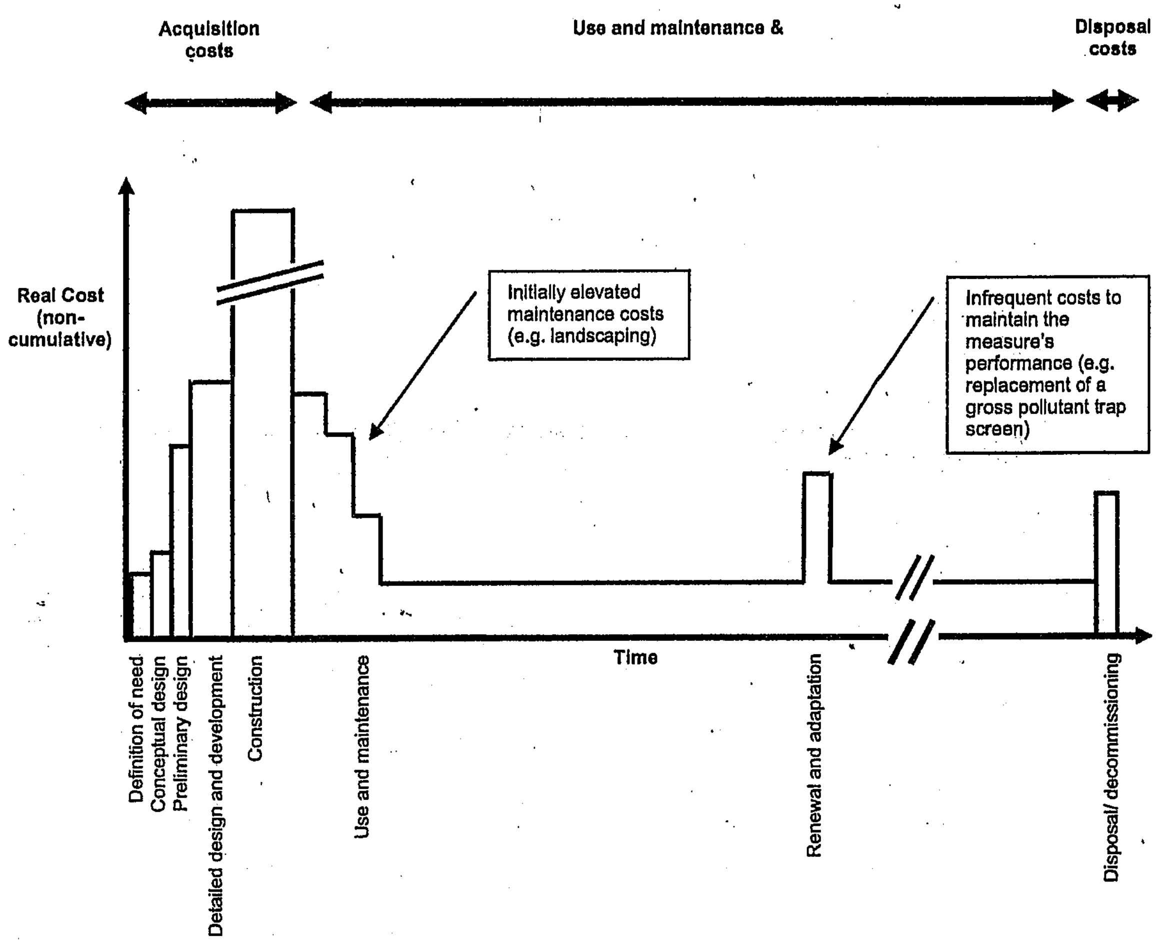
Source: modified from Standards Australia (1999).

AS/NZS 4536:1999 defines several phases in the life cycle of product or asset. These phases represent 'cost elements' and are defined as:

1. Acquisition, which should include the following (where relevant):
   - Identification and definition of the need for the stormwater management measure.
   - Conceptual design.
   - Preliminary design.
   - Detailed design and development.
   - Construction (or purchase of a proprietary device).
2. Use and maintenance.
3. Renewal and adaptation.
4. Disposal/decommissioning.

Figure 2 is a conceptual diagram of these phases in the life cycle and cost elements potentially associated with them.

Figure 2 – Phases in the Life Cycle of a Stormwater Quality Management Measure and Potentially Associated Costs



Source: modified from Standards Australia (1999).

The life cycle costing process as set out in the Australian Standard involves six steps which are summarised below. Note however that this "ideal process" is primarily designed for detailed analysis of new products (e.g. electrical appliances), and consequently needs to be simplified for practical application in the stormwater management arena.

1. ***Preparation of a life cycle costing analysis plan.*** This is essentially a project planning step, that outlines the objectives of the analysis, the scope of the analysis, identifies limitations and constraints, identifies the options to be evaluated (if relevant), and estimates the required resources to undertake the analysis.
2. ***Development or selection of a life cycle costing model.*** In its simplest form a life cycle costing model is an accounting structure that breaks down the life cycle costs into cost elements (as shown in Figure 2) and allows for the estimation of costs associated with each of these elements. An example of a simple life cycle costing model is a discounted cash flow spreadsheet that tracks all of the significant costs shown in Figure 2 over time and calculates a life cycle cost. A simplified, hypothetical example is given in Table 1.
3. ***Undertake life cycle costing model analysis.*** This step represents one of the more advanced elements of life cycle cost analysis. Analysis may include identifying cost drivers by examining model inputs and outputs to determine those cost elements that most significantly impact on the overall life cycle cost. Sensitivity analysis may also be undertaken to determine the impact on the results of variations to assumptions and uncertainties (e.g. discount rates). Finally the outputs of the life cycle costing analysis are compared against the initial objectives of the life cycle costing analysis plan.
4. ***Documentation of the life cycle costing analysis.*** The Australian Standard for life cycle costing encourages structured documentation of the life cycle costing analysis including a report which contains the following chapters: an executive summary; purpose and scope; life cycle costing model description; life cycle costing model analysis; discussion; and conclusions and recommendations. Again, it is suggested that for application in stormwater management, this step needs to be tempered with considerations of practicality.
5. ***Review of life cycle costing results.*** The Australian Standard for life cycle costing encourages life cycle costing results to be reviewed by an independent analyst to ensure objectivity.
6. ***Update the life cycle costing analysis.*** As knowledge grows on the costs associated with an asset throughout its life cycle, the Australian Standard recommended that the life cycle costing model be updated. This process is represented by the dotted line in Figure 1.

Table 1 – An Example of a Simple Life Cycle Cost Model for a Hypothetical Constructed Wetland

COSTS ($,000) Year (t) =	0	1	2		4	5		7	8		10	11		13	14		16	17	18	19	20	21
Acquisition costs																						
Total costs associated with defining the need for the wetland (e.g. running site selection processes, feasibility studies, grant application costs):	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total conceptual, preliminary and detailed design costs:	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total construction costs (including project management and/or contract management costs):	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-total	55	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total acquisition costs ("real costs" with a base date of year 0)	555	(75.8% of total real costs at year 0)																				
Use and maintenance costs																						
Cost of typical maintenance events, including costs associated with relevant administration, inspections, staff training and waste disposal:	0	0	15	15	5	5	10	5	5	5	5	10	5	5	5	5	10	5	5	5	5	10
Renewal and adaptation costs																						
Cost of unusual restoration events (e.g. additional landscaping, interpretive signage, rebuilding the outlet structure):	0	0	5	0	0	10	0	0	0	0	0	0	0	0	0	0	0	7.5	0	0	0	0
Total maintenance/ renewal costs ("real costs" with a base date of year 0)	162.5	(22.2% of total real costs at year 0)																				
Disposal/decommissioning costs																						
Cost of decommissioning the structure at the end of its useful life:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15

Continued ...

Table 1 – An Example of a Simple Life Cycle Cost Model for a Hypothetical Constructed Wetland (continued)

COSTS ($,000) Year (t) =	0		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Total disposal/ decommissioning costs ("real costs" with a base date of year 0)	15	(2% of total real costs at year 0)																				
Total costs ("real costs" with a base date of year 0)	55	500	20	15	5	15	10	5	5	5	5	10	5	5	5	5	10	12.5	5	5	5	25
Annual inflation rate (using the "new engineering construction" Implicit Price Deflator [ABS, 2003] to estimate the average annual rise in prices over the 1993-2002 period)	2.14%																					
Total costs adjusted for inflation (i.e. "nominal costs")	55	510.7	20.9	16.0	5.4	16.7	11.4	5.8	5.9	6	6.2	12.6	6.4	6.6	6.7	6.9	14	17.9	7.3	7.5	7.6	39
Nominal discount rate (derived from the discount rate used by Brisbane City Council in 2003 for water-related assets)	10%																					
Discounted costs	55	464.3	17.2	12	3.7	10.4	6.4	3.0	2.8	2.6	2.4	4.4	2.1	1.9	1.8	1.6	3.1	3.5	1.3	1.2	1.1	5.3
Net Present Value (at year 0)	552 ($552.036)																					
Life Cycle Cost (LCC) (sum of all discounted costs, or the sum of the NPV and the total costs at year 0)	**607** **($607,036)**	**Equivalent annual payment ($/yr) = $30,352** (i.e. LCC/life span)																				

Notes:

- This hypothetical constructed wetland has an unusually short life cycle (20 years) to simplify the example.
- 'Real cost' is defined as the cost expressed in values of the base date (e.g. year 0), including estimated changes in prices due to forecast changes in efficiency and technology, <u>excluding</u> general price inflation or deflation (AS/NZS 4536: 1999). 'Nominal cost' is defined as the expected price that will be paid when the cost is due to be paid, <u>including</u> estimated changes in prices due to the forecast changes in efficiency, inflation/deflation, technology and the like (AS/NZS 4536: 1999).

A SIMPLE DATA RECORDING SHEET FOR COLLECTING LIFE CYCLE COST INFORMATION FOR STRUCTURAL STORMWATER QUALITY MANAGEMENT MEASURES

This data recording sheet provides a framework that breaks down typical cost elements and prompts users to ensure all basic costing data is collected at the start of an asset's life cycle to enable subsequently life cycle cost analysis. It also prompts users to document important additional information that may be needed during subsequent life cycle cost analysis (e.g. whether there were any aspects of the asset's life cycle that contributed to unusually large cost elements).

The sheet has been designed to be consistent with the intent and terminology of the Australian Standard for Life Cycle Costing (*AS/NZS 4536:1999).*

PART A - DESCRIPTION OF THE BEST MANAGEMENT PRACTICE (BMP)

1. Commonly used name for the BMP (e.g. "Hay St. Wetland"): ....

2. Type of BMP (tick one box below):

- ❑ In-ground gross pollutant trap ('circular screen' type)
- ❑ In-ground gross pollutant trap ('return flow litter basket' type)
- ❑ In-ground gross pollutant trap ('sediment-oil separator' type)
- ❑ In-ground gross pollutant trap ('downwardly inclined screen' type)
- ❑ In-ground gross pollutant trap (other type)
- ❑ Combined trash rack and sediment trap (open gross pollutant trap)
- ❑ Litter collection basket
- ❑ Side entry pit traps for litter
- ❑ Floating litter trap/boom
- ❑ Fixed trash rack
- ❑ Release net (for litter)
- ❑ Sediment trap or settling basin
- ❑ Vegetated filter/buffer strip
- ❑ Vegetated/grassed swale
- ❑ Porous paving
- ❑ Bioretention system/infiltration system
- ❑ Extended detention basin
- ❑ Constructed wetland (greenfield)*
- ❑ Constructed wetland (retro-fitted)*
- ❑ Pond

** This BMP includes a macrophyte zone and upstream sediment basin.*

❑ Other (e.g. combined BMPs): ....

(For descriptions of these types of BMPs, refer to 'Urban Stormwater: Best Practice Environmental Management Guidelines' [VSC, 1999]. If you are unsure of the 'type' but it is a proprietary device, just write down the name of the product.)

3. The expected life span of the BMP (in years): ....

4. Describe how the 'expected life span' of the BMP was determined (e.g. advice from a product supplier, the design engineer, or the developer 'donating' the asset to Council):

....
....
....
....

PART B – KEY BMP DESIGN DETAILS

5. Estimate the area of the BMP's catchment (ha).

....
....
....

6. Estimate the percent of the BMP's catchment that is impervious (%).

....
....
....

7. Estimate the BMP's:
   - maximum allowable inflow rate (m^3/sec) for those BMPs without a detention element (e.g. gross pollutant traps); or
   - maximum allowable storage (m^3) for those BMPs with a detention function (e.g. ponds).

....
....
....

8. For vegetated filter/buffer strips, vegetated/grassed swales, porous paving, bioretention systems/infiltration systems, constructed wetlands and ponds, estimate the surface area of the BMP's treatment zone (m^2).

....
....
....

PART C – BMP COST

9. Estimate or track the following costs associated with the BMP:

Cost element[1]	Estimated cost ($)[2]									
Financial Year Starting:	20…	20…	20…	20…			20…	20…	20…	20…
Acquisition costs[3]:										
▪ Total costs associated with defining the need for the BMP (e.g. running site selection processes, feasibility studies, grant application costs):										
▪ Total conceptual, preliminary and detailed design costs:										
▪ Total construction costs (including project management costs, contract management costs, and cost of environmental assessment, permits and management):										
Maintenance costs[3]:										
▪ Costs associated with typical maintenance events (e.g. cleaning out a gross pollutant trap), including costs associated with relevant administration, BMP inspections, staff training and waste disposal:										
Renewal and adaptation costs[4]:										
Disposal/decommissioning costs[5]:										

Notes:
1. These costs should include staff time (incl. on-costs) as well as project, capital and recurrent expenses.
2. Cost estimates should be 'real costs' for the year they were incurred. For example, if the total construction cost was actually $200,000 in the year 2000, then this figure should be used in a column labelled "2000" and not adjusted for inflation/deflation.
3. These cost elements can be broken down further if required. It is recommended that any costs associated with the *purchase of land* be isolated from the life cycle costs associated with the *asset* (i.e. not included in traditional life cycle cost analysis as shown in Table 1). Note that the CRC for Catchment Hydrology is currently developing methodologies to assess the full range of issues that need to be considered when stormwater quality management measures are chosen (e.g. social considerations, ecological considerations, affect on nearby property values, land acquisition costs, opportunity costs, etc.).
4. "Renewal and adaptation costs" are incurred from significant alterations to the BMP (e.g. the addition of safety fencing, interpretive signage, new landscaping features).
5. These costs involve the removal of the BMP at the end of its life-span (e.g. due to redundancy or the need for replacement).

10. Describe how the above costing information was gathered (e.g. estimated or real costs):

....
....
....
....
....
....

11. If relevant, explain any unusual cost elements:
(e.g. unusually large construction costs due to excavation of bedrock or stringent environmental management requirements)

....
....
....
....
....
....

12. Where relevant, explain why the BMP's maintenance costs vary significantly over time (in real terms), and if possible, quantify the nature of these variations:
(For example, a given constructed wetland may require ~$2,000 every year to maintain the landscaping, ~$10,000 every 5 years to clean out the sediment in the inlet zone, and ~$50,000 every 30 years to re-contour and replant the macrophyte zone, where all cost estimates are in 2003 dollars and exclusive of GST)

....
....
....
....
....
....

PART D – DOCUMENT CONTROL

13. Name and position of the person entering data into the data recording sheet:

Name:............................ Position:..................................

14. Date(s) of data entry: 1)........................... 2)...........................
3)........................... 4)...........................

Notes:

....
....
....
....
....
....

REFERENCES

Australian Bureau of Statistics (2003). *5206.0 Australian National Accounts: National Income, Expenditure and Product. Table 9. Expenditure on GDP, Implicit Price Deflators: Seasonally Adjusted.* Australian Bureau of Statistics, Canberra. Available at: www.abs.gov.au

Australian Standards (1998). *AS/NZS ISO 44040:1998 Environmental Management – Life Cycle Assessment – Principles and Framework.* Standards Australia, Homebush, NSW.

Australian Standards (1999). *AS/NZS 4536:1999 Life Cycle Costing – An Application Guide.* Standards Australia, Homebush, NSW.

Taylor, A.C. and Wong, T.H.F. (2002). *Non-structural Stormwater Quality Best Management Practices – A Survey Investigating their Use and Value.* Technical Report from No 02/12. Cooperative Research Centre for Catchment Hydrology, Melbourne.

Victorian Stormwater Committee (VSC) (1999). *Urban Stormwater Best Practice Environmental Management Guidelines.* CSIRO Publishing, Melbourne.

ACKNOWLEDGEMENTS

The Victorian Government (through the Environmental Protection Authority as part of the Victorian Stormwater Action Program), Melbourne Water and Brisbane City Council are acknowledged for providing the bulk of the funding for the Cooperative Research Centre for Catchment Hydrology's recent research into life cycle costing of structural measures for stormwater quality improvement.

Tony Weber (WBM Oceanics), Tim Fletcher (CRC for Catchment Hydrology) and Simon Gibbs (Hunter Councils) are also acknowledged for their adroit comments on this paper.

Downstream Economic Benefits from Storm-Water Management

John B. Braden[1] and Douglas M. Johnston[2]

Abstract: Using benefits transfer methods, this paper assesses the downstream economic consequences of development designs that promote greater on-site water retention. It concludes that on-site retention provides many services that are conceptually distinct but empirically intertwined. Flood mitigation and water quality protection are the most important of these services. For residential properties, the economic value of those services is on the order of 0–5% of market value depending on the difference that retention makes to downstream flood exposure. For water quality improvements, the increases range up to 15% of market value for waterside residences where clarity of the water quality is greatly improved. The increases are much less for improvements that are less visible, properties that are not developed, and properties not adjacent to the watercourse. Our best estimate of total benefits to property owners is 2–5% of property value on average for all properties in the flood plain. The public sector realizes additional benefits through smaller bridges, culverts, and other drainage infrastructure and through increased aquifer recharge. Cities and industries may avoid costly upgrades to waste water treatment facilities if low flows increase. It is difficult to generalize about the economic value of the latter effects.

DOI: 10.1061/(ASCE)0733-9496(2004)130:6(498)

CE Database subject headings: Stormwater management; Storm drainage; Economic factors; Flood damage; Water quality; Benefits.

Introduction

This paper applies benefits transfer methods to quantify the downstream economic consequences of stormwater management. This information is important in quantifying benefit–cost tradeoffs associated with stormwater management policies and design standards for new development. Estimates of the downstream costs can inform developers about the value of preventive measures and help public officials balance prevention and mitigation.

Managing stormwater is a major challenge in most urban areas (Schueler 1995; Arnold and Gibbons 1996). Buildings, roads, and compacted soils reduce absorptive capacity. In suburban areas, 20–50% of the land is impervious to precipitation. In inner cities and commercial zones, imperviousness can exceed 80%. According to Schueler (1994, 2003), the hydrologic functions of streams change with as little as 5–10% imperviousness, and they change profoundly when imperviousness approaches 25%.

The increased runoff exacerbates flooding and increases conveyance requirements. Less water is left in the soil to recharge aquifers, replenish wells, and maintain base stream flows. Faster runoff increases erosion, scours stream banks, and entrains more sediment, landscape chemicals, petroleum residues, pet wastes, and other anthropogenic detritus. A consequence is surface water quality that is less able to support beneficial uses.

For several decades, detention basins have been the customary prescription for managing stormwater. Recently, "low impact" or "conservation design" principles use measures, such as vegetated swales and constructed wetlands, to maintain a nearly natural water budget and improve water quality (e.g., Arendt 1996; Wilson et al. 1998; Hager 2003). However, our analysis of downstream economic effects is independent of the specific on-site management measures.

While many studies have considered specific physical and biological effects of altered hydrology, there has been no effort to synthesize those elements into an overall benefit measure or to facilitate their transfer by scaling them to local conditions.

Downstream Benefits of Stormwater Management

The magnitude of the offsite hydrologic benefits of stormwater management depends on the scale of analysis. Reduced infiltration on a small parcel would be almost undetectable in a large watershed draining hundreds or thousands of acres. The following discussion is limited to "nearby" downstream effects that are proportional in scale to the development parcel.

Stormwater management can produce the following types of downstream benefits: (1) Reduced frequency, area, and impact of flooding; (2) less costly public drainage infrastructure; (3) reduced pollution treatment; (4) reduced erosion and sedimentation; (5) improved water quality; (6) improved in-stream biological integrity and aesthetics; and (7) increased ground water recharge. With the exception of ground water recharge, these effects are concentrated in stream corridors and riparian zones. Streiner and Loomis (1995, p. 268) group the economic effects of stream corridor enhancement into two categories: (1) Reductions in property damages, including residential and public plantings, structures, landscaping and parks; and (2) restoration of the natural values of the stream itself, including more stable stream banks (which may

[1]Professor, Dept. of Agricultural and Consumer Economics, Univ. of Illinois, 1301 W. Gregory Dr., Rm. 431, Urbana, IL 61801. E-mail: jbb@uiuc.edu

[2]Associate Professor, Dept. of Landscape Architecture, Univ. of Illinois, 611 E. Loredo Taft Dr., Champaign, IL 61820.

Note. Discussion open until April 1, 2005. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on August 27, 2003; approved on April 8, 2004. This paper is part of the *Journal of Water Resources Planning and Management*, Vol. 130, No. 6, November 1, 2004. ©ASCE, ISSN 0733-9496/2004/6-498–505/$18.00.

interfere with natural processes), enhanced aquatic habitat through restoration of pool–riffle sequences, and more attractive ecosystems. Stormwater management in upstream areas can be part of a strategy for stream restoration.

Since the Federal Water Pollution Control Act was passed in 1972, the U.S. Environmental Protection Agency (USEPA) has been concerned about the effects of urban development on surface water quality. In 1990, the USEPA promulgated "Phase I" rules for sediment and erosion control at large construction sites (USEPA 1990). In 2001, it issued "Phase II" rules for smaller construction sites and other sources (USEPA 1999b). In its analysis of the Phase II proposal, the USEPA recognized the difficulty of attributing changes in water quality to specific stormwater management practices (USEPA 1999a, pp. 6–28, 6–41). The same observation applies to the *benefits* of water quality improvements—attribution to particular causes is difficult, and the benefits will vary from place to place.

The following sections outline how each type of impact can be valued economically. From the available literature, with due regard for the difficulty of assigning complex values to specific causal factors, we extract estimates of their respective economic values. We conclude with an effort to aggregate across the various categories, recognizing that the categories overlap and cannot simply be summed together.

Economic Criteria for Benefit Measurement

A few basic economic concepts are important to what follows. First, the relevant question is not whether development will occur, but what form it will take. Second, the correct economic measure of value is the maximum amount people are willing to pay for a good or service—called by economists, "willingness to pay" (WTP). The cost of providing a good or service is *not* the proper measure of value although, in some instances, it may be the only realistic alternative.

Third, apart from external effects that may accompany production or consumption, market prices provide a reasonable first approximation of the relative economic value of marginal increments of different goods and services. Fourth, marginal economic value, as reflected in price, is different from total value. The marginal value of a good or service generally declines as more of the good is consumed. This translates into a negative relationship between marginal value and quantity consumed (a "demand curve"). Total value is the sum of price points along that curve up to the last unit consumed —equivalent to the area under the curve. Most stormwater management decisions are marginal in nature—producing, for example, small changes in flooding, low flows, and other consequences downstream.

Fifth, the economic value of a good or service depends on the other choices available to consumers. For example, the value of a park may be affected by the nearby presence of other parks, or even movie theaters. Changes in upstream management of stormwater will be more valuable if there are fewer options for downstream mitigation. Sixth, the composite value of a good (such as a stream or lake) that encompasses several services valued by consumers (such as boating, swimming, water supply, and aesthetic pleasure) is usually less than the simple sum of the values of the individual service flows (Hoehn and Randall 1989).

Seventh, many environmental goods and services are not exchanged in markets. Special techniques can measure values not expressed in markets (e.g., Braden and Kolstad 1991; Freeman 2003). Most of the benefit estimates reviewed here are based on nonmarket valuation.

Finally, stormwater management measures are not easily translated into economic commodities. For example, they may shift the distribution of flooding without entirely eliminating floods. Most economic transactions, however, relate to definitive quantities of goods or services. Translation of probabilistic outcomes into economic values is a complex undertaking.

In what follows, we are not concerned with specific upstream management measures. We care only about the effects on stream flows. We look first to the marketplace for evidence of downstream value. We supplement with nonmarket valuation results where the market fails to provide useful information, and we adapt the value estimates to stormwater outcomes.

Economic Benefits by Type of Impact

This section provides an interpretive literature review on the benefits of surface runoff mitigation. It is similar in spirit to the work of Kalman et al. (2000) but with more attention paid to the transferability of benefit estimates. We emphasize studies published since 1990. Older studies generally use less reliable analytical methods and are less reflective of contemporary values.

Reduced Frequency and Extent of Flooding

The economic costs of flood damages have been estimated in many different ways, including the summation of expenditures on clean up and repair, analysis of premiums paid for flood insurance, estimation of price differentials for flood-prone properties, and contingent valuation of hypothetical flood states.

Expenditures on clean up and repair (e.g., U.S. Army Corps of Engineers 1994) are easy to understand and compelling, but they reflect the cost of flooding rather than the value of prevention. Most people prefer preventive measures or assured compensation to ad hoc measures taken after the fact. Flood insurance premiums capture the value that property owners attach to the assurance of compensation if and when they experience losses. Under federal law, developed properties located within the 100-year floodplain (land subject to a 1% average annual probability of flooding) must be insured against flood damages if purchased with a loan from a federally chartered institution (National Flood Insurance Act of 1968, 42 *U.S.C.*, Sec. 4001 et seq.).

The federal flood insurance program is designed to be actuarially fair—premiums exactly equal to the expected damage costs. More than 4 million flood insurance policies are in effect and total coverage exceeds $600 billion. The average annual flood insurance premium is approximately $400 per policy and the value of a covered property is $135,000 (Federal Insurance and Mitigation Administration 2000). Discounting at real rates of 2–5%, the average premiums and property values imply an average expected cumulative damage over the life of the property of 6–10% of property value. Exclusion from the 100-year floodplain means only a reduction of flood risk below 1% annually, not its elimination, so the simple actuarial calculation overstates the value of flood reduction. Insurance coverage excludes deductibles and the costs of settling claims, so the full costs would exceed the insured costs.

The third approach to valuing flood damages looks at the direct effects on property values. Buyers who are informed about flood exposures should pay less for flood-prone property by at least the present value of the anticipated damages. For example, compared to a property with similar qualities and amenities but safe from flooding, the price of a property expected to sustain \$50,000 in damage with a 1% probability should be discounted by the present value of the expected loss. At a 5% real rate of interest, the price discount would be \$10,000 ((\$50,000 $\times 0.01)/0.05$).

Holoway and Burby (1990) and Chivers (2001) found that the prices of flood-prone properties are often not discounted as actuarial calculations indicate they should be. This "suggests that [even] compulsory insurance may fail to efficiently ration flood plain occupancy or to efficiently incorporate the social cost of flood plain occupancy into the decision calculus of home buyers" (Chivers and Flores 2002, p. 516). In other words, the systematic underestimation of flood damages may lead to too many buildings in the flood plain. Tobin and Montz (1994, 1997) found that properties with minor flooding recover their value more quickly and fully than those with extreme flooding.

Streiner and Loomis (1995) analyzed the property value effect of watershed protection measures, including flood protection, in 14 developing areas that have applied for California's Urban Stream Restoration Program. That program funds projects for flood mitigation and stream stabilization. (The "package" of treatments included various mixes of stabilization, clean up, clearing obstructions, revegetation, aesthetic improvements, and flood damage reduction. These dimensions were highly correlated in the projects considered, and their separate effects on value could not be distinguished.) Seven of the study areas were selected for the program and seven other similar sites were not. Using hedonic value estimation for real estate (Palmquist 1991), Streiner and Loomis (1995) concluded that flood damage reduction and stream stabilization *together* add 3–5% to mean residential property values. The high end of this range compares to the value calculated above for flood insurance using a 5% real discount rate. The low end may reflect a systematic underestimation of flooding or the fact that the projects reduce but do not eliminate flood risks. Unfortunately, the study did not provide information about the associated changes in expected flooding.

Thunberg and Shabman (1991) used contingent valuation methods to assess the willingness to pay for flood hazard reduction. They found that residents of a flood-prone area would pay significant positive amounts to mitigate community-wide effects (e.g., travel inconveniences and disruption of business activities) of flooding, in addition to the private property effects. They did not calculate a specific dollar amount.

Overall, the evidence suggests property value increases of 0–5% for marginal reductions in flooding. Properties that remain exposed to frequent profound flooding, or for which flood discounts are not apparent in the market, would gain the least. Those exempted from the 100-year floodplain, and hence federal insurance, as a result of stormwater management measures have the most visible consequence and stand to gain the most.

Smaller Drainage Infrastructure

Public drainage infrastructure consists of systems for collecting and conveying stormwater. It is usually designed to convey a peak flow of a specified probability. The design size increases with the scope of the protection. For example, a curb and gutter system that protects a neighborhood might be designed to fully convey the runoff from 80% of storm events while a bridge on a main thoroughfare serving a large region might be designed to accommodate the stream flow from 99% of storm events.

Retention of more water on-site means that design events produce less runoff and potentially lowers peak discharges. Smaller infrastructure can then provide the same level of protection from flooding. Reduced runoff volumes may also correlate with slower velocities, reducing the need for armoring to protect against channel scour.

Many factors affect the design of drainage infrastructure (Sample et al. 2003). We ignore aesthetic and corridor stability considerations and focus on peak flow conveyance costs. On-site construction costs for drainage (e.g., USEPA 1993; Center for Watershed Protection 1998) are much more commonly studied than downstream costs. The paucity of literature leads us to illustrate the size/cost trade offs using engineering costs of size differentials for culverts that convey flows under roads, railroads, and other crossings.

Standardized practices exist for iterative sizing of culverts (Federal Highway Administration 1985). We examine the costs for two round reinforced-concrete culverts ($n=0.012$), groove end with headwall (entrance loss coefficient $K_e=0.2$), allowable headwater depth of 1.22 m (4 ft), and 15.2 m (50 ft) in length. Each culvert is outlet-controlled pipe-full flow. Using a culvert nomography procedure (Center for Transportation Research and Education 2003), if the peak discharge is 2831.7 m^3/s (100 ft^3/s), the required culvert diameter is 1.07 m (42 in.). Some reports on conservation site design have claimed peak flow reductions in the range of 60% (Natural Resources Defense Council 1999). To be conservative, a 40% reduction in peak flow would reduce the required diameter to 0.76 m (30 in.). Published cost estimation data indicate that the material and installation costs would be 38% less for the smaller configuration (Get-A-Quote.Net 2003). Only construction costs (labor and materials) are included in these estimates. Additional factors, such as the costs for land, easements, engineering and design, are site specific, and probably do not scale proportionately with construction costs.

Reduced Pollution Treatment

Improved stormwater management can reduce the costs of pollution treatment in two ways. First, reducing peak runoff volumes can curtail storm sewer flows and related treatment and storage costs and overflow damages. The savings would be especially pronounced where storm and sanitary sewers are combined. Based on the cost analyses of Schueler (1987) and Heaney et al. (2002), Thurston et al. (2003) identified the costs of different methods for stormwater management with combined sewers in Cincinnati, OH. The modeled costs increased as storage and treatment volumes increased, especially if centralized storage and treatment were used. Decentralized stormwater management measures provided savings up to approximately 40% of flow volume.

The second type of treatment savings arises as a benefit of greater upstream infiltration. In some areas, the flow rate in the receiving water body is a limiting factor for effluent treatment requirements. With less dilution potential in the receiving water, more aggressive and costly treatment is necessary. Stormwater management measures that increase infiltration can increase the level and decrease the duration of low flows, thereby increasing the dilution capacity of the receiving waters and reducing treatment costs. The savings are particular to the location and to the type of effluent stream that is being treated. In this case, as with the preceding case of pollution due to stormwater, the benefits are difficult to generalize.

Reduced Erosion and Sedimentation

Soil erosion has effects both on and off site. On site, it impedes plant growth, forms surface gullies, and impairs landscape aesthetics (e.g., Crosson 1983). Off-site, eroded soil increases the turbidity of streams and lakes, degrading recreational usefulness, aesthetic values, and ecological functions. Sediment also increases water treatment costs, increases maintenance needs at hydroelectric plants, scours bridges and other structures, displaces the storage capacity of reservoirs, and impedes navigation. Sediment-clogged channels are more prone to flooding.

Urban erosion is characterized by a high rate of sediment delivery to streams (Novotny and Chesters 1989). Using benefits transfer methods in connection with an earlier study by Clark et al. (1985), Paterson et al. (1993) estimated the annual nationwide off-site damages due to erosion-related pollution from *urban sources alone*. They found quantifiable damages for the U.S. of between $192 million and $2.2 billion in 1990 dollar values, equivalent to $317 million to $3.6 billion in 2001 using the Consumer Price Index for adjustment (U.S. Department of Labor 2003).

Among the effects studied by Paterson et al. (1993) is water clarity. An hedonic study of lake water clarity in Maine found that shoreline property values increased by 10 to 15% when turbidity was reduced to permit a 1 m increase in the visibility of the water column (Michael et al. 1996). Greater visibility implies lesser concentrations of soil particles, algae, and other suspended solids. A Minnesota study found clarity to have an effect of nearly 5% per added foot of visibility on the appraised values of vacant shoreline lots (Steinnes 1992).

In addition to the benefits transfer analysis of overall erosion costs noted above, Paterson et al. (1993) used household surveys and engineering costing methods to estimate the benefits and costs associated with the federally mandated Phase I sediment reductions in North Carolina. (The Phase I regulations apply to large construction sites.) They surveyed urban households living on newly developed sites as well as those living "downstream." The mean WTP to maintain the Phase I rules was found to be $20/year/household ($28/year/household in 2001); the median WTP was $10/year/household ($14/year/household in 2001). The difference between mean and median indicates that a small number of respondents had a very high willingness to pay. This might be expected where the benefits of a program accrue disproportionately to one group, especially if that group is wealthy. Such a circumstance seems likely with urban streams, where waterside properties fetch premium prices.

These estimates presume that WTP remains constant as environmental quality changes. However, where Phase II sediment reductions follow on top of the Phase I reductions, the principle of diminishing returns suggest that their incremental value should be less.

Translating these impacts to percentages of property value would facilitate their extrapolation to other places and times. An average home in North Carolina, the area studied by Paterson et al. (1993), was valued at approximately $130,000 in year 2001. [The average nominal housing price in the Southern United States in 2000 was $128,300 (U.S. Census Bureau 2001)]. Assuming first that preferences were stable over the decade and second that the real discount rate is five percent, the mean WTP would be approximately 0.4% (median WTP would be 0.2%) of the year 2001 mean property value of all households. This is much below the results of the Maine lake clarity study, but it reflects an averaging over all households while the Maine study considered only waterside properties. The difference between mean and median values reported by Paterson et al. (1993) indicates a skewing of WTP, with most households willing to pay only a little while a small number are willing to pay a lot. Waterside households would capture a disproportionate share of the value and be more likely to express greater WTP. This is the population segment represented in the Maine study.

Improved Water Quality

Surface runoff entrains contaminants and conveys them to streams (Joint Task Force of the Water Environment Federation and American Society of Civil Engineers 1998). In addition to sediment, the runoff water can entrain landscaping chemicals, pet wastes, grease and oil products, and litter.

When surface waters percolate into the soil column rather than running off, many of these contaminates adhere to soil particles or are changed by microorganisms in the soil. This usually improves the quality of water entering surface bodies through connected aquifers.

For valuation purposes, the multiplicity of contaminants is a complication. Studies of water quality benefits typically focus on one or a small number of water quality parameters (e.g., Jordan and Elnageeb 1993), on specific practices (e.g., Doss and Taff 1996; Earnhart 2001); or on regulatory classifications of beneficial use, such as fishability and swimmability (e.g., Carson and Mitchell 1993). Furthermore, the value of an improvement in water quality may depend on the starting point (Carson and Mitchell 1993). While most valuation studies of water quality focus on drinking water quality, we are more interested in in situ water quality.

The studies of turbidity by Michael et al. (1996) and Steinnes (1992) bear on visual water quality. They were reviewed above in connection with erosion. Steinnes (1992) also tested the property value effects of water depth and suspended organic matter, in addition to water clarity (Secchi disk depth), but only the clarity indicator had a statistically significant effect.

Brox et al. (2003) used a generalized concept of surface water quality improvement in their study of the Grand River in an urbanizing area of Southwestern Ontario, Canada. The Canadian conditions are comparable to many areas in the North Central U.S. Residents of the area were asked about their WTP to restore the river from an unspecified degraded state to a condition where it would meet provincial water quality standards. The household monthly mean WTP was $8.29 in 1994 Canadian dollars (U.S. $7.23/month in 2001 dollars)—approximately 0.2% of annual family income (Statistics Canada 1996).

Loomis et al. (2000) administered a contingent valuation survey to a small sample of Colorado residents about a program to restore water quality services in the South Platte River. The services of interest were waste water dilution, natural purification through streamside vegetation and wetlands, erosion control, and improved habitat for fish and wildlife. The mean WTP was $252/household/yr in 1998, equivalent to approximately $276/household/yr in 2001 dollars, or approximately 3% of the median property value in Colorado (U.S. Census Bureau 2001; OFHEO 2003). Most of the improvements were on-site rather than upstream.

Leggett and Bockstael (2000) used hedonic and spatial econometric methods to analyze the effect of localized improvements in fecal coliform counts on waterfront property values along Maryland's western shore of the Chesapeake Bay. High fecal coliform counts lead to restrictions on water contact. They found that re-

Table 1. Adjusted Annual Household Values for Best Estimate of National Water Quality Benefits[a]

Incremental improvement in use classification	Mean	Standard error	95% confidence interval
WTP (boatable)	\$126	\$11	\$104–148
WTP (fishable)	\$ 95	\$ 8	\$ 79–111
WTP(swimmable)	\$106	\$12	\$ 81–130
WTP (total)	\$328	\$26	\$278–378

[a]Adapted to 2001 dollars from Carson and Mitchell (1993) by using the U.S. Bureau of Labor Statistics Consumer Price Index annual series and rounding to whole dollars. The mean values for boatable, fishable, and swimmable quality are incremental and additive to the total willingness to pay (WTP) (remaining differences are due to rounding). The standard errors and confidence intervals are not additive.

ducing coliform to meet the state standard of 200 counts/100 mL would add approximately 6% to the value of homes in areas with excessive counts.

Carson and Mitchell (1993) studied the value of improvements in use *classification*, as established in the Clean Water Act. Table 1 summarizes their best estimates for a representative household at the national level, adjusted to 2001 dollars using the consumer price index (U.S. Department of Labor 2003). The mean estimate is equivalent to approximately 0.7% of year 2001 median annual household income (U.S. Census Bureau 2001, 2002). A present value of an infinite stream of these annual payments amounts to approximately 5% of the 2001 median house value of approximately \$134,000 (OFHEO 2003). The benefits would be higher for households with above-average incomes, more water-based activities, and greater support for environmental goals. The values reported in Table 1 are for national improvements while the work of Brox et al. (2003), Loomis et al. (2000), and Leggett and Bockstael (2000) relates to localized improvements. It makes sense that the more pervasive improvements would be more highly valued. For our purposes, however, the localized estimates are more useful.

Improved In-stream Biological Integrity and Stream Aesthetics

In-stream biological integrity refers to the capacity of a stream to support a diverse and stable community of species. Ecosystems are adapted to local hydrologic characteristics and can be disrupted by hydrologic changes (Postel and Richter 2003). The analyses of Streiner and Loomis (1995) and Loomis et al. (2000), discussed above, attempted to encompass the benefits of in-stream biological integrity as perceived by local residents, just as they attempted to represent the downstream aesthetic effects of improvements in the stability of the stream channel. To the extent that upstream improvements enable downstream efforts at stabilization and beautification to be more successful, such as reducing flood damage to planted trees, the aesthetic improvements are not strictly a result of the upstream actions. For these reasons, it is difficult to isolate downstream aesthetic benefits as a separate category and we do not assign specific value estimates to them.

Increased Ground Water Recharge

Closely related to the effect of surface development on low flows is the effect on supplies of ground water. Schueler (1994) indicates that surface runoff is linearly related to impervious coverage. As impervious area increases, ground water recharge decreases.

The effect of reduced recharge on ground water supplies varies from area to area depending on the geologic structure. The overall effect can be large. For example, the Chicago area is estimated to lose access to between 10.2 and 23.7 billion gallons annually due to accelerated runoff—amounts comparable to the water consumed annually by 280,000 to 650,000 people (American Rivers, the Natural Resources Defense Council, and Smart Growth America 2002). Small or near-surface aquifers are more immediately affected than large or deep aquifers.

Recharge water has value as both a source of future withdrawals and a contributor to higher well levels and pressures that help to reduce pumping costs, prevent intrusion, and maintain the aqueous structure of the geologic formation (National Research Council 1997). For valuation purposes, the consumptive and *in situ* functions are separable.

Value in use. In a well-developed and competitive market, the price of water should vary with supply and demand conditions and reflect marginal WTP. However, markets for *raw* water exist in few places, such as the arid western United States. Those that do exist are typically not competitive. In many places, raw water is freely used and effectively has a price of zero. The prices charged by water utilities reflect pumping and treatment costs. Thus, while the total value of *raw* water is great (as evidenced, for example, by price premiums for waterside properties), its marginal value in many places is zero.

Assigning value to recharge water is further complicated by time lags. Because of discounting, water that becomes available for use in a year or two is much more valuable than water that takes tens or hundreds of years to percolate through geologic strata to a useable aquifer. Added percolation due to stormwater management can shift water from the surface to the subsurface, thereby delaying recapture. There may also be differences between surface and groundwater in pumping costs and the costs of the treatment required to meet drinking water standards.

Value in situ. In addition to the direct market value of ground water, added water in aquifers may reduce pumping heads and increase well pressure. These effects are site specific. In an extensive review, the National Research Council (1997) did not place a specific economic value on in situ services. The value of those services seems likely to be less than the value of direct consumption.

In conclusion, the value of added water infiltration depends on the amount of water, site-specific aquifer conditions, and the prevailing value of water. In many places, raw water is essentially a free good at the margin, even though its total value is great, so incremental changes in the amount or timing of water availability also have zero economic value. The effects of stormwater management measures on water supply are highly site specific.

Interpretive Summary and Synthesis

The preceding discussion is summarized in Table 2. The rightmost column of Table 2 provides an assessment of the respective values of stormwater retention based on best professional judgment. Where possible, values are translated into percentages of property values. The translation uses an approximate property value of \$134,000, the approximate national average price for a dwelling in 2001 (OFHEO 2003).

Many of the value categories are intertwined. Some, such as

Table 2. Synthesis of Economic Values of Downstream Effects

Effects category	Economic valuation studies: Source	Methodology/application	Estimate ($ 2001)	Categorical synthesis
Reduced flood damage	FEMA (2003)	Average flood insurance premium/nationwide	5%–6% of property value	≤2% of value for properties receiving partial mitigation; 2–5% of value for removal from 100-year floodplain
	Streiner and Loomis (1995)	Hedonic property valuation/California urban stream restoration projects	3%–5% of property value[a]	
	Chivers (2001)	Hedonic property valuation/Flood exposure in Boulder, CO	Ephemeral effect on improved properties	
Smaller public drainage infrastructure	None	Construction and operation costs	None	Unquantified, but probably significant
Reduced sedimentation	Paterson et al. (1993)	Benefits transfer/nationwide Contingent valuation/Phase I construction site rule in NC	\$317M–\$3.6B/year \$14–\$28/household/yr	0.2–0.4% of property value, all households; more for waterside properties
		Abatement cost/Phase I construction site rules in NC	\$453/treated ha/yr[b]	
Reduced pollution treatment	Sample et al. (2003) Schueler (1987)	Cost functions/best management practice costs for stormwater treatment	Site specific	Site specific
	None	Cost functions for point source effluent treatment	Industry specific	Industry specific
Improved water quality	Steinnes (1992)	Hedonic property valuation/incremental improvements in lake clarity affecting vacant lakefront lots in MN	5% increase in vacant lakefront property value/0.3 m increase in visibility	Inclusive of reduced sedimentation, 0.2%0.4% of average property value for *all* households in a watershed, including: 5% for *undeveloped waterside* properties; 10–15% for *waterside residential* properties
	Michael et al. (1996)	Hedonic property valuation/reduced turbidity in ME lakes	10–15% increase in lakefront residential property value/1 m increase in visibility	
	Brox et al. (2003)	Contingent valuation/restoration of river to provincial water quality standards in Ontario urbanizing area	\$7.23/mo/household, equivalent to 0.2% of average family income	
	Loomis et al. (2000)	Contingent valuation/restoration of wastewater dilution, natural purification through streamside vegetation and wetlands, erosion control, and improved habitat for fish and wildlife in the South Plate River, CO	\$ 276/yr/household, equivalent to 3% of median house value in CO	
	Leggett and Bockstael (2000)	Hedonic property valuation/impacts of reducing fecal coliform counts in Chesapeake Bay to meet state standards	6% of average property value for the 7% of all properties that are close to waters with excessive coliform (equivalent to 0.4% of all property values in MD study area)	
	Carson and Mitchell (1993)	Contingent valuation/incremental improvements to achieve Clean Water Act use classifications nationwide	\$278–\$378/yr/household, equivalent to 0.6%–0.8% of U.S. median annual household income and 4–6% of U.S. median house value	
Improved biological integrity and Aesthetics	Streiner and Loomis (1995) and Loomis et al. (2000)	See descriptions above	See descriptions above	See above
Increased ground-water recharge	*Use value* None	Price of potable water	Depends on years to availability and local prices	Site specific
	In-situ value NRC (1997)	N/A	Depends on aquifer structure	

[a]Includes reduced flood exposure, stream bank stabilization and revegetation, debris removal, improvements in fish habitat, additional buffer land around stream corridor, and aesthetic, educational and recreational features.

[b]Costs amortized over 20 years.

aquifer recharge, are not amenable to generalization. Others, such as infrastructure costs, have not been studied in ways that are useful for our purposes.

What does become clear is that flooding and water quality are important considerations in most places. Our best professional judgment is that flood damage mitigation is worth, on average, from 0–2% of the value of properties that would be in the 100-year floodplain with or without stormwater management measures but would experience less flooding as a result of upstream mitigation. The upstream flood mitigation is worth up to 5% of the value of properties that would otherwise be in the 100-year floodplain. These estimates are based largely on insurance calculations and they circumvent issues of incomplete information, faulty perception, and risk tolerance that lead people to behave in ways that are at odds with actuarial calculations.

Water quality, sedimentation, and aesthetic considerations are especially important to properties adjacent to water bodies. A number of studies indicate that aesthetic improvements to a stream or lake can add 3–15% to the value of adjacent land. The increases for undeveloped land are probably 5% or less while the increases for developed properties may be two to three times greater. (The addition of dwellings provides greater opportunity to experience directly the benefits of better water quality.) The benefits associated with water quality are tied to sensory effects. Visual clarity of the water column seems especially compelling. Coliform contamination that deters contact but does not affect appearance seems less consequential. General but ambiguously defined improvements in stream characteristics and ecosystem function are valued at the low end of the range.

The study by Streiner and Loomis (1995) is especially useful. In looking at actual market responses to a variety of stream corridor improvements (none of which related specifically to upstream measures), they found property price increases of 3–5%. This is on the low end of the range of other studies focusing on water quality. While the projects they analyzed were motivated in large measure by flood mitigation, their results should be placed in the context of other studies that find little or no market price response to flood mitigation. At the extreme, their estimates might reflect only aesthetic considerations and not capture any flood damage benefits, in which case adding flood reduction benefits based on actuarial calculations would produce a more complete estimate of social value.

We found no generalizable studies of the effect of stormwater discharges on public drainage infrastructure costs. Our culvert example, however, suggests that significant downsizing of conveyance infrastructure could have appreciable effects on those costs. The benefits would be especially great if the upstream measures preclude altogether the need for modifications to the channel or other downstream infrastructure. The incremental savings can be large.

Increased infiltration can increase low flows. The resulting aesthetic and water quality benefits are probably captured by the water quality estimates noted above. The presence of unique biota dependent on the stream could magnify these benefits. Low-flow augmentation can also be important to waste discharges. Their abatement costs are driven by ambient water quality conditions during low flow periods. The specific cost savings depend on which water quality parameters are limiting and the abatement options available to the dischargers.

Finally, increased percolation of stormwater should enhance aquifer recharge, providing more water for future withdrawals and increasing aquifer pressures. These benefits are higher where the marginal value of water is greater, percolation to an accessible aquifer is faster and does not simply offset reservoir storage, and threats to aquifer integrity are immediate.

Acknowledgments

This study was supported in part by Region 5 of the USEPA through Award No. X-97576401 to the Conservation Research Institute and through a Visiting Scholar appointment for Braden in Fall 2003. Additional support for Braden was provided by the Illinois Agricultural Experiment Station and Cooperative States Research, Education, and Extension Service, U.S. Department of Agriculture under Project No. 0305. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the supporting agencies. The writers thank Tom Brody, Wayland Eheart, Ron Griffin, John Haugland, Dan Injerd, Greg Lindsay, Ari Michelson, Tom Price, Jim Van Der Kloot, and three anonymous referees for their suggestions, but they bear no responsibility for our conclusions.

References

American Rivers, the Natural Resources Defense Council, and Smart Growth America. (2002). *Paving our way to water shortages: How sprawl aggravates drought*, Washington, D.C.

Arendt, R. G. (1996). *Conservation design for subdivisions: A practical guide to creating open space networks*, Island Press, Washington, D.C.

Arnold, C. L., Jr., and Gibbons, C. J. (1996). "Impervious surface coverage." *J. Am. Plan. Assn.*, 62(2), 243–258.

Braden, J. B., and Kolstad, C. D., eds. (1991). *Measuring the demand for environmental quality*, Elsevier, Amsterdam, The Netherlands.

Brox, J. A., Kumar, R. C., and Stollery, K. R. (2003). "Estimating willingness to pay for improved water quality in the presence of item nonresponse bias." *Am. J. Agric. Econom.*, 85(2), 414–428.

Carson, R. T., and Mitchell, R. C. (1993). "The value of clean water: The public's willingness to pay for boatable, fishable, and swimmable water quality." *Water Resour. Res.*, 29, 2445–2453.

Center for Transportation Research and Education. (2003). *Iowa statewide urban design standards manual*, Iowa State Univ., Ames, IA ⟨http://www.iowasudas.org/design.cfm⟩ (Aug. 8, 2003).

Center for Watershed Protection. (1998). *Better site design: A handbook for changing development rules in your community*, Center for Watershed Protection, Ellicott City, MD.

Chivers, J. (2001). "Flood risk, property values, and information market failure." MS thesis, Department of Economics, Univ. of Colorado, Boulder, Colo.

Chivers, J., and Flores, N. E. (2002). "Market failure in information: The National Flood Insurance Program." *Land Econ.*, 78(4), 515–521.

Clark, E. H., Haverkamp, J. A., and Chapman, D. (1985). *Eroding Soils: The Off-farm Impacts*, The Conservation Foundation, Washington, D.C.

Crosson, P. R. (1983). *Productivity effects of cropland erosion in the United States*, Johns Hopkins, Baltimore.

Doss, C., and Taff, S. (1996). "The influence of wetland type and wetland proximity on residential property values." *J. Agric. Resour. Econ.*, 21(1), 120–129.

Earnhart, D. (2001). "Combining revealed and state preference methods to value environmental amenities at residential locations." *Land Econ.*, 77(1), 12–29.

Federal Emergency Management Administration (FEMA). (2003).

Federal Highway Administration (FHWA). (1985). *Hydraulic design of highway culverts, Rep. No. FHWA-IP-85-15*, Hydraulic Design Series No. 5, FHWA, Washington, D.C.

Federal Insurance and Mitigation Administration. (2000). *National Flood Insurance Program, Statistics by Fiscal Year*, Washington, D.C. ⟨http://www.fema.gov/nfip/statsfisc.htm⟩ (Dec. 12, 2002).

Freeman, A. M. III. (2003). *The measurement of environmental and resource values*, 2nd Ed. Resources for the Future, Washington, D.C.

Get a Quote.Net (2003). *CD Estimator-Heavy Illinois* ⟨http://www.get-a-quote.net⟩ (Sept. 2, 2003).

Hager, M. C. (2003). "Low-impact development: Lot-level approaches to stormwater management are gaining ground." *Stormwater*, 4(1), 12–25.

Heaney, J. P., Sample, D., and Wright, L. (2002). "Costs of stormwater control." *EPA 600-R-02-021*, U.S. Environmental Protection Agency, National Risk Management Research Laboratory, Washington, D.C.

Hoehn, J. P., and Randall, A. (1989). "Too many proposals pass the benefit cost test." *Am. Econ. Rev.*, 79(3), 544–551.

Holoway, J. M., and Burby, R. (1990). "The effects of floodplain development controls on residential land values." *Land Econ.*, 66(3), 259–270.

Joint Task Force of the Water Environment Federation and American Society of Civil Engineers. (1998). *Urban runoff quality management*, WEF Manual of Practice No. 23 and ASCE Manual and Report on Engineering Practice No. 87, ASCE, Reston, Va.

Jordan, J. L., and Elnagheeb, A. H. (1993). "Willingness to pay for improvements in drinking water quality." *Water Resour. Res.*, 29(2), 237–246.

Kalman, O., Lund, J. R., Lew, D. K., and Larson, D. M. (2000). "Benefit-cost analysis of stormwater quality improvements." *Environ. Manage. (N.Y.)*, 26(6), 615–628.

Leggett, C. G., and Bockstael, N. E. (2000). "Evidence of the effects of water quality on residential land prices." *J. Environ. Econ. Manage*, 39(2), 121–144.

Loomis, J., Kent, P., Strange, L., Fausch, K., and Covich, A. (2000). "Measuring the total economic value of restoring ecosystem services in an impaired river basin: Results from a contingent valuation survey." *Ecologic. Econ.*, 33(1), 103–117.

Michael, H. J., Boyle, K. J., and Bouchard, R. (1996). "Water quality affects property prices: A case study of selected Maine lakes." *Misc. Rep. No. 398* Maine Agricultural and Forest Experiment Station, Orono, ME.

National Research Council (NRC). (1997). *Valuing groundwater: Economic concepts and approaches*, National Academy Press, Washington, D.C.

National Resources Defense Council. (1999). "Stormwater strategies: Community responses to runoff pollution." New York ⟨www.nrdc.org/water/pollution/storm/chap11.asp⟩ (Aug. 8, 2002).

Novotny, V., and Chesters, G. (1989). "Delivery of sediment and pollutants from nonpoint sources: A water quality perspective." *J. Soil Water Conservat.*, 44(1), 568–576.

Office of Federal Housing Enterprise Oversight (OFHEO). (2002). "OFHEO house Price indexes: 2002 Q4, State-level indexes: North Carolina." Washington, D.C. ⟨http://www.ofheo.gov/house/hpi_hist_frame.html⟩ (March 28, 2003).

Palmquist, R. B. (1991). "Hedonic methods." *Measuring the demand for environmental quality*, J. B. Braden and C. D. Kolstad, eds. North-Holland, Amsterdam, 77–120.

Paterson, R. G. et al. (1993). "Costs and benefits of urban erosion and sediment control: The North Carolina experience." *Environ. Manage. (N.Y.)*, 17(2), 167–178.

Postel, S., and Richter, B. 2003. *Rivers for life: Managing water for people and nature*, Island Press, Washington, D.C.

Sample, D. J. et al. (2003). "Costs of best management practices and associated land for urban stormwater control." *J. Water Resour. Plan. Manage.*, 129(1), 59–68.

Schueler, T. R. (1987). *Controlling urban runoff: A practical manual for planning and designing urban BMPs*, Washington Metropolitan Water Resources Planning Board, Washington, D.C.

Schueler, T. R. (1994). "The importance of imperviousness." Watershed Protec. Techniques, 1(3), 100–111.

Schueler, T. R. (1995). *Site planning for urban stream protection*, Metropolitan Washington Council of Governments, Washington, D.C.

Schueler, T. R. (2003). "Ideal urban forms to minimize land-use impacts on aquatic ecosystems in the Great Lakes Basin." prepared for *Great Lakes Science Advisory Board (GLSAB) Workshop on Urban Land-use Impacts on Great Lakes Water Quality*, GLSAB, Toronto.

Statistics Canada. (1996). *1996 Census: Nation tables*. Ottawa, ⟨http://www.statcan.ca/english/census96/may12/t5can.htm⟩ (Aug. 8, 2003).

Steinnes, D. N. (1992). "Measuring the economic value of water quality: The case of lakeshore land." *Ann. Region. Sci.*, 26, 171–176.

Streiner, C. F., and Loomis, J. B. (1995). "Estimating the benefits of urban stream restoration using the hedonic price method." *River*, 5(4), 267–278.

Thunberg, E., and Shabman, L. (1991). "Determinants of landowner's willingness to pay for flood hazard reduction." *Water Resour. Bull.*, 27(4), 657–665.

Thurston, H. W., Goddard, H. C., Szlag, D., and Lemberg, B. (2003). "Controlling stormwater runoff with tradable allowances for impervious surfaces." *J. Water Resour. Plan. Manage.*, 129(5), 409–418.

Tobin, G. A., and Montz, B. E. (1994). "The flood hazard and dynamics of the residential land market." *Water Resour. Bull.*, 30(4), 673–685.

Tobin, G. A., and Montz, B. E. (1997). "The impacts of a second catastrophic flood on property values in Linda and Olivehurst, California." Natural Hazards Research and Applications Center, Univ. of Colorado, Boulder, Colo.

U.S. Army Corps of Engineers. (1994). "The Great Flood of 1993 Post-Flood Report: Upper Mississippi River and Lower Missouri River Basins." Northcentral Division, St. Paul, Minn.

U.S. Census Bureau. (2001). *Statistical Abstract of the United States, 2001*, Washington, D.C.

U.S. Census Bureau. (2002). "Historical income tables"; *Table H-9* ⟨www.census.gov/hhes/income/histinc/h09.html⟩ (Feb. 13, 2003).

U.S. Department of Labor. (2003). "Consumer Price Index, All Urban Consumers—(CPI-U), U.S. city average." Bureau of Labor Statistics, Washington, D.C. ⟨ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt⟩ (Sept. 2, 2003).

U.S. Environmental Protection Agency (USEPA). (1990). "NPDES system." *55 Federal Register*, 48,602 USEPA, Washington, D.C.

U.S. Environmental Protection Agency (USEPA). (1993). *Costs of providing government services to alternative residential patterns*, U.S. Government Printing Office, Washington, D.C., Microfiche.

U.S. Environmental Protection Agency (USEPA). (1999a). "Chap 6: Costs and benefits of stormwater BMPs." *Preliminary data summary of urban stormwater best management practices*, Washington, D.C., *EPA-821-R-99-012*, ⟨www.epa.gov/OST/stormwater/⟩ (Aug. 19, 2002).

U.S. Environmental Protection Agency (USEPA). (1999b). "Stormwater phase II final rule." 64 *Federal Register*, 68,722, USEPA, Washington, D.C.

Wilson, A. et al. (1998). *Green development: Integrating ecology and real estate*, Wiley, New York.

U.S. Environmental Protection Agency
Region IX

California Regional Water Quality Control Board
Los Angeles Region

Review of Stormwater Best Management Practices at Large Construction Sites

DRAFT – June 13, 2005

Review of Stormwater BMPs at Large Construction Sites

EXECUTIVE SUMMARY

To be completed after review comments are received.

Table of Contents

1.0 Introduction

1.1 Purpose

The primary goal of this project was to review and assess the structural and non-structural BMPs typically implemented at large construction sites (greater than 100 acres) and develop a set of minimum recommended BMPs. The primary focus of the review was on erosion and sediment control BMPs, although stormwater management and housekeeping construction BMPs were also included in the review.

The secondary goal was to assist the Los Angeles Region Water Quality Control Board (Regional Water Board) in prioritizing active construction sites for inspections and permitting options. Factors such as disturbed acreage, proximity to an impaired waterbody, slope, or other factors were considered. Minimum recommended BMPs for large construction sites were also identified.

1.2 Construction General Permit Requirements

Construction activity within the Los Angeles Region is required to comply with the State Water Board's NPDES General Permit for Storm Water Discharges Associated with Construction Activity (Construction General Permit) (http://www.swrcb.ca.gov/rwqcb4/html/programs/stormwater/sw_construction.html)

The Construction General Permit applies to storm water discharges from construction activity disturbing one acre or more, except for discharges on tribal lands, in the Lake Tahoe Hydrologic Unit, and construction performed by Caltrans which are all regulated by separate permits.

The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). Section A of the Construction General Permit describes the elements that must be contained in a SWPPP. The SWPPP should contain a site map(s) indicating the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP must list BMPs proposed to protect recieving water quality and the location of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the Clean Water Act Section 303(d) List of Water Quality Limited Stream Segments (http://www.swrcb.ca.gov/tmdl/docs/2002reg4303dlist.pdf) for sediment.

1.3 Inventory and Data Collection

1.3.1 Construction Project Inventory

Using the General Stormwater Permittees Regional Database, the Regional Water Board developed an inventory of all construction projects of greater than 100 acres within the Los Angeles Region. In order to secure local permits many projects submit Notices of Intent (NOIs) in advance of grading activities. The Regional Water Board, therefore, had to contact selected sites to determine if the project had begun grading. Regional Water Board staff determined that it was impossible to verify whether all selected sites were in active construction, so additional construction sites less than 100 acres were also selected to increase the universe of projects reviewed. In some cases, Regional Water Board inspectors recommended additional sites based on inspection findings. Projects currently required to conduct water quality monitoring were not inspected, therefore, water quality monitoring data has not been assessed for this review.

1.3.2 BMP Data Collection

With assistance from the Regional Water Board, Tetra Tech developed a data collection sheet for field staff to use in assessing BMPs at very large construction sites. Basic information about the site was collected in addition to information on BMPs. The BMP fact sheets contained in the California Stormwater Quality Association's (CASQA) Construction BMP Manual were used to in the development of the collection sheet.

Inspections of the selected sites were conducted the week of April 4-7, 2005. After a kick-off meeting to discuss the BMP review process, four teams conducted the inspections. Each team was comprised of one Tetra Tech and one Regional Water Board inspector. The Regional Water Board inspector lead each inspection and the Tetra Tech inspector collected BMP data (e.g., installation, maintenance, relative effectiveness) and created a photo log of the primary BMPs and water quality problems identified at each construction site. Although the data collection sheet was comprehensive, some information was not available to complete a sheet for each site. In addition, since monitoring data was not reviewed, BMPs were determined to be effective by visual inspection only using best professional judgment (BPJ).

2.0 Assessment of Best Management Practices

2.1 Basic Site Details

A total of 24 construction sites were inspected during the week of April 4-7, 2005.

The range in size of sites inspected included:

Greater than 100 acres:	10 sites
Between 50-100 acres:	6 sites
Less than 50 acres:	8 sites

The primary land use at each site consisted of the following:

Residential	11 sites
Commercial	6 sites
Industrial	4 sites
Other	2 sites (cemetery and landfill)
Linear	1 site

Most of the inspected projects were located in Los Angeles County; however, two inspections were conducted in Ventura County. The weather during the inspection week was clear, with no rain recorded during the week.

2.2 Construction Site Observations

A variety of BMPs were observed during the construction site inspections. Because of the large size of many of the construction sites visited, the inspectors did not attempt to collect information on the number of BMPs implemented at each site. Instead, visual observations were made about the types of BMPs implemented at each site, whether they were adequately maintained or effective, and which BMPs which were specified in the SWPPP, but were not installed.

The BMPs are categorized according to the CASQA Construction BMP Handbook. Where appropriate, references to the CASQA Construction BMP fact sheet are included.

2.2.1 SWPPP Observations

Almost all sites had a SWPPP available on-site (the only sites lacking SWPPPs were two of the smallest sites visited). The quality of the SWPPPs varied, and some had deficiencies such as missing signatures on the certification page or missing maintenance records. Other SWPPPs included maps that did not accurately reflect current on-site conditions or did not have appropriate BMPs. Most SWPPPs included the required maintenance/inspection logs, however many were not completed or up to date. Many projects did not adequately document inspections before and after a rain event.

One site used a laminated SWPPP site map in order to easily identify and modify the locations of BMPs at the site.

2.2.2 Erosion Control BMPs

Erosion control BMPs are designed to prevent erosion through the protection and preservation of soil. Sediment control BMPs are designed to remove sediment from runoff before it is discharged from the site. The sites inspected relied heavily on sediment controls rather than a combination of erosion and sediment control controls.

Slope Stabilization: The primary erosion control BMP observed was slope stabilization. The construction sites visited employed a variety of BMPs to stabilize slopes including jute netting, visquine, soil binders (BMP EC-5), Bonded Fiber Matrix (BMP EC-3), and hydroseeding (BMP EC-4). The effectiveness of these BMPs varied by site, with failures observed on slopes using each of these types of BMPs. The primary factor influencing effectiveness appeared to be regular inspections and maintenance, including reinstallation or application of the BMP if necessary.

Common Problems: Rilling and gullying were observed on slopes using all types of slope stabilization BMPs. The inspection teams did not observe geotextiles or mats (BMP EC-7) being used at any of the sites visited. Other types of erosion control BMPs such as structural controls to divert storm water away from denuded areas, were not observed.

2.2.3 Sediment Control BMPs

The following sediment control BMPs were observed at most of the construction sites:

Perimeter sediment controls: The inspection teams observed a variety of perimeter sediment controls in use, including fiber rolls (SE-5), silt fences (SE-1) and gravel bags (SE-6). For projects on relatively flat slopes, the BMPs were employed around the perimeter.

Common Problems: Many of the perimeter sediment controls were poorly maintained or could not handle the amount of sediment reaching them. Many of the observed sediment control BMPs were in disrepair and showed signs of recent failure from the extremely heavy rainfall during the 2004-05 winter season. Maintenance problems included inadequate removal of sediment from behind the BMP and failure to replace the BMP when damaged.

Storm drain inlet protection (SE-10): A variety of BMPs were used for storm drain inlet protection, including gravel bags, fiber rolls, and commercially-available products.

Common Problems: Maintenance of the inlet protection was a common problem, with many sites failing to remove sediment from behind the BMP. When gravel bags were used for inlet protection, damage to the bags could allow gravel to enter the storm drain. Another common problem was failure to protect the entire width of the storm drain inlet, which negated the effectiveness of the BMP.

Sand & gravel

The most common BMPs is sand bagging. → damage to the bags is the most common problem

A004593

Gravel Bag Berms (SE-6)/Check Dams (SE-4): Gravel bag berms were primarily used in roadways as small check dams to slow stormwater flows and provide minor settling of sediment.

Common Problems: The most common problem observed was failure to repair damage to the gravel bags.

Sediment basins (SE-2)/Sediment Trap (SE-3): Sediment basins were employed by several larger construction projects, but were not universally applied at all large construction sites. Temporary sediment basins were the main BMP observed at several construction projects in the grading phase. The basins were constructed in an effort to prevent discharge from the construction site, but were not designed using runoff volume calculations for the watershed area. Sediment traps (for drainage areas less than 5 acres) were not used at most sites.

Common Problems: Many of the sediment basins observed were heavily silted and required maintenance. Because these inspections were conducted toward the end of the rainy season, construction operators may have been waiting until after the rainy season to clean out the basins. Also, construction operators indicated that cleaning out the basins during wet periods is difficult to do without getting equipment stuck. The sites relying solely on temporary sediment basins showed evidence of significant stormwater discharge with heavy erosion observed on non-stabilized slopes and silted channels. Relying on temporary sediment basins as the only construction site BMPs is unrealistic, especially for larger sites grading during the wet season.

Street sweeping (SE-7): Although not observed occurring during the inspections, most sites inspected included a BMP in the SWPPP to regularly sweep streets near the construction entrance. Sweeping typically consisted of either a mechanical broom street sweeper or using laborers to sweep the street.

Common Problems: Small amounts of sediment were observed in the street at many construction exits.

2.2.4 Tracking Control BMPs

Stabilized Construction Entrance/Exit(TR-2). This BMP usually consisted of metal rumble strips placed at the entrance to remove mud from tires, but also included construction exits stabilized by rock.

Common Problems: Even with the use of tracking control, it was still often necessary to sweep the street in front of the construction site. Also, rumble strips and entrances stabilized by rock required periodic maintenance to remove excess sediment accumulation. It was observed on several sites that many construction vehicle tracks went around the rumble strips.

2.2.5 Non-Stormwater Management

Poor housekeeping on construction sites can increase the discharge of many pollutants such as oil and grease, paints, fuel, concrete wash out and other raw construction materials. The following non-stormwater management BMPs were observed at the sites inspected:

Vehicle and Equipment Maintenance (NS-10), Cleaning (NS-8), and Fueling (NS-9): Projects employed a variety of BMPs for controlling the discharge of pollutants in stormwater from vehicles and equipment. These included drip pans, spill kits, berms and secondary containment.

Common Problems: Some leaking vehicles were observed, although drip pans were placed under parked heavy equipment at several construction projects. Fuel storage was not in secondary containment at one site.

2.5.6 Waste Management and Materials Pollution Control BMPs

Concrete Waste Management (WM-8): Construction operators used several types of practices to manage concrete wastes including plastic-lined detention formed using hay bales and a commercial roll-on container.

Common Problems: Inadequate sizing or location of the BMP was the most common problem. Also, some construction operators were not designating a contained area for stucco waste.

Material Delivery and Storage (WM-1): Construction operators used a variety of techniques to provide cover and/or secondary containment for materials. This included portable storage units, tarps, berms, and secondary containment units.

Common Problems: Because many construction sites lack adequate storage, materials with potential stormwater pollutants were stored without cover or secondary containment at some construction sites. This became more of a problem during the active building phase of projects.

Sanitary/Septic Waste Management (WM-9): Some construction operators used secondary containment around portable toilets.

Common Problems: Lack of secondary containment and improperly locating the portable toilets near a storm drain or in a drainage path. This is a problem when the portable toilet is drained, since some waste can spill.

Solid Waste Management (WM-5): Construction operators generally used large dumpsters or barrels for solid waste management.

Common Problems: Solid waste was primarily a problem only during the building construction phase. Clear signage and numerous waste containers helped to minimize the problem.

3.0 BMP Recommendations

The following are BMPs recommended by the Regional Water Board for large construction sites. These BMPs will commonly be applied to most large construction sites. Additional BMPs may be required at large construction sites depending on site conditions. Construction operators are referred to the California Stormwater Quality Association's *Construction Handbook* for a complete list of construction site BMPs.

Each BMP includes several key design, installation and maintenance issues that the review team found to be commonly misapplied. Complete information on each BMP's application, design, installation, and maintenance is available in the *Construction Handbook.*

NOTE: We've included relevant photos from the inspections, but we've only drafted key design, installation and maintenance issues for silt fence and stabilized construction entrance. If you like this format, we can do this for the rest of the BMPs.

3.1 Overall Recommendations

Inspections and recordkeeping

The General Permit requires inspections to be performed "before and after storm events and once each 24-hour period during extended storm events to identify BMP effectiveness." For each inspection, the discharger is required to complete an inspection checklist that includes the inspection date, weather information, description of inadequate BMPs, observations of all BMPs, corrective actions required, and inspectors name, title and signature.

Maintenance

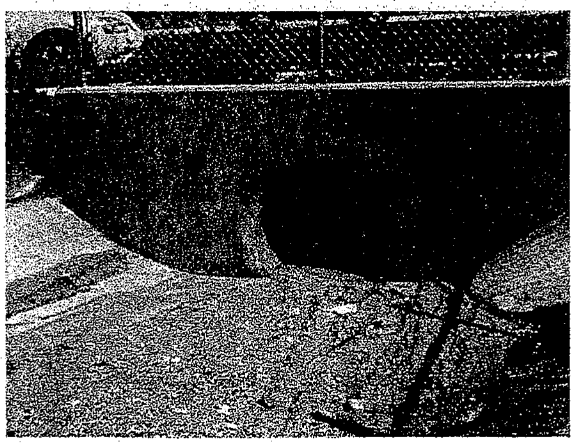


Photo 1. Failure to clean and maintain culvert.

Employee Education

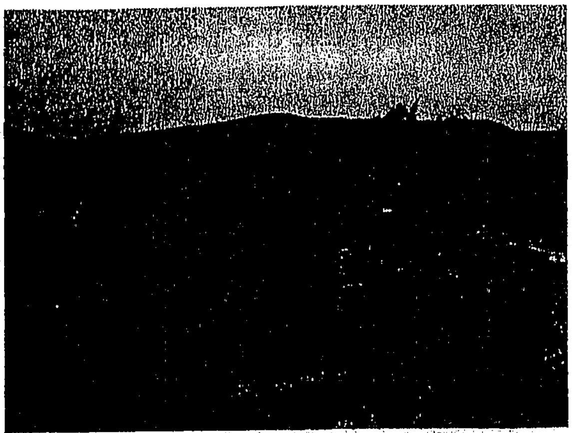


Photo 2: Employee education using signs.

3.2 *Erosion Control BMPs*

EC-1 Scheduling

EC-2 Preservation of Existing Vegetation

Slope stabilization

(using practices such as soil binders, straw mulch, geotextiles and mats, polyacrylamides, etc)

Photo 3. Slope failure at edge of visquine.

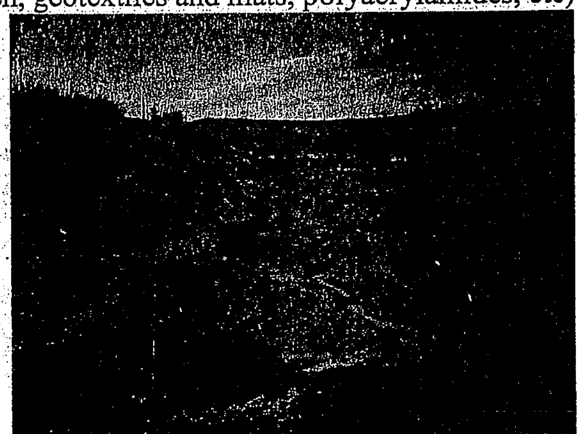


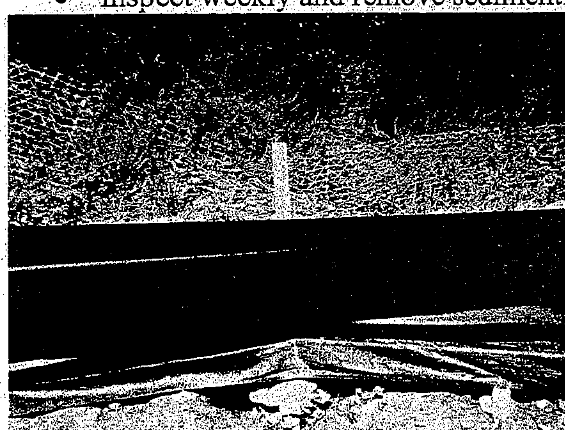
Photo 4. Rills/gullies forming along slope without erosion controls.

Photo 5. Slope stabilization with jute netting.

3.3 Sediment Control BMPs

SE-1 Silt Fence

- Trench and key in the silt fence
- Do not use in areas of concentrated flow
- Do not use as the only BMP at the base of long slopes
- Install along the contour and turn ends up to ensure water ponds behind the silt fence
- Inspect weekly and remove sediment when it reaches 1/3 the height of the silt fence



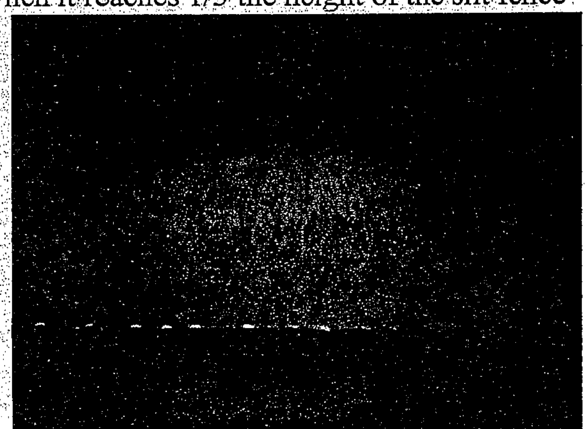


Photo 6: Silt fence that was not trenched and keyed in. **Photo 7**: Silt fence at bottom of long slope.

SE-2 Sediment Basin

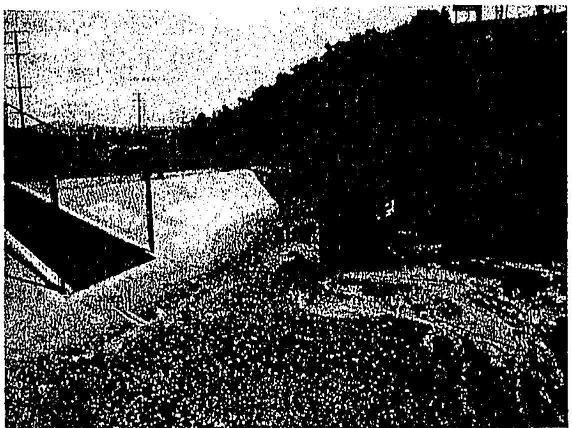


Photo 8: Sediment basin with outlet standpipe.

SE-5 Fiber Rolls

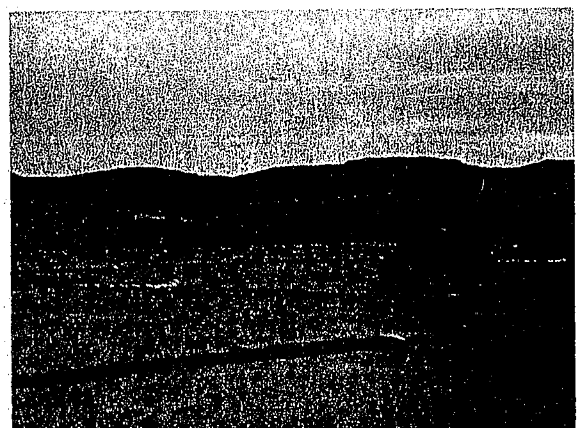


Photo 9. Fiber rolls on flat slope.

SE-6 Gravel Bag Berm/Check Dam (SE-4)

Photo 10. Gravel bag berm with broken gravel bags.

SE-7 Street sweeping and vacuuming

SE-10 Storm Drain Inlet Protection

Photo 11. Unprotected storm drain inlet.

3.4 Tracking Control BMPs

TR-1 Stabilized Construction Entrance/Exit

- Use 3-6 inch diameter stones – do not use gravel
- Use a geotextile fabric underneath stones
- Install perimeter fence or barriers to ensure vehicles use designated exits.
- Sweep the street periodically
- Inspect weekly and remove/replace stone as needed

Photo 12. Rumble pads for tracking control.

3.5 Non-Stormwater Management

Vehicle and Equipment Cleaning (NS8), Fueling (NS-9) and Maintenance (NS-10)

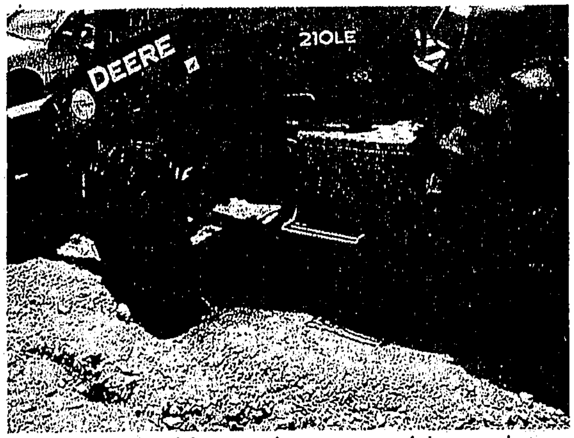


Photo 13. Leaking equipment requiring maintenance. **Photo 14**. Secondary containment around vehicle.

3.6 *Waste Management and Materials Pollution Control BMPs*

WM-1 Material Delivery and Storage

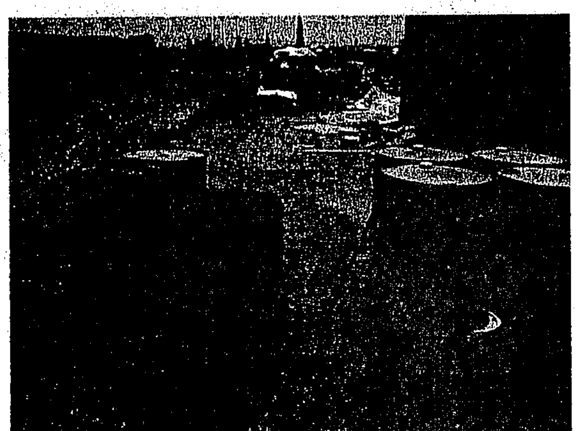


Photo 15. Improper storage of drums outside without containment.

WM-3 Stockpile Management

Photo 16. Stockpiles covered with visqueen.

Photo 17. Unprotected stockpile in drainageway.

WM-4 Spill Prevention and Control

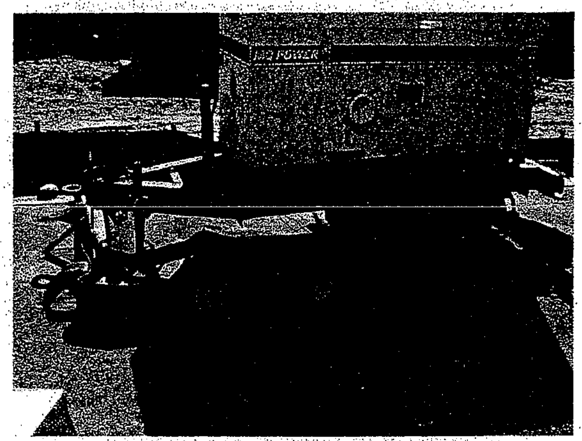


Photo 18. Secondary containment under generator.

WM-8 Concrete Waste Management

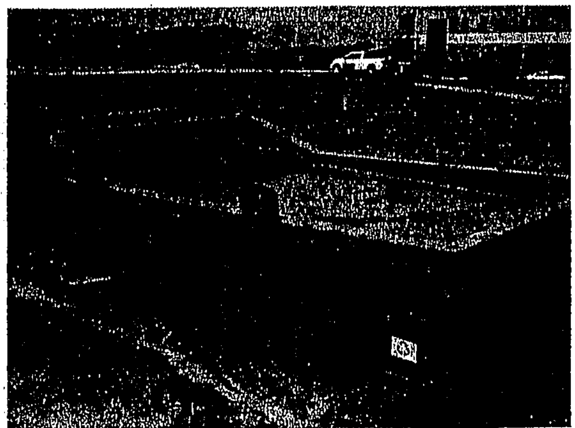


Photo 19: Commercial concrete washout.

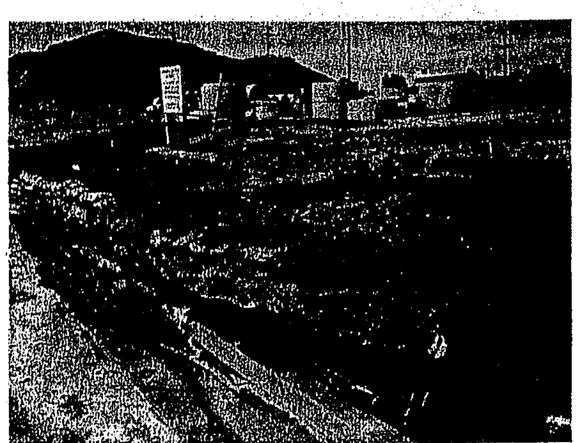


Photo 20: Failed concrete washout.

WM-9 Sanitary/Septic Waste Management

Photo 21. Secondary containment around portable toilets.

4.0 Recommendations for the Regulation of Large Construction Sites

To improve permit compliance and the efficiency of the NPDES construction stormwater program, the Region Water Board could develop a system to prioritize construction sites. High priority sites could then be inspected more frequency, given more stringent permitting requirements, or both. Increased inspection frequencies could be conducted under the current construction general permit. More stringent permitting requirements would require either a reissued general permit or new individual permits issued to specific construction sites.

4.1 Prioritization Process

The Regional Water Board could prioritize large construction sites based on a number of factors to be determined in the office and the field. Ideally, all construction sites above a certain disturbed acreage threshold (e.g., 100 acres) would be inspected during the prioritization process.

Several factors could be assessed in the office upon submittal of an NOI. However, as information available in the office on each construction site may be of limited value, the Regional Water Board should conduct inspections to confirm or adjust the factors used to assign priority.

The prioritization process should be further defined by assigning weighted values to factors considered most critical (i.e. size, proximity to impaired waters, etc.). A "score" could then be determined for each site with values denoting degrees of priority (e.g. high, medium, low). The following factors could be included:

1) *Disturbed Acreage Threshold*
   Size of disturbed area is an obvious factor to consider in the prioritization process. Typically, the larger the disturbed area, the greater the potential risk to water quality. The Regional Water Board would need to determine the appropriate size threshold for prioritization (e.g., 100, 75 or 50 acres).

   Once this threshold has been established, this would be an initial factor used to prioritize projects.

2) *Federal/State Operated Sites*
   Localities typically do not regulate or inspect federal or state construction projects, therefore, these sites could be assigned a higher priority. However, the vast majority of these sites are significantly smaller than 50 acres.

3) *Historic Compliance Problems*
   The Regional Water Board could assign a higher priority to construction sites operated by a company with past notices of violation (NOVs) or other enforcement actions on the current or past projects. The Regional Water Board could create a numeric scale to assign a value relative the number of violations which have occurred.

4) *Projects with Steep Slopes*
Critical factors such as slope ratio and slope length in addition to the total number of acres with steep slopes effect the type and location of necessary erosion and sediment control BMPs. Slopes with a greater than 3:1 slope ratio and greater than 50 foot slope length could indicate a priority site. Projects with slopes that are adjacent to receiving waters or with storm drains/curbed streets at the foot of the slope could receive a higher priority.

Alternatively, projects on flat slopes typically experience less sediment movement during storm events and could be a lower priority for the Regional Water Board.

5) *Projects Adjacent to Waterbodies*
Projects adjacent to waterbodies impaired by sediment or other pollutants generated at construction sites are a priority. Also, construction adjacent to non-impaired waterbodies could be a priority because of the potential direct impact to the waterbody if controls are not implemented.

6) *Time of Active Grading.*
Projects with large disturbed areas undergoing active grading during the wet season pose a significantly higher threat to water quality than dry season grading.

7) *Projects with Multiple Builders*
Large projects with multiple builders on-site could represent a higher priority because of the mixed responsibility for implementing BMPs and amount of construction activity at the site.

4.2 Options for High Priority Projects

Once a process for determining the priority of projects has been established, there are several options for improving the implementation and effectiveness of BMPs on high priority projects.

4.2.1 Increased Regulatory Inspection Frequencies

The Regional Water Board could increase the inspection frequency for projects based on priority. For example, high priority project inspections could be conduced at least once every 30 days (dependent upon season, rainfall etc.) and/or within 48 hours of the end of a storm event of 0.5 inches or greater. This may require increased inspection staff time or a redistribution of existing Regional Water Board resources.

4.2.2 General Permit Options

The Regional Water Board could opt to enhance general permit requirements for high priority construction projects. As previously stated, construction activity within the Los Angeles Region is required to comply with the State Water Board's NPDES General Permit for Storm Water Discharges Associated with Construction Activity (http://www.swrcb.ca.gov/rwqcb4/html/programs/stormwater/sw_construction.html) The Los Angeles Regional Water Board could amend this permit to include more specific permit provisions for high priority projects within the Los Angeles Region.

The Regional Water Board could choose from a variety of additional general permit provisions to improve compliance and BMP effectiveness on high priority construction projects. Options to consider for an amended General Permit include increased self-inspection requirements, training and certification requirements for operators, more specific SWPPP requirements, submittal of the SWPPP to the Regional Water Board for review and approval, water quality monitoring, and enhanced notification requirements.

For example, the Construction General Permit currently requires construction operators to conduct inspections "before and after storm events and once each 24-hour period during extended storm events." Construction operators sometimes claim that significant gaps in their on-site inspection records is due to a lack of rainfall, which can be difficult for Regional Water Board inspectors to verify in the field.

The Regional Water Board could require that construction operators conduct inspections weekly, while still conducting inspections before and after a rain event. Also, the Regional Water Board could require that construction operators install a rain gage to record daily rainfall at the construction site. These records could be cross-checked with the inspection records to verify that inspections were conducted before and after rain events.

The following are additional examples of existing enhanced requirements in state general permits:

Minnesota Construction General Permit
This permit has additional BMP requirements when construction sites discharge to "special waters." These additional BMP requirements include buffer zones of at least 100 feet, covering slopes over 3:1 within 3 days after being worked, and temperature controls. Also, the permit also include post-construction stormwater requirements, including the treatment of the first ½ inch of runoff from new impervious surfaces.
http://www.pca.state.mn.us/water/stormwater/stormwater-c.html

Georgia Construction General Permit
The State of Georgia requires the monitoring of turbidity in receiving waters or outfalls for most projects. Both an upstream sample and a downstream sample must be taken. In general, two samples are required – the first 0.5 inch or greater rain event after clearing operations have begun, and another event at least 0.5 inches at least 90 days after the first sample. In addition, the permit specifies a violation if BMPs have not been properly designed, maintained, and installed and monitoring of receiving waters indicates an increase of more than 10 nephelometric turbidity units (NTU) for trout streams and more than 25 NTU for warm water fisheries. If an outfall is monitored, the permit contains a table of NTU limits for cold water and warm water fisheries that varies based on watershed area and disturbed acreage.

EPA Region 4 Construction General Permit
This general permit, applicable only on Indian Lands in EPA Region 4, requires monitoring when a construction project discharges stormwater to a 303(d) listed waterbody impaired for total suspended solids (TSS) or other indicators of solids transportation such as turbidity,

siltation, or sedimentation. These requirements are similar to the California General Permit monitoring requirements, except monitoring for non-visual pollutants is not included.

Oregon Construction General Permit
This general permit includes a water quality standard for turbidity stating "no more than a ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity." However, monitoring requirements are not included in the permit.

The permit can be accessed at:
http://www.deq.state.or.us/wq/wqpermit/GenPermits/NPDES1200C/NPDES1200CPermitDraft.pdf

Pennsylvania Construction General Permit
Monitoring is not required in this general permit; however, the State requires individual permits for any construction activity located in a high quality or exceptional value watershed.
The permit can be accessed at:
http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StormwaterManagement/GeneralPermits/default.htm

2004 Effluent Guideline – Construction and Development
EPA proposed a construction and development effluent guideline in June 2002 to supplement existing regulations addressing stormwater discharges from construction sites which contained three options. The first option would have amended the NPDES regulations to include inspection and certification requirements for operators of construction sites disturbing at least one acre of land. The second option would have promulgated an effluent guideline that contained additional requirements for construction activity disturbing at least five acres of land. EPA also proposed a third option to continue to rely on the existing regulations and programs in place at the federal, state, and local levels. EPA chose the third option to rely on the range of existing regulations and programs in place at the federal, state and local levels to control stormwater runoff from construction sites and not develop an effluent guideline. However, the development document cites a number of specific inspection and certification requirements that were considered as a part of the first option. The Regional Water Board could consider including similar requirements in an amended general permit. For example:

- Require contractor inspections of high priority projects every 7 or 14 days and within 24 hours of the end of a storm event of 0.5 inches or greater.
- Contractor inspections must be conducted and certified by qualified personnel. The Regional Board could require training or certification of all contractors performing self-inspections.
- A qualified professional shall conduct an assessment of the site prior to groundbreaking to certify that BMPs have been implemented as described in the SWPPP
- Inspection report must also contain a site map showing all disturbed areas, areas that have undergone temporary stabilization, areas with planned disturbance in the next 14 days, and areas that have not undergone active site work for the past 14 days.

- Inspection report to note approximate degree of sediment accumulation as a percentage of the sediment storage volume for sediment control practices.
- The operator is required to submit a summary of the site inspection activities on a monthly basis to the Regional Water Board.
- A final site erosion and sediment control inspection to be completed and certified before filing a Notice of Termination

4.2.3 Individual Permit Options

Issuance of individual discharge permits for high priority construction projects could facilitate site-specific BMP, monitoring and inspection requirements. Tetra Tech is not aware of any individual permits that have been issued to construction dischargers in California or other states. Construction activities are considered to be an industrial sector by EPA, therefore, would require the same standard template and permitting provisions, public notice, and collection and response to comments as other industrial storm water individual permits in California.

4.3 Develop a notification system for active construction projects

As discussed in section 1.3.1, because many construction projects must show proof of coverage under the State's Construction General Permit before local permits are issued, many projects show up on the NOI database long before construction begins. The NOI database also has a number of completed projects because the operator has not submitted a Notice of Termination yet. These problems make it difficult for the Regional Water Board to identify which projects on the NOI database are active construction projects with exposed soils. The NOI database contains estimated start and completion dates, but project delays can make these unreliable.

There are several options that could help the Regional Water Board to address this problem:

- The next Construction General Permit could include a requirement for the construction operator to notify the appropriate Regional Water Board when soil disturbance activities begin. This could be accomplished by:
  - Developing a new notification form
  - Requiring construction operators to submit a change of information form if the anticipated start date changes
  - Developing a web or email-based notification system for the operator to use when soil disturbance activities begin
- The Regional Water Board could require one of the notification procedures above only for large construction sites.
- The Regional Water Board could contact construction operators after the date of construction commencement indicated on the NOI to verify that the site has begun grading.
- The Regional Water Board could require high priority construction sites (e.g., those over 50 or 100 acres) to schedule an inspection to verify that all BMPs are installed before grading activities begin.

4.4. Advanced Treatment Incentives

The State Water Board sponsored a conference on advanced treatment for construction sites in October 2004 (http://www.waterboards.ca.gov/stormwtr/advtreatment.html). These systems essentially treat sediment-laden runoff from sedimentation basins using polymers, coagulants and/or filtration systems. Several manufacturers of these advanced treatment systems presented case studies of their products at the conference.

The Regional Water Board could provide incentives for high priority construction sites to provide advanced treatment. This approach would be especially advantageous during active grading when many large sites rely on sedimentation basins for sediment control. The Regional Water Board could approve the use of advanced treatment on a case-by-case basis with extensive requirements for monitoring and recordkeeping to help document the effectiveness of the practice.

References

EPA. 2004. *Development Document for Final Action for Effluent Guidelines and Standards for the Construction and Development Industry*. EPA 841-B-04-001.

State Water Resources Control Board. 1999. National Pollutant Discharge Elimination System (NPES) General Permit for Storm Water Discharges Associated with Construction Activity, Water Quality Order 99-08-DWQ.

Performance-costs evaluation for urban storm drainage

M. Baptista*, S. Barraud**, E. Alfakih**, N. Nascimento*, W. Fernandes*, P. Moura* and L. Castro*

* Departamento de Engenharia Hidráulica e Recursos Hídricos, Escola de Engenharia da UFMG Av. Contorno, 842, 80 Andar 30110.060, Belo Horizonte, MG, Brazil (E-mail: *marbapt@ehr.ufmg.br*)

** URGC, INSA Lyon, Bâtiment J.C.A. Coulomb 34, avenue des Arts, 69621 Villeurbanne Cedex, France (E-mail: *barraud@urgc-hu.insa-lyon.fr*)

Abstract The design process of urban stormwater systems incorporating BMPs involves more complexity unlike the design of classic drainage systems for which just the technique of pipes is likely to be used. This paper presents a simple decision aid methodology and an associated software (*AvDren*) concerning urban stormwater systems, devoted to the evaluation and the comparison of drainage scenarios using BMPs according to different technical, sanitary, social environmental and economical aspects. This kind of tool is particularly interesting so as to help the decision makers to select the appropriate alternative and to plan the investments especially for developing countries, with important sanitary problems and severe budget restrictions.

Keywords Decision aided system; multicriteria decision; urban drainage

Introduction

Intense urbanization is a current worldwide phenomenon, leading to significant environmental impacts in urban areas. Impact concerns pollution of receiving bodies and alterations in the hydrological cycle mainly due to the urban drainage pipe systems that operate in critical conditions, with frequent crises. To lessen those effects of urbanization, Best Management Practices (BMPs) are being developed. They are based on storage and infiltration of stormwater in structures like trenches, swales, retention/infiltration basins, roof storage, porous pavements, etc.

The design process of urban stormwater systems incorporating BMPs involves two different phases, unlike the design of classic drainage systems for which just the technique of pipes is likely to be used. The first phase corresponds to an elimination of techniques which are not feasible for physical, hydrological, geotechnical, structural and environmental reasons. The second phase concerns the evaluation of scenarios of possible arrangements of different drainage solutions. Considering criteria and decision maker preferences, satisfactory scenarios can be ranked in order to help the decision makers to select the appropriate alternative and to plan investments.

Computational tools for decision aiding seem to assume a significant role in the elimination and the evaluation phases. Software like *Deltanoe* (Barraud *et al.*, 1999) and *TecAlt* (Baptista and Fernandes, 2002), focused on the elimination stage can be mentioned here. For the evaluation phase, general multicriteria methods such as Electre III and Compromise Programming for example (Roy, 1996; Bruen *et al.*, 2000) were adopted by different authors. The analysis of that kind of methods shows that development of specific tools is preferable.

In developing countries, with important sanitary problems and severe budget restrictions, the computational tools can have a significant role, helping the decision-maker who doesn't frequently dispose of well prepared technical teams and a large amount of data.

Water Science and Technology Vol 51 No 2 pp 99–107 © IWA Publishing 2005

The aim of this paper is to present a decision aiding methodology and an associated software concerning urban stormwater systems, devoted to the evaluation phase. The methodology is based on technical, environmental, sanitary, social and economical aspects. It makes comparison of alternatives possible and help in the choice of an appropriate alternative for the decision-maker.

Development of the methodology

The methodology is based on the definition of a global performance index and a cost indicator.

The performance indicator

The performance indicator used in this work is founded on the methodology described in Castro (2002). Its construction involved three major criteria:

- "design objectives" corresponding to the suitability of a drainage system to meet initial design requirements in terms of flow control and protection against flooding;
- "impacts" of drainage systems on downstream flow conditions, on water quality, on aquifer recharge, and on human health;
- "integration" in terms of ecological aspects, landscape and social acceptance.

Each major criterion was described by one or several sub-criteria. Each sub-criterion was evaluated by a partial indicator. Then, all partial indicators were aggregated.

The definition of the indicators was preferentially based on mathematical expressions. However, for some indicators, it was necessary to use a subjective evaluation founded on experience and knowledge of the decision team. Anyway, for all of them, the same numeric base was applied. A weight for each partial indicator was defined as the relative importance of a particular aspect compared to the others in a given decision context. Reference values of weights were defined by tendency of interviews with representatives of technical municipal services (TMS), designers of urban stormwater systems (DSS), environmental regulatory bodies (ERB) and researchers (RSC). The weights of the different indicators given by the decision makers are presented on Table 1, as well as the adopted value, which try to indicate a central tendency of these values.

Table 1 Weights of the different partial indicators in the global performance indicator

Criterion	Sub criterion	Partial indicator	Weight				
			TMS	DSS	ERB	RSC	Adopted
Objectives	–	Aptitude for a drainage system to meet the initial design requirements	15.0	20.0	15.3	8.5	10.0
Impacts	Hydrological	Impacts on the downstream flow conditions	15.0	11.3	13.7	10.5	14.1
		Aquifer recharge	3.0	6.3	5.0	8.3	4.9
	Sanitary	Possibility of disease transmission	3.0	8.2	9.7	7.2	8.1
		Possibility of insects proliferation	3.0	7.2	8.7	6.8	7.8
	Water quality	Impacts on the quality of water supply	5.0	8.7	10.0	8.7	10.9
		Impacts on the quality of underground water	5.0	7.3	7.0	8.0	7.7
Insertion	Environmental	Creation and preservation of habitats	10.0	5.7	6.7	8.5	9.4
		Landscape impact	10.0	6.3	4.0	6.5	5.9
	Social	Creation of recreational areas	10.0	4.2	5.3	4.3	6.1
		Traffic conditions	10.0	4.7	5.0	5.0	5.1
		Possibility of other uses	6.0	3.2	2.3	8.0	4.2
		Social appropriation	5.0	7.0	7.3	4.2	5.6

ty and an associated
aluation phase. The
economical aspects.
appropriate

ce index and a cost

idology described in

ystem to meet initial
: flooding;
n water quality, on

cceptance.
ch sub-criterion was
gated.
natical expressions.
aluation founded on
n, the same numeric
relative importance
Reference values of
technical municipal
onmental regulatory
given by the
to indicate a

cator

Weight		
ERB	RSC	Adopted
15.3	8.5	10.0
13.7	10.5	14.1
5.0	8.3	4.9
9.7	7.2	8.1
8.7	6.8	7.8
10.0	8.7	10.9
7.0	8.0	7.7
6.7	8.5	9.4
4.0	6.5	5.9
5.3	4.3	6.1
5.0	5.0	5.1
2.3	8.0	4.2
7.3	4.2	5.6

The results in Table 1 present large differences in the indicator's weights, as expected. The reason of these differences is that it includes groups of actors who analyse the situations according to various aspects of interest.

The global performance indicator for each alternative, called *Ip*, is calculated by Equation 1 and is all the better that the value is higher:

$$Ip = \frac{\sum_{i=1}^{n} I_i w_i}{\sum_{j=1}^{j=m} \left(\sum_{i=1}^{n} I_i w_i \right) j/m} \qquad (1)$$

where:

Ip: global performance indicator;
I_i: the performance indicator for the scenario i;
w_i: the weight of the indicator i;
n: number of performance indicators;
m: number of scenarios.

As it can be seen, the indicator *Ip* is sensitive to the weights and in the present method it is possible to account for the variation range of the weights. The analysis can be made in agreement with a defined point of view (e.g. technical municipal services) or using the final adopted values. The difference between weights given by the user of a particular design study and the weights attributed by the different specialists (see Table 1) can be estimated and integrated in the model, representing a kind of uncertainty on *Ip* evaluation.

The cost indicator

In a similar way, a cost indicator has been built, including the Net Present Value (NPV) of construction, operation and maintenance costs of the system during 30 years, which is currently adopted as the average lifetime of a classic drainage channel and pipe system.

Depending of an estimated lifetime of each technique along this 30 year period, some reconstruction will occur more than once. This is the case of BMPs, which usually present a shorter average life, as it can be seen in Table 2, obtained from the literature (CERTU, 1998; US-DT, 2003; WSDE, 2001; MWCG, 1992) and from Brazilians technical municipal services and designers of urban stormwater systems.

Operation and maintenance costs were obtained from literature too (DayWater, 2003; Baptista and Barraud, 2001; CERTU, 1998; MWCG, 1992) and from Brazilians technical municipal services databases (e.g. SUDECAP, 2003).

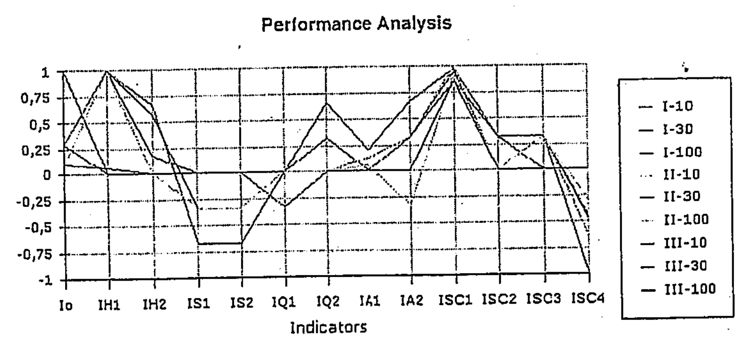


Figure 1 Performance chart (Technopolis)

Table 2 Lifetime of different drainage techniques (in years)

Technique	Detention basins concrete	Detention basins Earth or vegetated	Infiltration basins	Swales	Porous pavements
Lifetime (years)	30	10–15	5–10	5–15	10–25

Uncertainties associated to the estimated costs and the lifetime must be incorporated in the analysis. Uncertainties related to the cost evaluation of each technique, or drainage system to be studied, should be given by the user according to the quality of available data.

The cost indicator *Ic* can be calculated by Equation 2, the cost indicator being all the better that the value is greater.

$$Ic = \bar{C}/C_i \tag{2}$$

where: I_c: cost indicator i; $\bar{C}$: average updated global cost (NPV) of the different alternatives; C_i: global cost (NPV) of the alternative.

Integration of the cost and the performance indicators

The integration of the cost and performance indicators is done graphically by plotting the indicators values in a "Pareto chart" allowing visualization of dominant and dominated alternatives. The uncertainties associated to both indicators, are also plotted in the chart, showing eventual indifference between alternatives (Figure 3).

The Pareto chart, created this way, makes the identification of interesting solutions, with a global point of view, including performance and cost aspects, and at last helping the decision-maker to choose good alternatives among those that are not dominated.

The *AvDren* software

The implementation of the analysis method is done with the development of the software *AvDren*. It has been built using the Microsoft Visual Basic 6.0 language in the Windows environment making it easy to use. The software was created to assist a wide range of problem levels according to data availability and user's interest. Thus, it is possible to make a comparative analysis of the partial indicators integrated in the performance indicator by using a performance graph. This can lead to identify and remove alternatives which present unacceptable level of functionality.

Then, with the use of a global chart, viable alternatives can be analyzed and compared according to the global performance and the cost aspect that demands more detailed

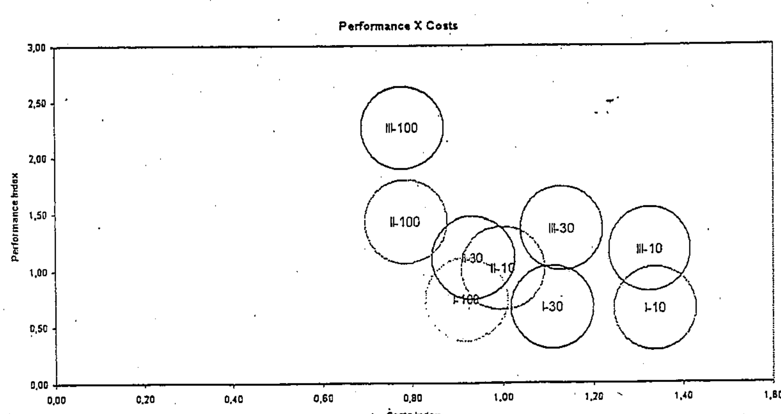


Figure 2 Pareto chart (Technopolis)

...ilos	Porous pavements
15	10–25

...ıust be incorporated in ...technique, or drainage ...ıality of available data. ...indicator being all the

(2)

...: different alternatives;

...ıically by plotting the ...ıinant and dominated ...) plotted in the chart,

...esting solutions, with ...d at last helping the ...dominated.

...of the software ...he Windows ...sist a wide range of ...is possible to make a ...rmance indicator by ...atives which present

...lyzed and compared ...ands more detailed

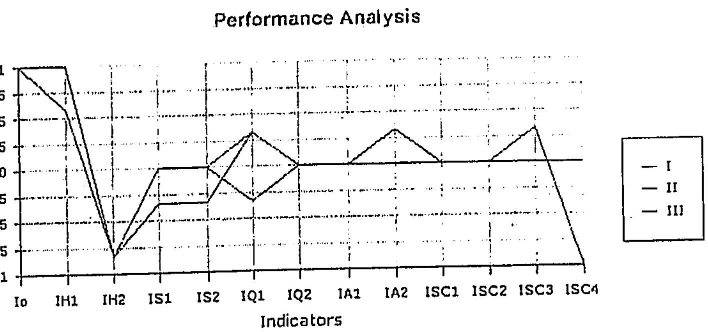


Figure 3 Performance chart (Goiânia)

information. *AvDren* offers the possibility to calculate the cost indicator based on data supplied by the user or using unitary costs information integrated into a data base. It is also possible for the user to introduce the Internal Rate of Return and uncertainties.

Case studies

For an evaluation of the methodology and the proposed computational tool, three applications were made in real case studies.

Case 1 – Technopolis

Because of the diversity, with a wide range of solutions, an industrial and services area, named Technopolis, located in south-western France was chosen. The total drainage surface is nearly 23 ha, with about 6 ha occupied by buildings and others 6 ha corresponding to streets and car parks (Baptista and Barraud, 2001). Three drainage scenarios were evaluated and compared with *AvDren*:

- Scenario I – classic pipe system, without any restriction in terms of maximum downstream flow;
- Scenario II – intermediate system, with the incorporation of a detention basin downstream a classic pipe system, in order to respect a fixed downstream flow limit;
- Scenario III – alternative system, with the use of porous pavements, ditches and a detention basin, respecting the fixed downstream flow limit.

Each one of these scenarios was simulated for three return periods (10, 30 and 100 years) and with the help of the *CANOE* software. The hydrological, environmental and social characteristics, related to the three scenarios, were introduced in the *AvDren* software so as to calculate the Performance Indicator.

Figure 1 shows the performance of each scenario according to each criterion. It is a representation of partial indicators used for the evaluation of the performance indicator *Ip*. The chart analysis allows to eliminate some alternatives, reducing the amount of work in terms of costs analysis.

Table 3 Performance and cost indicators (Technopolis)

Scenario I	*Ip*	*Ic*	Scenario II	*Ip*	*Ic*	Scenario III	*Ip*	*Ic*
I-10	0.651	1.339	II-10	1.011	1.001	III-10	1.178	1.326
I-30	0.669	1.109	II-30	1.104	0.936	III-30	1.364	1.128
I-100	0.742	0.920	II-100	1.429	0.786	III-100	2.258	0.778

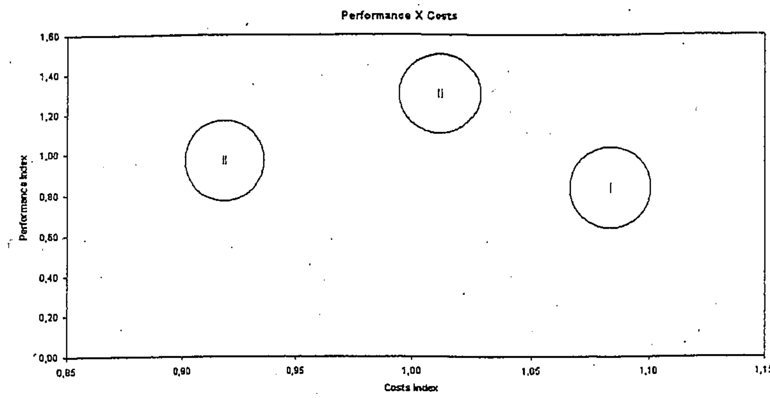


Figure 4 Pareto chart (Goiânia)

The quantities and construction costs concerning each scenario were directly obtained from a previous study (Baptista and Barraud, 2001). The maintenance costs were calculated by using the data base incorporated in the software *AvDren.*

In the context of this research, all the alternatives were completely studied. The global analysis results are presented in Table 3 and in Figure 2.

Ip is the performance index calculated with partial performance indicators of the alternatives using Equation 1 and *Ic* is the cost index, calculated with the costs of the alternatives according to Equation 2, presented before.

The results obtained are clearly in favour of the scenarios including BMPs, with the possible choice of the scenario III-100 which is exactly the alternative realized.

Case 2 – Goiânia

The other case study is referred to a residential area in the centre of Brazil, in Goiânia, center region of Brazil. The total drainage surface is 17 ha, intensively occupied by buildings and streets, with frequent floods problems. To control that, three scenarios were studied (Milograna, 2001):

- Scenario I: classic pipe system;
- Scenario II: two detention basins associated with the classic pipe system;
- Scenario III: micro-reservoirs associated with the classic pipe system.

The hydrological, environmental and social characteristics were introduced in the *AvDren* software so as to calculate the Performance Indicator.

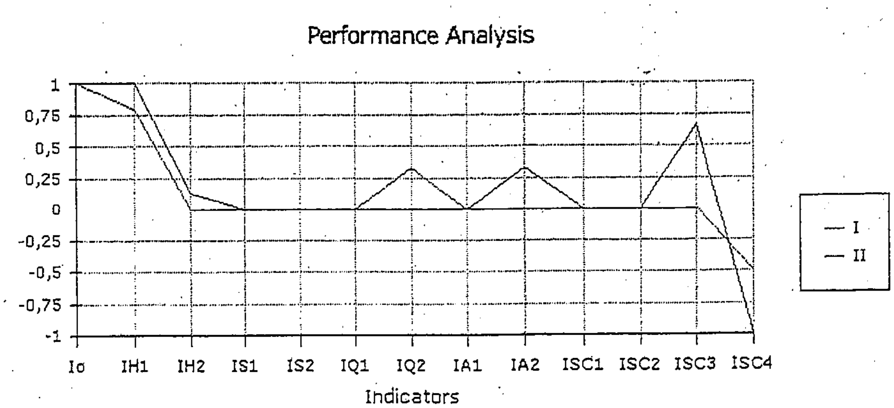


Figure 5 Performance chart (Igarapé)

Table 4 Performance and cost indicators (Goiânia)

Scenario	*Ip*	*Ic*
I	0.834	1.083
II	0.968	0.919
III	1.301	1.012

Figure 3 shows the performance of each scenario according to each criterion. Once again, the chart analysis allows to eliminate some alternatives, reducing the amount of work in terms of costs analysis. The quantities, construction and maintenance costs concerning each scenario were directly obtained from a previous study (Moura, 2004).

In the context of this research, all the alternatives were completely studied. The global analysis results are presented in Table 4 and in Figure 4.

In this case study the micro-reservoirs associated with pipe system (alternative III) are better classified than the one with classic pipe system (alternative I) in terms of performance; but the alternative I has a better cost index. Alternative III has better performance and cost indexes than alternative II so that alternative II can be eliminated. In this case the decision between alternative I and III has to be made by the decision maker himself. However the methodology allows to "estimate" the trade-off between cost and performance.

Case 3 – Igarapé

The last case study is referred to a neighbourhood in Igarapé, close to Belo Horizonte, in the southeastern Brazil, with a total area of 72 ha. Two different alternatives were studied:

- Scenario I: classic pipe system;
- Scenario II: alternative system, with infiltration trenches.

The hydrological, environmental and social characteristics were introduced in the *AvDren* software so as to calculate the Performance Indicator. Figure 5 shows the performance of

Table 5 Performance and cost indicators (Igarapé)

Scenario	*Ip*	*Ic*
I	0.893	0.618
II	1.136	2.613

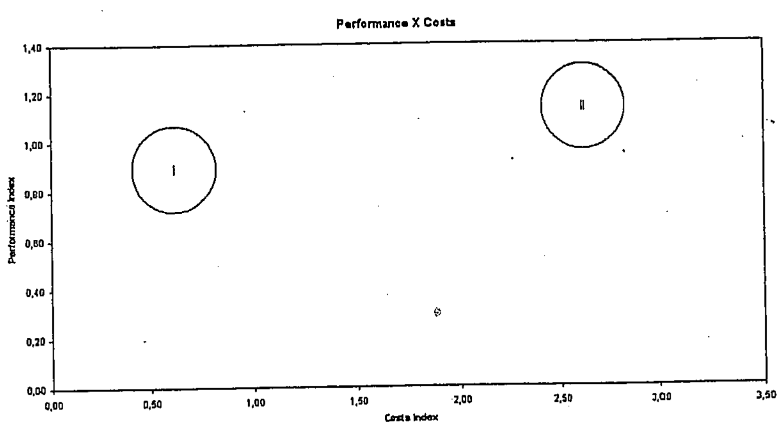


Figure 6 Pareto chart (Igarapé)

each scenario according to each criterion. The quantities, construction and maintenance costs concerning each scenario were directly obtained from a previous study (Moura, 2004). The global analysis results are presented in Table 5 and in Figure 6.

In this case study the alternative II is the most appropriate to be implanted, this scenario has the better cost and performance index.

Conclusions

This paper presents a simple tool for decision aid, incorporating performance and costs indicators concerning urban stormwater systems. The performance indicator is based in hydrological, sanitary, environmental and social criteria; the cost indicator takes construction, maintenance and operation costs into account. The integration of cost and performance allows a global vision of the viable alternatives for the urban stormwater system and of the associated uncertainties.

In spite of the great weight variability of the indicators associated to the several decision-makers, the application of the presented methodology indicates that it has a relatively low sensibility, according to changes in the weights and the values of the indicators. The global results indicate the robustness of the methodology.

The simplicity of the methodological structure is all the more interesting that it does not demand knowledge of complex numerical decision aid methods. The flexibility for customization and use allows to deal with a wide range of different physical and technological situations. The validation of performance indicators and the software, made for the Brazilian conditions, offers the opportunity to use them in other tropical developing countries without substantial modifications.

At last, the software *AvDren* which supports the methodology is available and can be downloaded from www.ehr.ufmg.br.

References

Baptista, M.B. and Fernandes, W.S. (2002). Proposição de sistema de auxílio à decisão para escolha de técnicas alternativas de drenagem urbana. *Procedings of VI Simpósio de Recursos Hídricos do Nordeste, ABRH*, Brazil.

Baptista, M.B. and Barraud, S. (2001). *Evaluation Economique de l'utilisation de techniques alternatives en assainissement pluvial.* INSA de Lyon Technical Report, 72 p.

Barraud, S., Azzout, A., Crès, F.N. and Chocat, B. (1999). Selection aid of alternative techniques in urban storm drainage – proposition of an expert system. *Wat. Sci. Tech.*, **39**(4), 241–248.

Bruen, M., Maystre, L.Y. and Rogers, M.G. (2000). ELECTRE and decision support. *Methods and Applications in Engineering and Infrastructure Investment*. Kluwer Academic Publishers, 224 p.

Castro, L.M.A. (2002). *Proposição de Indicadores para a Avaliação de Sistemas de Drenagem Urbana.* Dissertação de Mestrado (M.Sc. Thesis), Programa de Pós Graduação em Saneamento, Meio Ambiente e Recursos Hídricos, Universidade Federal de Minas Gerais, Brazil.

CERTU (1998). *Techniques alternatives aux réseaux d'assainissement pluvial – Eléments clés pour la mise en œuvre*, Edition du CERTU, Collection Environnement, Lyon, 155 p..

DayWater (2003). *Review of the use of stormwater BMPs in Europe*. Report. 5.1. 98 p. http://www.daywater.org/REPORT, access 11/19/2003.

Milograna, J. (2001). *Estudo de Medidas de Controle de Cheias em Ambientes Urbanos*. Dissertação de Mestrado (M.Sc. Thesis), Faculdade de Tecnologia, Universidade de Brasília, Brazil.

Moura, P.M. (2004). *Contribuição para a Avaliação Global de Sistemas de Drenagem Urbana.* Dissertação de Mestrado (M.Sc. Thesis), Programa de Pós Graduação em Saneamento, Meio Ambiente e Recursos Hídricos, Universidade Federal de Minas Gerais, Brazil.

MWCG – Metropolitan Washington Council of Governments (1992). *A current assessment of urban best management practices: techniques for reducing non-point source pollution in the coastal zone.* Washington, 127 p.

Orange, Ventura and Santa Barbara counties

The chart lists median prices in thousands of dollars for sales of existing single-family homes and condominiums by ZIP Code. Community names are included for convenience. Some ZIP Codes include multiple cities that, due to space limitations, cannot all be listed.

Percentage changes are a year-over-year comparison for the reporting month.

The price per square foot in the far right column includes only single-family home sales.

Prices, provided by DataQuick Information Systems in La Jolla, are drawn from official county records and are determined on the basis of the documentary transfer tax, when paid in full. If you have a question, call (909) 878-1051 or go to *www.dqnews.com*.

March 2006 Community	ZIP Code	Number of homes sold	Median house price ($1,000)	% Price change from Mar. 2005	Number of condos sold	Median condo price ($1,000)	% Price change from Mar. 2005	Home price per sq. ft.
ORANGE COUNTY								
Countywide resales		**2,262**	**$697**	**12.0%**	**1,048**	**$470**	**13.2%**	**$437**
Aliso Viejo	92656	30	$810	24.7%	75	$526	5.2%	$399
Anaheim	92801	33	$562	15.4%	8	$340	0.4%	$435
Anaheim	92802	16	$608	26.5%	5	$485	22.8%	$433
Anaheim	92804	65	$595	17.4%	9	$402	20.0%	$424
Anaheim	92805	41	$570	16.3%	6	$405	9.8%	$458
Anaheim	92806	25	$610	11.9%	3	$447	38.8%	$381
Anaheim Hills	92807	35	$758	27.7%	6	$415	20.8%	$396
Anaheim Hills	92808	20	$960	32.6%	17	$500	18.1%	$450
Balboa Island	92662	5	$1,939	6.2%	n/a	n/a	n/a	$1,711
Brea	92821	33	$635	11.4%	5	$514	12.1%	$388
Brea	92823	4	$699	-13.8%	n/a	n/a	n/a	$342
Buena Park	90620	39	$562	17.1%	1	$375	-38.0%	$459
Buena Park	90621	21	$529	20.4%	3	$570	20.5%	$346
Capistrano Beach	92624	9	$1,100	33.3%	2	$1,229	167.9%	$1,307
Corona del Mar	92625	11	$2,000	-9.1%	4	$995	-2.9%	$1,058
Costa Mesa	92626	22	$763	16.1%	2	$468	11.0%	$457
Costa Mesa	92627	31	$767	7.7%	19	$526	14.6%	$607
Cypress	90630	52	$582	2.1%	11	$349	-18.8%	$380
Dana Point	92629	21	$927	-0.1%	18	$448	-16.7%	$600
Foothill Ranch	92610	18	$795	21.3%	9	$434	0.9%	$250
Fountain Valley	92708	47	$720	13.4%	1	$383	11.0%	$415
Fullerton	92831	21	$670	24.2%	12	$400	23.1%	$443
Fullerton	92832	17	$585	14.7%	5	$175	-43.5%	$476
Fullerton	92833	50	$666	27.0%	21	$485	11.5%	$452
Fullerton	92835	29	$735	8.2%	3	$316	6.4%	$384
Garden Grove	92840	49	$595	16.7%	7	$370	13.0%	$459
Garden Grove	92841	23	$610	22.0%	4	$406	27.9%	$409
Garden Grove	92843	21	$590	14.5%	10	$413	19.6%	$450
Garden Grove	92844	17	$510	4.1%	2	$400	12.7%	$407
Garden Grove	92845	13	$649	20.2%	1	$401	16.2%	$431
Huntington Beach	92646	52	$750	8.7%	15	$475	11.4%	$472
Huntington Beach	92647	33	$685	12.3%	7	$435	18.7%	$506
Huntington Beach	92648	32	$1,199	36.3%	15	$549	-7.7%	$441
Huntington Beach	92649	27	$785	4.7%	17	$490	-2.0%	$554
Irvine	92602	20	$997	15.2%	21	$654	13.2%	n/a
Irvine	92603	13	$1,775	75.7%	21	$690	3.8%	$625
Irvine	92604	17	$690	4.2%	12	$622	22.0%	$422
Irvine	92606	8	$849	22.1%	6	$662	34.2%	$372
Irvine	92612	14	$693	-1.4%	23	$528	5.1%	$448
Irvine	92614	11	$800	5.3%	26	$543	25.3%	$438
Irvine	92618	7	$765	-33.5%	25	$530	36.2%	$568
Irvine	92620	30	$761	5.1%	16	$542	12.2%	$389
La Habra	90631	40	$592	31.6%	10	$375	25.0%	$383
La Palma	90623	12	$627	3.6%	n/a	n/a	n/a	$346

March 2006 Community	ZIP Code	Number of homes sold
Ladera Ranch	92694	34
Laguna Beach	92651	32
Laguna Hills	92653	17
Laguna Niguel	92677	56
Laguna Woods	92637	n/a
Lake Forest	92630	39
Los Alamitos	90720	15
Midway City	92655	2
Mission Viejo	92691	48
Mission Viejo	92692	61
Newport Beach	92660	25
Newport Beach	92661	3
Newport Beach	92663	16
Newport Coast	92657	12
Orange	92865	14
Orange	92866	9
Orange	92867	25
Orange	92868	15
Orange	92869	35
Placentia	92870	43
Rancho St. Marg.	92688	40
San Clemente	92672	35
San Clemente	92673	38
San Juan Cap.	92675	32
Santa Ana	92701	16
Santa Ana	92703	35
Santa Ana	92704	41
Santa Ana	92705	31
Santa Ana	92706	14
Santa Ana	92707	40
Seal Beach	90740	11
Silverado	92676	2
Stanton	90680	22
Sunset Beach	90742	n/a
Surfside	90743	n/a
Trabuco Canyon	92678	n/a
Trabuco Canyon	92679	60
Tustin	92780	31
Tustin	92782	18
Villa Park	92861	14
Westminster	92683	75
Yorba Linda	92886	45
Yorba Linda	92887	17
VENTURA COUNTY		
Countywide resales		**779**
Bell Canyon	91307	1
Camarillo	93010	41
Camarillo	93012	40
Fillmore	93015	24
Moorpark	93021	55
Newbury Park	91320	50
Oak Park	91377	9
Oak View	93022	11
Ojai	93023	30
Oxnard	93030	44
Oxnard	93033	46
Oxnard	93035	25
Oxnard	93036	34
Piru	93040	n/a
Port Hueneme	93041	11
Santa Paula	93060	19
Simi Valley	93063	74
Simi Valley	93065	77
Somis	93066	2
Thousand Oaks	91360	53

dian use ice 000)	% Price change from Mar. 2005	Number of condos sold	Median condo price ($1,000)	% Price change from Mar. 2005	Home price per sq. ft.
$893	7.5%	30	$553	14.0%	n/a
$1,827	35.3%	4	$1,978	167.7%	$1,331
$800	13.9%	22	$436	5.1%	$447
$915	13.7%	47	$459	9.5%	$450
n/a	n/a	31	$315	5.0%	n/a
$740	20.3%	42	$385	11.4%	$393
$875	19.1%	1	$468	-10.1%	$518
$567	12.3%	1	$395	32.1%	$608
$700	11.8%	17	$379	4.7%	$391
$750	6.8%	22	$552	17.8%	$379
$1,700	20.6%	10	$987	3.4%	$704
$2,200	-42.1%	n/a	n/a	n/a	$2,123
$1,797	28.1%	11	$825	42.7%	$1,391
$3,320	91.6%	11	$1,010	2.3%	$950
$665	17.7%	4	$364	11.8%	$389
$660	12.5%	1	$335	-24.5%	$562
$670	15.0%	3	$600	21.8%	$464
$570	32.6%	4	$363	17.9%	$498
$788	11.7%	25	$450	2.3%	$393
$685	16.3%	11	$404	-0.9%	$368
$720	16.0%	68	$475	12.8%	$415
$900	4.7%	4	$510	-12.8%	$570
$986	16.5%	9	$615	12.2%	$517
$736	20.8%	16	$429	25.1%	$432
$565	25.6%	23	$300	20.5%	$479
$573	22.4%	10	$335	21.4%	$491
$620	21.0%	26	$355	19.1%	$472
$935	25.5%	9	$385	12.9%	$449
$642	13.8%	5	$348	21.0%	$403
$577	15.5%	13	$435	44.8%	$541
$1,030	34.6%	4	$550	59.4%	$710
$720	4.4%	n/a	n/a	n/a	$799
$528	24.1%	5	$330	-4.3%	$438
n/a	n/a	1	$1,170	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a
$998	11.6%	20	$462	11.1%	$410
$612	7.7%	15	$369	10.1%	$398
$1,105	30.3%	26	$585	29.9%	$374
$1,313	4.2%	n/a	n/a	n/a	$452
$599	9.0%	4	$377	-4.6%	$447
$818	9.7%	5	$380	0.5%	$387
$845	0.6%	4	$463	19.4%	$338
$635	**10.4%**	**258**	**$440**	**14.3%**	**$407**
$1,720	1.2%	n/a	n/a	n/a	$554
$675	11.1%	14	$553	39.9%	$418
$687	6.3%	15	$520	28.4%	$388
$570	17.5%	1	$335	5.5%	$369
$652	5.6%	10	$428	11.9%	$347
$744	18.8%	11	$394	-7.5%	$395
$737	-12.0%	19	$505	15.7%	$391
$555	1.3%	n/a	n/a	n/a	$413
$629	1.2%	1	$524	83.7%	$471
$589	7.7%	12	$478	11.2%	$402
$560	14.3%	14	$353	-2.2%	$449
$722	18.4%	11	$545	1.9%	$503
$640	10.8%	6	$450	21.0%	$381
n/a	n/a	n/a	n/a	n/a	n/a
$555	16.1%	18	$375	9.5%	$506
$565	21.0%	5	$319	15.8%	$385
$592	13.2%	26	$368	19.3%	$376
$595	9.8%	24	$465	17.1%	$365
$318	-73.1%	n/a	n/a	n/a	$296
$675	7.3%	13	$420	17.2%	$421

March 2006 Community	ZIP Code	Number of homes sold	Median house price ($1,000)	% Price change from Mar. 2005	Number of condos sold	Median condo price ($1,000)	% Price change from Mar. 2005	Home price per sq. ft.
Thousand Oaks	91362	34	$853	-2.5%	19	$508	32.9%	$435
Ventura	93001	24	$612	11.5%	8	$458	2.1%	$612
Ventura	93003	37	$681	14.9%	20	$365	-3.3%	$466
Ventura	93004	25	$625	4.6%	2	$449	3.2%	$404
Westlake Village	91361	11	$1,595	81.1%	7	$495	-4.6%	$515
SANTA BARBARA COUNTY								
Countywide resales		**248**	**$570**	**12.9%**	**46**	**$402**	**-14.8%**	**$440**
Buellton	93427	11	$653	4.5%	n/a	n/a	n/a	$489
Carpinteria	93013	4	$1,700	97.1%	5	$620	24.2%	$1,027
Goleta	93117	12	$923	2.6%	3	$475	-13.9%	$690
Guadalupe	93434	3	$369	9.5%	n/a	n/a	n/a	n/a
Lompoc	93436	31	$420	1.2%	3	$260	-11.9%	$302
Santa Barbara	93101	9	$822	-0.8%	1	$620	-11.7%	$741
Santa Barbara	93103	5	$775	-33.9%	1	$700	n/a	$911
Santa Barbara	93105	20	$1,181	18.9%	3	$655	0.6%	$808
Santa Barbara	93108	20	$2,433	-17.2%	2	$1,360	-16.3%	$1,165
Santa Barbara	93109	7	$1,065	-7.2%	2	$375	-34.7%	$986
Santa Barbara	93110	2	$938	-37.3%	2	$790	7.1%	$681
Santa Barbara	93111	7	$915	-3.4%	n/a	n/a	n/a	$600
Santa Maria	93454	30	$468	12.6%	16	$321	6.8%	$314
Santa Maria	93455	49	$483	7.2%	3	$345	4.5%	$334
Santa Maria	93458	27	$430	2.4%	n/a	n/a	n/a	$370
Santa Ynez	93460	2	$619	-10.9%	n/a	n/a	n/a	$334
Solvang	93463	7	$700	-8.5%	5	$470	-27.7%	$459

For the record

Rent increase: An item in the Apartment Life column of the April 23 Real Estate section stated that, as of July 1, an apartment owner can raise the rent by 4% on the one-year anniversary of the tenant's move-in date. That information applies only to city of Los Angeles rent-controlled properties.

A004621

I. Introduction

The County of Ventura and the ten cities within it – Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, Santa Paula, Simi Valley, Thousand Oaks, and Ventura – are working to reconcile:

- Development pressures
- State housing mandates
- The supply of vacant land
- Environmental restrictions
- Pressure to preserve agricultural land
- Potential water shortages and mounting traffic congestion concerns
- Smart growth and sustainable growth principles and
- Residents' view of what their communities should look like as evidenced by the numerous citizen-initiated Save Open Spaces and Agricultural Resources (SOAR) and City Urban Restriction Boundary (CURB) measures.

The purpose of this study is to identify the vacant land around Ventura County's ten cities, and to compare the development potential of this land, both in terms of housing and employment, to current growth projections. It is hoped that this information will provide a useful foundation for addressing the issues described above, and particularly in implementing Smart Growth and Sustainable Development principles. It is also hoped that this information will demonstrate that *now* is the window of opportunity to make the land use and growth forecast changes needed to bring our communities in balance with a community vision.

Section II below summarizes the conclusions of the study.

The process used in this study to identify vacant land and calculate development potential is summarized below and described in detail in Section III.

A. **Identification of vacant land.** Vacant land was identified by using the Tax Assessor's Site Use codes. Maps depicting the vacant land thus identified were sent to the planning departments of the ten cities for their review, and were then revised based on the cities' comments. Land that was vacant as of December 2001 was considered to be vacant.

B. **Calculation of development potential.** Using the Specific Plan, zoning, and/or general plan designations, the ability of the identified vacant land to accommodate residential, commercial, industrial, and institutional growth was calculated. In those cases where zoning or general plan densities consist of a range, the middle of the range was used. Again, the initial calculations were distributed to the cities' planning departments, and their comments were incorporated into the final development potential calculation.

C. **Comparison to Growth Projections.** The development potential numbers were then compared to the growth projections adopted on May 24, 2001 by the Ventura Council of Governments (VCOG), using the projections for the years 2005 and 2025.

A004622

D. Jobs-Housing Ratio. Finally, the development potential was compared to the existing and projected jobs-housing balance for the city, to determine whether the available vacant land would promote achieving or maintaining a jobs-housing balance. Like the growth projections, the jobs/housing ratios are taken from the tables adopted by VCOG on May 24, 2001.

Section IV includes the detailed information for each of the ten cities.

Appendix A includes bar charts illustrating 1) the total number of dwelling units/jobs each city can provide for; 2) the percent of projected 2005 growth the city can absorb; and 3) the percent of projected 2025 growth the city can absorb. Also included are pie charts depicting each city's share of the projected growth in dwelling units and number of jobs.

Appendix B contains a small scale map of each city, showing the vacant land.

II. Summary of Conclusions.

The intent of this study is to determine the development potential of vacant, available land in the County's 10 cities, assess the match between the vacant land and VCOG's growth projections, and compare both to existing and projected jobs/housing ratios. It is not the purpose of this study to make recommendations on the cities' land use decisions, but rather to provide information regarding availability of vacant land compared to projected development.

It is hoped that this information can be used to focus decision-makers' attention on pending shortages of vacant land, particularly vacant residential land, and appropriate ways to address this issue. It is specifically hoped that this information will be used to encourage smart growth and sustainable development plans, by encouraging mixed-use and more intense development patterns. Early recognition of the potential adverse consequences of present trends, including increased pressure on limited housing supplies, more traffic congestion, and worsening air pollution, will allow more time to craft and implement solutions.

A secondary purpose of the study is to look at the quality and quantity of the information available. The study's findings point to the need for improved information on several fronts. This is described in more detail below.

The conclusions of the study are summarized below.

A. **The supply of vacant land is not well matched to growth projections**. As can be seen from Table II-1 below, there is little or no correlation between the cities' ability to provide for residential and commercial/industrial growth, and the growth projections.

Table II-1 – Projected Residential and Employment Growth

City	Residential (# of dwelling units)			Employment (# of jobs)		
	Growth Capacity	% Accommodated		Growth Capacity	% Accommodated	
			2025			2025
Camarillo	2,402	158%	34%	9,978	1,148%	197%
Fillmore	606	126%	18%	4,202	663%	132%
Moorpark	3,166		78%	8,141		135%
Ojai	273	54%	11%	1,057	1,047%	157%
Oxnard	10,950	388%	55%	50,325	1,549%	222%
Port Hueneme	127		72%	408		29%
Santa Paula	982		22%	2,521		55%
Simi Valley	1,703	35%	13%	47,916	636%	127%
Thousand Oaks	4,525		105%	4,152		19%
Ventura	8,396		108%	13,250		65%

Table II-2 below lists which year each city would use up its current supply of vacant land.

Table II-2

City	Year Vacant Residential Land Consumed	Year Vacant Commercial and Industrial Land Consumed
Camarillo	2008	2047
Fillmore	2006	2033
Moorpark	2020	2034
Ojai	2003	2038
Oxnard	2014	2053
Port Hueneme	2004	2007
Santa Paula	2004	2013
Simi Valley	2002	2032
Thousand Oaks	2026	2004
Ventura	2027	2016

Only two cities, Thousand Oaks and Ventura, have sufficient capacity for their projected residential growth, and in the case of Thousand Oaks that seems due more to a very small growth projection than to a plentiful supply of vacant residential land. Four of the cities (Ojai, Port Hueneme, Santa Paula, and Simi Valley) do not have enough land to accommodate projected residential growth through 2005. Eight (Camarillo, Fillmore, Moorpark, Ojai, Oxnard, Port Hueneme, Santa Paula, and Simi Valley) do not have enough to provide for residential growth through 2025.

Only the City of Thousand Oaks lacks sufficient commercial/industrial land to accommodate projected employment growth through 2005. Four cities (Port Hueneme, Santa Paula, Thousand Oaks, and Ventura) do not have enough to provide for commercial/industrial growth through 2025.

There are currently approximately 19,388 acres of vacant land within the CURB boundaries of the County's ten cities. It was intended that this land would accommodate the development needs of the cities until the year 2025, unless expansions are approved by the voters. As the supply of available land shrinks, through both development and SOAR measures, it becomes increasingly important to make the best possible use of the remaining land.

Countywide growth projections indicated that more than 66,000 residential units will be needed by the year 2025. The present supply of properly zoned vacant land would accommodate less than 32,000 units. Year 2025 Countywide growth projections indicated there will be approximately 123,497 new jobs. The combined ten-city vacant commercial/industrial land can accommodate more than 141,500 new jobs. If the vacant commercial/industrial land were to develop as zoned, it would generate a demand for more than 105,600 dwelling units, 73,600 more than the vacant residential land could accommodate. As presently zoned, these 73,600 additional units would not be located in any of Ventura County's cities, but by necessity, would be located further distances away, contrary to sustainable development principles.

As Table II-2 makes clear, the majority of the cities are lacking residential land, but are well supplied with commercial/industrial land. Given California's tax revenue structure, this is not surprising.

B. **The growth projections may not be realistic.** As described above, there is great disparity between the growth projections and the availability of vacant land to accommodate that growth. The lack of correlation between the supply of vacant land and the growth projections may not all be attributable to lack—or oversupply—of land. There may also be concerns with the growth projections.

Table II-3 – Residential Growth Projections (# of dwelling units)

City	2000 Base			Percent Increase			Percent Increase
Camarillo		25,637	1,522		31,211	7,096	
Fillmore	3,854	4,335	481	12%	7,196	3,342	87%
Moorpark	9,403			2%			43%
Ojai	10,018	10,522	504	5%	12,538	2,520	25%
Oxnard	47,690			6%			42%
Port Hueneme	8,220	8,397	177	2%	8,397	177	2%
Santa Paula		9,719	1,168		13,041	4,490	
Simi Valley	38,332	43,152	4,820	13%	51,086	12,754	33%
Thousand Oaks		46,131	655		49,775	4,299	
Ventura	41,029	42,993	1,964	5%	48,837	7,808	19%
Total/Average	236,688			6%			28%

1. **Residential Growth Projections.** Table II-3 above illustrates both the numerical and percentage increases in dwelling units (Please note that the numerical and percent increases for 2025 are from the 2000 base year). Some inconsistencies become immediately apparent.
   - Camarillo's numerical growth is nearly twice that for Thousand Oaks, a much larger city.
   - Fillmore's growth, while numerically small, amounts to 87% of its base, the largest percentage increase of all the cities.
   - Simi Valley would grow by 4,820 unit's for the 2000 to 2005 period, but would add only (12,754-4820) 7,934 units in the twenty years from 2005 to 2025. Thus, while the City is adding an average of 964 units per year for the first five years, the growth rate drops to an average of 397 units per year for the next 20 years.
   - Moorpark's growth trends are the opposite; the annual growth rate of 46 units per year for the period 2000 to 2005 jumps to 192 units per year for the period 2005 to 2025.
2. **Employment Growth Projections.** Table II-4 below presents the same information for employment projections. Again, there are some obvious inconsistencies.

Table II-4 – Employment Growth Projections (# of jobs)

City	2000 Employment	2005 Projection				Numerical Increase	Percent Increase
Camarillo	34,833	35,702	869	2%	39,899		15%
Fillmore	3,905	4,539	634	16%	7,084		81%
Moorpark	7,690	9,241	1,551	20%	13,728	6,038	79%
Ojai	6,523	6,624	101	2%	7,196	673	10%
Oxnard	53,716	56,965	3,249	6%	76,388	22,672	42%
Port Hueneme	16,870	17,154	284	2%	18,289		8%
Santa Paula	7,055	8,061	1,006	14%	11,629		65%
Simi Valley	34,110	41,647	7,537	22%	71,794		110%
Thousand Oaks	71,255	76,191	4,936	7%	93,108	21,853	31%
Ventura	60,915	64,896	3,981	7%	81,254	20,339	33%
CityTotal/Average	296,872	321,020	24,148	8%	420,369	123,497	42%

- Oxnard's growth rate of 650 jobs per year from 2000 to 2005 will jump to 975 jobs per year from 2005 to 2025.
- Simi Valley's 2025 employment growth is projected to be 37,684 jobs, or nearly one-third of the total County growth of 123,497.

3. **Comparison Between the Residential and Employment Growth Projections.** There are also inconsistencies between the residential and employment projections.

   - Moorpark anticipates a 79% increase in employment, but only a 43% increase in dwelling units.
   - Thousand Oaks is projected to have a 31% increase in employment by 2025, but only a 9% increase in dwelling units.
   - Simi Valley projects a 110% increase in employment, but only a 33% increase in dwelling units.

Based on this review, it is clear that when available vacant land does not fit with the growth projections, it is necessary to consider whether the growth projections may be at least partially at fault.

A first step to addressing this issue would be to generate realistic growth projections based on standard statistical procedures, including estimation of natural increase through age cohorts, and prediction of immigration based on current trends. Cities would then be able to make decisions based on more accurate projections.

C. **If commercial/industrial growth occurs in accordance with the available vacant land, it will create substantial additional demand for housing, when vacant residential land is already insufficient.**

One important measure of a well-balanced community is the jobs/housing ratio. This ratio measures the balance between a community's housing and its employment; a city should provide approximately enough housing for the people employed in its commercial/industrial sector. The jobs/housing ratio is calculated by dividing the number of jobs by the number of houses.

In the Ventura County subregion, a jobs/housing ratio between 1.10 and 1.34 is considered to be equilibrium. A ratio above 1.34 is considered to be jobs-rich, and in need of additional housing to reach equilibrium. A ratio below 1.10 is considered to be housing-rich, in need of jobs to reach equilibrium. A city that is within the equilibrium range has a better chance of its employees being housed within the city, thus reducing vehicle miles traveled, commute times, air pollution, and traffic congestion, among other problems.

The jobs/housing ratios illustrated in Table II-5 are based on the VCOG employment and dwelling unit projections. As can be seen, only Oxnard is within the equilibrium range. Six cities (Fillmore, Moorpark, Ojai, Oxnard, Santa Paula, and Simi Valley) are housing rich, while four (Camarillo, Port Hueneme, Thousand Oaks, and Ventura) are jobs-rich.

Table II-5 – Jobs/Housing Ratios

City	2000 Jobs/Housing Ratio	2005 Jobs/Housing Ratio	2025 Jobs/Housing Ratio
Camarillo	1.44	1.39	1.28
Fillmore	1.01	1.05	.98
Moorpark	.82	.96	1.02
Ojai	.65	.63	.57
Oxnard	1.13	1.13	1.13
Port Hueneme	2.05	2.04	2.18
Santa Paula	.83	.83	.89
Simi Valley	.89	.97	1.41
Thousand Oaks	1.57	1.65	1.87
Ventura	1.48	1.51	1.66

If growth occurs in accordance with the available residential and commercial/industrial land, however, the excess commercial/industrial land would generate substantial additional housing demand. The combined total of the ten cities' employment capacity is 141,588 jobs, while the combined residential capacity is 31,730 units. Using the top of the jobs/housing equilibrium range, 1.34 jobs per dwelling unit, the employment capacity would generate a demand for 105,663 housing units. This is an additional 73,933 units, or more than twice the available residential capacity.

It is unlikely that development will proceed strictly in accordance with available vacant land, since many other factors drive development projects. However, even a strong trend in this direction would exacerbate the existing housing shortage. Probable results would be increased traffic congestion, Increased air pollution, longer commute times, and a generally decreased quality of life as employees drive in from surrounding areas, such as Newhall Ranch.

One obvious remedy would be for cities to redesignate some of the existing land from commercial/industrial to residential. Unfortunately, California's current tax and revenue structure provides a substantial disincentive for jurisdictions to zone for more residential growth. Another approach would be to allow mixed uses, including housing, in the commercial/industrial areas. This option would be particularly effective in providing affordable housing.

D. Unused Residential Capacity Exists.

As noted above, the residential capacities were calculated at the middle of the density ranges, where there is a range rather than a single number. Many jurisdictions could significantly increase their capacity simply by approving development at the maximum densities permitted by the zoning and general plan. For example, Santa Paula could increase its residential unit capacity from 982 units to 1,259 units, or nearly 30%, in this way. Higher densities have other benefits; higher density housing is usually more affordable, more conducive to mass transit and pedestrian activity, uses urban infrastructure more efficiently, and consumes less agricultural land.

Citizen protests are a key reason that most residential projects are built at less than maximum density. Until this issue is addressed, it is unlikely that elected officials will vote to approve higher density housing developments.

A sequel to this study, Growth Visioning, is under preparation. It will present various Countywide growth scenarios. These scenarios will provide some first steps in addressing the issues that are raised in this analysis.

III. Procedures, Assumptions, and Standards.

In identifying vacant land and calculating its development potential, it was necessary to establish standards and assumptions. These are described in detail below.

A. **Identification of Vacant Land**. In conducting a vacant land assessment, it is necessary to make some assumptions as to what constitutes "available" vacant land. Availability is affected by political considerations such as whether the land is within a city's Sphere of Influence, or whether it requires voter approval under a Save Our Open Space and Agricultural Resources (SOAR) or City Urban Restriction Boundary (CURB) measure; and by physical constraints such as what if any geological hazards are present. A specific set of assumptions, described below, was made to define availability for the purposes of this study.

1. **Legal/Political Constraints.**

   a. Sphere of Influence. The purpose of Spheres of Influence is to delineate where urban development is expected to go.

   b. SOAR/CURB measures. Eight of the County's ten cities have adopted some form of SOAR or CURB measure; only the cities of Port Hueneme and Ojai have not. This study makes a distinction between SOAR and CURB measures although they are often used interchangeably.

   Seven of the measures (Camarillo, Fillmore, Moorpark, Oxnard, Santa Paula, Simi Valley, and Thousand Oaks) have CURB measures; that is, a line has been drawn around the city and any property outside that line requires voter approval prior to development. One city, Ventura, (as well as the County of Ventura) have SOAR measures; that is, any property that has specified Comprehensive Plan designations (typically Agriculture and Open Space) requires voter approval prior to development. In addition to its original SOAR measure, the City of Ventura's Hillside Voter Participation Act (HVPA) requires voter approval prior to development in a defined area of its hillsides.

   For the purposes of this study, only property which is both within a city's Sphere of Influence and not constrained by a SOAR or CURB measure was considered in the primary analysis. However, there are additional tables and discussions including property which is within a Sphere but constrained by a SOAR/CURB measure, or outside a Sphere but not constrained by a SOAR/CURB measure. No distinction was made based on whether property was incorporated or unincorporated, as long as it was within a city's Sphere.

   c. Land Conservation Act (LCA) Contracts. Owners of agricultural land can reduce their property taxes by entering into a Land Conservation Act contract, agreeing to maintain the land in agriculture for a 10- or 20-year period. Once the property owner decides to terminate the contract, he/she gives notice, and after 10 or 20 years, depending on the contract, the property may be developed. Property that is in an LCA contract was not considered to be available.

2. **Geologic Constraints.** Three specific types of geologic constraints were examined: earthquake fault zones, 100-year flood plains, and steep slopes.

   a. Earthquake fault zones. Parcels which are totally or partially within an Alquist-Priolo fault zone were considered to be constrained by earthquake hazards.

   b. 100-Year Flood Plains. Parcels which are totally or partially within a 100 year flood plain zone were considered to be constrained by flooding hazards. Parcels within a 500-year flood plain were not considered to be constrained by flood hazards.

   c. Steep slopes. Slopes over 25% were considered steep, unless a city's planning policies called for a different definition. In cases where a city used a different factor—usually 20%--the city's factor was used.

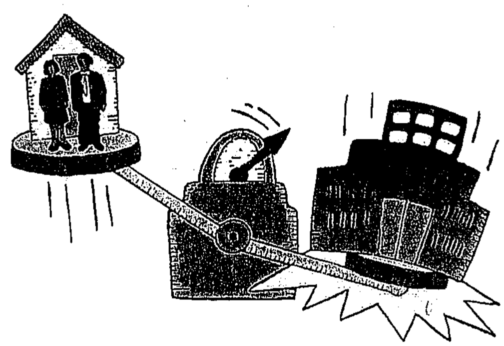
   Land that is affected by one or more of these conditions is called out separately.

B. Development Potential. Once the vacant land was identified, it was necessary to estimate the land's development potential. This study used general plan designations, zoning classifications, and Specific Plans for this purpose.

1. **Zoning and General Plan designations.** Zoning or General Plan designations were used to determine a property's development potential. If a property had a city zoning designation, that was used. However, in some cases unincorporated property that is within a city's Sphere has a General Plan designation, but no zoning, or the zoning is a "holding" zone, such as the City of Ventura's R-1-1acre zone. In these cases, the General Plan designation was used. In cases where a Specific Plan was in effect, the Specific Plan designations and densities were used. In some cases, the Specific Plan listed numbers of units without corresponding acreages; in these cases, there is an explanatory footnote for the acreage column.

   In cases where property carries a mixed use designation, such as Ventura's PMXD (Planned Mixed Use Development) half of the property was assumed to develop residentially and half with commercial/industrial uses.

2. **Density.** In many cases, residential zoning or General Plan designations are expressed in terms of a range, such as 9-15 units per acre. In these cases, the middle of the range was used; i.e., property zoned for 9-15 units per acre was assumed to develop at 12 units per acre. As noted in Section II-D above, if jurisdictions were to develop at the maximum density allowed by their zoning and comprehensive plans, residential capacity would be significantly increased.



3. **Employment Factors.** Employment potential for commercial, industrial, and institutional land was calculated using the following factors, unless the city provided its own employment factors. These factors were taken from Ventura County's General Plan.

A004632

Table III-1 – Employment Factors

Employment Factors (Jobs per Acre)	
Commercial	13.07
Office	60.98
Industrial	17.42
Schools	4.36
Government	13.07

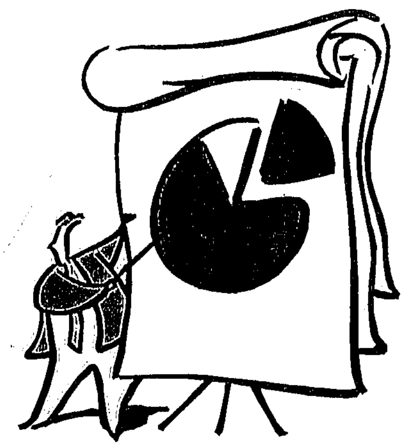
C. Growth Projections. A primary purpose of this study is to compare cities' available vacant land to current growth projections. The growth projections used were VCOG's projections for housing and employment growth for the years 2005 and 2025. This study uses the projections for each city's growth area, since that is most nearly equivalent to the Sphere of Influence area used for the vacant land assessment.

D. Jobs/Housing Ratio. Table II-5 in Section II illustrates the current and projected jobs/housing ratios of the cities, unincorporated area, and the county as a whole. The jobs/housing ratio measures the balance between a community's housing and its employment. It is calculated by dividing the number of jobs by the number of houses. In the Ventura County subregion, a jobs/housing ratio between 1.10 and 1.34 is considered to be equilibrium. A ratio above 1.34 is considered to be jobs-rich, and in need of additional housing to reach equilibrium. A ratio below 1.10 is considered to be housing-rich, in need of jobs to reach equilibrium. These ratios are taken from the projections and data adopted by VCOG in May 2001.

Jobs/housing balance is a key indicator of many important factors. When the jobs/housing ratio is significantly out of equilibrium, when a jurisdiction has substantially more housing than jobs, or vice versa, residents will probably experience long commutes, traffic congestion, air pollution, and other problems.

IV. Analysis

The cities vary widely in their ability to accommodate the projected growth. The sections below analyze each city's capacity in terms of its vacant land. A table is included for each city that lists its year 2000 base, in terms of number of dwelling units or jobs; its capacity, based on its vacant land, to absorb new dwelling units and jobs; and, for the 2005 and 2025 time periods, the projected increase in units/jobs, what percent increase that is of the year 2000 base, and the percent of the increase that could be accommodated on the identified vacant land. Also included is the city's jobs/housing ratio for the years 2000, 2005, and 2025.



The table below summarizes this data for all cities.

Table IV-1 Year 2000: Ability to Accommodate Residential and Employment, by City

City	Residential Capacity		Employment Capacity	
	Acres	Dwelling units	Acres	Jobs
Camarillo	1,439	2,402	730	9,978
Fillmore	228	606	274	4,202
Moorpark	N/A*	3,166	330	8,141
Ojai	954	273	67	1,057
Oxnard	1,648	10,950	2,128	50,325
Port Hueneme	9	127	27	408
Santa Paula	69	982	149	2,521
Simi Valley	3,499	1,363	1,840	46,310
Thousand Oaks	3,906	4525	189	4,152
Ventura	1,089	8,396	813	13,250
Total	**12,841**	**31,730**	**6,547**	**141,588**

*Moorpark's residential unit potential includes units from the City's Specific Plans. Precise residential acreage numbers are not available from these plans.

A004634

A. Camarillo.

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	24,115	34,833	Year 2000 1.44
Growth Capacity*	2,402	9,978	
2005 - Projected Numerical Increase	1,522	869	Year 2005 1.39
2005 - Percent Increase	6%	2%	
2005 - Percent Accommodated**	158%	1,291%	
2025 - Projected Numerical Increase***	7,096	5,066	Year 2025 1.28
2025 - Percent Increase	29%	15%	
2025 - Percent Accommodated	34%	222%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Camarillo has abundant land for its projected commercial/industrial growth. It has sufficient vacant land to provide for its residential growth even through 2008. As noted before, in assessing the match between vacant land and growth projections, it is necessary to consider the accuracy of the projections as well as the availability of land. Camarillo's greater ability to accommodate employment growth may be partly attributable to its relatively smaller employment projections. Camarillo is one of the few cities that is anticipating a residential growth rate greater than its employment growth rate.

As of 2000, Camarillo's jobs/housing ratio was a jobs-rich 1.44, projected to decrease to 1.28 (within the equilibrium range of 1.10 to 1.34) by 2025. This reflects the relatively greater growth projected for dwelling units as compared to employment. However, given Camarillo's abundance of vacant commercial and industrial land, and comparatively limited residential land, this may not occur. If growth were to occur in accordance with Camarillo's supply of zoned vacant land, the jobs/housing ratio would be a jobs-rich 1.81.

Additional Vacant Land. Camarillo has additional vacant parcels that are outside of its Sphere of Influence but within its CURB line. Should the City succeed in obtaining a Sphere amendment, these parcels would allow for commercial/industrial development amounting to an additional 5,143 jobs. Since the city already has enough land to provide for commercial and industrial development, this would not affect its capacity to provide for projected growth.

B. Fillmore.

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	3,854	3,905	Year 2000 1.01
Growth Capacity*	606	4,202	
2005 - Projected Numerical Increase	481	634	Year 2005 1.05
2005 - Percent Increase	12%	16%	
2005 - Percent Accommodated**	126%	663%	
2025 - Projected Numerical Increase***	3,342	3,179	Year 2025 .98
2025 - Percent Increase	87%	81%	
2025 - Percent Accommodated	18%	132%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Like most of the cities, Fillmore has more commercial/industrial than residential capacity. At the projected rates, Fillmore will run out of residential land in 2007, when its projected growth of 673 units overtakes its residential land capacity of 606 units. This may be due in part to high growth projections rather than a lack of residential land.

Overall Fillmore has the largest percentage increases of the ten cities, at 87% residential and 81% commercial/industrial. Simi Valley's commercial/industrial percentage increase is greater, at 110%, but its residential increase is only 33%. Like Camarillo and most other cities, Fillmore has more commercial\industrial capacity than residential capacity, relative to projected growth. However, in Fillmore's case, its residential and commercial/industrial growth rates are comparatively similar.

Fillmore's jobs/housing ratio was a housing-rich 1.01 in 2000, decreasing to .98 by 2025. Because Fillmore's supply of commercial and industrial land is greater than its residential land, this change may not occur. If growth were to occur in accordance with Fillmore's supply of zoned vacant land, the jobs/housing ratio would be a jobs-rich 1.82.

Additional vacant land. Fillmore has additional vacant parcels that are outside of its Sphere of Influence but within its CURB line. Should the City succeed in obtaining a Sphere amendment, these parcels would provide for 35 additional residential units and 1,472 jobs. These parcels would not make an appreciable difference on the city's ability to accommodate projected growth; there is already sufficient commercial/industrial land, and the additional dwelling units would only raise its 2025 percent accommodated to 19%.

There are also some parcels which are inside the Sphere of Influence line but outside the CURB. These were not considered, since it is assumed that the City Council's adoption of the CURB measure signifies its intent to concentrate on areas inside the CURB line.

C. Moorpark.

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	9,403	7,690	Year 2000 .82
Growth Capacity*	3,166	8,141	
2005 - Projected Numerical Increase	230	1,551	Year 2005 .96
2005 - Percent Increase	2%	20%	
2005 - Percent Accommodated**	1,377%	525%	
2025 - Projected Numerical Increase***	4,066	6,038	Year 2025 1.02
2025 - Percent Increase	43%	79%	
2025 - Percent Accommodated	78%	135%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Moorpark, like most of the other cities, is better prepared to provide for commercial/industrial growth than for residential growth. It is noteworthy that Moorpark's residential growth is very unevenly distributed through the years. From 2000 to 2005, the City is projected to gain 230 dwelling units, an average of 46 units per year. From 2005 to 2025, it would gain 3,836 units, an average of 192 per year. This accounts for the unusually large difference the percent accommodated in 2005 versus in 2025. Assuming an average annual increase of 192 units between 2005 and 2025, Moorpark with use up its supply of available residential in about the year 2020.

Moorpark's jobs/housing ratio was a housing-rich .82 in 2000, and is anticipated to increase to .98 by 2025, reflecting the higher rates of projected employment growth over residential growth. The supplies of vacant land are consistent with this prediction. If growth were to occur in accordance with Moorpark's supply of zoned vacant land, the jobs/housing ratio would be 1.26, within the equilibrium range.

Additional vacant land. Moorpark's Sphere and CURB lines are coterminous, so that there are no parcels outside the Sphere but within the CURB to consider.

A004637

D. Ojai.

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	10,018	6,523	Year 2000 .65
Growth Capacity*	273	1,057	
2005 - Projected Numerical Increase	504	101	Year 2005 .63
2005 - Percent Increase	5%	2%	
2005 - Percent Accommodated**	54%	1,047%	
2025 - Projected Numerical Increase***	2,520	673	Year 2025 .57
2025 - Percent Increase	25%	10%	
2025 - Percent Accommodated	11%	157%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Ojai has among the smallest growth projections of the ten cities, second only to Port Hueneme for percent commercial/industrial growth, and Port Hueneme and Thousand Oaks for percent residential growth. Even so, it is severely lacking in residential capacity compared to the forecast. Given the identified vacant residential land, and assuming an average annual increase of 101 units per year, Ojai would use up its vacant residential land by 2003.

Ojai's growth picture is further complicated by the Clean Air Ordinance, which limits residential development to 16 dwelling units per year. In recent years, development has not reached even this limited amount. In addition, there is a ballot measure on the November 2002 election which would prohibit approval of any project (except single family houses on existing legal lots) that would cause any adverse traffic impacts, unless mitigation measures are included. If passed, this measure would severely restrict Ojai's ability to approve either residential or commercial/industrial projects.

Ojai's jobs/housing ratio was a housing-rich .65, expected to decrease to .57 by 2025. Given the relatively greater availability of commercial/industrial land, this may not be an accurate projection. If growth were to occur in accordance with Ojai's supply of zoned vacant land, the jobs/housing ratio would be .74, still housing-rich but somewhat closer to equilibrium.

Additional vacant land. Ojai has no CURB line, so there are no parcels outside the Sphere but within the CURB to consider.

E. Oxnard

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	47,690	53,716	Year 2000 1.13
Growth Capacity*	10,950	50,325	
2005 - Projected Numerical Increase	2,819	3,249	Year 2005 1.13
2005 - Percent Increase	6%	6%	
2005 - Percent Accommodated**	388%	1,549%	
2025 - Projected Numerical Increase***	19,997	22,672	Year 2025 1.13
2025 - Percent Increase	42%	42%	
2025 - Percent Accommodated	55%	222%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Oxnard's growth projections include the largest numerical increase in housing, nearly one-third of the county's total of 66,549. At an average annual increase of 859 units from 2005 to 2025, Oxnard would use up its residential land by 2015.

Oxnard is unique among the cities in that its residential and commercial/industrial growth projections are equal—6% through the year 2005 and 42% through 2025.

Oxnard had a jobs/housing ratio of 1.13 in 2000, within the 1.10-1.34 equilibrium range. This ratio is expected to remain steady through 2025, reflecting the equal rates of growth—42% in each case—projected for its residential and commercial/industrial sectors. However, given the City's abundance of commercial/industrial land compared to residential land, the balance may tip toward a jobs-rich ratio. If growth were to occur in accordance with Oxnard's supply of zoned vacant land, the jobs/housing ratio increase to a jobs-rich 1.77.

Additional vacant land. There were three areas in which Oxnard's CURB line was not coterminous with its Sphere boundary; 1) approximately 250 acres located northeast of Victoria Avenue and Gonzales Road, 2) approximately 79 acres located northeast of Fifth Street and Harbor Boulevard (North Shore), and 3) approximately 50 acres located southwest of Victoria Avenue and Teal Club Road. Since adoption of the CURB measure, the Sphere boundary has been amended to be coterminous with the first two of these, and they are included in the above calculations. The third area is actually already incorporated, although it is outside of the Sphere boundary. This area is eligible to be considered in this study, but since it is designated Community Reserve, it was not possible to calculate its development potential.

F. Port Hueneme

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	8,220	16,870	Year 2000 2.05
Growth Capacity*	127	408	
2005 - Projected Numerical Increase	177	284	Year 2005 2.04
2005 - Percent Increase	2%	2%	
2005 - Percent Accommodated**	72%	144%	
2025 - Projected Numerical Increase***	177	1,419	Year 2025 2.18
2025 - Percent Increase	2%	8%	
2025 - Percent Accommodated	72%	29%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Port Hueneme has the smallest growth projections of the ten cities, both in absolute numbers and by percent. Bordered on three sides by the City of Oxnard and on the fourth by a small strip of developed unincorporated area, then the Pacific Ocean, it cannot grow outward. Further, a large part of its incorporated area is occupied by the U. S. Naval Construction Battalion Center. Given these constraints, the city has limited development opportunities. Its residential growth is projected to stop after 2005, but it will use up its available residential land before that. Despite its small projected growth, however, it does not have enough land to provide for the projected growth. It is one of only two cities (Santa Paula is the other) which does not have enough land to absorb either residential or commercial growth.

Its 2000 jobs/housing ratio was a jobs-rich 2.05, anticipated to increase to 2.18 by 2025. If growth were to occur in accordance with Port Hueneme's supply of zoned vacant land, the jobs/housing ratio would increase to a jobs-rich 2.07.

Additional vacant land. Port Hueneme has no CURB line, so that there are no parcels outside the Sphere but within the CURB to consider.

G. Santa Paula

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	8,551	7,055	Year 2000 .83
Growth Capacity*	982	2,521	
2005 - Projected Numerical Increase	1,168	1,006	Year 2005 .83
2005 - Percent Increase	14%	14%	
2005 - Percent Accommodated**	84%	251%	
2025 - Projected Numerical Increase***	4,490	4,574	Year 2025 .89
2025 - Percent Increase	53%	65%	
2025 - Percent Accommodated	22%	55%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Santa Paula is one of only three cities—together with Port Hueneme and Thousand Oaks—that doesn't have enough land to provide for 2025 employment growth. It is also one of only two cities (Port Hueneme is the other) that does not have enough residential or commercial/industrial land. It would consume its available residential land in 2004 and its commercial/industrial land in 2013. This disparity between land and projections may be partly due to that fact that the growth projections are relatively high, with a 53% increase in residential growth and a 65% increase in commercial/industrial growth through 2025, compared to county averages of 28% and 42% respectively.

Santa Paula's jobs/housing ratio is a jobs-poor .83, expected to increase to .89 by 2025. This is still well below the equilibrium range of 1.10 to 1.34. Santa Paula's residential and commercial/industrial growth projections are relatively well-balanced, at 53% projected residential growth and 65% projected commercial/industrial growth. If growth were to occur in accordance with Santa Paula's supply of zoned vacant land, the jobs/housing ratio would be 1.00, somewhat closer to equilibrium.

Additional Vacant Land. Santa Paula has two areas that are inside the Sphere of Influence but outside its CURB line; Adams Canyon and West Area 2. A measure has been placed on the November 2002 ballot to extend the CURB line out around Adams Canyon.

According to the information that was submitted with the Sphere amendment application that brought these areas into the Sphere, Adams Canyon could provide 2,250 dwelling units, and enough commercial acreage for 131 jobs. West Area 2 has enough commercial/industrial acreage to provide for 2,178 jobs. These additional dwelling units would bring Santa

Paula's ability to absorb projected residential growth through 2025 to 72%. The additional jobs growth would allow Santa Paula to provide for 106% of its projected commercial/industrial growth through 2025.

H. Simi Valley

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	38,332	34,110	Year 2000 .89
Growth Capacity*	1,363	46,311	
2005 - Projected Numerical Increase	4,820	7,537	Year 2005 .97
2005 - Percent Increase	13%	22%	
2005 - Percent Accommodated**	28%	614%	
2025 - Projected Numerical Increase***	12,754	37,684	Year 2025 1.41
2025 - Percent Increase	33%	110%	
2025 - Percent Accommodated	11%	123%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Simi Valley has the second largest expected increase in housing units, with only the City of Oxnard's projecting a larger number (19,997). Due in part to this factor, the city's vacant land is well below the amount needed to accommodate the projected increase. At an average annual increase of 964 units, it would have consumed its available residential land by 2002. However, it is unlikely that actual construction rates would equal that number.

Simi Valley's jobs/housing ratio was a housing-rich .89 in 2000, projected to increase to 1.41 by 2025. Given the City's ample supply of commercial/industrial land, compared to residential land, this projected change could occur. If growth were to occur in accordance with Simi's supply of zoned vacant land, the jobs/housing ratio would be a jobs-rich 2.03. In fact, Simi's projected job growth through 2025 is greater than its existing jobs base.

Additional Vacant Land. Simi Valley's CURB line encompasses five areas that are outside its Sphere of Influence. These areas could accommodate an additional 772 dwelling units and 836 jobs. With these parcels, Simi Valley could absorb 17% of its projected 2025 residential growth, and 125% of its projected 2025 employment growth.

I. Thousand Oaks

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	45,476	71,255	Year 2000 1.57
Growth Capacity*	4,525	4,152	
2005 - Projected Numerical Increase	655	4,936	Year 2005 1.65
2005 - Percent Increase	1%	7%	
2005 - Percent Accommodated**	691%	84%	
2025 - Projected Numerical Increase***	4,299	21,853	Year 2025 1.87
2025 - Percent Increase	9%	31%	
2025 - Percent Accommodated	105%	19%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Thousand Oaks and Ventura are the only cities with more residential than commercial and industrial vacant land. However, this may reflect the very low residential growth projections rather than an abundance of vacant land. Thousand Oaks' percent increase in residential units, at 1% through 2005 and 9% through 2025, is lower than all of the other cities except Port Hueneme. The city will have sufficient vacant residential land to provide for development through 2025. However, at an average production of 987 jobs per year (if this in fact occurs), its commercial/industrial land will be consumed in 2004.

Thousand Oaks' jobs/housing ratio was a jobs-rich 1.57 in 2000 and is expected to increase to 1.87 by 2025. Given the comparative lack of commercial/industrial land, this may not occur. If growth were to occur in accordance with Thousand Oaks' supply of zoned vacant land, the jobs/housing ratio would be 1.51, still jobs-rich but less so than with the growth projections.

Additional vacant land. Thousand Oaks' Sphere and CURB lines are coterminous, so that there are no parcels outside the Sphere but within the CURB to consider.

J. Ventura

	Residential (Dwelling Units)	Commercial/Industrial (Jobs)	Jobs/Housing Ratio
2000 Base	41,029	60,915	Year 2000 1.48
Growth Capacity*	8,396	13,350	
2005 - Projected Numerical Increase	1,964	3,981	Year 2005 1.51
2005 - Percent Increase	5%	7%	
2005 - Percent Accommodated**	427%	335%	
2025 - Projected Numerical Increase***	7,808	20,339	Year 2025 1.66
2025 - Percent Increase	19%	33%	
2025 - Percent Accommodated	108%	65%	

* *Based on specific plan densities, zoning, or general plan designations. Where residential density is a range, the middle of the range was used.*

** *Percent Accommodated means the percent of the projected growth that the city's capacity can absorb.*

*** *The 2025 increases (Projected Numerical, Percent, and Percent Accommodated) represent the increase from 2000 to 2025, and therefore include the 2005 increase.*

Ventura is the only city other than Thousand Oaks that is more able to accommodate its residential growth than its commercial/industrial growth. This is due not so much to an abundance of vacant residential land as to the fact that its projected commercial/industrial growth rate is half again greater than its residential growth rate. At a projected increase of 818 jobs per year, the City would consume its commercial/industrial land in 2016.

Ventura's jobs/housing ratio was a slightly jobs-rich 1.48, projected to increase to 1.66 by 2025. If growth were to occur in accordance with Ventura's supply of zoned vacant land, the jobs/housing ratio would increase only to 1.50.

Additional Vacant Land. Ventura has both a SOAR measure, requiring voter approval prior to development of property designated "Agriculture" in the General Plan, and the Hillside Voter Participation Act (HVPA) which requires voter approval prior to development in a specified area of the hillsides. A measure on the November 2002 ballot, the Open 80 proposal, which, if approved, would allow 1,390 dwelling units and 40,000 square feet of commercial space. Since the city already has enough land to accommodate residential growth, the additional residences are not an issue from the perspective of matching projected growth to capacity. The small amount of commercial development would not appreciably affect the City's ability to accommodate projected commercial/industrial growth.

Note: Vacant parcels that are in a Land Conservation Act (LCA) contract were not included in this study. For this reason, many of the large parcels in Ventura's hillside area are not shown on the map depicting Ventura's vacant parcels.

News and Current Events [click to return to news and events home page]

Can you afford to Live in Ventura County?

California is enjoying a booming economy. Most Californians are prospering, resulting in low unemployment, higher housing occupancy rates. As a consequence, housing rental rates are soaring in many areas throughout California.

Dawn Dyer of the Dyer Sheehan Group, Inc. reports that:

"The five-county Southern California region, which includes Ventura County, has been leading the state's economic growth and is responsible for more than half of the state's total labor force. In Ventura County, there is record growth in tourism, an accelerated rate of new job creation and vibrant business expansion.

Tremendous attention and effort is being exerted to retain and attract businesses to Ventura County. Nearly 9,000 jobs were created in the Ventura County economy during 1998, with the unemployment rate continuing to fall to 5.2%, the lowest level in a decade."

What is wrong with this picture?

California has a number of high cost housing markets with rental housing vacancy rates of less than one to two percent. ''ntura County is one of them. Rents are skyrocketing as landlords attempt to catch up on bad times. Vacancy rates have)n below 2%, in many cases they hover between .75 and 1.5%. Ventura County's lower income families are finding it .t to impossible to find a vacancy let alone one they can afford. Many communities have adopted "no growth 'or' slow growth" policies; coupled with high building costs, construction of affordable homes or apartments has been rare.

Median rent, county-wide, increased 6.8% from January 1998 through January 1999. The cities of Camarillo and Ventura posted even higher increases averaging 9%. County-wide, apartment rents range from a low of $480 for a small studio to as much as $2,500 per month for larger two and three bedroom units in prime areas.

Landlords routinely refuse to accept Section 8 residents. An alarming number of landlords are refusing to renew Section 8 contracts, forcing residents to move out and then raising their rents. Owners of existing units are currently able to maintain very high occupancy rates, even on poorly maintained properties. Lower income persons are being driven out and are being forced to concentrate in lower cost areas. This in turn is creating a concentration of low and very low income communities, exactly the opposite of community goals and public laws. An additional community burden.

Why should we be concerned?

The principal areas of employment growth were in the service, retail, and light manufacturing industries. Many of the workers in these categories are traditionally apartment residents. Available housing units do not provide for the needs of additional entry level and non-skilled workers. This could ultimately create an economic backlash due to businesses relocating to other areas.

Numerous governmental and business leaders, as well as real estate industry experts, recognize housing affordability as one of the most pressing issues facing our nation. The Southern California Association of Governments (SCAG) stated that the: "production of affordable housing in California has developed into a complex, convoluted, and disjointed array of programs, mandates, and funding mechanisms. Consequently, the housing funding process is characterized by unpredictability and lack of connection between state and local bodies. Additionally, resources for housing at the federal, state and local level are increasingly scarce."

''ntura County is ranked 114th out of 125 metropolitan areas for housing affordability in the United States. The cost of)g is 15% higher than the average U.S. city. The rise in single family home sales prices has kept ownership out of reach many of Ventura County's residents. The Affordability Index (percentage of households able to afford a median price home) for Ventura County is 47%, indicating that over half of County residents cannot qualify for homeownership. The median price of homes rose 7.6% to $237,000 as of January 1999. Fueled by an expanding local economy , the shortage of available homes will continue to put upward pressure on prices and increase reliance on rental housing.

A004646

How does this affect the Area Housing Authority and the people we serve?

The Area Housing Authority of the County of Ventura serves seven (7) distinct communities. Five communities have seen impressive increase in the development of higher end single family detached housing. Very few apartments have been .t and almost none are available to lower income people. Market rents average $1100 for a two bedroom unit. Higher rents and home prices are being fed by increased demand and have led to lower vacancy rates. A tighter market leads to higher rents and increased cost of housing. Lack of construction means that the supply of homes and apartments at prices that are affordable to working families are in short supply. This again leads to higher prices. The cycle continues.

Lower income families, who currently work and live in Ventura County Communities are finding it next to impossible to find an affordable place to live. Many families are forced to pay in excess of 50% of their limited income for housing. Simply stated, their ability to rent a decent unit has been dramatically reduced as market rents continue to rise. This also results in loss of spendable income for food, medicine and other necessities, placing heavy pressure on other community support resources.

The ability of the Area Housing Authority (AHA) to provide financial assistance has not kept up with local demands. Fair Market Rents (FMR's), the rent the AHA is able to pay, is set at regional levels and do not reflect the economic reality of Ventura County. Currently the FMR is set much too low for the Ventura County market in which the Section 8 holder is trying to find a unit. The Section 8 holder has a maximum of four months (120 days) to find a unit, before returning it to the Housing Authority for use by another hopeful household. The individual who cannot locate housing is then eliminated from the waiting list.

There is a direct correlation between the cost and availability of housing, and a community's ability to sustain economic vitality. The fact that the available housing units cannot provide for the needs of additional entry level and non-skilled workers is beginning to cause concern to Ventura County's business community. Most of the people working in Ventura County industries earn significantly less than the median income. For them, finding an affordable apartment is an arduous task and a home becomes just a dream, incapable of being fulfilled.

This creates a significant problem for Ventura County. As the local economy continues to thrive, the number of traditional and non traditional households is on the rise; and the gap between housing demand and supply widens. If local policies and priorities continue to focus on job growth and economic expansion without addressing the pressing needs of affordable housing, Ventura County's economic growth could be stymied. If local businesses are forced to recruit commuters from other areas in order to meet their workforce needs, the County may face considerable increased traffic congestion, and the corresponding air pollution.

.ently the Fair Market Rent (FMR) for a 2 bedroom unit in Ventura County is $793. Finding a unit at this rate in Camarillo, Moorpark, Simi Valley, or Thousand Oaks is next to impossible. FMR's in Ventura County have been historically low. Consider the following FMR summary for two bedroom rents in Ventura County:

1999/$793, 1998/$793, 1997/$781, 1996/$775, 1995/$885,

1994/$909, 1993/$793, 1992/$769, 1991/$769, 1990/$737.

While HUD has made some effort to address some of these different cost situations, its Annual Adjustment Factor (AAF) for Section 8 contract renewals still fails to make such high cost rental areas affordable. In the case of Ventura County the AAF is 1 percent! Rents are escalating between 3 and 7% as owners react to demand and attempt to increase their income to make up for lost revenues.

The difference between the AAF and the actual cost of housing reduces the number of families that the Area Housing Authority is able to serve. Limiting the Fair Market Rent (FMR) to the 40th percentile of local rents reduces the number of neighborhoods in which Section 8 holders can locate affordable housing. This contravenes the Quality and Work Responsibility Act of 1998 that Congress recently passed.

What do we need to do?

The Area Housing Authority of the County of Ventura recommends the following:

- **First**, the Fair Market Rent (FMR) should be established for smaller areas, (city by city) so that lower-cost area within a county doesn't artificially lower the rents in high cost areas in that same county. HUD makes no allowance for lower cost areas within their review. This dramatically skews the review.
- **Second**, local housing authority's must be allowed bigger exception rents and increased funding to support those exceptions. (Exception rents are those which exceed 120% of the FMR when conditions require them.) If a local agency is to serve local communities, they must be able to react to local conditions.
- **Third**, communities should make it a priority ~~that~~ housing is available at rents that are affordable to people earning 50% of the Area Median Income.

A004647

- **Fourth,** It is critical that local communities re-examine long held perceptions about multi-family housing.

rtments enrich communities by promoting efficient land use, fostering urban revitalization, minimizing sprawl, and preserving open space. While many middle class individuals are now making the choice to rent rather than buy, apartments are often the only affordable type of housing available to low and moderate income families. With county-wide vacancy rates at an unnaturally low level, rents are expected to continue to rise, creating a serious hardship for many local residents. The long-term consequences of this trend for current & future generations should not be underestimated.

[return to the top of the article or return to news and events home page]

Area Housing Authority, County of Ventura
1400 West Hillcrest Drive . Newbury Park, CA 91320 . phone: (805) 480-9991 . fax: (805) 480-1021 . e-mail

Nonpoint Source
News-Notes
May 2005, #75
The Condition of the Water-Related Environment
The Control of Nonpoint Sources of Water Pollution
The Ecological Management & Restoration of Watersheds

SPECIAL FOCUS ISSUE: Economic Benefits of Nonpoint Source Pollution Control

Notes on the National Scene

Saving Money Through Source Water Protection

Preventing contamination of raw drinking water supplies generally is more efficient than trying to identify and remove that contamination from the water stream at the treatment plant. By dedicating funds to restore and protect source water areas, communities are saving tremendous amounts of money over the long term. The following discussion, excerpted from "Protecting the Source: Conserving Forests to Protect Water," an article in the May 2004 issue of the American Water Works Association's newsletter, addresses the wastewater treatment economic benefits gained by protecting source water.

Clean Source Water is Key

Advancements in science and technology have enabled water utilities to effectively treat most known contaminants from drinking water sources and to provide American citizens with some of the safest drinking water in the world. However, these advancements have contributed to a movement away from protecting and managing our source areas and to the unfortunate notion that the quality of our raw water supplies is less important.

Oh noooo! Look who's helping Governor Blanco save Louisiana's wetlands. See article on page 12.

Inside this Issue

Saving Money Through Source Water Protection (continued)

Treatment alone, although critical to preventing disease, should not be the sole protection of our drinking water. Multiple barriers to disease agents need to be maintained if we are to provide the greatest protection to public health. A multiple-barrier approach to drinking water protection involves several consecutive and interrelated steps, including selection of high-quality source water(s), source water management and protection, appropriate treatment, distribution system management, and water quality monitoring.

More than a century ago, many of America's fastest growing cities, such as Boston and New York, bought land in their source areas to provide lasting protection of water resources critical for sustaining their populations in the future. To this day, these cities, some of the largest in the country, have relatively clean source waters that require minimal treatment.

Protecting the Source Saves Money

More and more often, potable water suppliers are realizing that allowing raw water quality to degrade, in addition to threatening public health, increases treatment and capital costs. Although little research has been done on this issue, a study of 27 water suppliers conducted in 2002 by the Trust for Public Land and American Water Works Association's Source Water Protection Committee found that water treatment costs for utilities using primarily surface water supplies varied depending on the amount of forest cover in the watershed. Water utilities were solicited for this survey based on the goal of providing a diverse range of watershed types.

What is Source Water?

Source water is untreated water from streams, rivers, lakes, or underground aquifers which is used to supply private wells and public drinking water. Most public and some private well drinking water is treated before it enters homes. While some treatment is usually necessary, the costs of treatment and risks to public health can be reduced by ensuring that source water is protected from contamination.

The survey results indicated that operating treatment costs decreased as forest cover in a source area increased. For every 10 percent increase in forest cover in the source area (up to about 60 percent forest cover), treatment and chemical costs decreased approximately 20 percent. Approximately 50 to 55 percent of the variation in operating treatment costs can be explained by the percent of forest cover in the source area. Not enough data were obtained on suppliers that had more than 65 percent forest cover in their watersheds to draw conclusions; however, the researchers believe that treatment costs level off when forest cover is between 70 and 100 percent. The remaining 45 to 50 percent variation in treatment costs that cannot be explained by the percent forest cover in the watershed is likely due to varying treatment practices, economies of scale, the location and intensity of development and/or row crops in the watershed, and the prevalence of agricultural, urban, and forestry best management practices.

Table 1 shows the change in treatment costs predicted by this analysis, and the average costs of treatment if a supplier treated 22 million gallons per day (mgd).

% of Watershed Forested	Treatment and Chemical Costs per million gallons	% Change in Costs	Average Treatment Costs (at 22 mgd)	
			Per Day	Per Year
10%	$115	19%	$2,530	$923,450
20%	$93	20%	$2,046	$746,790
30%	$73	21%	$1,606	$586,190
40%	$58	21%	$1,276	$465,740
50%	$46	21%	$1,012	$369,380
60%	$37	19%	$814	$297,110

Table 1. Water treatment and chemical costs based on percent of watershed that is forested.

Forest Conservation as a Barrier

Changes in land use can affect source water quality and, thus, treatment costs. Efforts to protect standing forests and natural lands from development or intensive agriculture will help communities avoid future increases in treatment expenditures. Improving land use practices and protecting lands that serve as natural filters for contaminants, such as forests, riparian areas, and wetlands, is critical to reducing pollutants that reach our raw water sources.

A growing understanding of the role that forests and natural lands play in filtering pollutants and maintaining water quantity has led many municipalities and water suppliers, particularly those in growing communities, to consider land protection as part of a multiple-barrier approach to providing safe drinking water. These communities have found that land conservation:

- offers permanent protection of critical watershed or recharge land;
- is perceived as equitable when landowners are compensated for their property's value;
- is broadly supported by voters;

Forests Yield Clean Water

Protecting forests is a cost-effective way to provide clean drinking water. Forests reduce flooding and erosion, filter impurities from water, and allow water to infiltrate and recharge aquifers. *Running Pure*, a report by the World Wildlife Fund and the World Bank (www.panda.org/downloads/freshwater/runningpurereport.pdf), explores the important role forests play in drinking water protection.

Clean Source Water Saves Money

The Trust for Public Land and the American Water Works Association collaborated on a report titled *Protecting the Source: Land Conservation and the Future of America's Drinking Water*, which features a number of case studies showing how communities across the nation have protected their drinking water supplies. The report makes the case for protecting source water, and delves into the costs associated with many communities' need for increased treatment. The report highlights a number of cases where insufficient source water protection has led to the need for extensive capital outlay for treatment facilities, including:

- *Wilmington, North Carolina.* In part as a result of an increase in industrial and agricultural runoff in their watershed in the late 1990s, the city spent $36 million to add ozonation and to expand its treatment facility.
- *Danville, Illinois.* In 2000 the city invested $5 million in a nitrate removal facility to treat spikes in nitrogen resulting from agricultural runoff.
- *Decatur, Illinois.* In 2001 the city invested $8.5 million in a nitrate removal facility to treat pollution associated with agricultural runoff.

The report also highlights examples of communities that, through source water protection efforts, have successfully alleviated the need for treatment facility construction, including:

- *Auburn, Maine.* The city saved $30 million in capital costs, and an additional $750,000 in annual operating costs, by spending $570,000 to acquire land in their watershed. By protecting 434 acres of land around Lake Auburn, the water systems are able to maintain water quality standards and avoid building a new filtration plant.
- *City of New York, New York.* Instead of spending $6 to $8 billion on a new Catskill/Delaware filtration plant and $300 million in annual operating expenses, the city chose to adopt an aggressive watershed management plan with land acquisition as its centerpiece. In January 1997 the city entered into a Watershed Memorandum of Agreement with 76 partners, including the U.S. EPA, the State of New York, virtually all of the counties, towns, and villages in its watersheds, and a number of environmental and public interest organizations. This agreement established a far-reaching program to protect all three of the city's watersheds—Catskill, Delaware, and Croton—including adoption of new watershed regulations, environmental and economic partnerships with watershed communities, and a watershed land acquisition program. Altogether, the city projects spending approximately $1.2 billion over the first 10 years on a variety of watershed improvements.

To view the entire report, download *Protecting the Source* from www.tpl.org (Click on "Publications" in the left hand column). Hard copies are available for $15.

Saving Money Through Source Water Protection (continued)

- provides multiple benefits to communities, such as flood control, recreation, and the protection of historic and environmental resources; and
- offers land use control options for communities that do not have regulatory authority in their source area.

Local governments and water suppliers around the country are teaming up with land trusts, community groups, and other stakeholders to protect forests, wetlands, and other natural lands as part of a comprehensive, economical approach to protecting their drinking water sources.

[*This article excerpted from Opflow, Vol. 30, No. 5 (May 2004), by permission. Copyright © 2004, American Water Works Association. For more information, contact AWWA at 6666 West Quincy Avenue, Denver, CO 80235-3098; Phone: 303-794-7711; Web: www.awwa.org.*]

Online Course Explains Benefits of Source Water Protection

The U.S. EPA's Drinking Water Academy (DWA) develops and provides training to federal, state, and tribal drinking water staff to help ensure that they will be adequately prepared to implement the provisions of the Safe Drinking Water Act (SDWA). The *Introduction to EPA's Drinking Water Source Protection Programs*, excerpted below, is one of the DWA's four introductory courses. The course is available online at www.epa.gov/safewater/dwa/electronic/presentations/swp/swp.pdf as a 119-page annotated slide presentation. The presentation conveys the concept of source water protection and program components, explains the economic and public health benefits of source water protection, outlines types of protection measures, describes interrelationships with Clean Water Act programs, and presents funding mechanisms for source water protection programs. The following six excerpts from the presentation provide valuable information about the economic and other benefits of source water protection.

(1) **Protect Source Water Now to Save Money Later.** The benefits to communities of protecting their drinking water supplies might best be understood by describing the costs of failing to protect them. These costs include those that are relatively easy to capture in monetary or economic terms and those that are not. Some easily quantifiable costs of drinking water supply contamination include treatment and remediation; finding and developing new supplies and providing emergency replacement water; paying for consulting services and staff time; litigating against responsible parties; and loss of property value or tax revenue.

Some costs that are not easily quantified include health-related costs from exposure to contaminated water, lost production of individuals and businesses, interruption of fire protection, loss of economic development opportunities, and lack of community acceptance of the claim that their drinking water is sufficiently treated to remove the contamination.

(2) **Economic Costs of Not Protecting Water Supplies.** Dealing with contamination is expensive. Consider the following communities' experiences. In Perryton, Texas, carbon tetrachloride was detected in the ground water supply. Remediation of the problem cost this small community an estimated $250,000. Pesticides and solvents in the groundwater of Mililani, Hawaii, required the city to build and operate a new treatment plant. The plant cost $2.5 million, and annual operation costs are $154,000. The towns of Coeur d'Alene, Idaho, and Atlanta, Michigan, have experienced contamination of their ground water supplies. Each had to replace its water supply, at costs of approximately $500,000. Preventing drinking water contamination at the source can save communities similar response costs.

(3) **Economic Benefits of Source Water Protection.** Protecting the quality of source water can save communities money in a number of ways, including:

- *Fewer Regulatory Costs.* Communities with effective drinking water contamination prevention programs may enjoy substantial savings in the costs of complying with SDWA or similar state regulations. They also may be eligible for waivers from some monitoring

Online Course Explains Benefits of Source Water Protection (continued)

requirements, thereby reducing monitoring costs. Such waivers have already saved Massachusetts water systems approximately $22 million over the three-year compliance cycle, while Texas water systems saved $49 million over two and one-half years.

- *Maintain Clean Water's High Value.* Water can be thought of as a commodity that water systems sell and farmers use as a raw material. Once it becomes contaminated, it loses value because it cannot be sold to customers, or it must be treated prior to being sold or used. Uncontaminated water has value to the public water system, determined by the price of water its customers are willing to pay.
- *Maintain Land Value.* Preventing contamination of drinking water can also help to maintain real estate values in areas served by protected water supplies. A survey by the Freshwater Foundation found that five Minnesota cities collectively lost over $8 million in tax revenues because of real estate devaluation due to ground water pollution.

(4) Clean Water's Quality of Life Benefits. In addition to the monetary benefits of preventing contamination of drinking water supplies, there are benefits that are difficult (or controversial) to assign a dollar value. While difficult to quantify monetarily, many of these are tied to quality of life and may rival or exceed more tangible benefits in importance. For example, protection of human health is the driving force behind the nation's water supply protection programs. Other quality of life benefits include safeguarding resources for future generations, building confidence in the water supply, and maintaining healthy ecosystems and opportunities for recreation.

(5) Clean Water's Human Health Benefits. Preventing contamination of drinking water supplies should result in reduced risk to human health from both acute and chronic ailments. Overall, the U.S. is doing a good job delivering safe drinking water to the public, but challenges remain and may increase as new variants of waterborne disease agents and chemicals are discovered in water supplies. Although most people experience only mild illnesses from waterborne microbes, pathogenic organisms such as Cryptosporidium and some strains of E. coli can be transmitted to people through drinking water and cause serious illness or even death. In addition to threats posed by microbial contaminants, other substances can contaminate water supplies and threaten human health. Metals, volatile organic carbons, synthetic organic chemicals, and pesticides can cause serious health problems for persons exposed to them over long periods of time at levels exceeding health-based drinking water standards. Potential health effects of long-term exposure to these pollutants include cancer, birth defects, and organ, nervous system, and blood damage. The health-related costs of contamination can include lost wages, hospital and doctor bills, and in extreme cases, death.

(6) Costs of Prevention Versus Reaction. EPA studied the contamination and prevention costs borne by six small-and medium-sized communities that experienced contamination of their ground water supplies and subsequently established a national wellhead protection program framework. Costs of contamination included costs of remediation activities, replacing water supplies, and providing clean water. Prevention costs include basic program costs for delineating a protection area, identifying potential sources of contamination, developing an initial management plan, and planning for alternative water supplies and other responses in case of an emergency. The ratio of the benefits of avoiding contamination to the costs of

EPA's Source Water Protection Mission

Preventing contamination of drinking water supplies is an important mission within EPA's Office of Ground Water and Drinking Water. This office supports a Source Water Protection Web site (www.epa.gov/safewater/protect.html), which provides a collection of available source water protection tools for community planners, public water supply operators, members of local source water protection teams, and anyone interested in protecting their sources of drinking water. It primarily focuses on source water resources either produced by EPA, or which EPA has supported through grants. Resources include source water information and guidance publications, public outreach materials, information about training, financial assistance information, examples of local source water protection, and tribal source water program information. The site also provides links to other organizations involved in source water protection, including other federal agencies, states, drinking water organizations, environmental and public health organizations, trade associations, and international organizations.

Online Course Explains Benefits of Source Water Protection (continued)

the wellhead programs ranged from 5:1 to 200:1. (For more information, see *Benefits and Costs of Wellhead Protection: Case Studies of Community Wellhead Protection.* EPA 813-B-95-005, March 1996 – available for free from the National Service Center for Environmental Publications: www.epa.gov/ncepihom).

Comparing the costs of contamination to the costs of prevention reveals that prevention programs are generally well worth the cost and effort as an effective "insurance" against contamination and its associated costs. If you add the considerable quality of life benefits that are potentially provided by a source water protection program, the program may prove to be a bargain.

[To read the Drinking Water Academy source water training presentation in its entirety, see www.epa.gov/safewater/dwa/electronic/presentations/swp/swp.pdf.]

National Wildlife Refuges Offer Economic Windfall for Neighbors

A 2002 study by the U.S. Fish and Wildlife Service (USFWS) showed that the USFWS' National Wildlife Refuges are major economic engines for neighboring communities, adding hundreds of millions of dollars in jobs and retail sales. The importance of these areas for wildlife protection, natural area preservation, and economic benefits is obvious. According to the study, the more than 35.5 million visits to the nation's 540 refuges fueled more than $809 million in sales of recreation equipment, food, lodging, transportation, and other expenditures in 2002. That figure is more than double the $401.1 million generated in 1995, the last time the study was conducted.

As refuges generated recreation spending, nearly 19,000 jobs were created and more than $318 million was generated in employment income. The 2002 employment statistics were nearly double the 1995 figures, when 10,200 jobs were attributed to the existence of refuges and about $163 million was generated. The total for sales and tourism related revenue plus employment income — $1.12 billion, in total – is nearly four times the $320 million that the National Wildlife Refuge System received in FY 2002 for operation and maintenance.

[For more information, see Banking on Nature 2002: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation, available at http://refuges.fws.gov/policyMakers/pdfs/BankingOnNature2002_101403.pdf.]

American Wetlands Month Observed

During the month of May, the nation will celebrate American Wetlands Month, focusing on the economic benefits that wetlands provide. The Environmental Protection Agency joins with other federal, state, and local agencies to recognize the wonderful ways that wetlands enrich the environment and society. Events are scheduled all across the country to educate and involve Americans in better understanding the importance of one of Earth's most valuable and fragile ecosystems. Also known as marshes, swamps and bogs, wetlands are important for flood control, acting as buffers to absorb and reduce damage caused by flood waters. They are productive ecosystems that support sometimes rare plant and animal habitat. Wetlands also help to remove pollutants from water, cleaning streams and lakes, thereby reducing the cost of drinking water treatment. Wetlands are important to the multi-billion dollar commercial fishing industry and provide a boost to recreation industry activities such as fishing, birding, canoeing and hunting. While more than half of the nation's original wetlands have been lost or converted to other uses in the lower 48 states, EPA's goal is to help increase the quantity and quality of wetlands nationwide. To learn more about activities for American Wetlands Month, go to www.epa.gov/owow/wetlands and www.iwla.org/sos/awm/events/.

The slogan for this year's Wetlands Month celebration is "It Pays to Save Wetlands."

A004654

News from States, Tribes, and Localities

Low-Impact Development Pays Off

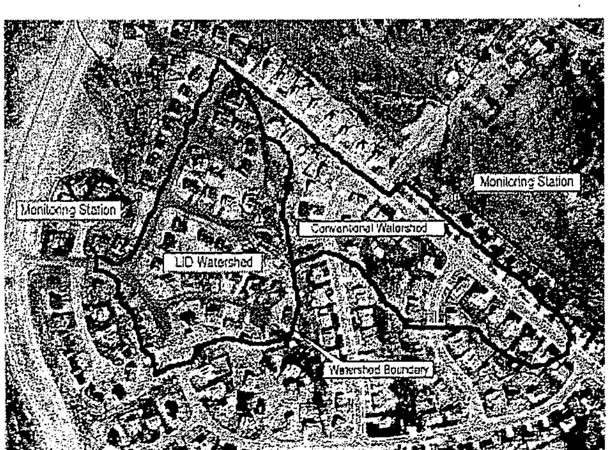
What exactly is low-impact development (LID), and how does it compare with conventional stormwater management? In traditional stormwater management, water from a development site is moved away as quickly as possible to a centralized facility, such as a stormwater pond or a local stream. LID attempts to mimic the drainage patterns that were present before development by encouraging runoff infiltration, storage, filtering, evaporation, and detention.

Estimates from pilot projects and case studies suggest that LID projects can be completed at a cost reduction of 25 to 30 percent over conventionally developed projects. The need for costly stormwater ponds, drainage pipes, curbs and gutters, and wide streets is eliminated or dramatically reduced, which usually more than offsets the cost of relatively less expensive LID features such as rain gardens, cisterns, and permeable surfaces. The following examples show how rapidly LID is gaining acceptance across the country.

Prince George's County, Maryland. In the early 1990s, Somerset subdivision became one of the first large residential communities to include rain gardens as part of an LID drainage design. Rain gardens were a local innovation when Larry Coffman, associate director of the county's Department of Environmental Resources, considered options for the Somerset project. Coffman helped design a plan to create open drainage swales and replace the typical ponds, curbs, gutters, and sidewalks with special gardens on each lot to capture the runoff. Rain gardens are inexpensive to build, need very little maintenance, and restore water to the soil. Somerset is an 80-acre subdivision containing about 200 homes valued at approximately $160,000 in 1995. Most 10,000-square-foot lots have a 300- to 400- square-foot rain garden, although some of the subdivision was completed prior to inclusion of LID.

Each rain garden cost about $150 for excavation and $350 for plants. About $100,000 was needed to install rain gardens at Somerset, in comparison to nearly $400,000 needed to install conventional detention ponds, which did not include the expense of curbs, gutters, and sidewalks. Elimination of the need for a stormwater pond allowed the development of six extra lots and resulted in a cost savings of more than $4,000 per lot.

In November 2000, Prince George's County initiated a field monitoring program to compare the stormwater hydrologic and water quality responses between two watersheds in Somerset subdivision. Development in the first watershed was completed in the early 1990s with conventional stormwater conveyance techniques (curb, gutters, and pipes). Development in the second watershed, located directly next to the first, was completed in 2000 and includes the rain garden and grassed swale LID techniques (see photo). Preliminary monitoring results indicate that the LID site experienced a 20 percent lower average annual runoff volume per unit area than did the conventionally designed watershed. The LID watershed generated fewer runoff-producing events overall (see table 2).



Paired watershed study in Maryland's Somerset subdivision offered opportunity for comparison between conventional and LID stormwater design techniques.

Measurement	Watershed	
	Conventional	LID
Number of events with measurable runoff >100 cubic feet*	104	83
Total runoff volume (cubic feet/acre)*	41,403	33,391
Percent of rainfall converted to total runoff*	19.0%	15.3%

* Difference is significant at the 95% confidence interval

Table 2. Somerset Paired Watershed Study: 2-Year Hydrologic Summary

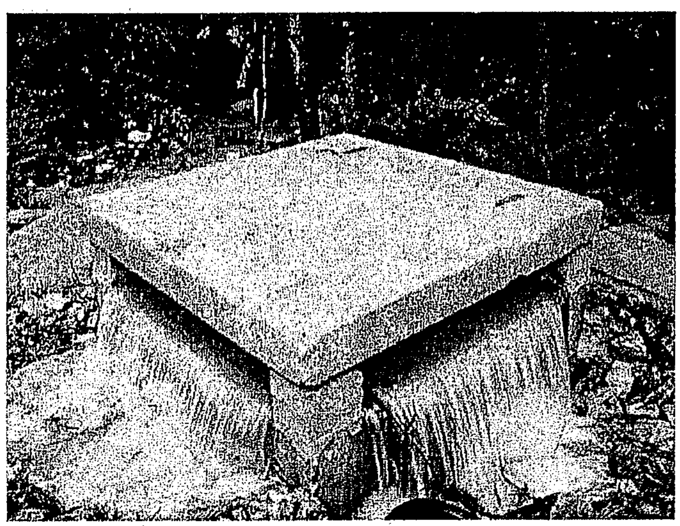
Preliminary monitoring also showed that metal levels in the runoff in the LID watershed were significantly lower than in the conventional watershed (36%, 21%, and 37% lower for copper, lead, and zinc, respectively). However, nitrogen levels were the same in both watersheds, while phosphorus levels were actually higher in the LID watershed. Project leaders suspect the LID watershed has higher-than-expected nutrient levels because it is still relatively new and is experiencing unstable soils and over-fertilization by homeowners. Project leaders expect the water quality in the LID watershed to improve significantly over time.

Prince George's County is pleased with the performance of the LID techniques at Somerset. Residents are also pleased—they have enthusiastically accepted their rain gardens and maintain them like they do other parts of their yard. Originally viewed as "free landscaping" by many residents, the naturalized rain gardens have become a key part of subdivision's identity. (*Sources:* (1) *U.S. HUD, 2003.* The Practice of Low Impact Development *(LID). U.S. Department of Housing and Urban Development, Office of Policy Development and Research. Available online at www.lowimpactdevelopment.org/lid%20articles/practLowImpctDevel_jul03.pdf.* (2) Hydrological Responses from Low Impact Development comparing with Conventional Development, *by Mow-Soung Cheng, Larry S. Coffman, Yanping Zhang, and Z. John Licsko.*)

Sherwood, Arkansas. Developers of the Gap Creek Subdivision used LID concepts, allowing them to gain 17 additional lots. Each lot sold for $3,000 more than comparable competitors' lots, and lowered the total cost per lot by $4,800. The project also resulted in 23.5 acres of green space and parks, $2.2 million in additional profit, and national recognition. The new design worked with the land's features. For instance, drainage areas were preserved and buffered by green space called greenbelts. The network of greenbelts were connected to neighborhood hiking trails. Streets meandered with terrain to minimize excavation needs. By maximizing the number of lots that backed up to greenbelts, the developers provided homeowners with a sense of privacy which led to higher lot prices.

The original plan's street was changed to include green space buffers and traffic calming circles thus allowing the developer to reduce street widths from 36 to 27 feet. In addition, trees were allowed to stay close to the curb line. The site uses native vegetation such as buffalo grass, and cleared trees were transformed into mulch. The original plan preserved 1.5 acres of green space while the revised plan preserved 23.5 acres. Some of the development cost savings went to fund a neighborhood park with picnic facilities, a pavilion, and ball fields. (*Source: Tyne, Ron, 2000. Bridging the Gap: Developers Can See Green.* National Association of Home Builders Land Development Magazine, *Spring - Summer 2000, pp 27-31.*)

Aberdeen, North Carolina. Design engineers for the Poplar Street Apartments used an alternative LID stormwater control design for a new 270-unit apartment complex and saved the developer approximately 72 percent, or $175,000, of the conventional stormwater construction costs. At the site, almost all of the conventional underground storm drains associated with curb and gutter projects were eliminated. Strategically located bioretention areas, compact weir outfalls (see photo), depressions, grass channels, wetland swales, and specially designed stormwater basins were some of the LID techniques used. These design features allow for longer flow paths, reduce the amount of polluted runoff, and filter pollutants from stormwater runoff. (*Source: Storm Water Solutions For New Mandatory Federal Storm Water Regulations, Fall 1999 newsletter of* BLUE: Land, Water, and Infrastructure, *available at www.blwi.com/n_fall99.htm*)



In Aberdeen, NC, a compact weir releases water on all sides, distributing stormwater to bioretention cells.

Largo, Maryland. At the Inglewood Demonstration Project, engineers retrofitted an existing parking facility with a bioretention area. They selected a landscaped island measuring

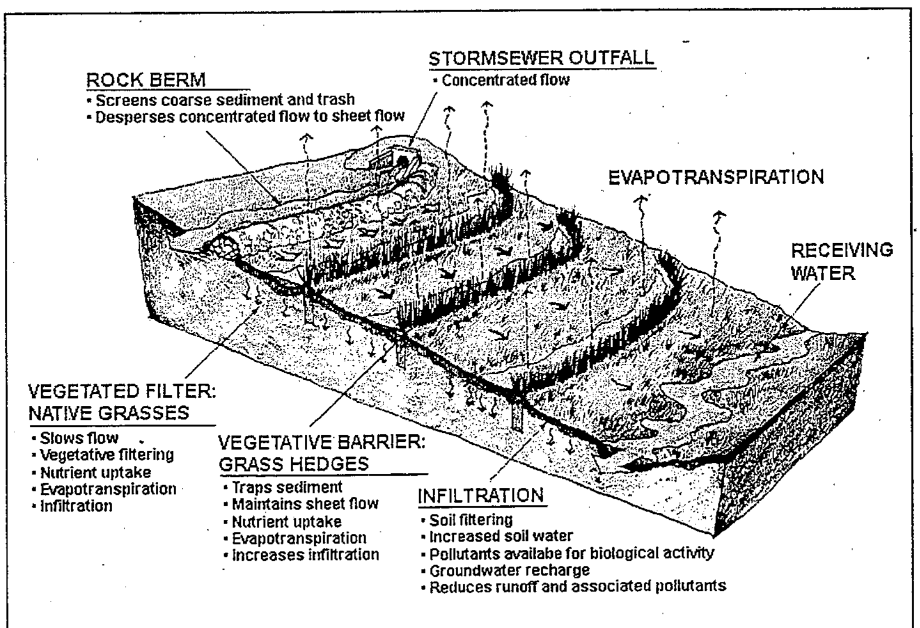
A004656

about 38 feet by 12 feet to be retrofitted to treat runoff from a half-acre of impervious surface. They cut a four-foot slot into the curb immediately before the storm drain inlet, excavated the landscaped island to a depth of four feet, and installed an underdrain that would allow the soil in the island to slowly drain, preventing oversaturation. Next, they covered the underdrain with eight inches of one- to two-inch gravel and backfilled with typical bioretention soil mix up to a depth of about 12 inches below the top of the curb. Finally, they planted the area and covered it with three inches of shredded hardwood mulch. Water collects in the island to a ponding depth of approximately six inches before a backwater is created at the curb opening.

Results showed that the project lowered runoff temperature by 12 degrees C, and significantly reduced metals and other pollutants present in the runoff. The retrofit cost $4,500 to construct, while usual methods of treating that runoff would have cost $15,000-$20,000 and involved fewer environmental benefits and higher maintenance costs. (*Source: USEPA, 2000.* Bioretention Applications. *Document 841-B-00-005A. Available online at epa.gov/nps/bioretention.pdf)*

Pierce County, Washington. Pierce County directed a study looking at the use of potential LID technologies in Kensington Estates, a conventional, 103-lot single-family development planned on 24 acres. The LID design of the roadways and utilities called for a reduced roadway width, porous paving, and cul-de-sac clusters. The cul-de-sac design included vegetated depressions in the center of each that would capture and retain six inches to one foot of runoff. These LID features generated costs that would be slightly higher than the costs for conventional materials and design. However, the study showed that over the entire 24-acre development site, the LID approach would generate construction cost savings of more than 20 percent over a conventional approach, preserve 62 percent of the site in open space, maintain the project density of 103 lots, reduce the need for, and size of, storm pond structures, eliminate catch basins and piped storm conveyances, and achieve "zero" effective impervious surfaces. *(Source: CH2MHill, 2001.* Pierce County Low Impact Development Study. *Available online at www.pierce.wsu.edu/Water_Quality/LID/CH_Final_LI_Report.pdf.)*

Austin, Texas. The City has had a plan for buffering streams for the protection of the Edwards Aquifer for many years, but in some cases, runoff from subdivisions was still collected by curb and gutter and discharged as a concentrated flow directly to the buffered streams. In Austin's Circle C Ranch subdivision, engineers converted the concentrated storm sewer point discharge to a system that encouraged sheet flow along the buffer (see picture). The redesign included placement of a rock berm along a drainage ditch located at the top of the grassed stream buffer. The runoff percolated through the berm and flowed across the entire width of the buffer before entering the stream. The engineers also planted a series of native grass hedges to help distribute flow along the buffer. This redesign created four biodetention areas at a total cost of $65,000, much less than the $250,000 sedimentation-filtration pond that would have otherwise been required. Per lot cost was approximately $450 compared to $1,700 for the sedimentation-filtration pond. Additional cost savings were realized through reductions in storm drain pipe sizes and trenching depth. (*Source: Scaief and Murfee. 2004.* Subdivision



At Austin, Texas' Circle C Ranch Subdivision, engineers designed a drainage system that encourages stormwater sheet flow across a vegetated buffer.

Design to Maximize Utilization of Stream Buffers, *from AWRA Summer Specialty Conference, June 28-30, 2004. Murfee Engineering Co., Inc., 1101 Capital of Texas Highway South, D-110, Austin, TX 78746; Phone: 512-327-9204; E-mail: jscaie@murfee.com*)

River Stars Program Saves Money and the Environment

The nonprofit Elizabeth River Project's River Stars Program exemplifies the notion that pollution prevention can yield profits for companies. The southeastern Virginia-based program encourages industry, government, and other facilities in the Elizabeth River watershed to pursue voluntary pollution prevention and wildlife habitat goals, and rewards them for their successes. Since its inception in 1997, the River Stars Program has documented a reduction of hazardous waste and other pollution by more than 144 million pounds and restoration or conservation of more than 220 acres of wildlife habitat. Thanks to a bit of innovative thinking, the River Stars Program facilities found economically feasible—and sometimes economically beneficial—ways to reduce pollution.

The 200-square mile Elizabeth River watershed includes the Virginia cities of Norfolk, Portsmouth, Chesapeake, and part of Virginia Beach. The Elizabeth River drains into the Chesapeake Bay, and has been identified by the Chesapeake Bay Program as one of the three most toxic regions of concern in the bay watershed, due to high levels of pollution in its waters and sediments.

Program Promotes Ongoing Achievement

Through the River Stars Program, the Elizabeth River Project promotes a non-regulatory, partnership-based approach with private industry and others to reduce and prevent pollution. Elizabeth River Project staff provide River Stars facilities with project recommendations, project funding acquisition, project design and other technical assistance, volunteer event planning, documentation of results, and public recognition of successes. River Stars projects typically include reduction, elimination, or recycling of waste materials in an industrial process, establishment or restoration of a wildlife habitat area, and onsite stormwater management improvements such as efforts to capture and reuse stormwater. Most companies have enjoyed corresponding cost savings through reduced need for materials, labor, and waste treatment or disposal.

About 50 facilities currently participate in this program. (The Elizabeth River Project also has a separate River Stars schools program.) The program provides for three levels of achievement, each of which requires different degrees of success with pollution prevention or wildlife habitat projects. This three-tiered, interdisciplinary approach allows facilities to start small and build on their successes. Many River Star facilities maintain their designated level of environmental excellence from year to year by adding to previously initiated projects and enlarging wildlife habitat areas. The River Stars Program encourages participating facilities to continually implement new projects so they can be recognized each year and/or be awarded a higher level of achievement.

Reducing Pollution and Costs

River Stars' impact on nonpoint source pollution is growing. Historically, many of the projects were associated with pollution reduction in industrial processes and the impact on water quality was an indirect one. This impact was largely associated with reductions in landfill waste, air emissions, and contaminants in treated wastewater. Now, more River Stars facilities are branching out into stormwater management and wildlife habitat projects—projects that can directly reduce nonpoint source pollution. Many of these projects have also provided unexpected economic benefits.

NOVA Chemicals, Inc., a manufacturer of polystyrene resin, created an 11-acre "no-mow" area of 3,000 native trees and shrubs, designed to provide food and shelter for migrating songbirds. The native plants also reduce soil erosion and improve the quality of stormwater runoff reaching the river. After implementing the project in 1999 at a cost of less than $8,000, the company found it was saving $16,000 annually by no longer mowing the land. "We tried to do the right thing for

River Stars Program Saves Money and the Environment (continued)

the environment and were rewarded with an unexpected cost savings," explains Van White, NOVA Chemical's Environmental Manager. "We've also received a number of awards and great publicity from several newspaper articles." NOVA isn't the only River Stars facility reaping rewards from its wildlife habitat project. ExxonMobile invested $3,000 in a similar wildlife area, and now saves approximately $4,000 annually in mowing costs. Exxon's project earned them the ExxonMobile Corporation's "Terminal of the Year" award in 2002.

NOVA Chemical's "no-mow" area before and after project completion.

A growing number of River Stars facilities capture and reuse their stormwater, reducing the need to purchase water and reducing the amount of water released to the river. Southern States Cooperative, a fertilizer manufacturer, saves money with its innovative rainwater collection project. Using an existing retention pond and adding a new $600 portable pump, the company began pumping the site's stormwater to an old rail tanker car that they converted into a cistern. The tanker car stores the water for use in the manufacturing process. The company uses about 150,000 gallons of rainwater per year this way—water that would otherwise be purchased—saving the company more than $500 each year. This captured stormwater already contains low levels of nitrogen and phosphorus (largely from airborne sources) that are incorporated into the fertilizer, saving the company roughly an additional $1,500 annually. Because the runoff is collected and reused, the company no longer has to pay to monitor stormwater which costs more than $500 each year for sample analysis plus the variable costs of the time staff spent collecting samples whenever it rained. "For an extremely minimal cost we are seeing significant savings," explains Mark Cowley, Southern State's River Stars representative. "And every bit of savings helps." More information about these and other River Stars projects is available on the Elizabeth River Project Web site at www.elizabethriver.org/RiverStars/RiverStars.htm.

The success of the River Stars Program is great for the companies and the Elizabeth River watershed, notes Pam Boatwright, Elizabeth River Project's River Stars Program manager. "The companies are pleased that their River Star projects are not only protecting the environment and the bottom line, but also generating publicity and recognition within the community and beyond." The River Stars Program is a great example of

One Piece of a Much Larger Puzzle

The River Stars Program is one of the Elizabeth River Project's many activities. In its 2002 Watershed Action Plan, the Elizabeth River Project outlined 14 actions to help restore the river over the long term. These include the "Goo Must Go" campaign, which promotes river sediment clean up, as well as point and nonpoint source pollution prevention, public education, water quality monitoring, habitat restoration, and other environmental improvements and protections. For more information, see the Action Plan and other Elizabeth River Project publications at www.elizabethriver.org/Publications/.

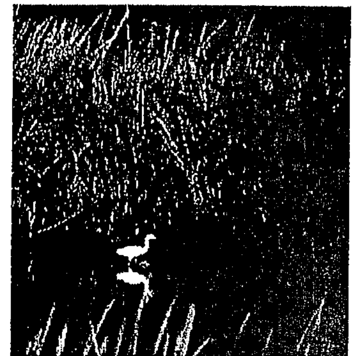
River Stars Program Saves Money and the Environment (continued)

how investing in non-regulatory, partnership-based approaches can often lessen costs while reducing pollution from point and nonpoint sources.

[*For more information, contact Pam Boatwright, Elizabeth River Project, Admirals Landing, 475 Water Street, Suite 103A, Portsmouth, VA 23704; Phone: 757-399-7487; E-mail: pboatwright@elizabethriver.org; Web: www.elizabethriver.org.*]

Looming Economic Losses Energize Louisiana's Coastal Restoration

Louisiana's uncomfortably close call with Hurricane Ivan last year renewed the sense of urgency in ongoing efforts to protect Louisiana's continually eroding coastline and vulnerable low-elevation inland areas. According to the Louisiana Department of Natural Resources, coastal Louisiana wetlands are being lost at the rate of 24 square miles every year, a total of 1,900 square miles since the 1930s. The loss of coastal wetlands increases the likelihood that a hurricane or other strong storm will cause devastating, and expensive, damage to resources both onshore and off.



Louisiana coastal wetlands provide wintering habitat for more than 5 million waterfowl and migratory birds.

Hoping to increase national awareness of the importance of Louisiana wetlands and the role they play in protecting life and property, Louisiana governor Kathleen Blanco spoke out in a Washington Post editorial in December 2004. She emphasized that the nationally significant energy, economic, and transportation infrastructure that is situated along the Louisiana coast could be damaged by future large storms—effectively crippling the nation. Like other governors before her, she is seeking innovative financial mechanisms to help mitigate the impact of natural disasters by restoring the state's disappearing coastal wetlands. Governor Blanco argues that by investing restoration dollars today, the nation could better protect itself from a future national disaster.

Why are Louisiana's Coastal Wetlands Disappearing?

For the last several thousand years, Louisiana's coastal wetlands expanded as floodwaters from the Mississippi River deposited enormous volumes of sediment and nutrients on the continental shelf at the river's mouth. During the twentieth century this pattern was reversed, resulting in continuous coastal erosion. Why? In 1928, to protect floodplain property from periodic flooding, the federal government began building levees and dams to contain and constrict the Mississippi River. Levees prevented the slow-flowing, sediment-laden natural flooding events from replenishing the coastal wetlands. They also cut off natural secondary and tertiary distributaries that fed the wetlands with freshwater, replacing them with straightened channels that often sent salt water back into freshwater marshes and destroying them. Over time, the wetlands shrank. Other factors contributing to wetland declines include channels dug for oil and natural gas conveyance, and battering by periodic hurricanes. For photos and videos of historic wetland losses, see www.lacoast.gov/education/loss.

Partnering for Restoration

To reverse the trend of wetland loss and better protect the Louisiana shoreline, the state of Louisiana has been working with the U.S. Army Corps of Engineers, the National Oceanic and Atmospheric Administration, and other partners to develop and implement a plan for coastal wetlands restoration. Known as the Coast 2050 Plan, the plan seeks to restore and/or mimic natural landforms and ecosystem functions along a wide swath of Louisiana coastal area.

The restoration will not be easy—or cheap. Cost estimates run as high as $14 billion over 30 years. Len Bahr, Director of Applied Science at the Louisiana Governor's Office of Coastal Affairs, points out that the restoration plan is "one of the largest engineering projects ever attempted in the world." The plan attempts to reengineer the deltaic river system with marsh creation, barrier island restoration, river water re-introduction, sediment diversions, sediment and nutrient trapping, and vegetative planting. The plan has gained attention for its potential to decrease nutrient flux into the Gulf of Mexico, by trapping nutrients in the marshes, which might help alleviate the problem of the hypoxic "dead" zone, an area of low dissolved oxygen in the Gulf. For more details on Coast 2050, see http://lacoast.gov/programs/2050.

Funding Coast 2050

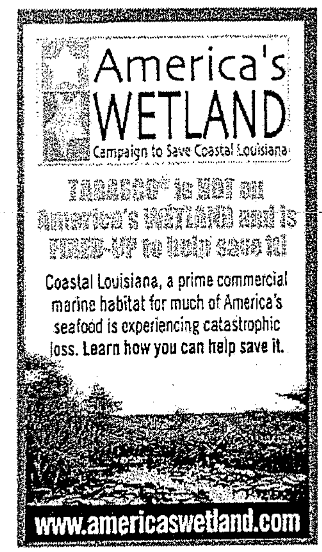
Considering the national importance and high cost of the plan, Louisiana continues to negotiate for additional federal funding while also seeking other public and private funding sources. The state currently receives regular federal assistance for coastal restoration projects through the Breaux Act, also known as the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). Each year the Louisiana restoration program receives approximately $50 - $60 million, to which it adds matching funds. This is far from enough to cover the implementation of the Coast 2050 Plan, but the Breaux Act may continue to be a federal funding vehicle. In December 2004, the President signed a bill that included an extension of the Breaux Act until 2019.

An Ounce of Prevention is Worth a Pound of Cure

At the heart of the Coast 2050 Plan is the economic argument that the potential cost to the nation and the state if the wetlands are not restored is $100 billion in infrastructure alone. Investing $14 billion seems more reasonable when viewed from this angle. A strong consideration in the "opportunity cost" accounting of wetlands restoration is the vulnerability of key oil ports in the Gulf of Mexico to threats from storm surges. If high water covers the vulnerable production platforms and critical highways to and from the area, oil and gas supplies that currently serve almost a quarter of the nation will be cut off. (For more information, see www.la1coalition.org.) Both the energy industry and the nation's energy consumers have a lot at stake. For this reason, Louisiana is working to increase the local and national visibility of its wetland problems.

Campaigning for America's Wetland

In 2002, Louisiana launched "America's Wetland," a nationwide publicity campaign and education effort intended to raise the visibility and concern about the disappearing coastal wetlands to a national scale, commensurate with the effect it could have on America's economy and natural heritage. "America's Wetland" campaign participants include oil industries, business groups, local and national environmental organizations, and local, state, and federal agencies. The campaign's innovative publicity strategies include national television spots featuring 1970s Saturday Night Live claymation icon Mr. Bill, a Web site, print media ads, press releases, and press packets. (For more information, see www.americaswetland.com.)



All boxes of Tabasco sauce now feature information about the America's Wetland campaign.

Campaign partners give time and resources for either public education or restoration efforts. The Shell Oil Company Foundation pledged $3 million in seed money to start the campaign. The McIlhenny Company, producer of Louisiana's famous Tabasco Hot Sauce, is including informational cards on bottles of Tabasco distributed internationally. The Louisiana Bankers Association funded a $40,000 initiative to insert literature into bank statements for public

Why are Louisiana Wetlands so Important?

- They support a commercial fishing industry that harvests more than 1.1 billion pounds of finfish and shellfish annually, accounting for approximately 27 percent of the total catch by weight in the lower 48 states.
- They provide habitat for more than five million wintering waterfowl.
- They ensure continued revenue from hunting, recreational fishing, and ecotourism. Recreational fishing revenues contribute more than $235 million per year to Louisiana's economy.
- They provide storm protection for natural gas production worth $7.4 billion per year.
- They provide storm protection for coastal refineries, which produce $30 billion worth of petroleum products annually.
- They provide storm protection for a waterborne commerce industry that moves 400 million tons of products through coastal channels every year and handles more commodities than all west coast ports combined.

For more information, see http://lacoast.gov/education/2050faq.htm.

A004661

Looming Economic Losses Energize Louisiana's Coastal Restoration (continued)

education. They also help sponsor campaign fundraisers. Ducks Unlimited is giving $10 million for restoration efforts outlined in the Coast 2050 Plan. A number of other organizations partnered to build a wetland trail and now work with canoe and kayak outfitters to help promote eco-tourism. Louisiana hopes that the campaign will help secure additional funding for the restora effort by increasing the public and private sectors' understanding of the immediate need to stem the tide of coastal wetland loss.

[For more information, contact Sidney Coffee, Executive Assistant, Office of the Governor/Coastal Activities, 1051 N. Third St., Capitol Annex Bldg, Suite 138, Baton Rouge, LA 70802; Phone: 225-342-4844; E-mail: sidneyc@dnr.state.la.us.]

Notes on Watershed Management

Lake Clarity Yields Property Value Increases

Two Bemidji State University (Minnesota) professors found strong links between lake clarity and land value in their June 2003 report titled "Lakeshore Property Values and Water Quality." The researchers examined 1,205 sales of lake-adjacent properties in Minnesota's upper Mississippi River basin from 1996 to 2001 to develop a quantitative relationship between lake clarity measurements and prevailing prices for properties adjacent to those same lakes.

The report is important because it "defines a dollar value of water quality to the northern Minnesota economy," according to Jane Eckholm, Executive Director of the Mississippi Headwaters Board. Similarly, previous studies of lakefront properties in Maine (see box) found that landowners place a premium on living next to clearer lakes. Both the Maine and Minnesota studies used hedonic regression analysis, a technique used to determine the implicit price of something that cannot be priced directly—in this case, water quality.

The researchers surmised that the value of water quality would be captured in the value of the land and that this portion of a property's price could be determined by examining how property price change with differing levels of water quality, while controlling for other property characteristics. Lake clarity measurement was used as a surrogate for overall water quality. Eckholm noted that "Through objective scientific method, this study attaches tremendous economic value to investing in a clean environment."

The Price of One Meter

Based on the data, both the Maine study and the Minnesota study developed demand equations for various sub-regions in their respective study areas that infer the marginal amounts that people are willing to pay for improved water clarity. These equations show that for every meter of improved water clarity, a property's value would rise by tens to hundreds of dollars for each foot of lake frontage. The Minnesota study found "evidence [that] shows that management of the quality

Lake Clarity Makes a Difference in Maine

Researchers from the Maine Department of Environmental Protection (DEP) and the University of Maine recently published data showing that lake clarity can significantly affect the property values of lakeside homes. Ray Bouchard and Kevin Boyle investigated property values around 36 Maine lakes and found that properties on a lake with a clarity one meter greater than another similar lake have higher property values in the range of 2.6 percent ($2,563) to 6.5 percent ($9,271), depending on the market. Likewise, a one meter decrease in clarity causes property values to decrease anywhere in the range of 3.1 percent ($3,084) to 8.5 percent ($12,050). Like previous studies, researchers compared properties based on location variables such as distance to nearest substantial town, type of road surface (gravel versus paved), density of other properties and cottages, property's lakefront footage, and lake surface area. Researchers also considered the structural variables that impact property value, including age and floor area of the unit, type of water supply and wastewater system, and presence of improvements (additions). Of all variables considered, lake surface area seems to have a large effect on the range of property values as it may affect individual perceptions of acceptable water quality. The researchers published their results in the Fall 2003 (Volume 23(3)) issue of the North American Lake Management Society's *LakeLine* magazine, available for order at www.nalms.org/lakeline/ll23-03.htm. For more information on economic impacts of Maine lakes from the 1980s to the present, see www.state.me.us/dep/blwq/doclake/research.htm, the Maine DEP's Lake Assessment Program Web site called "More on Dollars and Sense: The Economic Impact of Lake Use and Water Quality."

Lake Clarity Yields Property Value Increases (continued)

of lakes is important to maintaining the natural and economic assets of north-central Minnesota." The Bemidji, Minnesota team, economist Dr. Patrick Welle and geographer Dr. Charles Parson, concluded that "collectively, changes in lake water clarity will result in millions of dollars in property values—lost or gained—in this lake region." They see education as the key to sustaining or improving lake quality. Other research has corroborated the Minnesota and Maine findings: in 2000, two economists from the University of Maryland found that water quality had a significant positive effect on residential property values along the Chesapeake Bay.

The 58-page report is available on the Web at www.mhbriverwatch.dst.mn.us/publications/lakeshore_property.pdf. The authors Dr. Patrick Welle and Dr. Charles Parson may be reached via e-mail at pwelle@bemidjistate.edu and cparson@bemidjistate.edu, respectively.

Report Reviews Economic Benefits of Watershed Protection

The Center for Watershed Protection (www.cwp.org), under contract with the Virginia Department of Conservation and Recreation, developed a report in 2001 to document economic costs and benefits of implementing environmental regulations. Through a comprehensive literature search, the CWP identified sources that illustrate land value and other benefits associated with environmental protection programs, as well as possible negative economic consequences of ineffective or non-existent programs.

The report, titled *Economic Benefits of Protecting Virginia's Streams, Lakes, and Wetlands*, documents the economic benefits of specific environmental regulations, including those pertaining to floodplains, water quality, conservation area protection, buffers, erosion and sediment control, and zoning. The numerous examples and references in this report identify several types of economic benefits resulting from these regulations. These benefits include increased property values, income from fisheries, recreation, tourism, and the marine industry, as well as savings or avoidance of costs related to flood damage, stormwater treatment, construction, infrastructure and maintenance, drinking water treatment, home heating and cooling, medical treatment (arising from waterborne illnesses), and stream/lake restoration. CWP found that these economic benefits, combined with the other, immeasurable benefits of preserving forests, and protecting habitat, biodiversity, and natural resources, makes the decision to establish many types of environmental regulations a justifiable and responsible approach to protecting water resources and the environment in general.

Although the cost and benefit figures are slightly out of date, this 2001 report still provides an eye-opening look at the significant economic benefits that nonpoint source control and other environmental protection and land conservation programs can provide. For a copy of the report, see www.dcr.state.va.us/sw/docs/swmecon.pdf.

Riparian Buffers Yield Economic Returns

Homeowners are willing to pay more to live near buffered streams and open space, according to a study in Missouri's Dardenne Creek watershed. When St. Charles County passed a "Natural Watercourse Protection Ordinance," local developers raised concerns that the need to plan for and comply with the new requirements would ultimately increase the price of new homes. The ordinance requires a 25- to 50-foot buffer around streams (depending on stream size) on all land developed for residential or other non-agricultural uses. Fortunately, the Missouri Department of Natural Resources had an opportunity to fund a study that helped to address those concerns and provide a broader insight into the economics behind environmental amenities.

What Will People Pay?

Researchers from the University of Missouri and the Greenway Network teamed up to conduct the study. They used two methods to determine people's "Willingness To Pay" (WTP) to live near a buffer, farmland, or other open space. First, researchers estimated people's WTP using a contingent valuation method (CVM), which is a survey-based methodology for estimating the value of natural resources not subject to market forces. CVM is sometimes regarded as unreliable because the method asks people questions rather than observes their behavior. Second, the researchers estimated the actual market value of open space in the real estate market of the study area using a hedonic pricing method (HPM). HPM is a statistical method used to estimate economic values for environmental services that directly affect market prices. For more information about CVM, see www.ecosystemvaluation.org/contingent_valuation.htm. For more information about HPM, see www.ecosystemvaluation.org/hedonic_pricing.htm.

Contingent Valuation Method. The researchers developed a survey with the help of a group representing a wide range of local stakeholders. The survey asked a variety of questions, some designed to gather basic demographic information, and others designed to assess the respondent's awareness of water quality issues and the economic and environmental importance of riparian buffers. The survey also presented a map with a variety of hypothetical home location scenarios (near a buffer, in a neighborhood with an accessible buffer, etc.) and asked the respondent to identify if he or she would be would be willing to pay more to live in each place. The researchers mailed the survey at random to 1500 households in the Dardenne Creek watershed. Researchers received and analyzed 264 completed surveys using CVM.

Results showed that people had a WTP of approximately $6,858 to live on properties immediately adjacent to the community-owned and open accessible riparian buffers. Moreover, people were willing to pay approximately $1,625 to live on a property in the same subdivision but not immediately adjacent to the buffer. For properties adjacent to preserved farmland the researchers determined the WTP to be approximately $5,450.

Hedonic Pricing Method. To verify the results of the WTP survey, the researchers looked at the actual prices people paid for local properties immediately adjacent or near to preserved farmland or community-owned and open accessible riparian buffers. Using county property tax maps and information, the researchers selected a subset of homes purchased since January 2000 with the sale price within the range of $75,000 to $200,000. Of the 5,756 properties that met these criteria, the team selected 1,955 properties at random to ensure an even distribution of properties across the study area. The research team then used ArcView GIS to identify pertinent attributes of each property, including presence of nearby open space and proximity to flood zones and streams. An HPM statistical analysis of the sales price and property attributes showed that all properties within a 500-foot wide buffer zone around Dardenne Creek and its tributaries sold for $2,500 to $3,800 more than properties farther away. Properties adjacent to open space sold for $4,600 to $6,400 more than properties without open space.

Development Drives New Protection Efforts

Residential development is swallowing prime farmland all across the United States at an alarming pace. The Natural Resource Conservation Service of USDA estimates that, over the past 20 years, the U.S. has lost enough farmland to fill the entire State of Illinois. St. Charles County has been experiencing rapid development, which covers the land with roads, houses, sidewalks and parking lots. These impervious surfaces prevent rainwater from soaking into the ground, and as a result, runoff is increased, flooding occurs, water quality is degraded, and wildlife habitat is lost. When it passed its new buffer ordinance, St. Charles County became one of countless communities across the nation that are trying keep development impacts under control by mandating implementation of low impact development techniques and preservation of riparian buffer zones. Buffers provide aesthetically pleasing open space for communities, and benefit the environment by filtering pollutants and promoting infiltration of runoff.

Both the CVM and HPM types of analysis, although very different, produced similar results. The authors believe that the similar results show that CVM can be a reliable tool if applied carefully. Regardless of the valuation method you prefer, the study showed that people are willing to, and do, pay more to live near a riparian buffer or other open space.

[For more information, contact the authors of the study: (1) Zeyuan Qiu, Assistant Professor, Environmental Policy Studies Program, New Jersey Institute of Technology, 317 Cullimore Hall, University Heights, Newark, NJ 07102; Phone: 973-596-5357; Fax: 973-642-4689; E-mail: zeyuan.qiu@njit.edu. (2) Tony Prato, Professor, Department of gricultural Economics, University of Missouri, 130 Mumford Hall, Columbia, MO 65211; Phone: 573-882-0147; E-mail: PratoA@missouri.edu. (3) Gerry Boehm, Executive Director, Greenway Network, Inc., St. Charles Community College Center, Suite 202, Room E, 4601 Mid Rivers Mall Dr.; St. Peters, MO 63376; Phone: 636-720-2250; E-mail: gboehm@naturallystcharles.com.]

Riparian Restoration Benefits Exceed Costs in Little Tennessee River

Researchers in the Little Tennessee River watershed found that the economic benefits of restoring riparian areas far outweigh the costs needed to do so. The Little Tennessee River (LTR) watershed, located just north of Clayton, Georgia, is predominantly forested (86 percent), but is under increasing pressure from agricultural, commercial, and residential development. Concerns about water quality led the Natural Resources Conservation Service (NRCS) to initiate a watershed restoration program in 1995. Since then, the NRCS has restored 8.55 miles of riparian buffer along the LTR and its tributaries.

A 2000 study (Bergstrom et al.) showed that, on average, local residents were willing to pay $37 per year to restore a two-mile stretch of the LTR (in 1996 dollars). A 2002 study (Kask and Orr) used this and other data to conduct a cost-benefit analysis of LTR restoration activities. Activities included planting buffers and installing revetments (large branches or small trees anchored to stream banks to provide protection from erosion). To determine costs, researchers looked at the actual costs of installing buffers and revetments. To determine benefits, Kask and Orr considered the value of restoration for the general public, and asked participating landowners to estimate the value of restoration in terms of decreased risk of erosion and flooding, better water quality, and improved aesthetics and wildlife habitat.

At the time of the study, Kask and Orr determined that the 8.55 miles restored along the LTR provided $1.95 million in total benefits, at a cost of only $242,569 in project expenditures. Each individual restoration project provided an average benefit of $33,186, but only cost an average of $4,353 (using onsite trees) to $8,262 (bringing trees from offsite) for revetments and an average of $606 (without fencing) to $3,670 (with fencing) for buffers. The researchers calculated the social and private benefits from completing additional restoration at $43.40 per foot, while additional costs would range from $0.68 to $16.95 per foot, leading the researchers to conclude that "additional restoration is beneficial to society from the project scale." However, they caution that without public funding for this type of program, there is no guarantee that landowners would be willing to pay all restoration costs needed to provide the associated social and private benefits.

Related results published in 2004 (Holmes et al.) showed that the benefit/cost ratio for riparian restoration in the LTR ranged from 4.03 (for 2 miles of restoration) to 15.65 (for 6 miles of restoration), leading the authors to conclude that riparian restoration in the LTR is an economically feasible investment of public funds. This study also showed that the benefits of partial restoration exceeded their costs, indicating that "partial restoration should proceed with available funds."

For more details on these studies, please consult the following papers:

- Holmes, T.P., Bergstrom. J.C., Huszar, E., Kask, S.B., Orr III, F. 2004. Contingent valuation, net marginal benefits, and the scale of riparian ecosystem restoration. *Ecological Economics*, 49, 19-30. (Available online at http://econpapers.hhs.se/article/eeeecolec). Contact tholmes@fs.fed.us for more information.)

- Kask, S.B., Orr III, F. 2002. *The economic benefits and costs of riparian restoration on the Little Tennessee River.* Final Report, USDA Southern Research Station contract FS-SRS-4851. (Contact skask@warren-wilson.edu for more information.)

- Bergstrom, J., Holmes, T., Huzar, E., Kask, S. 2000. *Ecosystem valuation in southern Appalachians with applications to the Little Tennessee River Watershed.* Final report, USDA contract number SRS33-CA-99-713 and SRS33-CA-99-713. (Contact jbergstrom@agecon.uga.edu for more information.)

Profiting from Agricultural BMP Implementation

Agricultural BMPs often call for an initial investment, but can provide significant savings over time. Savings can be realized as money saved by sowing fewer seeds, using less fertilizer, spraying pesticides on a smaller portion of a field, or by achieving a greater efficiency of operations. Modern farmers and growers make use of many different technologies to increase the return on their crops.

Nutrient Management Planning Pays Off

Nutrient tests for soil and manure are valuable tools for farmers planning fertilizer purchases. Often, farmers spend money needlessly on fertilizer because they don't know how much fertilizer is already in the soil or how much is in the manure they spread on their crops. Nitrogen is usually the fertilizer applied most heavily in crop production, and manure from livestock provides a cheap, abundant source of nitrogen. Savvy farmers test the manure first to determine available nitrogen levels. Moreover, annual soil testing for nutrient levels is paramount, as nitrogen may remain in the soil from the previous year's crop, especially if legumes were grown. For corn producers, testing the soil in late spring when the corn is six to 12 inches high provides the most reliable readings of the amount of usable nitrogen, and is early enough in the growing season to correct any deficiencies by boosting nutrient levels sufficiently to generate optimal yields.

According to the 1990 USDA *Farm Costs and Returns Survey*, farmers used 22.2 billion nutrient pounds of nitrogen fertilizer in 1990. Priced at the 1990 average of 18.7 cents per pound, spending came to more than $4 billion. A 1992 study by Babcock and Blackmer in the *Journal of Agricultural and Resource Economics* showed that a late spring soil test could reduce fertilizer application by 38 percent in Iowa, allowing farmers to significantly increase their net returns.

Another Iowa study of 200 farms conducted from 1991 through 1994 by Trachtenberg and Ogg showed that by keeping an account of nitrogen supplied from legumes and livestock, 52 percent of growers had saved a total of $200,000 in nitrogen purchases, with a reduction of more than one million pounds of nitrogen loadings with no decrease in production.

Prescription Farming

Prescription farming accounts for the different conditions that typically occur across a single field. (See *NPS News-Notes* #41, June 1995, for an article on prescription farming.) Application of prescription farming (also known as precision agriculture), requires an accurate knowledge of where a piece of farm equipment is as it moves across a field, and a mapping of the particular conditions pertinent to the crop being grown. A Global Positioning System (GPS) locates within a few centimeters the exact position of equipment in a field, and a Geographic Information System (GIS) maps data on a grid corresponding to the position of the equipment. Technology costs can vary widely depending on the degree of program sophistication. For information on start-up costs and economic returns, see http://precisionag.osu.edu/resources/ or www.oardc.ohio-state.edu/fabe/precisionag/.

Precision agriculture has been successfully applied to cotton production, thanks to the vision of Tim Sharp, head of the Precision Agriculture Department at Jackson State Community College in Jackson, Tennessee. Sharp explains, "Experimenting with different timings and applications, it became apparent that there were distinct zones within fields that could be managed using different strategies." So, when precision agriculture technology began to come on line, Sharp started looking for ways to make it work for cotton. "We always said, 'If it won't make money for growers, we won't do it.'"

Sharp based the program's path on a key fundamental assumption that every field can be zoned into areas of high, medium, or low productivity. Identification of these zones allows a grower to plant seed at variable rates, thus providing savings of seed money as compared with planting the entire field at the same rate. GPS allows the planting equipment to recognize those areas and a computer varies the number of seeds planted accordingly.

Once a farmer has this necessary background information, precision agriculture advisors from Jackson State Community College formulate a plan for optimum cotton production that includes seeding amounts and pesticide and fertilizer application rates. Imagery recognition of lush growing zones locates high breeding spots of destructive insects early in the season and allows for spraying only about 20 percent of the field for insect control rather than the entire field. In addition to time and money saved by spraying only a small portion of a field, this strategy is a major plus for cotton farmers who must control bollworms and budworms. Spraying only 20 percent of the field leaves 80 percent free of spray for the development of a population of beneficial insects such as praying mantises and assassin bugs which will control the remaining bud and boll worms. Yet another feature of zone recognition encourages optimum cotton boll development, and more return on the crop. Farmers can spray to reduce the height of high zone production plants, causing the plant to put more energy into developing a larger cotton boll.

Automated Steering Systems

Installing an automatic steering system on three tractors cost two Ohio farmers, Tom and Ed Miller, just under $60,000. The system essentially eliminates human error while driving through fields—it ensures that the tractor drives in a straight line with no overlapping or skipping of rows. The driver is only responsible for end-row turns. "We strip-till corn," says Tom, "and we estimate we will save 10 to 20 percent just on time spent going through the field. That's not only time but fuel costs and wear and tear on the equipment." Strip-till means that crops are planted and grown in narrow slots or tilled strips established in the untilled bed of the previous crop.

Now that they've upgraded their tractors, the next step will be to add automatic steering to their combines, delivering greater harvesting efficiency. "With beans," says Tom," we expect to see between 16 and 20 percent increase in efficiency in harvesting as well as tillage. The cost will be about $20,000 per unit, but will be well worth it." The Millers estimated that between cost savings and improved efficiency the new technology will pay for itself in two years.

Researchers in the National Air and Space Administration, U.S. Department of Agriculture (USDA), and U.S. Geological Survey are working cooperatively to improve this fledgling technology. USDA estimates there are 2.1 million U.S. farms using 941 million acres of land with production worth $200 billion a year. As Doug Rickman wrote in the November 2003 *Geotimes:* "Agriculture is a huge portion of our economy. Just a 1 percent increase in efficiency is a $2 billion change. We all depend on farmers, literally, for the bread we eat. No other human activity on land matches the impact of farming. If the development of precision agriculture can help farmers better manage their land, we may all benefit."

[Case studies in Tennessee and Ohio were adapted from a report by Paul Schrimpf, published in PrecisionAg Special Reports, 2003 (www.precisionag.com). For more information, contact paul_schrimpf@meisternet.com.]

Ensuring Economic Returns in the Mad River Watershed

Ohio State University Extension wants some farmers in the Mad River watershed to get more for less. In 2002 Ohio State University (OSU) Extension implemented a grant-funded nitrogen (N) reduction program that includes a BMP "net returns performance warranty" in the Kings Creek watershed, a tributary of the Mad River. The program entices operators to adopt OSU Extension's tri-state N recommendations, which suggest applying less N than most operators typically apply. OSU Extension hopes that this project will convince operators that, in most cases, N application at the recommended rate will not significantly reduce corn yields, will actually save money on fertilizer purchase, and can help reduce nitrate pollution in groundwater.

Ensuring Economic Returns in the Mad River Watershed (continued)

The N reduction program protects the operator who is skeptical of applying less N by guaranteeing the net returns of the crop. Program participants apply N to their enrolled crop acres following OSU's recommended rates, but also plant a check strip utilizing their normal N application rates (see table 3). OSU compares yields of the two areas at the end of the growing season. OSU Extension compensates cooperators for loss of income if the tri-state N recommended rate yields a lower net return than the higher N rate.

Year	Total acres in program	Avg N applied on enrolled acres (lbs/ac)	Avg N applied on check strips (lbs/ac)	Yield: enrolled acres *(B/ac)	Yield: check strip (B/ac)	Net return: enrolled acres ($/ac)	Net return: check strip ($/ac)
2002	150	159	194	92	93	$175	$170
2003	226	156	198	173	177	$358	$357
2004	238	159	225	186	197	$434	$448

*B/ac= Bushels per acre

Table 3. Nitrogen Reduction Program Results

Program Results

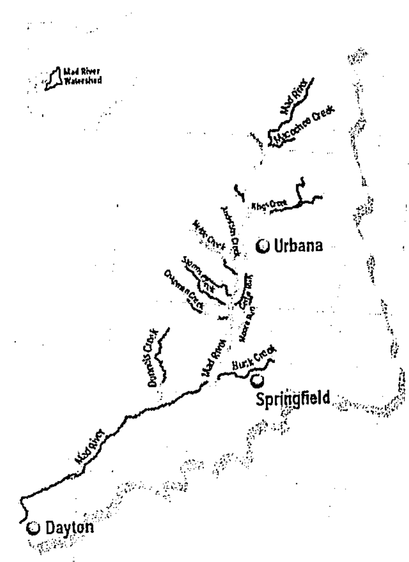
After three growing seasons, the program results are mixed. In all growing seasons, check strip yields actually exceeded that of enrolled acres (see table). However, during 2002 and 2003, enrolled acres yielded a higher net return ($5/ac and $0.51/acre, respectively) because operators purchased and applied less fertilizer. In 2004, check strip yields exceeded those on enrolled acres by more than 11 bushels/acre, providing farmers with $14/acre more on check strips than on the enrolled acres.

Farming is an Inexact Science

The variability in yields and net returns is likely due to unpredictable weather in the area, explains Jennifer Ganson, Mad River Watershed Coordinator. "The weather has gone from very wet to very dry—often during the same growing season. The timing of these weather extremes can play an important role in overall productivity." Average yields in 2002 were almost half of what is expected because cool, rainy weather delayed planting, and wet soil conditions during emergence and early vegetative growth resulted in restricted, shallow root systems. The wet weather was followed by a drought that began in mid June and severely reduced yields.

Ganson believes the drought in 2004 is an example of why farmers typically apply more every year. "Farmers rely on their crops for their livelihood. They often plan for the worst-case scenario to ensure the best yields possible." In 2004 the higher levels of N applied on the check strips actually paid off because the rain that did fall carried a larger amount of N to the root zone at one time. In normal years, rainfall would carry the lower, recommended levels of N to the root zone many times throughout the growing season, sufficiently meeting the plant's needs.

Because the average return on check strips in 2004 exceeded that of enrolled acres by $14 per acre, all participating farmers qualified for compensation under the program. OSU paid a total of $3,510, noted Ganson, which is "a small price to pay when you consider how much less nitrogen was applied to the watershed during the past three years. This program shows that, in most cases, farmers can make more money by applying less nitrogen."



Ohio's Mad River watershed (image courtesy of Miami Conservancy).

Ensuring Economic Returns in the Mad River Watershed (continued)

The current program is funded for one more year; a grant application requesting program renewal is pending. Ganson hopes the program will continue to allow OSU to gather additional data. Data on a greater number of growing seasons will ensure a more representative overview of the viability of OSU Extension's tri-state N recommendations.

[For more information, contact Jennifer Ganson, Mad River Watershed Coordinator, The Ohio State University Extension, 1512 S. U.S. Hwy. 68, Suite B100, Urbana, Ohio 43078; Phone: 937-484-1526; E-mail: ganson.6@osu.edu.]

Agricultural Payments Linked to Water Quality Improvement

Enticing farmers to implement best management practices (BMPs) in exchange for monetary compensation is nothing new. But what if those farmers had to show that the BMPs actually improved the water quality flowing from their land before they received their money? That is exactly the scenario soon to play out in two small Ohio watersheds. In an EPA-funded pilot project, farmers have agreed to implement structural or management BMPs and defer the full compensation for these practices until monitoring data show that water quality improvement goals have been met. In this case, nonpoint source controls will yield economic benefits—but only if the controls really work and are implemented efficiently.

This six-year project is in its second year, and the exciting part—learning whether it will be successful—is still a year away. The project represents a broad collaboration between Ohio State University Extension, the Stillwater Watershed Project, the Dark Soil and Water Conservation Service, the USDA Natural Resource Conservation Service, the Miami Conservancy District, and the participating farmers. It is funded as part of the 2003 Great Miami River U.S. EPA Watershed Initiative Grant. The collaborators chose to implement the pilot project in two small subwatersheds (less than 1000 acres each) of Stillwater Creek, a tributary of southwestern Ohio's Great Miami River. Project staff members are currently collecting background water quality data. They have held numerous meetings to share the data with the farmers, educate them about the project, and solicit their participation.

How Will it Work?

Participating farmers bid for contracts with OSU. The farmers agree to adopt management and/or structural BMPs, and will receive annual payments tied to measured changes in annual nitrogen, phosphorus, and/or sediment loads in the stream. In their bids, farmers specify their proposed reduction in pollutants, and the payment they want in exchange for their efforts. They do not need to specify what BMPs they will implement. Farmers will work with local conservation personnel or consultants to develop their plans for reducing nutrients, and to estimate the costs of providing these reductions. OSU has approximately $300,000 to spend contracting with farmers.

Want more information?

A paper providing more detail about the project is available at yosemite.epa.gov/ee/epa/eermfile.nsf/vwAN/EE-0472-01.pdf.

Project staff will look at the bids and, based on what the farmers say they can achieve, establish aggregate water quality targets for each subwatershed. Determining the water quality leaving individual farms is cost-prohibitive, so OSU will monitor the water downstream of the group of farmers in the subwatershed and tie payments to group performance rather than individual performance. Obviously, farmers will need to work together and support each other's efforts to achieve maximum nutrient reductions and receive full compensation.

Each group of farmers will have three years to reach its target pollution reductions, explains project coordinator Brent Sohngen, an economist with The Ohio State University (OSU), Department of Agricultural, Environmental, and Development Economics. "Right now, we are planning to have a goal that meets ten percent of the target the first year, 30 to 40 percent the second year, and the full target the third year." Payments to the farmers will be allocated according to a similar schedule. Increasing the amount of reduction over time "allows farmers to become more familiar with what BMPs work best," Sohngen added. Each contract will be negotiated to include clauses

Agricultural Payments Linked to Water Quality Improvement (continued)

that limit financial losses from the contract if severe weather interferes. Farmers will receive an initial payment to get started, and can expect payments each year as long as the aggregate target for all farmers in the small watershed is met. No payments will be made in years when the aggregate target is not met.

Not all farmers in each project watershed have to participate to make the project work. In fact, Sohngen expects only about 75 percent of the land to have farmers participating. "As long as the non-participating farmers don't make any significant changes to their farming practices, our results will be valid." Sohngen notes that they have a good relationship with all the watershed farmers, but that some have chosen to simply not participate.

Water Quality Trading and Performance-Based BMPs

Performance-based contracts open up the possibility for more widespread water-based pollution trading. In any trading system, debits and credits must involve known quantities of pollution. Performance-based contracts provide known pollution reduction quantities, and compliance is encouraged with monetary incentives rather than through less popular regulatory channels.

What's in it for Farmers?

Getting farmers to agree to performance-based contracts on a broad scale will likely be a challenge, noted Sohngen, especially since the traditional cost-share programs don't carry a risk of non-payment if the BMPs don't improve water quality. However, he noted, "farmers can realize a profit with performance-based contracts if they discover a way to meet their targets without spending all the money they thought they'd need." The farmers in the pilot project are willing to participate for the sake of being involved in "something bigger than themselves," he added. "They understand the benefit of the research, and the profit motive helps to keep them interested."

Unlike many traditional cost-share programs, the pilot project will not pre-select BMPs for implementation. Rather, farmers will have the freedom to choose which practices they believe would be most successful. Sohngen expects farmers to implement lower-risk, inexpensive changes in management, such as shutting off tile drains or modifying when and how much manure is spread on the fields. "If the group of farmers is unable to meet the target outlined in the contract, no farmer wants to be left paying for a $100,000 manure storage pit," he explained. By specifically tying cost-share payments to performance, farmers will have more incentives to assess their overal farm practices, and discover inexpensive modifications that benefit the environment.

What Happens at the Project's End?

Project staff plan to continue the project if they can secure additional funding. If not, Sohngen hopes to keep monitoring the stream to see whether the project has long-term impacts. "Even if the farmers revert back to their original practices and the nutrient levels in the stream return to pre-project levels, at least the project will have shown that this approach can work," he explained. However, he anticipates that farmers will discover very inexpensive ways to reduce nutrient pollution, and that they will continue to use their modified practices after the project is over. "Some farmers will probably discover cost-savings that they didn't know were there, such as a reduced need for application of purchased fertilizer." For this reason, the project has the potential to offer long-term benefits both for farmers' wallets and local water quality.

[For more information, contact Brent Sohngen, Department of Agricultural, Environmental, and Development Economics, The Ohio State University, 2120 Fyffe Road, Columbus, OH 43210-1067; Phone: 614-688-4640; E-mail: sohngen.1@osu.edu.]

Beyond Environmental Compliance: Stewardship as Good Business

Growing evidence suggests that good economic performance is compatible with good environmental performance. For example, firms in the Dow Jones Sustainability Index (companies that incorporate environmental and societal concerns into their long-term economic investment strategies) outperformed the 2,500 largest capitalized companies that make up the Dow Jones Global Index. Specifically, between 1993 and 2003, the Sustainability Index saw cumulative gains in nominal market value of 85 percent, compared with 57 percent from the Global Index. The positive correlation between environmental and economic performance is especially apparent in

Beyond Environmental Compliance: Stewardship as Good Business (continued)

industrial sectors with substantial exposure to environmental risk. This evidence challenges the traditional notion that complying with environmental regulations saps profitability and suggests that going "beyond compliance" can result in a competitive advantage. For example, firms with better environmental records may be more attractive to investors due to reduced compliance costs and a lower risk of future liabilities.

Recent analysis by the USDA Economic Research Service (ERS) suggests that agricultural producers can also benefit economically by voluntarily adopting environmentally beneficial practices. An efficient farm would naturally minimize unnecessary applications of pesticides and fertilizer, enhancing the bottom line as well as minimizing environmental impacts. But additional incentives may exist for farms to invest in environmental management. For example, those producers who accurately anticipate regulations or changes in consumer tastes for food grown with environmentally friendly technologies could gain a competitive advantage in the marketplace. In other words, incentives facing agriculture are not that different from those facing other firms trying to plot a sustainable growth path.

Economic Advantage of Crop Residue Management

Specifically, ERS research found this to be true for U.S. corn producers who use crop residue management (CRM) to minimize damages from agricultural runoff. These producers enjoy a clear economic edge over non-CRM corn producers. The ERS study found that the average total resource cost (which includes land and operator labor costs as well as material inputs) across all farms producing corn was $1.78 per dollar of output. The average was 31 cents lower for CRM corn farms versus non-CRM corn farms. For more detailed information about this study, see www.ers.usda.gov/Amberwaves/April04/Features/BeyondEnvironmental.htm.

What is Crop Residue Management (CRM)?

Conventional or "clean tillage" practices turn over soil in order to clear away the remains of the previous crop and prepare the seedbed prior to planting. With CRM, the producer plants the new crop directly into residue from the previous crop. This practice has been used for several decades because it reduces planted areas and yields only slightly, yet significantly decreases soil loss and agricultural runoff relative to conventional tillage. Agricultural engineers estimate that soil erosion can be reduced by a third if 15 percent of afterharvest residue from corn is left on the field rather than turned under by tilling. Use of CRM sometimes requires higher pesticide use, in which case reduced soil erosion must be weighed against a greater potential for pesticide runoff.

A number of studies have noted that CRM tends to lower costs of labor, equipment, and fuel in corn production, and that these cost savings more than offset any declines in crop yields and/or the need for increased pesticide use. The gap in economic efficiency is observable not only at the mean, but among both lowest cost and highest cost farms as well. Of course, economic efficiencies vary widely among both adopters and non-adopters of CRM due to underlying differences in management and growing conditions. Along the full range of corn farms, those that employ CRM are more efficient than those that do not. In general, the gap in efficiencies between the two groups grows as total costs per dollar of output increase.

In the corn sector, many farmers are employing crop residue management practices voluntarily. Although, in part, CRM use is likely the result of the desire to maintain eligibility for farm program payments, CRM also brings demonstrable efficiency gains to farmers. So why have 40 percent of the corn farms sampled not adopted this technology? For one, farmers may consider the benefits small relative to other ways that can improve profitability. Moreover, year-to-year fluctuations in costs and returns may obscure the returns to CRM. The technology may also be less suited to some regions and soil types. In particular, CRM adoption rates have been lower in colder and wetter climates. However, ERS results indicate that even in these areas, corn producers adopting CRM on their corn acres were no less profitable than non-adopters.

Exploring Economic Benefits of No-Till and Conservation Buffers

In 2001, the Conservation Technology Information Center released an educational brochure titled *Economic Benefits with Environmental Protection: No Till and Conservation Buffers in the Midwest* (available at www.ctic.purdue.edu/ctic/final.pdf). This report explores how no-till and conservation buffers—especially when used together—have proven to be not only economically beneficial, but also efficient and effective tools for reducing erosion, protecting the quality of surface and ground water, and providing habitat for a variety of wildlife species.

Beyond Environmental Compliance: Stewardship as Good Business (continued)

The data behind the ERS survey, although extensive, are unfortunately not comprehensive enough to control for everything affecting farm profitability, and some of these factors could help explain non-adoption. Farmers ultimately make bottom line decisions in a context that includes not only market conditions but also regulations, voluntary incentive programs, and household goals and objectives. While the findings indicate that many farmers will choose to go beyond compliance with program requirements, whether most farmers go "far enough" to meet broader environmental objectives remains an open question.

[The article was excerpted with permission from the April 2004 issue of Amber Waves, a magazine published by the U.S. Department of Agriculture, Economic Research Service. To view the article in its entirety, see www.ers.usda.gov/Amberwaves/April04/Features/BeyondEnvironmental.htm. For more information, contact the authors: Jeffrey Hopkins at jhopkins@ers.usda.gov or Robert Johansson at rjohanss@ers.usda.gov.]

Notes on Education

Watershed Education Pays Off for the Hackensack River

Hackensack Riverkeeper's Eco-Programs generate funds by combining river recreation with watershed education. The Eco-Programs, which include Eco-Cruises (pontoon boat cruises), Eco-Paddles (guided paddling trips and canoe / kayak rentals) and Eco-Walks (guided naturalist hikes), provide the public with an up-close look at the lower Hackensack River and its watershed. Participants are asked to donate anywhere between $5 and $25 each, depending on the Eco-Program and the age and number of people taking part.

Hackensack Riverkeeper's pontoon boat sets out on an Eco-Cruise.

The lower Hackensack River wouldn't strike many people as the ideal location for a nature retreat. The 45-mile long river begins in southeastern New York State and flows across mostly suburban and urban northeastern New Jersey. Nearly 20 million people live within a short drive or train ride from its banks. Before the passage of the Clean Water Act in 1972, the river served as an open sewer for human and industrial wastewater, and its wetlands served as a regional garbage dump. Pollution from these activities remains buried in the sediments today and continues to seriously restrict the local fishery. The river's greatest ongoing pollution threat is nonpoint source pollution (trash and chemicals) carried by stormwater flowing off of lawns, parking lots, and streets. In the Hackensack watershed, as in most communities across the nation, local conservation groups like Hackensack Riverkeeper are leading the effort to educate the public about the value of their local water resource.

What is a Riverkeeper?

Hackensack Riverkeeper is part of the Waterkeeper Alliance, an international association that connects and supports local Waterkeeper programs (with names like Riverkeeper, Lakekeeper, Baykeeper, Coastkeeper, etc., depending on the type of water resource being protected). Waterkeepers provide a voice for waterways and their communities worldwide. For more information on Waterkeeper programs, see www.waterkeeper.org or refer to News-Notes Issue #69 at www.epa.gov/newsnotes/issue69/69issue.pdf.

Getting Back to Nature

Hackensack Riverkeeper's Eco-Programs are central to its mission to restore river-based recreation on the Hackensack and to educate visitors about the river, the impact of nonpoint source pollution, and ways they can help restore and protect it. "Eco-Program participants are often very surprised to find such a beautiful natural resource in this urban area," explained Captain Bill Sheehan, Hackensack Riverkeeper's executive director. "They learn about our efforts to protect the river and are motivated to help. Some actively contribute to making the river a nicer place by taking part in our river clean ups. Others recommend our Eco-Programs to their friends. Participation keeps growing every year."

This circle of success has generated more and more money for the Hackensack Riverkeeper. Last year, the Eco-Programs provided enough profit to fund an entire full-time staff position (approximately $40,000). "Our program more than pays for itself, plus we are able to educate countless people about the river," added Sheehan.

A004672

Raising the Visibility of the River

In 2004, Hackensack Riverkeeper reached almost 16,000 people through its Eco-Programs and public outreach efforts.

- More than 3,300 people participated in 208 Eco-Cruises on Riverkeeper's two specially rigged pontoon boats.
- More than 1,550 people paddled canoes or kayaks either on guided tours or by renting boats for independent exploration. Riverkeeper runs the only boat rental business on the Hackensack River.
- More than 750 people participated in 48 Eco-Walks.
- Volunteers provided nearly 1,100 hours during 12 river clean-ups. They removed trash from 17 miles of river—enough to fill 25 dumpsters.
- Hackensack Riverkeeper staff members, including dedicated AmeriCorps volunteers, had face-to-face encounters with approximately 10,000 people through presentations, seminars, and other special events.

Capt. Sheehan started the Eco-Cruise program in 1994 (three years before he founded Hackensack Riverkeeper) to supplement grassroots efforts to restore and protect the river. Since then, Riverkeeper and its programs have grown and expanded through many generous grants and donations, which help offset the cost of boats and staff time. Over the past ten years, both the river's water quality and Eco-Program participation rates have steadily improved, explains Hugh Carola, Hackensack Riverkeeper's program director. "Many people have told me how much cleaner the river has gotten over the past 10 years—so we are all doing something right." He attributes the improvements to a combination of factors: the Riverkeeper's river clean ups, their public education efforts on and off the river, outreach efforts by other local conservation organizations, more environmental education available in the schools, and more stringent stormwater regulations now in place for municipalities.

A group of kayakers enjoy a Hackensack Riverkeeper Eco-Paddle through marsh grasses.

Reaching Beyond the Locals

The Hackensack is no longer just for New Jersey residents. The number of Eco-Program participants from outside of the watershed is growing, notes Carola, "More tourists means more dollars being introduced into our local economy." He sees an increasing number of participants from New York City, located just across the Hudson River to the east. Hackensack Riverkeeper is working with local travel companies to establish Eco-Programs as an option in bus tour packages put together for people visiting New York City. "Many people stay in New Jersey to keep costs down. They opt to take bus tours to see the sights in New York City. We would like them to see the City one day, and then come visit us on another!"

Carola foresees that the Hackensack and the wetlands associated with it can become a bird-watchers and nature-lovers destination, bringing in extra tourist dollars. Recently a local land trust acquired the Empire Tract—587 acres of wetlands on the lower Hackensack River. The area will be turned into a nature preserve, pushing the dream of creating a major tourist destination a step closer to reality. In the meantime, Hackensack Riverkeeper's Eco-Programs will continue to educate and enthrall children and adults alike. Riverkeeper staff and supporters can be proud that their investment in education and outreach is paying such large returns for both the organization and the river itself.

Ecotourism Helping to Keep New Jersey Green—and in the Black

New Jersey's 39 state parks and 11 state forests provide economic benefits amounting to at least $1.2 billion per year, or $30 billion over a 25-year period, according to a study released in October 2004 by the NJ Department of Environmental Protection (DEP), Division of Science, Research, and Technology. The study, *The Economic Value of New Jersey State Parks and Forests*, highlights that the state's parks and forests create almost 14,000 jobs, positively impact property values, and provide enhanced public services including education. According to the study, New Jersey's parks and forests annually provide $812 million in benefits from recreation and tourism, including the indirect economic activity generated by recreation and tourism expenditures. In addition, the almost 400,000-acre park system annually provides benefits of $228 million from the operating and capital expenditures for the state parks and forests, including the indirect economic activity that those expenditures generate. Benefits worth at least $140 million are annually derived from the parks system's ecosystem services, such as watershed and groundwater protection, flood control, water purification, wildlife conservation, biodiversity preservation, and storage of carbon, the leading greenhouse gas.

"And that's really just the half of it here in New Jersey," said Hugh Carola, Hackensack Riverkeeper's program director. "In addition to state parks and forests, there are over 210,000 acres of state wildlife management areas, nearly 140,000 acres of federally protected lands, and thousands more acres of natural open space owned by counties, municipalities, and private conservancies – all of it helping the economy as well as the environment."

A soon-to-be-created nature preserve along the Hackensack River is expected to generate a tremendous amount of indirect economic activity from the "ripple effect" that will spread as a result of increased consumer spending related to ecotourism in the region. The effect is pretty simple: when nature preserve visitors purchase things like food, lodging, and gas, the local businesses that provide those goods make money as do their employees and suppliers. Everybody wins. For more information, see www.state.nj.us/dep/newsrel/2004/04_0121.htm.

[For more information contact Hugh Carola, Hackensack Riverkeeper, Inc., 231 Main Street, Hackensack, NJ 07601-7304; Phone: 201-968-0808; E-mail: hugh@hackensackriverkeeper.org; Web: hackensackriverkeeper.org.]

Environmental Education Provides Extensive Benefits

In February 2002 the Washington State legislature's House and Senate Education Chairs asked the Governor's Council on Environmental Education to review and report on the status of environmental education in Washington. Specifically, the request asked for an analysis of the current status, funding needs, and potential revenue sources for environmental education (EE). The resulting *Report Card on the Status of Environmental Education in Washington State* featured successful EE examples from around the state, and explored why these EE opportunities benefitted the students. The report concluded that, to maximize the benefits available from EE, Washington State needs to develop a better funded, more comprehensive approach to EE. To review the report, see http://wa.audubon.org/new/audubon/userdocuments/EEReportCard.pdf.

Reviews and Announcements

"After the Storm" Now Available for Local Broadcasts

A half-hour television special about watersheds and stormwater runoff is now available for broadcast on television stations or in classrooms. "After the Storm," co-produced by the U.S. Environmental Protection Agency and The Weather Channel, explores how polluted runoff threatens the nation's waters. EPA now owns full rights to "After the Storm" and is making the TV show available to the public for free. EPA encourages watershed groups and others to work with their local cable and other TV stations to air the half-hour program (22 minutes without commercial breaks). The program can be used by communities to educate citizens as part of their stormwater management program. Copies are available by contacting the National Service Center for Environmental Publications (NSCEP) at 513-489-8190 or 800-490-9198 or by sending an e-mail to ncepimal@one.net. Please request "After the Storm," refer to document number EPA 840-V-04-001, and specify VHS or Beta SP (for cable and other TV stations) format. For more information, visit www.epa.gov/weatherchannel/.

BASINS 3.1 Water Quality Model Released

EPA just released the newly updated Better Assessment Science Integrating point and Nonpoint Sources (BASINS) software system. BASINS is multi-purpose environmental analysis system that integrates a geographical information system (GIS), national watershed data, and state-of-the-art environmental assessment and modeling tools into one convenient package. Like the previous release, the new BASINS 3.1 includes a data extractor, geographic coordinate projector, project builder, GIS interface, various GIS-based tools, a series of models, and custom databases. But instead of including the data on multiple CDs as in version 3.0, data are now available entirely through a web data extraction tool. This web data extractor provides a tool for dynamic downloading of GIS data and databases from the BASINS web site and a variety of other sources. This feature will help ensure that BASINS users are working with the most up-to-date data sets for their projects. Other significant enhancements in version 3.1 include updated data holdings, a new tool to archive and restore BASINS projects, a tool to update the BASINS software interactively, and several new modeling capabilities. For more information, and to download BASINS 3.1, visit www.epa.gov/waterscience/basins.

DoD LID Design Manual Unveiled

In October 2004, the Department of Defense (DoD) published *Design: Low-Impact Development Manual* (document number UFC 2-210-10). This manual was created as part of the Unified Facilities Criteria (UFC) document series that provides planning, design, construction, sustainment, restoration, and modernization criteria for military departments, defense agencies, and DoD field activities. The Low-Impact Development (LID) manual provides guidance for integrating LID planning and design into a facility's regulatory and resource protection programs, and is one of three accepted standard approaches for designing and building DoD projects. The document is available for download at www.ccb.org/docs/UFC/3_210_10.pdf.

Economic Valuation of Wetlands Paper Now Online

In this paper, titled *Economic Valuation of Wetlands: an Important Component of Wetland Management Strategies at the River Basin Scale*, author Alain Lambert defines economic valuation and discusses the most common quantitative wetland evaluation methods used. The paper was developed for the May 2003 Ramsar Convention on Wetlands and is available for viewing at www.ramsar.org/features_econ_val1.htm.

EPA Report Reviews Economic Benefits of Runoff Control

Available at www.epa.gov/nps/runoff.html, this 1995 EPA report describes how certain urban runoff management controls can be incorporated into a development in a way that provides aesthetic and economic benefits.

Guidebook Reveals the Economic Value of Protecting the Great Lakes

Revealing the Economic Value of Protecting the Great Lakes, published in 2001 by the Northeast Midwest Institute, presents economic analysis of environmental benefits in the Great Lakes region. The guidebook describes how economic benefits assessment ties into environmental regulations and decision-making in the Great Lakes region and nationally, the various methods available for accounting of environmental benefits, and case studies illustrating each method. The report is available for download at www.nemw.org/GLEconVal.pdf.

Reports Review Value of Wetlands

Dr. Richard Kazmierczak of Louisiana State University's Agricultural Center compiled results from existing wetland values studies into a series of three reports. The following reports, available for download at www.agecon.lsu.edu/faculty_staff/FacultyPages/Kazmierczak, provide estimates of wetland values for habitat protection, water quality, and hunting and fishing.

(1) *Economic Linkages Between Coastal Wetlands and Habitat/Species Protection: A Review of Value Estimates Reported in the Published Literature* (2001), summarizes eight peer-reviewed studies published from 1975 to 2001, reporting 24 separate estimates for the value of habitat and species protection services provided by coastal and non-coastal wetlands (file name: SP2001-04_Habitat.pdf).

(2) *Economic Linkages Between Coastal Wetlands and Water Quality: A Review of Value Estimates Reported in the Published Literature* (2001), summarizes 12 peer-reviewed studies, published from 1981 to 2001, reporting 28 separate estimates for the value of water quality services provided by coastal and non-coastal wetlands (file name: SP2001-02_Water_Quality.pdf).

(3) *Economic Linkages Between Coastal Wetlands and Hunting and Fishing: A Review of Value Estimates Reported in the Published Literature* (2001), summarizes 12 peer-reviewed studies, published from 1978 to 2001, reporting 32 separate estimates for the value of hunting and fishing services provided by coastal and non-coastal wetlands (file name: SP2001-03_Fishing.pdf).

Source Water Protection Handbook Now Available

This handbook, *Source Protection: Using Land Conservation to Protect Local Drinking Water Supplies*, provides local governments, water suppliers and agencies, and community drinking water advocates with the tools to identify source water conservation opportunities, implement funded source water conservation programs, and acquire and protect the lands that will help keep drinking water clean. The 88-page spiral-bound publication was produced by the Trust for Public Land (TPL) and the American Water Works Association (AWWA), and can be purchased for $25 on TPL's Web site (www.tpl.org). The first chapter is available for free download for a limited time at http://tpl.org/content_documents/TPLSPH_chapter1.pdf.

Will Water Quality Trading Advance Your Watershed's Goals?

EPA has just released a new publication: *Water Quality Trading Assessment Handbook: Can Trading Help Advance Your Watershed's Goals?* The handbook is intended to help users evaluate whether the circumstances in a particular watershed make it likely or unlikely that trading can be effectively implemented on a watershed basis to address existing water quality problem(s). Water quality professionals and stakeholders are increasingly interested in water quality trading, but need assistance answering questions such as "How do you know when and where trading is the right tool?" and specifically, "Will water quality trading work in this watershed?" The handbook helps to answer these questions for any given watershed, providing a simplified analytical framework that can be used to assess the conditions and water quality problem(s) in a watershed and determine whether trading might be effectively used to meet TMDL allocations or other pollutant "caps." The handbook and fact sheet are available in PDF format at www.epa.gov/owow/watershed/trading/handbook. Hard copies may be ordered free of charge from the National Center for Environmental Publications at 800-490-9198 or www.epa.gov/ncepihom (document number EPA 841-B-04-001).

WWF Report Explores Economic Values of the World's Wetlands

This 32-page report, prepared in 2004 by the World Wildlife Fund with support from the Swiss Agency for the Environment, Forests, and Landscape, explores the economic value of global wetlands. The report is available for download at http://panda.org/downloads/freshwater/wetlandsbrochurefinal.pdf.

Recent and Relevant Periodicals Articles

Downstream Economic Benefits from Storm-Water Management

The November/December 2004 issue of the *Journal of Water Resources Planning and Management* features this article by J. B. Braden and D. M. Johnston. The authors assessed the downstream economic consequences of incorporating onsite water retention development designs. They concluded that onsite retention provides valuable downstream services, including flood mitigation and water quality protection. These services increased downstream floodplain property values – by up to five percent for flood mitigation and up to 15 percent for improved water clarity. The authors estimate the total average benefits to floodplain property owners to be two to five percent of property value. See http://ascelibrary.aip.org/wro for a complete abstract.

Economic Value of Lakes

In Fall 2003, the North American Lake Management Society devoted an entire issue of their *LakeLine* magazine to the "Economic Values of Lakes." See www.nalms.org/lakeline/ll23-03.htm for issue content and ordering information.

Limiting Dead Zones

The June 12, 2004 (Vol. 165, No. 24 , p. 378) issue of *Science News Online* features this article by Janet Raloff. She discusses the cause and economic and ecological impacts of the Gulf of Mexico's "dead zones"—areas that become devoid of oxygen and life because of nutrient pollution. Raloff discusses a number of ongoing efforts to curb nutrient pollution in the Mississippi River watershed, including:

- Offering farmers insurance to reduce the amount of nitrogen they apply to their crops—farmers receive compensation if their yields suffer as a result. (For an example of a BMP insurance program, see the article "Ensuring Economic Returns in the Mad River Watershed," located earlier in this issue.)
- Implementing controlled drainage, allowing farmers to reduce the amount of water flowing from fertilized fields
- Diversifying crops to create field cover year-round
- Implementing "nutrient farming," the practice of renewing or creating wetlands to soak up nitrate from the water column.

See: www.sciencenews.org/articles/20040612/bob9.asp.

Natural Capital

The Winter 2005 issue of American Forest's quarterly newsletter, *American Forests*, features this article by Todd Wilkinson. Wilkinson discusses the economic and social values of nature, and notes the growing awareness that forests and trees provide untold economic benefits related to water quality protection and wildlife habitat. He highlights a number of communities that are focusing on forest preservation and urban forest renewal to help manage stormwater, protect wildlife, and save money on water treatment. See www.americanforests.org/productsandpubs/magazine/archives for a copy of the article.

Reengineering the Mississippi

The July 2004 issue of *Civil Engineering Magazine* features this article by Dominic Izzo, P.E., the principal Deputy Assistant Secretary of the Army for Civil Works from 2001 to 2002. Izzo discusses the economic and ecological ramifications of the shrinking of the Mississippi River Delta, attributed largely to the removal of sediment from the water column by dams located along the river. He describes the need to implement the 30-year, $14 billion comprehensive Louisiana Coastal Area Program to reverse the damage and avoid the need to spend more than $100 billion in infrastructure alone over 30 years. See: www.pubs.asce.org/ceonline/ceonline04/0704feat.html.

Streambank Stabilization: An Economic Analysis from the Landowner's Perspective

The November/December 2004 (Vol. 59, No.6) issue of the *Journal of Soil and Water Conservation* features this article by J.R. Williams, P.M. Clark, and P.G. Balch. The authors performed an economic analysis of streambank stabilization projects on the Little Blue River in Washington County, Kansas. The results show each project offers annual values ranging from $126 to $1,760 with an average of $781. Cost share payments are important for the landowner to benefit from the projects. For a complete abstract, see www.swcs.org/en/publications/jswc/abstracts_and_archives/2004_abstracts/ and click on the link for "Nov-Dec 2004."

Successful Watershed Management

The July/August 2004 (Vol. 59, No. 4) issue of the *Journal of Soil and Water Conservation* features a guest editorial by G. Tracy Mehan, III, a former assistant administrator for Water at the U.S. Environmental Protection Agency. Mehan discusses the water quality improvement over the past 30 years, explores current water quality challenges presented by nonpoint source pollution, and emphasizes the importance of properly pricing and investing in the nation's water infrastructure (pipes and treatment plants). To underscore how undervalued water infrastructure is in the United States, Mehan cites that U.S. households spend an average of $707 per year on soft drinks and other beverages, compared to an average of $474 per year on drinking water and wastewater charges. For information on obtaining a copy of the publication, see www.swcs.org/en/publications/jswc.

Web Sites Worth a Bookmark

Economic Research Service (ERS)

www.ers.usda.gov. The ERS is the main source of economic information and research from the U.S. Department of Agriculture. ERS research informs and enhances public and private decision-making on economic and policy issues related to agriculture, food, natural resources, and rural development. In particular, the ERS offers in-depth discussions of topics such as irrigation and water use, land use, manure management, organic agriculture and production, rural amenities and urbanization, soil conservation, water quality, wetlands, and wildlife.

Ecosystem Valuation

www.ecosystemvaluation.org. This Web site describes how economists value the beneficial ways that ecosystems affect people. The site is designed for non-economists who need answers to questions about benefits of ecosystem conservation, preservation, or restoration. It provides a clear, non-technical explanation of ecosystem valuation concepts, methods, and applications.

Environmental Valuation and Cost Benefit News

www.cost-benefit.com. This online news resource posts legal, academic, and regulatory developments pertaining to the valuation of environmental amenities and disamenities, such as clean air, trees, parks, congestion, and noise. All stories include actual cost, benefit, or damage estimates.

EPA's National Center for Environmental Economics

http://yosemite.epa.gov/ee/epa/eed.nsf/pages/homepage. NCEE analyzes relationships between the economy, environmental health, and environmental pollution control. The Center investigates economic benefits and costs; economic incentives; size, composition, and effects of the pollution control industry; and risk assessment data used in economic analyses. This site offers publications, information about job and grant opportunities, events, and links to other environmental economic information on the Web.

NEMO Impervious Surfaces Web Page

http://nemo.uconn.edu/impervious_surfaces. This Nonpoint Education for Municipal Officials (NEMO) site provides resources and links pertaining to impervious surfaces. The site provides introductory and other educational material on impervious surfaces and offers techniques for measuring, estimating and mapping impervious surfaces. Land cover data is available for Connecticut.

Calendar

The calendar is prepared with the cooperation of our readers. If you would like a meeting or event posted, please e-mail forshee.carol@epa.gov.

For an updated events calendar, see www.epa.gov/newsnotes/calendar.htm.

May 2005

9-11	*RIVERMorph Software Training,* Carolina Beach, North Carolina. For more information see www.rivermorph.com/training.
9-13	*EPA's Water Quality Standards Academy,* Washington, DC. For more information, see www.glec-online.com/form.htm.
11	*Introduction to the Safe Drinking Water Act – Web conference* (for federal and state drinking water staff). For more information, contact the Drinking Water Academy at dwaweb.conference@epa.gov.
11-13	*Tribal Nonpoint Source Program Workshop,* Palm Springs, CA. For more information, call Stacie Craddock at 202-566-1204 or e-mail craddock.stacie@epa.gov.
16-18	*2005 EPA Science Forum: Collaborative Science for Environmental Solutions,* Washington, DC. For more information, see www.epa.gov/ord/scienceforum.
17-18	*Getting in Step with Phase II: A Workshop for Stormwater Program Managers,* Memphis, TN. For more information, visit www.epa.gov/npdes/gettinginstepwithphase2.
24-26	*New England Interstate Water Pollution Control Commission's 16th Annual Nonpoint Source Pollution Conference,* Bretton Woods, New Hampshire. For more information see www.neiwpcc.org/npsannualmeeting.htm.

June 2005

5-10	*The South Atlantic Chapter of the Society of Wetland Scientists' 26th Annual International Wetlands Meeting,* Charleston, SC. For more information, see: www.sws.org/charleston2005.
8-10	*Susquehanna River Basin Commission's 2005 Riverfront Symposium,* Harrisburg, PA. For more information, see http://srbc.net/RiverfrontSymposium.htm.
11-17	*Association of State Floodplain Managers' 2005 Annual Conference,* Madison, Wisconsin. For more information, see www.floods.org.
12-15	*Ninth North American Agroforestry Conference: "Moving Agroforestry into the Mainstream,"* Rochester, Minnesota. For more information, see http://cinram.umn.edu/afta2005.
12-16	*American Water Works Association's 124th Annual Conference and Exposition,* San Fransisco, CA. For more information, see www.awwa.org/ace2005.
27-29	*Institutions for Sustainable Watershed Management: Reconciling Physical and Management Ecology,* Honolulu, HI. For more information, see www.awra.org/meetings/Hawaii2005.

July 2005

9-11	*Managing Watersheds for Human and Natural Impacts: Engineering, Ecological, and Economic Challenges,* Williamsburg, VA. For more information, see www.asce.org/conferences/watershedmanagement2005.
12-14	*River and Lake Restoration - Changing Landscapes,* Portland, Maine. For more information, see www.ucowr.siu.edu/05CoP.pdf.
31	*Watershed Planning: Blueprint for Action!* (Part of the Soil and Water Society's Annual Conference in Rochester, NY). For more information, see www.swcs.org.

August 2005

3-4	*Getting in Step with Phase II: A Workshop for Stormwater Program Managers,* Indianapolis, IN. For more information, visit www.epa.gov/npdes/gettinginstepwithphase2.

Contribute to Nonpoint Source News-Notes

Do you have an article or idea to share? Want to ask a question or need more information? Please contact NPS News-Notes, c/o Carol Forshee, by mail at U.S. EPA, Mail Code 4503-T, 1200 Pennsylvania Ave., NW, Washington, DC 20460, by phone at 202-566-1208, or by e-mail at forshee.carol@epa.gov.

Disclaimer of Endorsement

Nonpoint Source News-Notes is produced by the U.S. Environmental Protection Agency, with support from Tetra Tech, Inc. Mention of commercial products, publications, or Web sites does not constitute endorsement or recommendation for use by EPA or its contractors, and shall not be used for advertising or product endorsement purposes.

EPA
United States
Environmental Protection Agency
(4503T)
Washington, DC 20460

Official Business
Penalty for Private Use $300

First Class Mail
Postage and Fees Paid
EPA
G-35

A004680

MOORPARK Acorn
Serving Moorpark and the surrounding areas

Other Publications
The Acorn
Thousand Oaks Acorn
Simi Valley Acorn

News
Front Page
Community
Health & Wellness
Bulletin Board
Business
Sports
Faith
On The Town
Letters
Editorials
Archive
Contact Us
Advertising
Nutshell
Classifieds
Classified Order
Real Estate
Moorpark Acorn
Shopping Page
ch Archive

Search

E-mail Us

Editorials

December 2, 2005

Ventura County falls far short of goals on affordable housing

Disturbing news came to light recently from the Cabrillo Economic Development Corp., a nonprofit affordable housing developer based in Ventura County. Cabrillo produced a study showing that construction for lowto moderate-income homes in the area has been significantly lacking—and that too much attention has been focused on the construction of new homes for the wealthy.

The Cabrillo study showed that only about one-third of the units needed for low-income buyers over the past decade were actually built. By comparison, the homes built for upper-income families exceeded projected needs by 28 percent.

The study covered a period from 1990 to 2000, but judging from the plethora of new expensive homes in the area—from Moorpark west to Simi Valley—it's hard to imagine that the last five years have shown much improvement. The housing needs for lowto moderate-income families simply are *not* being met.

The housing imbalance is no surprise. Market forces governing home prices since 1999 have shown little mercy, and many would-be homebuyers have been left out in the cold.

Rising prices make new home construction highly profitable for builders. And who can blame them? For years, they've faced stifling constraints and regulations—and a depressed market in the early '90s drove many out of business. It's their day in the sun and they should be congratulated for their role in the real estate boom.

The construction of affordable homes, however, has nothing to do with the forces of the market. Affordable housing is a social policy decision, one that only works when it's imposed upon developers.

True, there are some local affordable housing ordinances on the books, but the laws focus on areas such as mortgage buydown programs and in-lieu developer fees that can be used, for example, to help an existing homeowner repair his leaky roof. This approach is like using a pop-gun to shoot an elephant.

When was the last time an upscale city such as Simi Valley, Moorpark or Thousand Oaks actually used its developer kitty to build an affordable housing project?

We can't keep sending average wage earners to live somewhere else. This is their community, too.

A004682

The Acorn
Serving Agoura Hills, Calabasas, Hidden Hills, Oak Park, North Ranch, and Westlake Village

Other Publications
Thousand Oaks Acorn
Moorpark Acorn
Simi Valley Acorn

Marketplace: Shopping Going Out Health Faith Youth Real Estate

News
Front Page
Community
Health & Wellness
Bulletin Board
Schools
Sports
Pets
Police
Faith
On The Town
Motoring
Letters
Columns
Editorials
Archive
Contact Us
Advertising
Nutshell
Classifieds
;ified Order
rch Archive

Search

E-mail Us

Front Page

February 14, 2002

Experts say Ventura County down, not out
By John Loesing
Acorn Staff Writer

Southern California and Ventura County have weathered the recession better than the rest of the country, according to a forecast by economic experts last week, but a slowdown in jobs and spending may put a damper on retail activity and home sales in the area.

"[Home sales] are still at what we consider very strong levels," said state Controller Kathleen Connell, keynote speaker at the 2002 Ventura County Real Estate and Economic Conference in Westlake Village, but she warned homeowners to be "cautious."

"The run-up in home prices may not be able to be sustained," Connell said.

Ventura County's median home sales price of $312,500 increased 5.5 percent last year, 2 percent below the state average.

The single-family homes of Westlake Village remained the highest in the county.

Mark Schniepp, whose Santa Barbara-based California Economic Forecast prepared the 50-page forecast, said a tight housing supply from Conejo Valley to Ventura will keep existing home values intact.

"Average and media home selling prices have risen sharply since 1996 and now stand at all-time record highs," Schniepp said. "Not enough homes are being built in the county and not enough inventory of for-sale homes will be forthcoming."

The average selling price of new homes—most of them in Thousand Oaks—rose 10.4 percent in 2001 to $433,300.

"In the next few years, local governments in Ventura County will be faced with a difficult choice," said William Fulton, a public policy research specialist. "Either find ways to increase the amount of housing constructed inside SOAR boundaries or else change those boundaries to accommodate housing demand."

SOAR [Save Open space and Agricultural Resources] was the 1998 county initiative limiting new home construction.

A004683

Fulton said Ventura County will "run out" of residential land before SOAR sunsets in 2020. Demand will exceed supply over the next three years by 60,000 homes, he said.

Because of the tight single family housing market, apartment rents remain high. Thousand Oaks has the county's highest average rent at $1,298 a month.

While the Bay Area economy has been hit hard by the dot-com bust, Southern California remains resilient because of an up tick in defense and entertainment spending, Connell said. Film producers who left Los Angeles for greener pastures in Canada have returned because of a travel scare from the Sept. 11 terrorist attacks.

Connell said the state's recession is "momentary" and "nowhere near" the extended recession of the early 1990s.

"We believe we are in a V-shaped recession in California and the bottom occurred in December ... People still come to California looking for the dream, so when the rest of country begins tanking people come west."

Schniepp, a consultant to Connell, said that while the Ventura County economy remains healthy overall, he anticipates "sluggish" business activity until mid-year.

"We expect a slowing of the principal indicators of economic activity including job growth, per capital income growth and consumer spending," Schniepp said. "The spending will be felt most acutely in the retail sector."

The county's non-farm employment figure is on the decline for the first time in five years, according to Schniepp's report.

Connell said California would lose 80,000 jobs this year and that the loss in income tax revenue will be devastating to the state budget. She said the so-called "white collar recession" has lopped $1.3 billion off January receipts alone.

The biggest culprit has been Silicon Valley, which accounted for 70 percent of the state's budget surplus last year. Because of the tech meltdown, California's budget now faces a $12 billion shortfall.

Capital gains will provide only 7 percent of the state's tax revenue, the controller's office predicts, down from 30 percent the year before.

Connell also said she'd try to protect employee retirement funds in California from another occurrence like Enron. She said employees shouldn't be "forced to invest" more than 15 percent of their 401K retirement in company stock.

Connell closed her comments by criticizing California's investment in long term energy contracts, required because of last year's energy crisis.

"We are paying for energy that we don't need at prices that are four, five, six times higher than the market," she said. "This is going to be a binder that will shadow California's economy for the next 10 years."

The Residential Economic Review is a quarterly report that presents jobs-to-housing ratios, housing cost-to-income ratios, a composite index of leading indicators, and new housing sales and price appreciation projections for major California new home markets.

Annual subscriptions to this report are a nominal cost of $195. Included in an annual subscription are 4 quarterly issues, which are released in January, April, July and October. Single issues are available at a cost of $49. Current subscribers to The *Residential Economic Report* will receive this report at no charge. To subscribe to this report, please create an account at our web site, www.realestateeconomics.com, or contact Steven Guerrero, Director of Marketing for further information at 949-363-9951, or via email at steveng@realestateeconomics.com

A NOTE REGARDING RECENT DATA REVISIONS

It should be noted that assessed market conditions and forecasts shown in this report are largely based upon job growth data supplied by California's Employment Development Department (EDD). The EDD has recently re-benchmarked job figures, resulting in revisions all the way back to 1996. A comparison of former and re-benchmarked data is shown below:

Ventura County Nonagricultural Job Estimates By The EDD			
Month/Year	Based on 3/00 Benchmark	Based on 3/01 Benchmark	Difference
Jan-01	275,900	276,700	800
Apr-01	278,700	279,600	900
Jul-01	279,800	281,200	1,400
Oct-01	278,200	281,200	3,000

Surprisingly, Ventura County job forecasts were actually revised upward by the EDD. The benefit to the model is actually offset by a severe downward adjustment in Los Angeles County job estimates. These revisions in Ventura and Los Angeles Counties job estimates change the results of our model, slightly reducing our sales forecast from that presented in the previous issue (because of job loss in Los Angeles County). We, like all other analysts, are at the mercy of the EDD's changes. Incorporation of these changes act as a break in the data series from those presented in previous issues.

JOBS-TO-HOUSING

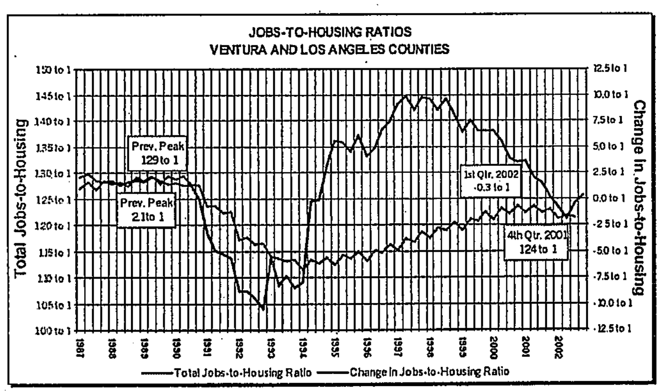
Because of its proximity to Los Angeles County, Ventura County's new housing market is actually more dependent upon the Los Angeles economy than the indigenous economy. The table below arrays employment trends in Ventura and Los Angeles Counties since 1989:

Month/Year	Ventura County: Total Jobs	Ventura County: 12 Mo. Change #	Ventura County: 12 Mo. Change %	Ventura County: Jobless Rate	Los Angeles County: Total Jobs	Los Angeles County: 12 Mo. Change #	Los Angeles County: 12 Mo. Change %	Los Angeles County: Jobless Rate
	For the Month of March							
Mar-89	216,500		-	3.9%	4,121,200	-	-	4.9%
Mar-90	227,700	11,200	5.2%	4.0%	4,176,000	54,800	1.3%	5.4%
Mar-91	229,900	2,200	1.0%	6.8%	4,012,400	-163,600	-3.9%	6.9%
Mar-92	226,200	-3,700	-1.6%	7.2%	3,840,500	-171,900	-4.3%	9.0%
Mar-93	226,800	600	0.3%	8.1%	3,725,000	-115,500	-3.0%	10.4%
Mar-94	230,700	3,900	1.7%	7.4%	3,704,700	-20,300	-0.5%	9.8%
Mar-95	236,700	6,000	2.6%	6.3%	3,747,000	42,300	1.1%	7.5%
Mar-96	236,700	0	0.0%	6.3%	3,776,000	29,000	0.8%	8.5%
Mar-97	240,500	3,800	1.6%	5.6%	3,854,400	78,400	2.1%	7.0%
Mar-98	247,700	7,200	3.0%	4.9%	3,930,600	76,200	2.0%	6.4%
Mar-99	257,600	9,900	4.0%	4.4%	3,980,600	50,000	1.3%	5.9%
Mar-00	270,500	12,900	5.0%	3.9%	4,063,400	82,800	2.1%	5.3%
Mar-01	279,000	8,500	3.1%	3.6%	4,115,200	51,800	1.3%	4.9%
Mar-02p	280,200	1,200	0.4%	4.6%	4,073,000	-42,200	-1.0%	6.5%
Mar-03p	282,600	2,400	0.9%	4.9%	4,110,700	37,700	0.9%	6.9%

Source: Real Estate Economics; State of California Employment Development Dept.

Job growth has slowed in Ventura County, and has turned negative for Los Angeles County. The projection for March 2003 actually reflects the beginnings of recovery. During 2nd quarter 2002, job change is expected to continue to decline in both Counties. By mid-year 2002, an upward trend in job growth should become apparent, though it will remain modest during Year 2002.

Jobs-to-housing ratios are shown graphically in the chart below:



The 1st quarter total jobs-to-housing ratio (red curve) of 1.24 is lower than the previous peak ratio of 1.29 that existed in Ventura County and Los Angeles County during Year 1989. The change in jobs-to-housing ratio (blue curve) has been falling in recent quarters, to a current level of 0.30 jobs lost for every home built in the current quarter. During 2nd quarter 2002, this ratio is forecast to bottom, then start trending upward. The change in this ratio leads changes in the new home market, and the impact has yet to filter to the new home market. It will soon, resulting in slower market conditions during the Summer of 2002.

Despite the damage to the jobs-to-housing ratios, the economic foundation in Ventura County remains sufficiently strong to support its own housing stock, but will continue to experience reduced support from Los

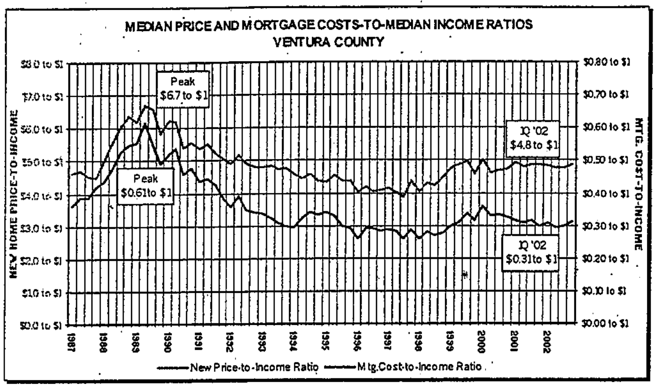
A004586

VENTURA COUNTY RESIDENTIAL ECONOMIC REVIEW – 2nd Qtr 2002 TO 1st Qtr 2003

Angeles County, and will offer less upward pressure on new home prices during Year 2002.

HOUSING COSTS-TO-INCOME

The trends and projections of the above ratios are shown graphically in the chart below:



As shown, the current ratio between median new home prices and household incomes (shown by the red curve) is $4.80 - still well below the previous peak ratio of $6.70 set in 1989. The current ratio between mortgage costs and incomes is $0.31 (shown by the blue curve), which remains well below the peak ratio of $0.61 set in 1989.

Of the two ratios shown above, the more important is the mortgage cost-to-income ratio, which is directly impacted by interest rates. The recent decline in interest rates during Year 2001 has actually resulted in much improved value positioning relative to Year 2000.

COMPOSITE INDEX OF LEADING INDICATORS

An index for each of the above-mentioned ratios was created by applying the ratios for individual years to the long-term median of ratios. By weighing each of the resultant indexes, a composite index of leading indicators was created which effectively describes new housing market conditions the year following the index. The composite index of leading indicators is shown below:

Qtr. or Year	INDEXES OF LEADING INDICATORS: Total Jobs-to Housing* (Weight 45%)	Change in Jobs-to Housing* (Weight 5%)	Price-to-Income (Weight 20%)	Cost-to-Income (Weight 30%)	Weighted Composite Index	The Following Year's New Housing Market Conditions Will Be:
1989	104.0	100.0	75.5	63.5	86.0	Weak
1990	104.6	39.8	81.7	67.8	85.7	Weak
1991	100.9	-268.3	90.4	78.0	73.5	Very Weak
1992	96.4	-520.9	96.7	95.1	65.2	Very Weak
1993	94.1	-396.3	100.0	107.5	74.8	Very Weak
1994	94.0	2.9	106.3	100.0	93.7	Moderate
1995	95.1	335.0	107.6	111.2	114.5	Strong
1996	96.1	320.5	116.7	113.5	116.7	Strong
1997	98.0	503.9	116.4	121.6	129.0	Strong
1998	100.0	511.5	111.7	123.3	129.9	Strong
1999	101.6	356.0	99.9	103.1	114.4	Strong
2000	103.4	272.0	100.7	99.5	110.1	Strong
2001e	103.9	71.3	98.2	108.3	102.5	Strong
2002p	103.2	-73.1	99.6	110.7	95.9	Moderate
02 1e	94.6	-44.6	99.1	108.9	92.8	Moderate
2p	95.1	-107.0	100.7	113.4	91.6	Moderate
3p	94.8	-26.4	100.3	112.9	95.2	Moderate
4p	95.7	17.1	98.3	107.9	95.9	Moderate
03 1p	94.7	81.7	97.4	105.8	97.9	Moderate

Note: Index numbers above 100 denote stronger market conditions the following year.
Note: Index numbers below 100 denote weaker market conditions the following year.

Source: Real Estate Economics; County Assessors Office; Bureau of the Census;Real Estate Research Council; Dept. of Labor; Dept. of Finance.

In the table above, the composite indexes above 100 represent especially strong employment growth and/or under-valued housing prices and costs relative to income, leading to strong market conditions the year following the index. Years where the index falls below 100 indicate years where employment growth was low or negative and/or housing prices and costs were overstated, leading to weaker market conditions the following year.

FORECAST NEW HOUSING SALES AND PRICES

The table below arrays a numeric comparison of actual sales and estimates, and presents a forecast of new housing sales in Ventura County for the next four quarters:

12 Month Period (Qtr. to Qtr.)	Actual New Home Sales	Forecast New Home Sales	Difference No.	Difference %
1st Qtr 97 to 4th Qtr 97	2,083	1,850	(233)	-11.2%
2nd Qtr 97 to 1st Qtr 98	2,026	1,790	(236)	-11.6%
3rd Qtr 97 to 2nd Qtr 98	1,863	1,860	(3)	-0.2%
4th Qtr 97 to 3rd Qtr 98	2,001	1,950	(51)	-2.5%
1st Qtr 98 to 4th Qtr 98	2,000	2,020	20	1.0%
2nd Qtr 98 to 1st Qtr 99	2,085	2,130	45	2.2%
3rd Qtr 98 to 2nd Qtr 99	2,247	2,220	(27)	-1.2%
4th Qtr 98 to 3rd Qtr 99	2,050	2,300	250	12.2%
1st Qtr 99 to 4th Qtr 99	2,265	2,400	135	6.0%
2nd Qtr 99 to 1st Qtr 00	2,273	2,420	147	6.5%
3rd Qtr 99 to 2nd Qtr 00	2,174	2,370	196	9.0%
4th Qtr 99 to 3rd Qtr 00e	2,150	2,320	170	7.9%
1st Qtr 00 to 4th Qtr 00	2,223	2,340	117	5.3%
2nd Qtr 00 to 1st Qtr 01	2,187	2,350	163	7.5%
3rd Qtr 00 to 2nd Qtr 01	2,336	2,350	14	0.6%
4th Qtr 00 to 3rd Qtr 01	2,490	2,370	(120)	-4.8%
1st Qtr 01 to 4th Qtr 01	2,328	2,270	(58)	-2.5%
2nd Qtr 01 to 1st Qtr 02e	2,335	2,190	(145)	-6.2%
3rd Qtr 01 to 2nd Qtr 02f		*2,130*		
4th Qtr 01 to 3rd Qtr 02f		*2,110*		
1st Qtr 02 to 4th Qtr 02f		*2,230*		
2nd Qtr 02 to 1st Qtr 03f		*2,390*		

Source: Real Estate Economics; County Assessors Office; Real Estate Research Council of Southern California 'or the next four quarters, the forecast level of new ıousing sales (closed escrows) is 2,390 homes. The forecast is slightly lower than that presented in the previous issue due to re-benchmarked job estimates and job loss in Los Angeles County.

Given recent annual trends, the 2,390-unit sales forecast is a realistic expectation for the next four quarters. This forecast, however, would be much higher if a wider spectrum and a greater supply of new housing product were made available in Ventura County. Given recent land prices, it will become increasingly difficult for builders to supply lower priced, entry-level product unless densities are increased. Densities are being increased in some markets of Ventura, which will improve affordability, but price exclusion and restricted supply levels will combine with short-term market disruption to continue to hamper the volume of new housing sales during the next four quarters.

The table below arrays a numeric comparison of actual new home price averages with modeled estimates, and presents a forecast of new housing prices in Ventura County for the next four quarters:

12 Month Period (Qtr. to Qtr.)	Actual Av. New Home Price('00$)	Forecast New Home Price('00$)	12-Month Change in Prices	Difference No.	Difference %
1st Qtr 97 to 4th Qtr 97	$296,072	$294,500	5.8%	($1,572)	-0.5%
2nd Qtr 97 to 1st Qtr 98	$298,515	$299,250	4.4%	$735	0.2%
3rd Qtr 97 to 2nd Qtr 98	$307,476	$308,500	7.3%	$1,024	0.3%
4th Qtr 97 to 3rd Qtr 98	$317,417	$318,250	10.6%	$833	0.3%
1st Qtr 98 to 4th Qtr 98	$322,323	$328,000	8.9%	$5,677	1.7%
2nd Qtr 98 to 1st Qtr 99	$337,788	$343,500	13.2%	$5,712	1.7%
3rd Qtr 98 to 2nd Qtr 99	$351,293	$361,000	14.3%	$9,707	2.7%
4th Qtr 98 to 3rd Qtr 99	$368,477	$372,750	16.1%	$4,273	1.1%
1st Qtr 99 to 4th Qtr 99	$374,058	$378,250	16.1%	$4,192	1.1%
2nd Qtr 99 to 1st Qtr 00	$381,991	$380,000	13.1%	($1,991)	-0.5%
3rd Qtr 99 to 2nd Qtr 00	$378,969	$374,500	7.9%	($4,469)	-1.2%
4th Qtr 99 to 3rd Qtr 00e	$374,303	$372,250	1.6%	($2,053)	-0.6%
1st Qtr 00 to 4th Qtr 00	$377,131	$374,000	0.8%	($3,131)	-0.8%
2nd Qtr 00 to 1st Qtr 01	$373,602	$375,250	-2.2%	$1,648	0.4%
3rd Qtr 00 to 2nd Qtr 01	$376,503	$377,500	-0.7%	$997	0.3%
4th Qtr 00 to 3rd Qtr 01	$377,057	$380,000	0.7%	$2,943	0.8%
1st Qtr 01 to 4th Qtr 01	$384,102	$381,750	1.8%	($2,352)	-0.6%
2nd Qtr 01 to 1st Qtr 02e	$386,119	$383,000	3.4%	($3,119)	-0.8%
3rd Qtr 01 to 2nd Qtr 02f		***$385,000***	2.3%		
4th Qtr 01 to 3rd Qtr 02f		***$386,000***	2.4%		
1st Qtr 02 to 4th Qtr 02f		***$389,000***	1.3%		
2nd Qtr 02 to 1st Qtr 03f		***$394,000***	2.0%		

Source: Real Estate Economics; First American Real Estate Solutions; County Assessors Office; Real Estate Research Council of So. Cal

The forecast increase in the overall new home price average in Ventura County (shown above) is only 2.0% during the next four quarters. During the past four quarters, the change in the price average has been 3.4%. The forecast reflects continued, but moderating, price appreciation as economic growth recovers and as ales volumes are increasingly inhibited by price-xclusion during the next few quarters.

MORE INFORMATION

For further information on trends and forecasts, including detailed sub-market analyses, we invite you to subscrib to ***The Residential Economic Report.*** Our repo provides an analysis of factors influencing the supply, demand and supportable prices of new housing by county and region. ***The Residential Economic Report*** and other real estate information tools are available at www.realestateeconomics.com, or by contacting:

Steven Guerrero
Director of Web Development
REAL ESTATE ECONOMICS
8961 Research Drive, Suite 200
Irvine, CA 92618
Phone: 949-502-5151
Fax: 949-502-5155
Email: steveng@realestateeconomics.com

A004688

Interim Projections of the Total Population for the United States and States: April 1, 2000 to July 1, 2030							
Geographic Area	Census April 1, 2000	Projections July 1, 2005	Projections July 1, 2010	Projections July 1, 2015	Projections July 1, 2020	Projections July 1, 2025	Projections July 1, 2030
United States	281,421,906	295,507,134	308,935,581	322,365,787	335,804,546	349,439,199	363,584,435
Alabama	4,447,100	4,527,166	4,596,330	4,663,111	4,728,915	4,800,092	4,874,243
Alaska	626,932	661,110	694,109	732,544	774,421	820,881	867,674
Arizona	5,130,632	5,868,004	6,637,381	7,495,238	8,456,448	9,531,537	10,712,397
Arkansas	2,673,400	2,777,007	2,875,039	2,968,913	3,060,219	3,151,005	3,240,208
California	33,871,648	36,038,859	38,067,134	40,123,232	42,206,743	44,305,177	46,444,861
Colorado	4,301,261	4,617,962	4,831,554	5,049,493	5,278,867	5,522,803	5,792,357
Connecticut	3,405,565	3,503,185	3,577,490	3,635,414	3,675,650	3,691,016	3,688,630
Delaware	783,600	836,687	884,342	927,400	963,209	990,694	1,012,658
District of Columbia	572,059	551,136	529,785	506,323	480,540	455,108	433,414
Florida	15,982,378	17,509,827	19,251,691	21,204,132	23,406,525	25,912,458	28,685,769
Georgia	8,186,453	8,925,796	9,589,080	10,230,578	10,843,753	11,438,622	12,017,838
Hawaii	1,211,537	1,276,552	1,340,674	1,385,952	1,412,373	1,438,720	1,466,046
Idaho	1,293,953	1,407,060	1,517,291	1,630,045	1,741,333	1,852,627	1,969,624
Illinois	12,419,293	12,699,336	12,916,894	13,097,218	13,236,720	13,340,507	13,432,892
Indiana	6,080,485	6,249,617	6,392,139	6,517,631	6,627,008	6,721,322	6,810,108
Iowa	2,926,324	2,973,700	3,009,907	3,026,380	3,020,496	2,993,222	2,955,172
Kansas	2,688,418	2,751,509	2,805,470	2,852,690	2,890,566	2,919,002	2,940,084
Kentucky	4,041,769	4,163,360	4,265,117	4,351,188	4,424,431	4,489,662	4,554,998
Louisiana	4,468,976	4,534,310	4,612,679	4,673,721	4,719,160	4,762,398	4,802,633
Maine	1,274,923	1,318,557	1,357,134	1,388,878	1,408,665	1,414,402	1,411,097
Maryland	5,296,486	5,600,563	5,904,970	6,208,392	6,497,626	6,762,732	7,022,251
Massachusetts	6,349,097	6,518,868	6,649,441	6,758,580	6,855,546	6,938,636	7,012,009
Michigan	9,938,444	10,207,421	10,428,683	10,599,122	10,695,993	10,713,730	10,694,172
Minnesota	4,919,479	5,174,743	5,420,636	5,668,211	5,900,769	6,108,787	6,306,130
Mississippi	2,844,658	2,915,696	2,971,412	3,014,409	3,044,812	3,069,420	3,092,410
Missouri	5,595,211	5,765,166	5,922,078	6,069,556	6,199,882	6,315,366	6,430,173
Montana	902,195	933,005	968,598	999,489	1,022,735	1,037,387	1,044,898
Nebraska	1,711,263	1,744,370	1,768,997	1,788,508	1,802,678	1,812,787	1,820,247
Nevada	1,998,257	2,352,086	2,690,531	3,058,190	3,452,283	3,863,298	4,282,102
New Hampshire	1,235,786	1,314,821	1,385,560	1,456,679	1,524,751	1,586,348	1,646,471
New Jersey	8,414,350	8,745,279	9,018,231	9,255,769	9,461,635	9,636,644	9,802,440
New Mexico	1,819,046	1,902,057	1,980,225	2,041,539	2,084,341	2,106,584	2,099,708
New York	18,976,457	19,258,082	19,443,672	19,546,699	19,576,920	19,540,179	19,477,429
North Carolina	8,049,313	8,702,410	9,345,823	10,010,770	10,709,289	11,449,153	12,227,739
North Dakota	642,200	635,468	636,623	635,133	630,112	620,777	606,566
Ohio	11,353,140	11,477,557	11,576,181	11,635,446	11,644,058	11,605,738	11,550,528
Oklahoma	3,450,654	3,521,379	3,591,516	3,661,694	3,735,690	3,820,994	3,913,251
Oregon	3,421,399	3,596,083	3,790,996	4,012,924	4,260,393	4,536,418	4,833,918
Pennsylvania	12,281,054	12,426,603	12,584,487	12,710,938	12,787,354	12,801,945	12,768,184
Rhode Island	1,048,319	1,086,575	1,116,652	1,139,543	1,154,230	1,157,855	1,152,941
South Carolina	4,012,012	4,239,310	4,446,704	4,642,137	4,822,577	4,989,550	5,148,569
South Dakota	754,844	771,803	786,399	796,954	801,939	801,845	800,462
Tennessee	5,689,283	5,965,317	6,230,852	6,502,017	6,780,670	7,073,125	7,380,634
Texas	20,851,820	22,775,044	24,648,888	26,585,801	28,634,896	30,865,134	33,317,744
Utah	2,233,169	2,417,998	2,595,013	2,783,040	2,990,094	3,225,680	3,485,367
Vermont	608,827	630,979	652,512	673,169	690,686	703,288	711,867
Virginia	7,078,515	7,552,581	8,010,245	8,466,864	8,917,395	9,364,304	9,825,019
Washington	5,894,121	6,204,632	6,541,963	6,950,610	7,432,136	7,996,400	8,624,801
West Virginia	1,808,344	1,818,887	1,829,141	1,822,758	1,801,112	1,766,435	1,719,959
Wisconsin	5,363,675	5,554,343	5,727,426	5,882,760	6,004,954	6,088,374	6,150,764
Wyoming	493,782	507,268	519,886	528,005	530,948	529,031	522,979

Suggested Citation:
Table A1: Interim Projections of the Total Population for the United States and States: April 1, 2000 to July 1, 2030
Source: U.S. Census Bureau, Population Division, Interim State Population Projections, 2005.
Internet Release Date: April 21, 2005

State & County QuickFacts

Ventura County, California

People QuickFacts	Ventura County	California
Population, 2004 estimate	797,699	35,893,799
Population, percent change, April 1, 2000 to July 1, 2004	5.9%	6.0%
Population, 2000	753,197	33,871,648
Population, percent change, 1990 to 2000	12.6%	13.6%
Persons under 5 years old, percent, 2000	7.5%	7.3%
Persons under 18 years old, percent, 2000	28.4%	27.3%
Persons 65 years old and over, percent, 2000	10.2%	10.6%
Female persons, percent, 2000	50.1%	50.2%
White persons, percent, 2000 (a)	69.9%	59.5%
Black or African American persons, percent, 2000 (a)	1.9%	6.7%
American Indian and Alaska Native persons, percent, 2000 (a)	0.9%	1.[illegible]
Asian persons, percent, 2000 (a)	5.3%	10.9%
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.2%	0.3%
Persons reporting some other race, percent, 2000 (a)	17.7%	16.8%
Persons reporting two or more races, percent, 2000	3.9%	4.7%
White persons, not of Hispanic/Latino origin, percent, 2000	56.8%	46.7%
Persons of Hispanic or Latino origin, percent, 2000 (b)	33.4%	32.4%
Living in same house in 1995 and 2000', pct age 5+, 2000	51.7%	50.2%
Foreign born persons, percent, 2000	20.7%	26.2%
Language other than English spoken at home, pct age 5+, 2000	33.0%	39.5%
High school graduates, percent of persons age 25+, 2000	80.1%	76.8%
Bachelor's degree or higher, pct of persons age 25+, 2000	26.9%	26.6%
Persons with a disability, age 5+, 2000	121,648	5,923,361
Mean travel time to work (minutes), workers age 16+, 2000	25.4	27.7
Housing units, 2002	259,663	12,507,767
Homeownership rate, 2000	67.6%	56.9%
Housing units in multi-unit structures, percent, 2000	20.5%	31.4%
Median value of owner-occupied housing units, 2000	$248,700	$211,5
Households, 2000	243,234	11,502,870

Persons per household, 2000	3.04	2.87
Median household income, 1999	$59,666	$47,493
Per capita money income, 1999	$24,600	$22,711
Persons below poverty, percent, 1999	9.2%	14.2%

Business QuickFacts	**Ventura County**	**California**
Private nonfarm establishments with paid employees, 2001	17,510	806,733
Private nonfarm employment, 2001	249,865	13,239,616
Private nonfarm employment, percent change 2000-2001	5.0%	2.8%
Nonemployer establishments, 2000	50,655	2,103,178
Manufacturers shipments, 1997 ($1000)	6,163,377	379,612,443
Retail sales, 1997 ($1000)	6,476,610	263,118,346
Retail sales per capita, 1997	$8,968	$8,167
Minority-owned firms, percent of total, 1997	20.4%	28.8%
Women-owned firms, percent of total, 1997	28.2%	27.3%
Housing units authorized by building permits, 2002	2,525	159,573
Federal funds and grants, 2002 ($1000)	3,841,014	206,401,495

Geography QuickFacts	**Ventura County**	**California**
Land area, 2000 (square miles)	1,845	155,959
Persons per square mile, 2000	408.2	217.2
FIPS Code	111	06
Metropolitan or Micropolitan Statistical Area	Oxnard-Thousand Oaks-Ventura, CA Metro Area	

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

FN: Footnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
S: Suppressed; does not meet publication standards
Z: Value greater than zero but less than half unit of measure shown
F: Fewer than 100 firms

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Last Revised: Thursday, 12-Jan-2006 13:30:30 EST

Census Bureau Links:

A004691

State & County QuickFacts

Camarillo (city), California

People QuickFacts	Camarillo	California
Population, 2003 estimate	60,445	35,484,453
Population, percent change, April 1, 2000 to July 1, 2003	5.9%	4.8%
Population, 2000	57,077	33,871,648
Population, percent change, 1990 to 2000	9.1%	13.6%
Persons under 5 years old, percent, 2000	6.6%	7.3%
Persons under 18 years old, percent, 2000	25.3%	27.3%
Persons 65 years old and over, percent, 2000	17.0%	10.6%
Female persons, percent, 2000	51.6%	50.2%
White persons, percent, 2000 (a)	80.7%	59.5%
Black or African American persons, percent, 2000 (a)	1.5%	6.7%
merican Indian and Alaska Native persons, percent, 2000 (a)	0.5%	1.0[illegible]
Asian persons, percent, 2000 (a)	7.2%	10.9[illegible]
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.2%	0.3%
Persons reporting some other race, percent, 2000 (a)	6.3%	16.8%
Persons reporting two or more races, percent, 2000	3.6%	4.7%
Persons of Hispanic or Latino origin, percent, 2000 (b)	15.5%	32.4%
Living in same house in 1995 and 2000', pct age 5+, 2000	51.6%	50.2%
Foreign born persons, percent, 2000	13.3%	26.2%
Language other than English spoken at home, pct age 5+, 2000	19.8%	39.5%
High school graduates, percent of persons age 25+, 2000	90.6%	76.8%
Bachelor's degree or higher, pct of persons age 25+, 2000	32.9%	26.6%
Mean travel time to work (minutes), workers age 16+, 2000	22.5	27.7
Housing units, 2000	21,946	12,214,549
Homeownership rate, 2000	73.5%	56.9%
Median value of owner-occupied housing units, 2000	$252,100	$211,500
Households, 2000	21,438	11,502,870
ersons per household, 2000	2.62	2.87
Median household income, 1999	$62,457	$47,4[illegible]
Per capita money income, 1999	$28,635	$22,7[illegible]
Persons below poverty, percent, 1999	5.3%	14.2%

A004692

Business QuickFacts	Camarillo	California
Manufacturers shipments, 1997 ($1000)	1,513,514	31,700,008
Wholesale trade sales, 1997 ($1000)	632,788	548,864,451
Retail sales, 1997 ($1000)	607,888	263,118,346
Retail sales per capita, 1997	$10,424	$8,167
Accomodation and foodservices sales, 1997 ($1000)	69,671	42,312,641
Total number of firms, 1997	5,497	2,565,734
Minority-owned firms, percent of total, 1997	21.8%	28.8%
Women-owned firms, percent of total, 1997	27.1%	27.3%

Geography QuickFacts	Camarillo	California
Land area, 2000 (square miles)	19	155,959
Persons per square mile, 2000	3,015.3	217.2
FIPS Code	10046	06
Counties		

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

FN: Footnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
S: Suppressed; does not meet publication standards
Z: Value greater than zero but less than half unit of measure shown
F: Fewer than 100 firms

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Last Revised: Thursday, 12-Jan-2006 13:30:29 EST

Census Bureau Links:

A004693

State & County QuickFacts

San Buenaventura (Ventura) (city), California

People QuickFacts	San Buenaventura	California
Population, 2003 estimate	104,140	35,484,453
Population, percent change, April 1, 2000 to July 1, 2003	3.2%	4.8%
Population, 2000	100,916	33,871,648
Population, percent change, 1990 to 2000	7.8%	13.6%
Persons under 5 years old, percent, 2000	6.6%	7.3%
Persons under 18 years old, percent, 2000	25.0%	27.3%
Persons 65 years old and over, percent, 2000	12.8%	10.6%
Female persons, percent, 2000	50.8%	50.2%
White persons, percent, 2000 (a)	78.8%	59.5%
lack or African American persons, percent, 2000 (a)	1.4%	6.7%
American Indian and Alaska Native persons, percent, 2000 (a)	1.2%	1.
Asian persons, percent, 2000 (a)	3.0%	10.9%
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.2%	0.3%
Persons reporting some other race, percent, 2000 (a)	11.1%	16.8%
Persons reporting two or more races, percent, 2000	4.3%	4.7%
Persons of Hispanic or Latino origin, percent, 2000 (b)	24.3%	32.4%
Living in same house in 1995 and 2000', pct age 5+, 2000	47.6%	50.2%
Foreign born persons, percent, 2000	13.0%	26.2%
Language other than English spoken at home, pct age 5+, 2000	21.5%	39.5%
High school graduates, percent of persons age 25+, 2000	85.7%	76.8%
Bachelor's degree or higher, pct of persons age 25+, 2000	29.2%	26.6%
Mean travel time to work (minutes), workers age 16+, 2000	22.3	27.7
Housing units, 2000	39,803	12,214,549
Homeownership rate, 2000	58.7%	56.9%
Median value of owner-occupied housing units, 2000	$245,400	$211,500
Households, 2000	38,524	11,502,870
Persons per household, 2000	2.56	2.87
Median household income, 1999	$52,298	$47,4
Per capita money income, 1999	$25,065	$22,711

A004694

Persons below poverty, percent, 1999	9.0%	14.2%

Business QuickFacts	San Buenaventura	California
Manufacturers shipments, 1997 ($1000)	374,728	31,700,008
Wholesale trade sales, 1997 ($1000)	639,882	548,864,451
Retail sales, 1997 ($1000)	1,249,786	263,118,346
Retail sales per capita, 1997	$12,692	$8,167
Accomodation and foodservices sales, 1997 ($1000)	166,394	42,312,641
Total number of firms, 1997	10,126	2,565,734
Minority-owned firms, percent of total, 1997	21.6%	28.8%
Women-owned firms, percent of total, 1997	25.6%	27.3%

Geography QuickFacts	San Buenaventura	California
Land area, 2000 (square miles)	21	155,959
Persons per square mile, 2000	4,790.6	217.2
FIPS Code	65042	06
Counties		

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

FN: Footnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
S: Suppressed; does not meet publication standards
Z: Value greater than zero but less than half unit of measure shown
F: Fewer than 100 firms

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Last Revised: Thursday, 12-Jan-2006 13:30:42 EST

Census Bureau Links:

A004695

State & County QuickFacts

Oxnard (city), California

People QuickFacts	Oxnard	California
Population, 2003 estimate	180,872	35,484,453
Population, percent change, April 1, 2000 to July 1, 2003	6.2%	4.8%
Population, 2000	170,358	33,871,648
Population, percent change, 1990 to 2000	19.6%	13.6%
Persons under 5 years old, percent, 2000	8.9%	7.3%
Persons under 18 years old, percent, 2000	31.8%	27.3%
Persons 65 years old and over, percent, 2000	8.1%	10.6%
Female persons, percent, 2000	48.9%	50.2%
White persons, percent, 2000 (a)	42.1%	59.5%
Black or African American persons, percent, 2000 (a)	3.8%	6.7%
merican Indian and Alaska Native persons, percent, 2000 (a)	1.3%	1.[illegible]
Asian persons, percent, 2000 (a)	7.4%	10.[illegible]
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.4%	0.3%
Persons reporting some other race, percent, 2000 (a)	40.4%	16.8%
Persons reporting two or more races, percent, 2000	4.7%	4.7%
Persons of Hispanic or Latino origin, percent, 2000 (b)	66.2%	32.4%
Living in same house in 1995 and 2000', pct age 5+, 2000	51.9%	50.2%
Foreign born persons, percent, 2000	36.9%	26.2%
Language other than English spoken at home, pct age 5+, 2000	62.1%	39.5%
High school graduates, percent of persons age 25+, 2000	59.5%	76.8%
Bachelor's degree or higher, pct of persons age 25+, 2000	13.7%	26.6%
Mean travel time to work (minutes), workers age 16+, 2000	23.3	27.7
Housing units, 2000	45,166	12,214,549
Homeownership rate, 2000	57.3%	56.9%
Median value of owner-occupied housing units, 2000	$189,400	$211,500
Households, 2000	43,576	11,502,870
ersons per household, 2000	3.85	2.87
Median household income, 1999	$48,603	$47,[illegible]
Per capita money income, 1999	$15,288	$22,7[illegible]
Persons below poverty, percent, 1999	15.1%	14.2%

A004696

Business QuickFacts	Oxnard	California
Manufacturers shipments, 1997 ($1000)	1,440,730	31,700,008
Wholesale trade sales, 1997 ($1000)	795,903	548,864,451
Retail sales, 1997 ($1000)	1,398,691	263,118,346
Retail sales per capita, 1997	$9,209	$8,167
Accomodation and foodservices sales, 1997 ($1000)	166,934	42,312,641
Total number of firms, 1997	7,963	2,565,734
Minority-owned firms, percent of total, 1997	39.3%	28.8%
Women-owned firms, percent of total, 1997	24.7%	27.3%

Geography QuickFacts	Oxnard	California
Land area, 2000 (square miles)	25	155,959
Persons per square mile, 2000	6,729.7	217.2
FIPS Code	54652	06
Counties		

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

FN: Footnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
ıpressed; does not meet publication standards
.ue greater than zero but less than half unit of measure shown
ewer than 100 firms

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Last Revised: Thursday, 12-Jan-2006 13:30:39 EST

Census Bureau Links:

A004697

State & County QuickFacts

Moorpark (city), California

People QuickFacts	Moorpark	California
Population, 2003 estimate	35,168	35,484,453
Population, percent change, April 1, 2000 to July 1, 2003	12.0%	4.8%
Population, 2000	31,415	33,871,648
Population, percent change, 1990 to 2000	22.8%	13.6%
Persons under 5 years old, percent, 2000	8.1%	7.3%
Persons under 18 years old, percent, 2000	34.2%	27.3%
Persons 65 years old and over, percent, 2000	4.5%	10.6%
Female persons, percent, 2000	50.1%	50.2%
White persons, percent, 2000 (a)	74.4%	59.5%
Black or African American persons, percent, 2000 (a)	1.5%	6.7%
American Indian and Alaska Native persons, percent, 2000 (a)	0.5%	1.0%
Asian persons, percent, 2000 (a)	5.6%	10.9%
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.1%	0.3%
Persons reporting some other race, percent, 2000 (a)	13.9%	16.8%
Persons reporting two or more races, percent, 2000	3.9%	4.7%
Persons of Hispanic or Latino origin, percent, 2000 (b)	27.8%	32.4%
Living in same house in 1995 and 2000', pct age 5+, 2000	57.4%	50.2%
Foreign born persons, percent, 2000	19.2%	26.2%
Language other than English spoken at home, pct age 5+, 2000	28.3%	39.5%
High school graduates, percent of persons age 25+, 2000	84.7%	76.8%
Bachelor's degree or higher, pct of persons age 25+, 2000	34.2%	26.6%
Mean travel time to work (minutes), workers age 16+, 2000	28.7	27.7
Housing units, 2000	9,094	12,214,549
Homeownership rate, 2000	82.1%	56.9%
Median value of owner-occupied housing units, 2000	$281,300	$211,500
Households, 2000	8,994	11,502,870
Persons per household, 2000	3.49	2.87
Median household income, 1999	$76,642	$47,4[illegible]
Per capita money income, 1999	$25,383	$22,7[illegible]
Persons below poverty, percent, 1999	7.0%	14.2%

A004698

Business QuickFacts	Moorpark	California
Manufacturers shipments, 1997 ($1000)	370,150	31,700,008
Wholesale trade sales, 1997 ($1000)	242,348	548,864,451
Retail sales, 1997 ($1000)	77,859	263,118,346
Retail sales per capita, 1997	$2,641	$8,167
Accomodation and foodservices sales, 1997 ($1000)	D	42,312,641
Total number of firms, 1997	2,392	2,565,734
Minority-owned firms, percent of total, 1997	43.4%	28.8%
Women-owned firms, percent of total, 1997	50.3%	27.3%

Geography QuickFacts	Moorpark	California
Land area, 2000 (square miles)	19	155,959
Persons per square mile, 2000	1,651.9	217.2
FIPS Code	49138	06
Counties		

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

FN: Footnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
...pressed; does not meet publication standards
...ue greater than zero but less than half unit of measure shown
...ewer than 100 firms

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Last Revised: Thursday, 12-Jan-2006 13:30:38 EST

Census Bureau Links:

A004699

State & County QuickFacts

Simi Valley (city), California

People QuickFacts	Simi Valley	California
Population, 2003 estimate	117,115	35,484,453
Population, percent change, April 1, 2000 to July 1, 2003	5.2%	4.8%
Population, 2000	111,351	33,871,648
Population, percent change, 1990 to 2000	11.0%	13.6%
Persons under 5 years old, percent, 2000	7.3%	7.3%
Persons under 18 years old, percent, 2000	28.4%	27.3%
Persons 65 years old and over, percent, 2000	7.6%	10.6%
Female persons, percent, 2000	50.5%	50.2%
White persons, percent, 2000 (a)	81.3%	59.5%
Black or African American persons, percent, 2000 (a)	1.3%	6.7%
American Indian and Alaska Native persons, percent, 2000 (a)	0.7%	1.[illegible]
Asian persons, percent, 2000 (a)	6.3%	10.9%
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.1%	0.3%
Persons reporting some other race, percent, 2000 (a)	6.5%	16.8%
Persons reporting two or more races, percent, 2000	3.7%	4.7%
Persons of Hispanic or Latino origin, percent, 2000 (b)	16.8%	32.4%
Living in same house in 1995 and 2000', pct age 5+, 2000	52.1%	50.2%
Foreign born persons, percent, 2000	15.1%	26.2%
Language other than English spoken at home, pct age 5+, 2000	21.0%	39.5%
High school graduates, percent of persons age 25+, 2000	86.9%	76.8%
Bachelor's degree or higher, pct of persons age 25+, 2000	24.9%	26.6%
Mean travel time to work (minutes), workers age 16+, 2000	29.0	27.7
Housing units, 2000	37,272	12,214,549
Homeownership rate, 2000	77.6%	56.9%
Median value of owner-occupied housing units, 2000	$239,900	$211,500
Households, 2000	36,421	11,502,870
Persons per household, 2000	3.04	2.87
Median household income, 1999	$70,370	$47,[illegible]
Per capita money income, 1999	$26,586	$22,711
Persons below poverty, percent, 1999	5.8%	14.2%

A004700

Business QuickFacts	Simi Valley	California
Manufacturers shipments, 1997 ($1000)	1,208,305	31,700,008
Wholesale trade sales, 1997 ($1000)	843,909	548,864,451
Retail sales, 1997 ($1000)	852,368	263,118,346
Retail sales per capita, 1997	$7,831	$8,167
Accomodation and foodservices sales, 1997 ($1000)	92,652	42,312,641
Total number of firms, 1997	9,651	2,565,734
Minority-owned firms, percent of total, 1997	18.2%	28.8%
Women-owned firms, percent of total, 1997	21.8%	27.3%
Geography QuickFacts	**Simi Valley**	**California**
Land area, 2000 (square miles)	39	155,959
Persons per square mile, 2000	2,841.9	217.2
FIPS Code	72016	06
Counties		

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.

FN: Footnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
pressed; does not meet publication standards
ue greater than zero but less than half unit of measure shown
ewer than 100 firms

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Last Revised: Thursday, 12-Jan-2006 13:30:44 EST

Census Bureau Links:

A004701

State & County QuickFacts

Thousand Oaks (city), California

People QuickFacts	Thousand Oaks	California
Population, 2003 estimate	124,192	35,484,453
Population, percent change, April 1, 2000 to July 1, 2003	6.1%	4.8%
Population, 2000	117,005	33,871,648
Population, percent change, 1990 to 2000	12.5%	13.6%
Persons under 5 years old, percent, 2000	6.7%	7.3%
Persons under 18 years old, percent, 2000	26.0%	27.3%
Persons 65 years old and over, percent, 2000	11.1%	10.6%
Female persons, percent, 2000	50.9%	50.2%
White persons, percent, 2000 (a)	85.1%	59.5%
Black or African American persons, percent, 2000 (a)	1.1%	6.7%
American Indian and Alaska Native persons, percent, 2000 (a)	0.5%	1.[illegible]
Asian persons, percent, 2000 (a)	5.9%	10.9%
Native Hawaiian and Other Pacific Islander, percent, 2000 (a)	0.1%	0.3%
Persons reporting some other race, percent, 2000 (a)	4.5%	16.8%
Persons reporting two or more races, percent, 2000	2.8%	4.7%
Persons of Hispanic or Latino origin, percent, 2000 (b)	13.1%	32.4%
Living in same house in 1995 and 2000', pct age 5+, 2000	52.3%	50.2%
Foreign born persons, percent, 2000	15.6%	26.2%
Language other than English spoken at home, pct age 5+, 2000	19.1%	39.5%
High school graduates, percent of persons age 25+, 2000	91.4%	76.8%
Bachelor's degree or higher, pct of persons age 25+, 2000	42.2%	26.6%
Mean travel time to work (minutes), workers age 16+, 2000	26.2	27.7
Housing units, 2000	42,958	12,214,549
Homeownership rate, 2000	75.3%	56.9%
Median value of owner-occupied housing units, 2000	$324,800	$211,500
Households, 2000	41,793	11,502,870
Persons per household, 2000	2.75	2[illegible]
Median household income, 1999	$76,815	$47,4[illegible]
Per capita money income, 1999	$34,314	$22,711

A004702

Persons below poverty, percent, 1999	5.0%	14.2%

Business QuickFacts	Thousand Oaks	California
Manufacturers shipments, 1997 ($1000)	601,973	31,700,008
Wholesale trade sales, 1997 ($1000)	6,480,334	548,864,451
Retail sales, 1997 ($1000)	1,706,440	263,118,346
Retail sales per capita, 1997	$14,963	$8,167
Accomodation and foodservices sales, 1997 ($1000)	179,928	42,312,641
Total number of firms, 1997	14,049	2,565,734
Minority-owned firms, percent of total, 1997	11.5%	28.8%
Women-owned firms, percent of total, 1997	34.5%	27.3%

Geography QuickFacts	Thousand Oaks	California
Land area, 2000 (square miles)	55	155,959
Persons per square mile, 2000	2,132.8	217.2
FIPS Code	78582	06
Counties		

(a) Includes persons reporting only one race.
... spanics may be of any race, so also are included in applicable race categories.

... ootnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
S: Suppressed; does not meet publication standards
Z: Value greater than zero but less than half unit of measure shown
F: Fewer than 100 firms

Source U.S. Census Bureau: State and County QuickFacts. Data derived from Population Estimates, 2000 Census of Population and Housing, 1990 Census of Population and Housing, Small Area Income and Poverty Estimates, County Business Patterns, 1997 Economic Census, Minority- and Women-Owned Business, Building Permits, Consolidated Federal Funds Report, 1997 Census of Governments

Last Revised: Thursday, 12-Jan-2006 13:30:46 EST

Census Bureau Links:

A004703

DP-3. Profile of Selected Economic Characteristics: 2000
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Ventura County, California**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
EMPLOYMENT STATUS		
Population 16 years and over	**562,080**	**100.0**
In labor force	372,020	66.2
Civilian labor force	367,453	65.4
Employed	348,338	62.0
Unemployed	19,115	3.4
Percent of civilian labor force	5.2	(X)
Armed Forces	4,567	0.8
Not in labor force	190,060	33.8
Females 16 years and over	**284,127**	**100.0**
In labor force	165,047	58.1
Civilian labor force	164,506	57.9
Employed	156,105	54.9
Own children under 6 years	**63,717**	**100.0**
›arents in family in labor force	33,635	52.8
COMMUTING TO WORK		
Workers 16 years and over	**345,658**	**100.0**
Car, truck, or van -- drove alone	262,238	75.9
Car, truck, or van -- carpooled	52,219	15.1
Public transportation (including taxicab)	3,746	1.1
Walked	7,169	2.1
Other means	5,754	1.7
Worked at home	14,532	4.2
Mean travel time to work (minutes)	25.4	(X)
Employed civilian population 16 years and over	**348,338**	**100.0**
OCCUPATION		
Management, professional, and related occupations	127,157	36.5
Service occupations	46,762	13.4
Sales and office occupations	95,006	27.3
Farming, fishing, and forestry occupations	10,869	3.1
Construction, extraction, and maintenance occupations	28,589	8.2
Production, transportation, and material moving occupations	39,955	11.5
INDUSTRY		
Agriculture, forestry, fishing and hunting, and mining	14,265	4.1
Construction	21,946	6.3
Manufacturing	48,154	13.8
Wholesale trade	13,811	4.0
Retail trade	38,539	11.1
Transportation and warehousing, and utilities	11,385	3.3
Information	14,639	4.2
›ance, insurance, real estate, and rental and leasing	28,328	8.1
›essional, scientific, management, administrative, and waste management services	38,476	11.0
Educational, health and social services	59,820	17.2
Arts, entertainment, recreation, accommodation and food services	23,669	6.8
Other services (except public administration)	16,377	4.7
Public administration	18,929	5.4

A004704

Subject	Number	Percent
CLASS OF WORKER		
Private wage and salary workers	265,224	76.1
Government workers	50,193	14.4
Self-employed workers in own not incorporated business	31,536	9.1
Unpaid family workers	1,385	0.4
INCOME IN 1999		
Households	**243,503**	**100.0**
Less than $10,000	11,934	4.9
$10,000 to $14,999	9,383	3.9
$15,000 to $24,999	20,567	8.4
$25,000 to $34,999	22,967	9.4
$35,000 to $49,999	35,036	14.4
$50,000 to $74,999	51,585	21.2
$75,000 to $99,999	36,546	15.0
$100,000 to $149,999	34,600	14.2
$150,000 to $199,999	11,284	4.6
$200,000 or more	9,601	3.9
Median household income (dollars)	59,666	(X)
With earnings	207,383	85.2
Mean earnings (dollars)	73,100	(X)
With Social Security income	56,552	23.2
Mean Social Security income (dollars)	11,451	(X)
With Supplemental Security Income	9,267	3.8
Mean Supplemental Security Income (dollars)	6,826	(X)
With public assistance income	7,046	2.9
Mean public assistance income (dollars)	4,234	(X)
With retirement income	42,534	17.5
Mean retirement income (dollars)	19,577	(X)
Families	**184,378**	**100.0**
Less than $10,000	6,086	3.3
$10,000 to $14,999	4,933	2.7
$15,000 to $24,999	13,262	7.2
$25,000 to $34,999	15,928	8.6
$35,000 to $49,999	25,949	14.1
$50,000 to $74,999	40,599	22.0
$75,000 to $99,999	29,920	16.2
$100,000 to $149,999	29,451	16.0
$150,000 to $199,999	9,803	5.3
$200,000 or more	8,447	4.6
Median family income (dollars)	65,285	(X)
Per capita income (dollars)	24,600	(X)
Median earnings (dollars):		
Male full-time, year-round workers	45,310	(X)
Female full-time, year-round workers	32,216	(X)
POVERTY STATUS IN 1999 (below poverty level)		
Families	**11,716**	(X)
Percent below poverty level	(X)	6.4
With related children under 18 years	9,675	(X)
Percent below poverty level	(X)	9.1
With related children under 5 years	5,057	(X)
Percent below poverty level	(X)	11.6
Families with female householder, no husband present	**4,574**	(X)
Percent below poverty level	(X)	17.6
With related children under 18 years	3,960	(X)
Percent below poverty level	(X)	23.4
With related children under 5 years	1,845	(X)
Percent below poverty level	(X)	34.1
Individuals	**68,540**	(X)
Percent below poverty level	(X)	9.2
18 years and over	43,133	(X)

Subject	Number	Percent
Percent below poverty level	(X)	8.1
65 years and over	4,644	(X)
Percent below poverty level	(X)	6.3
Related children under 18 years	24,217	(X)
Percent below poverty level	(X)	11.6
Related children 5 to 17 years	17,143	(X)
Percent below poverty level	(X)	11.2
Unrelated individuals 15 years and over	20,228	(X)
Percent below poverty level	(X)	19.4

(X) Not applicable.
Detailed Occupation Code List (PDF 42KB)
Detailed Industry Code List (PDF 44KB)
User note on employment status data (PDF 63KB)
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices P30, P32, P33, P43, P46, P49, P50, P51, P52, P53, P58, P62, P63, P64, P65, P67, P71, P72, P73, P74, P76, P77, P82, P87, P90, PCT47, PCT52, and PCT53

A004706

DP-4. **Profile of Selected Housing Characteristics: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Ventura County, California**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
Total housing units	**251,712**	**100.0**
UNITS IN STRUCTURE		
1-unit, detached	160,529	63.8
1-unit, attached	27,322	10.9
2 units	4,720	1.9
3 or 4 units	11,690	4.6
5 to 9 units	10,694	4.2
10 to 19 units	8,852	3.5
20 or more units	15,743	6.3
Mobile home	11,702	4.6
Boat, RV, van, etc.	460	0.2
YEAR STRUCTURE BUILT		
1999 to March 2000	5,602	2.2
1995 to 1998	12,088	4.8
1990 to 1994	14,840	5.9
1980 to 1989	49,348	19.6
1970 to 1979	67,434	26.8
1960 to 1969	58,091	23.1
1940 to 1959	34,322	13.6
1939 or earlier	9,987	4.0
ROOMS		
1 room	5,809	2.3
2 rooms	16,195	6.4
3 rooms	26,574	10.6
4 rooms	32,632	13.0
5 rooms	44,964	17.9
6 rooms	47,344	18.8
7 rooms	36,709	14.6
8 rooms	24,131	9.6
9 or more rooms	17,354	6.9
Median (rooms)	5.5	(X)
Occupied Housing Units	**243,234**	**100.0**
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	46,463	19.1
1995 to 1998	75,974	31.2
1990 to 1994	39,918	16.4
1980 to 1989	43,112	17.7
1970 to 1979	23,918	9.8
1969 or earlier	13,849	5.7
VEHICLES AVAILABLE		
None	12,215	5.0
1	68,176	28.0
2	105,212	43.3
3 or more	57,631	23.7
HOUSE HEATING FUEL		
Utility gas	203,827	83.8
Bottled, tank, or LP gas	3,381	1.4
Electricity	31,386	12.9

A004707

Subject	Number	Percent
Fuel oil, kerosene, etc.	83	0.0
·l or coke	0	0.0
.d	1,066	0.4
Solar energy	445	0.2
Other fuel	148	0.1
No fuel used	2,898	1.2
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	1,153	0.5
Lacking complete kitchen facilities	1,627	0.7
No telephone service	2,196	0.9
OCCUPANTS PER ROOM		
Occupied housing units	**243,234**	**100.0**
1.00 or less	213,123	87.6
1.01 to 1.50	12,612	5.2
1.51 or more	17,499	7.2
Specified owner-occupied units	**142,543**	**100.0**
VALUE		
Less than $50,000	660	0.5
$50,000 to $99,999	1,637	1.1
$100,000 to $149,999	8,961	6.3
$150,000 to $199,999	28,697	20.1
$200,000 to $299,999	55,648	39.0
$300,000 to $499,999	34,986	24.5
$500,000 to $999,999	10,505	7.4
$1,000,000 or more	1,449	1.0
Median (dollars)	248,700	(X)
·RTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
a mortgage	118,565	83.2
Less than $300	220	0.2
$300 to $499	1,935	1.4
$500 to $699	3,550	2.5
$700 to $999	8,379	5.9
$1,000 to $1,499	31,675	22.2
$1,500 to $1,999	35,551	24.9
$2,000 or more	37,255	26.1
Median (dollars)	1,671	(X)
Not mortgaged	23,978	16.8
Median (dollars)	308	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	36,770	25.8
15 to 19 percent	21,087	14.8
20 to 24 percent	21,385	15.0
25 to 29 percent	16,988	11.9
30 to 34 percent	12,174	8.5
35 percent or more	33,433	23.5
Not computed	706	0.5
Specified renter-occupied units	**78,068**	**100.0**
GROSS RENT		
Less than $200	1,322	1.7
$200 to $299	1,962	2.5
$300 to $499	4,818	6.2
$500 to $749	16,494	21.1
·50 to $999	21,455	27.5
00 to $1,499	21,932	28.1
·,500 or more	6,550	8.4
No cash rent	3,535	4.5
Median (dollars)	892	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	10,584	13.6

A004708

Subject	Number	Percent
15 to 19 percent	10,755	13.8
20 to 24 percent	11,125	14.3
25 to 29 percent	9,754	12.5
30 to 34 percent	6,732	8.6
35 percent or more	24,471	31.3
Not computed	4,647	6.0

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H1, H7, H20, H23, H24, H30, H34, H38, H40, H43, H44, H48, H51, H62, H63, H69, H74, H76, H90, H91, and H94

A004709

DP-4. **Profile of Selected Housing Characteristics: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Moorpark city, California**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
Total housing units	9,096	100.0
UNITS IN STRUCTURE		
1-unit, detached	6,600	72.6
1-unit, attached	1,234	13.6
2 units	38	0.4
3 or 4 units	185	2.0
5 to 9 units	241	2.6
10 to 19 units	288	3.2
20 or more units	180	2.0
Mobile home	330	3.6
Boat, RV, van, etc.	0	0.0
YEAR STRUCTURE BUILT		
1999 to March 2000	11	0.1
1995 to 1998	722	7.9
1990 to 1994	900	9.9
0 to 1989	5,016	55.1
0 to 1979	1,565	17.2
1960 to 1969	428	4.7
1940 to 1959	385	4.2
1939 or earlier	69	0.8
ROOMS		
1 room	69	0.8
2 rooms	174	1.9
3 rooms	535	5.9
4 rooms	775	8.5
5 rooms	1,510	16.6
6 rooms	1,824	20.1
7 rooms	1,565	17.2
8 rooms	1,632	17.9
9 or more rooms	1,012	11.1
Median (rooms)	6.3	(X)
Occupied Housing Units	8,984	100.0
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	1,364	15.2
1995 to 1998	2,785	31.0
1990 to 1994	1,999	22.3
1980 to 1989	2,387	26.6
1970 to 1979	311	3.5
1969 or earlier	138	1.5
VEHICLES AVAILABLE		
None	158	1.8
	1,616	18.0
	4,832	53.8
3 or more	2,378	26.5
HOUSE HEATING FUEL		
Utility gas	8,042	89.5
Bottled, tank, or LP gas	85	0.9
Electricity	696	7.7

A004710

Subject	Number	Percent
Fuel oil, kerosene, etc.	0	0.0
[illegible]l or coke	0	0.0
[illegible]od	61	0.7
Solar energy	6	0.1
Other fuel	7	0.1
No fuel used	87	1.0
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	17	0.2
Lacking complete kitchen facilities	17	0.2
No telephone service	33	0.4
OCCUPANTS PER ROOM		
Occupied housing units	**8,984**	**100.0**
1.00 or less	8,201	91.3
1.01 to 1.50	298	3.3
1.51 or more	485	5.4
Specified owner-occupied units	**6,767**	**100.0**
VALUE		
Less than $50,000	0	0.0
$50,000 to $99,999	42	0.6
$100,000 to $149,999	244	3.6
$150,000 to $199,999	986	14.6
$200,000 to $299,999	2,646	39.1
$300,000 to $499,999	2,601	38.4
$500,000 to $999,999	226	3.3
$1,000,000 or more	22	0.3
Median (dollars)	281,300	(X)
[illegible]RTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
[illegible] a mortgage	6,332	93.6
Less than $300	0	0.0
$300 to $499	28	0.4
$500 to $699	142	2.1
$700 to $999	178	2.6
$1,000 to $1,499	1,415	20.9
$1,500 to $1,999	2,097	31.0
$2,000 or more	2,472	36.5
Median (dollars)	1,830	(X)
Not mortgaged	435	6.4
Median (dollars)	349	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	1,121	16.6
15 to 19 percent	978	14.5
20 to 24 percent	1,130	16.7
25 to 29 percent	1,006	14.9
30 to 34 percent	731	10.8
35 percent or more	1,785	26.4
Not computed	16	0.2
Specified renter-occupied units	**1,572**	**100.0**
GROSS RENT		
Less than $200	13	0.8
$200 to $299	24	1.5
$300 to $499	56	3.6
$500 to $749	101	6.4
[illegible]50 to $999	196	12.5
[illegible]00 to $1,499	885	56.3
[illegible],500 or more	254	16.2
No cash rent	43	2.7
Median (dollars)	1,172	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	122	7.8

A004711

Subject	Number	Percent
15 to 19 percent	235	14.9
o 24 percent	213	13.5
.o 29 percent	237	15.1
30 to 34 percent	147	9.4
35 percent or more	541	34.4
Not computed	77	4.9

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H1, H7, H20, H23, H24, H30, H34, H38, H40, H43, H44, H48, H51, H62, H63, H69, H74, H76, H90, H91, and H94

A004712

DP-4. **Profile of Selected Housing Characteristics: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Simi Valley city, California**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
Total housing units	**37,330**	**100.0**
UNITS IN STRUCTURE		
1-unit, detached	27,711	74.2
1-unit, attached	2,624	7.0
2 units	199	0.5
3 or 4 units	1,459	3.9
5 to 9 units	1,458	3.9
10 to 19 units	1,537	4.1
20 or more units	1,449	3.9
Mobile home	874	2.3
Boat, RV, van, etc.	19	0.1
YEAR STRUCTURE BUILT		
1999 to March 2000	1,667	4.5
1995 to 1998	2,249	6.0
1990 to 1994	2,097	5.6
0 to 1989	8,974	24.0
0 to 1979	8,583	23.0
50 to 1969	11,984	32.1
1940 to 1959	1,572	4.2
1939 or earlier	204	0.5
ROOMS		
1 room	306	0.8
2 rooms	1,431	3.8
3 rooms	3,049	8.2
4 rooms	3,256	8.7
5 rooms	6,128	16.4
6 rooms	7,526	20.2
7 rooms	7,394	19.8
8 rooms	5,150	13.8
9 or more rooms	3,090	8.3
Median (rooms)	6.1	(X)
Occupied Housing Units	**36,478**	**100.0**
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	6,807	18.7
1995 to 1998	11,449	31.4
1990 to 1994	5,850	16.0
1980 to 1989	7,116	19.5
1970 to 1979	3,410	9.3
1969 or earlier	1,846	5.1
VEHICLES AVAILABLE		
None	1,108	3.0
	7,873	21.6
	16,896	46.3
r more	10,601	29.1
HOUSE HEATING FUEL		
Utility gas	32,475	89.0
Bottled, tank, or LP gas	212	0.6
Electricity	3,600	9.9

A004713

Subject	Number	Percent
Fuel oil, kerosene, etc.	13	0.0
…l or coke	0	0.0
…d	44	0.1
Solar energy	21	0.1
Other fuel	19	0.1
No fuel used	94	0.3
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	65	0.2
Lacking complete kitchen facilities	71	0.2
No telephone service	110	0.3
OCCUPANTS PER ROOM		
Occupied housing units	**36,478**	**100.0**
1.00 or less	34,347	94.2
1.01 to 1.50	1,287	3.5
1.51 or more	844	2.3
Specified owner-occupied units	**25,548**	**100.0**
VALUE		
Less than $50,000	67	0.3
$50,000 to $99,999	108	0.4
$100,000 to $149,999	873	3.4
$150,000 to $199,999	5,072	19.9
$200,000 to $299,999	13,378	52.4
$300,000 to $499,999	4,977	19.5
$500,000 to $999,999	1,038	4.1
$1,000,000 or more	35	0.1
Median (dollars)	239,900	(X)
…RTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
… a mortgage	22,944	89.8
Less than $300	12	0.0
$300 to $499	199	0.8
$500 to $699	458	1.8
$700 to $999	1,407	5.5
$1,000 to $1,499	5,929	23.2
$1,500 to $1,999	8,181	32.0
$2,000 or more	6,758	26.5
Median (dollars)	1,694	(X)
Not mortgaged	2,604	10.2
Median (dollars)	318	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	5,227	20.5
15 to 19 percent	4,061	15.9
20 to 24 percent	4,393	17.2
25 to 29 percent	3,502	13.7
30 to 34 percent	2,453	9.6
35 percent or more	5,794	22.7
Not computed	118	0.5
Specified renter-occupied units	**8,159**	**100.0**
GROSS RENT		
Less than $200	198	2.4
$200 to $299	136	1.7
$300 to $499	237	2.9
$500 to $749	778	9.5
…750 to $999	2,080	25.5
…00 to $1,499	3,602	44.1
…,500 or more	901	11.0
No cash rent	227	2.8
Median (dollars)	1,058	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	1,110	13.6

A004714

Subject	Number	Percent
15 to 19 percent	1,231	15.1
20 to 24 percent	1,243	15.2
25 to 29 percent	1,189	14.6
30 to 34 percent	844	10.3
35 percent or more	2,211	27.1
Not computed	331	4.1

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H1, H7, H20, H23, H24, H30, H34, H38, H40, H43, H44, H48, H51, H62, H63, H69, H74, H76, H90, H91, and H94

A004715

DP-4. **Profile of Selected Housing Characteristics: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **San Buenaventura (Ventura) city, California**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
Total housing units	**39,828**	**100.0**
UNITS IN STRUCTURE		
1-unit, detached	22,251	55.9
1-unit, attached	3,430	8.6
2 units	1,519	3.8
3 or 4 units	2,610	6.6
5 to 9 units	2,354	5.9
10 to 19 units	1,567	3.9
20 or more units	3,472	8.7
Mobile home	2,417	6.1
Boat, RV, van, etc.	208	0.5
YEAR STRUCTURE BUILT		
1999 to March 2000	341	0.9
1995 to 1998	1,279	3.2
1990 to 1994	1,490	3.7
0 to 1989	5,972	15.0
0 to 1979	9,396	23.6
1960 to 1969	9,625	24.2
1940 to 1959	8,311	20.9
1939 or earlier	3,414	8.6
ROOMS		
1 room	1,324	3.3
2 rooms	2,794	7.0
3 rooms	4,773	12.0
4 rooms	6,677	16.8
5 rooms	7,807	19.6
6 rooms	7,631	19.2
7 rooms	5,155	12.9
8 rooms	2,302	5.8
9 or more rooms	1,365	3.4
Median (rooms)	5.1	(X)
Occupied Housing Units	**38,571**	**100.0**
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	8,281	21.5
1995 to 1998	12,604	32.7
1990 to 1994	5,768	15.0
1980 to 1989	5,761	14.9
1970 to 1979	3,573	9.3
1969 or earlier	2,584	6.7
VEHICLES AVAILABLE		
None	2,724	7.1
	13,184	34.2
	15,742	40.8
3 or more	6,921	17.9
HOUSE HEATING FUEL		
Utility gas	33,538	87.0
Bottled, tank, or LP gas	391	1.0
Electricity	3,874	10.0

Subject	Number	Percent
Fuel oil, kerosene, etc.	18	0.0
...l or coke	0	0.0
...d	101	0.3
Solar energy	172	0.4
Other fuel	29	0.1
No fuel used	448	1.2
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	204	0.5
Lacking complete kitchen facilities	309	0.8
No telephone service	430	1.1
OCCUPANTS PER ROOM		
Occupied housing units	**38,571**	**100.0**
1.00 or less	35,560	92.2
1.01 to 1.50	1,404	3.6
1.51 or more	1,607	4.2
Specified owner-occupied units	**18,428**	**100.0**
VALUE		
Less than $50,000	53	0.3
$50,000 to $99,999	135	0.7
$100,000 to $149,999	984	5.3
$150,000 to $199,999	2,583	14.0
$200,000 to $299,999	9,661	52.4
$300,000 to $499,999	4,105	22.3
$500,000 to $999,999	869	4.7
$1,000,000 or more	38	0.2
Median (dollars)	245,400	(X)
...RTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
...a mortgage	14,523	78.8
Less than $300	23	0.1
$300 to $499	326	1.8
$500 to $699	615	3.3
$700 to $999	1,234	6.7
$1,000 to $1,499	4,569	24.8
$1,500 to $1,999	4,633	25.1
$2,000 or more	3,123	16.9
Median (dollars)	1,546	(X)
Not mortgaged	3,905	21.2
Median (dollars)	266	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	5,586	30.3
15 to 19 percent	2,873	15.6
20 to 24 percent	2,609	14.2
25 to 29 percent	2,044	11.1
30 to 34 percent	1,550	8.4
35 percent or more	3,691	20.0
Not computed	75	0.4
Specified renter-occupied units	**15,961**	**100.0**
GROSS RENT		
Less than $200	245	1.5
$200 to $299	540	3.4
$300 to $499	938	5.9
$500 to $749	4,188	26.2
...750 to $999	4,966	31.1
...00 to $1,499	3,754	23.5
...500 or more	907	5.7
...o cash rent	423	2.7
Median (dollars)	841	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	2,072	13.0

A004717

Subject	Number	Percent
15 to 19 percent	2,313	14.5
'o 24 percent	2,221	13.9
ɔ 29 percent	2,228	14.0
30 to 34 percent	1,411	8.8
35 percent or more	5,137	32.2
Not computed	579	3.6

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H1, H7, H20, H23, H24, H30, H34, H38, H40, H43, H44, H48, H51, H62, H63, H69, H74, H76, H90, H91, and H94

A004718

DP-4. **Profile of Selected Housing Characteristics: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Thousand Oaks city, California**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
Total housing units	**42,928**	**100.0**
UNITS IN STRUCTURE		
1-unit, detached	28,521	66.4
1-unit, attached	5,148	12.0
2 units	208	0.5
3 or 4 units	1,524	3.6
5 to 9 units	1,614	3.8
10 to 19 units	1,529	3.6
20 or more units	3,313	7.7
Mobile home	1,071	2.5
Boat, RV, van, etc.	0	0.0
YEAR STRUCTURE BUILT		
1999 to March 2000	1,404	3.3
1995 to 1998	2,729	6.4
1990 to 1994	2,181	5.1
1980 to 1989	8,583	20.0
0 to 1979	15,938	37.1
0 to 1969	9,813	22.9
1940 to 1959	2,120	4.9
1939 or earlier	160	0.4
ROOMS		
1 room	494	1.2
2 rooms	1,947	4.5
3 rooms	2,728	6.4
4 rooms	4,044	9.4
5 rooms	6,461	15.1
6 rooms	7,788	18.1
7 rooms	7,709	18.0
8 rooms	6,631	15.4
9 or more rooms	5,126	11.9
Median (rooms)	6.2	(X)
Occupied Housing Units	**41,796**	**100.0**
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	7,530	18.0
1995 to 1998	12,888	30.8
1990 to 1994	6,628	15.9
1980 to 1989	8,351	20.0
1970 to 1979	4,680	11.2
1969 or earlier	1,719	4.1
VEHICLES AVAILABLE		
None	1,502	3.6
1	10,449	25.0
	19,573	46.8
more	10,272	24.6
HOUSE HEATING FUEL		
Utility gas	35,162	84.1
Bottled, tank, or LP gas	253	0.6
Electricity	6,186	14.8

A004719

Subject	Number	Percent
Fuel oil, kerosene, etc.	0	0.0
·l or coke	0	0.0
·d	57	0.1
Solar energy	33	0.1
Other fuel	0	0.0
No fuel used	105	0.3
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	92	0.2
Lacking complete kitchen facilities	219	0.5
No telephone service	110	0.3
OCCUPANTS PER ROOM		
Occupied housing units	**41,796**	**100.0**
1.00 or less	39,915	95.5
1.01 to 1.50	996	2.4
1.51 or more	885	2.1
Specified owner-occupied units	**28,513**	**100.0**
VALUE		
Less than $50,000	119	0.4
$50,000 to $99,999	59	0.2
$100,000 to $149,999	687	2.4
$150,000 to $199,999	2,091	7.3
$200,000 to $299,999	9,334	32.7
$300,000 to $499,999	12,373	43.4
$500,000 to $999,999	3,193	11.2
$1,000,000 or more	657	2.3
Median (dollars)	324,800	(X)
·RTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
·a mortgage	24,942	87.5
Less than $300	7	0.0
$300 to $499	247	0.9
$500 to $699	632	2.2
$700 to $999	1,394	4.9
$1,000 to $1,499	4,552	16.0
$1,500 to $1,999	6,777	23.8
$2,000 or more	11,333	39.7
Median (dollars)	1,916	(X)
Not mortgaged	3,571	12.5
Median (dollars)	391	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	6,788	23.8
15 to 19 percent	4,670	16.4
20 to 24 percent	4,419	15.5
25 to 29 percent	3,327	11.7
30 to 34 percent	2,471	8.7
35 percent or more	6,734	23.6
Not computed	104	0.4
Specified renter-occupied units	**10,241**	**100.0**
GROSS RENT		
Less than $200	147	1.4
$200 to $299	128	1.2
$300 to $499	238	2.3
$500 to $749	699	6.8
·750 to $999	2,482	24.2
·00 to $1,499	4,323	42.2
·,500 or more	1,990	19.4
No cash rent	234	2.3
Median (dollars)	1,131	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	1,382	13.5

A004720

Subject	Number	Percent
15 to 19 percent	1,441	14.1
20 to 24 percent	1,560	15.2
25 to 29 percent	1,163	11.4
30 to 34 percent	979	9.6
35 percent or more	3,303	32.3
Not computed	413	4.0

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H1, H7, H20, H23, H24, H30, H34, H38, H40, H43, H44, H48, H51, H62, H63, H69, H74, H76, H90, H91, and H94

A004721

DP-4. **Profile of Selected Housing Characteristics: 2000**
Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data
Geographic Area: **Camarillo city, California**

NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, definitions, and count corrections see http://factfinder.census.gov/home/en/datanotes/expsf3.htm.

Subject	Number	Percent
Total housing units	**21,931**	**100.0**
UNITS IN STRUCTURE		
1-unit, detached	12,847	58.6
1-unit, attached	4,492	20.5
2 units	319	1.5
3 or 4 units	506	2.3
5 to 9 units	658	3.0
10 to 19 units	598	2.7
20 or more units	1,454	6.6
Mobile home	1,057	4.8
Boat, RV, van, etc.	0	0.0
YEAR STRUCTURE BUILT		
1999 to March 2000	738	3.4
1995 to 1998	1,328	6.1
1990 to 1994	1,415	6.5
[illegible]80 to 1989	5,044	23.0
[illegible]0 to 1979	7,886	36.0
1960 to 1969	4,260	19.4
1940 to 1959	1,111	5.1
1939 or earlier	149	0.7
ROOMS		
1 room	263	1.2
2 rooms	933	4.3
3 rooms	1,783	8.1
4 rooms	2,980	13.6
5 rooms	4,255	19.4
6 rooms	4,501	20.5
7 rooms	3,574	16.3
8 rooms	2,313	10.5
9 or more rooms	1,329	6.1
Median (rooms)	5.7	(X)
Occupied Housing Units	**21,444**	**100.0**
YEAR HOUSEHOLDER MOVED INTO UNIT		
1999 to March 2000	4,068	19.0
1995 to 1998	6,508	30.3
1990 to 1994	3,516	16.4
1980 to 1989	3,858	18.0
1970 to 1979	2,597	12.1
1969 or earlier	897	4.2
VEHICLES AVAILABLE		
None	886	4.1
[illegible]	6,924	32.3
[illegible]	9,223	43.0
3 or more	4,411	20.6
HOUSE HEATING FUEL		
Utility gas	16,476	76.8
Bottled, tank, or LP gas	168	0.8
Electricity	4,715	22.0

A004722

Subject	Number	Percent
Fuel oil, kerosene, etc.	0	0.0
..l or coke	0	0.0
..od	18	0.1
Solar energy	14	0.1
Other fuel	0	0.0
No fuel used	53	0.2
SELECTED CHARACTERISTICS		
Lacking complete plumbing facilities	30	0.1
Lacking complete kitchen facilities	61	0.3
No telephone service	34	0.2
OCCUPANTS PER ROOM		
Occupied housing units	**21,444**	**100.0**
1.00 or less	20,398	95.1
1.01 to 1.50	503	2.3
1.51 or more	543	2.5
Specified owner-occupied units	**14,031**	**100.0**
VALUE		
Less than $50,000	54	0.4
$50,000 to $99,999	98	0.7
$100,000 to $149,999	584	4.2
$150,000 to $199,999	2,143	15.3
$200,000 to $299,999	7,182	51.2
$300,000 to $499,999	3,101	22.1
$500,000 to $999,999	733	5.2
$1,000,000 or more	136	1.0
Median (dollars)	252,100	(X)
..RTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS		
..a mortgage	10,677	76.1
Less than $300	22	0.2
$300 to $499	245	1.7
$500 to $699	306	2.2
$700 to $999	715	5.1
$1,000 to $1,499	2,875	20.5
$1,500 to $1,999	3,430	24.4
$2,000 or more	3,084	22.0
Median (dollars)	1,656	(X)
Not mortgaged	3,354	23.9
Median (dollars)	346	(X)
SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	4,152	29.6
15 to 19 percent	2,076	14.8
20 to 24 percent	2,022	14.4
25 to 29 percent	1,541	11.0
30 to 34 percent	1,119	8.0
35 percent or more	3,050	21.7
Not computed	71	0.5
Specified renter-occupied units	**5,674**	**100.0**
GROSS RENT		
Less than $200	116	2.0
$200 to $299	168	3.0
$300 to $499	178	3.1
$500 to $749	619	10.9
..750 to $999	1,696	29.9
..00 to $1,499	1,803	31.8
..500 or more	605	10.7
..o cash rent	489	8.6
Median (dollars)	975	(X)
GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999		
Less than 15 percent	680	12.0

A004723

Subject	Number	Percent
15 to 19 percent	756	13.3
20 to 24 percent	734	12.9
ɔ 29 percent	864	15.2
.o 34 percent	447	7.9
35 percent or more	1,643	29.0
Not computed	550	9.7

(X) Not applicable.
Source: U.S. Census Bureau, Census 2000 Summary File 3, Matrices H1, H7, H20, H23, H24, H30, H34, H38, H40, H43, H44, H48, H51, H62, H63, H69, H74, H76, H90, H91, and H94

A004724

County of Ventura

Planning Division

About Us | Contact Us | Jobs Internships

Home Page
Permits
Plans
Ordinances • Regulations
Programs • Services
Fees • Charges
Meetings • Agendas
Studies • EIR's
Information Documents • Maps
Forms

Your Tool Box

Click here for Acrobat Reader

Click here for Word Converter

Housing Programs

The Planning Division helps the County meet state mandated housing goals by overseeing periodic updates of the housing element of the County General Plan, implementing housing policies and programs detailed in the General Plan, and conducting Board-directed special studies on major housing issues.

In June 2001, the Board of Supervisors adopted the County's "housing element" for the 1998-2005 time period. The housing element is integrated into the Population and Housing chapters of the Land Use Appendix and Goals, Policies and Programs of the County General Plan, which guide County actions in addressing existing and future housing needs of residents of all income levels in the unincorporated areas. By law, the County is required to update the housing element every five years. Yearly updates on the County's progress in meeting its fair share of regional housing needs is provided in the General Plan Annual Report.

The Board of Supervisors approved the County of Ventura Farmworker Housing Study in August 2002. The purpose of the study was to survey farmworkers regarding their existing housing conditions and needs, estimate future farmworker housing needs, identify potential sites for development of farm labor housing projects, and recommend amendments to the zoning ordinance to reduce regulatory impediments to permitting farmworker housing. The results of the survey and the resulting policy recommendations are detailed in the Farmworker Housing Study.

In response to recommendations contained in the Farmworker Housing Study, the Board of Supervisors directed Planning staff to initiate amendments to the County's Non-Coastal Zoning Ordinance. The Amendments to the Non-Coastal Zoning Ordinance for Farmworker Housing were adopted by the Board in May 2003. The adopted changes amend the definitions, discretionary permits, and development standards for farmworker housing to better reflect current needs and standards.

In May 2003, responding to State law (AB 1866 of the 2002 Legislative Session), the Board of Supervisors approved revisions to the County's ordinance standards for Second Dwelling Units. These amendments allow second dwellings that meet the specific development criteria for their location and zoning to be approved over-the-counter without a public hearing. Amendments to the Non-Coastal Zoning Ordinance for Second Dwelling Units have been incorporated into the July 2003 version of the County's Non-Coastal Zoning Ordinance. In addition, the California Coastal Commission approved Coastal Zoning Ordinance amendments in January 2004. The new development standards for second dwelling units and frequently asked questions are detailed in the Second Dwelling Unit Public Information brochure.

>>	Farmworker Housing Study	PDF 514 kb
>>	Amendments to the Non-Coastal Zoning Ordinance for Second Dwelling Units	PDF 251 kb
>>	Amendments to the Non-Coastal Zoning Ordinance for Farmworker Housing	PDF 205 kb
	Amendments to the Coastal Zoning Ordinance for Second	

A004725

>>	Dwelling Units	PDF 36 kb

Back Home

Environmental Regulations and the Housing Market: A Review of the Literature

Katherine A. Kiel
College of the Holy Cross
Department of Economics

Abstract

Environmental regulations in the United States are intended to improve the quality of the environment; preserve ecosystems, including wildlife; and protect human health. This article considers the impact of regulations such as the Clean Air Act Amendments; the Clean Water Act; the Comprehensive Environmental Response, Compensation, and Liability Act; the Endangered Species Act; the National Environmental Policy Act; and state and local regulations (including "smart growth" controls) on the U.S. housing market. The extent of the impacts could be measured by looking at changes in house prices and the quantity of housing available.

Whether or not environmental regulations are placed directly on the suppliers of housing, it is possible that these regulations will have an impact on the housing market. Environmental laws can impact the supply of land, a key input in the production of housing. Laws can also change the prices of other inputs into the construction of housing (for example, lumber) and can affect the supply of housing in that way. Laws can impact the supply of housing if they increase the amount of time necessary to build housing units or if they increase the possibility of litigation faced by housing developers. On the other hand, if the regulations are effective, they can impact the demand for housing by changing the quality of available housing. All these effects can lead to changes in both the price and the quantity of housing in the market.

The academic literature has focused on the increase in the demand for housing due to improvements in environmental quality. Very few studies attempt to estimate the impact on the supply of land or housing. Some researchers examine the issue by interviewing developers and public officials and asking for estimates of cost impacts (for example, James and Muller, 1977). Others use statistical techniques to control for factors that impact sales prices so that the effect of the regulations can be more clearly seen (for example, Frech and Lafferty, 1984). Generally, these studies find that regulations restricting possible uses of undeveloped land lead to decreases in the prices of that land (for example, Guttery, Poe, and Sirmans, 2000), and land near restricted areas can increase in value due to increased demand (for example, Beaton and Pollock, 1992).

To better understand the impact of environmental regulations on the housing market, research must be extended in several directions. Studies that use statistical techniques to examine the housing market both before and after regulations are put in place are necessary. Although the data requirements of such studies are large, the results will estimate the extent of the increase in prices due solely to the regulations. If policy analysts want to know whether the increase is due to a decrease in housing supply, an increase in housing demand, or a combination of the two, the results from such studies can be used in a "second stage" estimation of separate housing supply and demand equations.

Research also needs to estimate the amount of land removed from the housing market due to environmental restrictions. Landis (2001) has undertaken such a study in California; his work should be extended to other areas. He demonstrated the importance of estimating how much of the land that is removed would be "developable," as well as how the removal impacts the ability of the area under study to grow.

Finally, research should examine the general equilibrium impacts of environmental laws on all markets because the housing market also is affected by the labor market. Riddel (2001) estimated this type of model and showed that open space purchases in Colorado increased the demand for housing by more than they reduced the supply of housing.

If regulations lead to increases in housing prices that make housing unaffordable, the next step would be to consider how to make the regulations less costly or how to subsidize those most affected by the price increases.

Introduction

Environmental regulations in the United States are intended to improve the quality of the environment; preserve ecosystems, including wildlife; and protect human health. These regulations are often written without considering how much they will cost; some regulations are explicitly required to ignore costs. In evaluating current regulations as well as future laws, both the costs and the benefits must be considered. Only in this way can careful decisions be made on which regulations will be enacted and enforced. A decision may be made to ignore the costs, but in doing so, decisionmakers must be mindful of what is being sacrificed as well as what is being gained.

Some environmental regulations impact the housing market by affecting the supply of developable land or by restricting its use. Other environmental regulations focus not on the land market but rather on polluters such as factories, utility plants, and automobiles. Polluters may, however, attempt to pass the costs placed on them to other consumers, including housing developers and landowners. Thus, environmental regulations can impact the cost of supplying housing.

Because environmental regulations can be local in nature, homeowners often will experience the benefits. Thus, researchers often examine changes in the price of housing due to regulations and then use those changes to quantify the benefits received. One can see that increases in the price of housing can be due to decreases in supply and/or increases in demand for housing. The literature has yet to separate those two impacts in a way that the increases due to changes in supply of housing can be measured separately from those due to changes in demand for housing.

This article surveys environmental regulations in the United States with a particular focus on how the housing market is impacted. It first looks at the current regulations, then at the theoretical impact of the regulations on the housing market, and next at empirical studies that attempt to quantify the impact. After a discussion of what the literature examines, the following sections look at the gaps in the literature, and then make some proposals about how future research could be directed for a clearer understanding of the overall impact of regulations on the housing market.

Environmental Regulations in the United States

Federal regulations intended to improve the quality of the environment began in the United States with the Rivers and Harbor Act of 1899. This law forbade the dumping of refuse into any navigable water in the United States. Other laws have followed, especially since the U.S. Environmental Protection Agency (EPA) was created in 1970. State and local governments also have passed laws that regulate the use of air, water, wildlife, and other natural resources.

Environmental regulations in the United States generally focus on a single media, such as air or water. The EPA typically oversees federal regulations, although other agencies, such as the U.S. Army Corps of Engineers (Corps), also can be responsible. The overarching goal of these regulations is to protect the health and well-being of individuals as well as plants and animals.

The quality of air in the United States is the focus of the Clean Air Act (CAA) of 1970, which was most recently amended in 1990 by the Clean Air Act Amendments (CAAA). The goal of the CAA and its amendments is to ensure that the National Ambient Air Quality Standards are met. These standards are set to protect the health of all individuals in the United States. The CAAA control the amount of pollution emitted by both stationary and mobile sources, with an estimated 27,000 stationary sources of air and more than 200 million mobile sources (Tietenberg, 2001). Currently, the regulations typically work through command and control policies, such as requirements on the quantity of emissions from automobiles. Some regulations, however, do allow for more market-based regulations, such as emissions permits in the case of certain pollutants in certain areas (for example, sulfur dioxide trading programs). The regulations are believed to have been effective in reducing air pollution in the United States because air quality has generally improved since 1970 (see exhibits 1-4).

Water pollution is controlled under the Clean Water Act (CWA) of 1972 and the reauthorizations of that act in 1977 and 1987. The three main goals of the CWA are as follows:

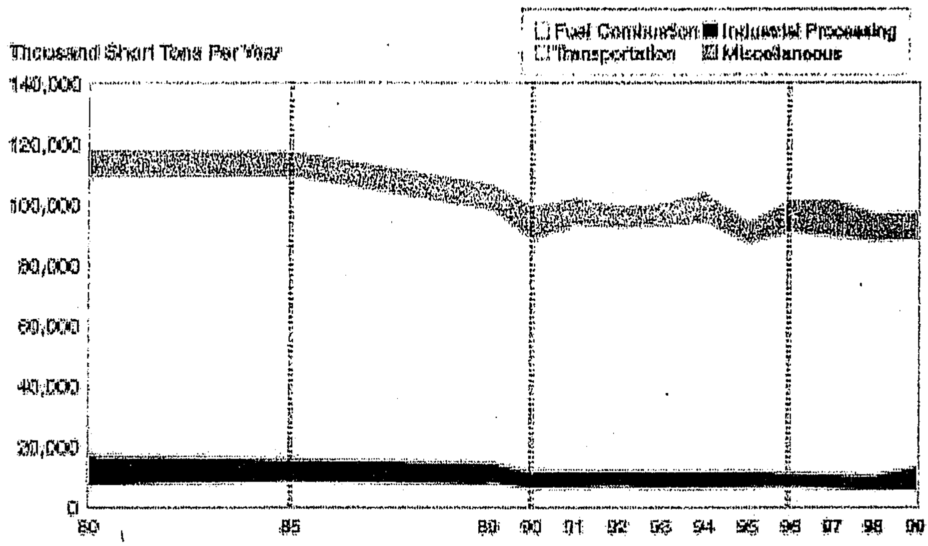
- Elimination of pollution discharges into all navigable waters.
- Ability of all surface waters to be able to support recreational activities.
- Elimination of the discharge of toxic pollutants into water.

These goals are typically met by effluent limitations on identifiable sources and the funding of the construction of publicly owned water treatment plants. It is estimated that more than 60,000 sources of effluent are regulated (Tietenberg, 2001). Water quality has generally improved in the United States since the 1970s, even though the regulation of nonpoint sources has not been stressed.

Drinking water in the United States is legislated by the Safe Drinking Water Act in 1974 and its 1977, 1986, and 1996 amendments, which set standards for the quality of drinking water. The amendments also include funds to help states and localities maintain the quality of their local water purification and testing infrastructure.

Exhibit 1

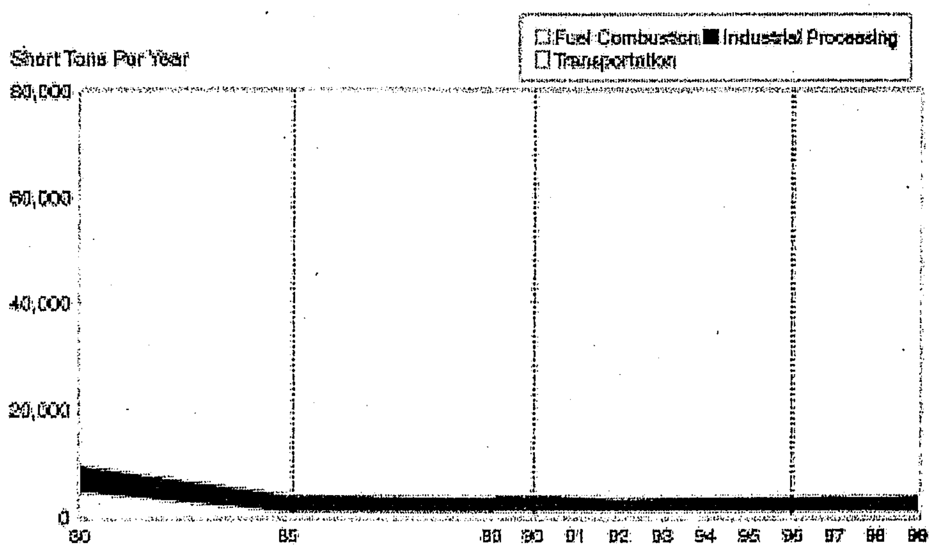
National Total Carbon Monoxide Emissions, 1980–99



Source: U.S. Environmental Protection Agency, 2001a: 14

Exhibit 2

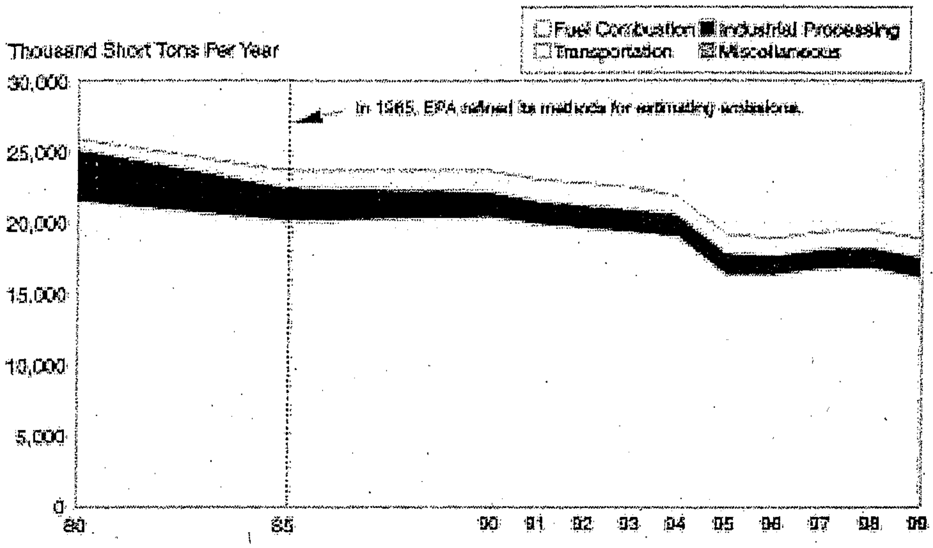
National Total Lead Emissions Trend, 1980–99



Source: U.S. Environmental Protection Agency, 2001a: 20

Exhibit 3

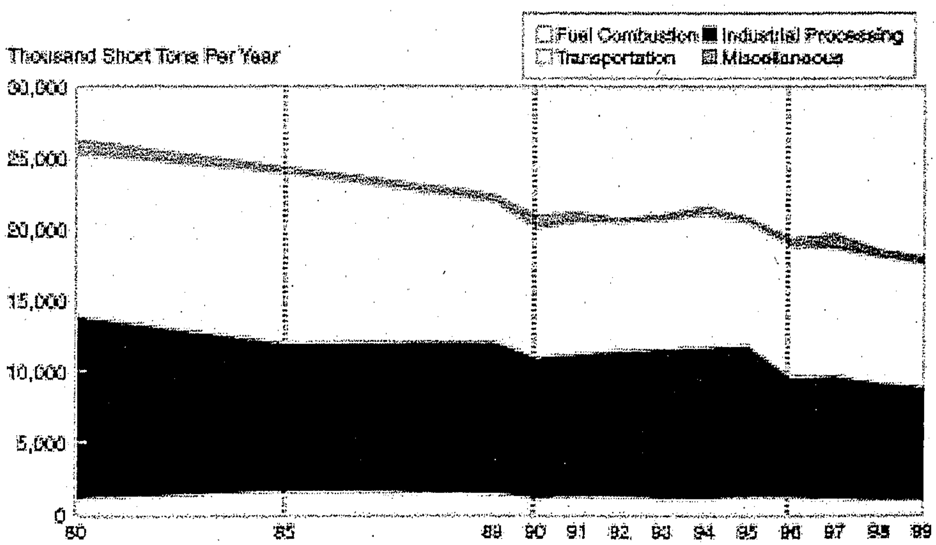
National Total Sodium Dioxide Emissions Trend, 1980–99



Source: U.S. Environmental Protection Agency, 2001b: 63

Exhibit 4

Trend in National Total Anthropogenic VOC Emissions, 1980–99



Source: U.S. Environmental Protection Agency, 2001a: 36

The federal government regulates wetlands in the United States in an effort to preserve them as much as possible. The EPA and the Corps, under the Clean Water Act, enforce these regulations. The CWA requires landowners to receive permission from the Corps before conducting dredging or filling activities on any land defined as a "wetland" or other water of the United States. States and localities can have stricter requirements on landowners in this aspect, and many do. Before issuing a permit, landowners can be required to submit their land to an environmental review to determine the impact on the local area and its habitats if the wetlands were to be altered. Under wetlands regulations, more than human health and well-being are taken into account; the ecosystem, including fish and wildlife, also must be considered (Guttery, Poe, and Sirmans, 2000). The regulations have been successful in slowing the draining of wetlands.

> According to a report issued by the National Wetland Inventory (*Status and Trends of Wetlands in the Conterminous United States 1986 to 1997*, U.S. Fish and Wildlife Service), the rate of wetland loss in the United States has decreased to an estimated annual loss of 58,500 acres (an 80 percent reduction compared to the previous decade). The Natural Resource Conservation Service's Natural Resource Inventory (NRI), reporting on the health of America's private lands, also shows significant reduction in wetland losses. The NRI found an average annual net loss of 32,600 acres of wetlands on nonfederal lands from 1992 to 1997 (a 58 percent reduction compared to the previous decade) (EPA, 2000: 45).

Environmental laws directed toward hazardous waste sites focus on cleaning the sites and getting the responsible parties to pay for the cleaning. The federal regulations governing hazardous waste site cleaning and payment for this are included in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund. These laws are meant to reduce the risk to humans from improperly disposed-of toxic substances. Brownfields sites are properties "the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (EPA, "Brownfields," n.d.). Some states have changed the legal liability assumed by purchasers of such property in an effort to increase the development of such sites, especially in urban areas.

Current federal regulations on air and water quality focus primarily on human health. The Endangered Species Act (ESA) of 1973 was enacted to protect the biodiversity of the United States by identifying plants and animals at risk of becoming extinct and then requiring that their ecosystems be protected. The ESA does not allow considering the costs of protecting the ecosystem; if a species is at risk, it must be protected. At least 600 species have been identified as endangered or threatened under the ESA, ranging from the Florida manatee to the black lace cactus (EPA, "Endangered Species," n.d.).

The National Environmental Policy Act (NEPA) of 1969 requires that all federal public policy proposals be assessed for environmental impact, regardless of the agency that is evaluating the program. In 1997, 498 Environmental Impact Statements were completed by the agencies and departments of the U.S. government (Callan and Thomas, 2004). Many states have similar legislation to oversee the environmental impacts of state-level laws. The federal agency that most directly impacts housing is the U.S. Department of Housing and Urban Development (HUD), but other agencies also can affect development (Braconi, 1996). Because state agencies are often called on to administer federal programs, the requirement to assess the impact of a proposed policy on the local environment can filter down to the state level.

The Coastal Zone Management Act of 1972 (CZMA) is not generally thought of as an environmental regulation. Administered by the National Oceanic and Atmospheric

Administration, CZMA is intended to provide a means for states and localities to manage their coastal areas. Some states, such as New Jersey and California, have used the law to restrict or regulate development in their coastal areas in an effort to manage that particular environment (Frech and Lafferty, 1984).

States and localities also enact environmental legislation, some of which has been mentioned above.[1] For example, Washington state allows city and county governments to declare areas "environmentally sensitive," which makes development in the area subject to agency reviews (see Steiner, 2001, for a discussion). New York City requires an "analysis of the environmental impacts of all privately sponsored projects that need discretionary approvals from a government agency" (Salama, Shill, and Stark, n.d.: 49). Such laws can lead to delays and increase the uncertainty about the ability of developers to successfully complete a project. If such delays are anticipated, any expected costs will be capitalized into the price of the land, thus lowering the price of the land.

Although urban growth controls are not inherently environmental regulations, some are designed to enhance the quality of life of an area, and thus include requirements on open space; other controls are intended to decrease the amount of traffic in an area. Therefore, such controls may have environmental goals included in them. Currently, the term *smart growth* is used to encompass urban growth controls and the "prevention of urban sprawl, integration of transportation and land use plans, provision of affordable housing, protection of open space and timely and efficient provision of urban infrastructure" (Knaap, 2001: xi). Some 73 metropolitan areas have used urban growth boundaries to try to limit expansion (see Burby et al., 2001), although it is not clear if this has been done to improve the local environment.

The environmental regulations in the United States are wide-reaching, covering factories, automobiles, municipal water supplies, wetlands, wildlife, and coastal areas. Although few of these laws are specifically directed toward the housing market, we turn now to consider how the laws can directly and indirectly affect that market.

Impact of Environmental Regulations on Housing: Theory

Whether or not environmental regulations are placed directly on the suppliers of housing, these regulations may have an impact on the housing market. If regulations increase costs for firms, the firms' owners will attempt to shift the costs to others. If costs can be shifted to housing suppliers, the incidence of the regulation differs from those that the law is originally directed to. Freeman (1992) discussed what he called the "naïve" view of the cost of environmental regulations when only the costs of pollution controls bought and maintained by the regulated firms are considered. Freeman argued that those costs can be shifted forward. Thus, even if the environmental regulations are not placed directly on the suppliers of housing, the cost of supplying housing can increase due to the regulations.

Environmental laws can impact the supply of land, a key input in the production of housing. These laws also can affect the supply of housing in other ways by changing the prices of other inputs. If the regulations are effective, they can impact the demand for housing by increasing the local environmental quality. All these effects can lead to changes in both the price and the quantity of housing in the market.

Supply of Housing

The first consideration is the market for land. Any regulations that restrict the supply of land will lead to an increase in the price of land. This would include regulations such as the ESA, wetlands regulations, and coastal zone management laws. If the land removed from the market was desirable land in the eyes of developers, the price of similar land not similarly regulated will increase. An increase in the price of land—a critical factor in housing production—will decrease the supply of housing in the market, leading to an increase in the price of housing, all other factors remaining constant.

In the housing market, supply can be affected by changes other than an increase in the price of land. If the regulations increase the prices of other inputs, supply will again decrease. For example, if the intensified regulation on water treatment plants increases the costs of sewer pipelines, the cost of new developments where such pipelines must be installed will increase.

The supply of new housing can be affected if the increased regulations cause delays in the development process. If the delays are expected, such as situations where reviews must be conducted, developers can incorporate the lags into their timeline, which will increase their holding costs, including interest payments. If the delays are unexpected—for example, when the review process leads to changes in the design of the project—the cost impact will be even greater because developers will not be able to schedule deliveries and workers appropriately.

If the regulations increase the possibility of litigation, the supply of new housing can be affected. Litigation, whether expected or unexpected, can increase the cost of new housing by either forcing the developers to fight the problem in court or encouraging them to be overly inclusive in their reviews in an attempt to avoid potential lawsuits (see discussion by Braconi, 1996). If the litigation is anticipated, the expected costs of such litigation should be capitalized into the price of the land that developers purchase.

Demand for Housing

Demand for housing can also be impacted by environmental regulations. If the regulations are successful in the sense that they improve the quality of the local environment, the demand for housing in that area should increase, thus increasing the price of housing. The notion here is that if there were two identical houses, but one was in a neighborhood with cleaner air, that house would sell for more because individuals would be more interested in obtaining it (see Boyle and Kiel, 2001, for a review of studies on this topic).

One of the reasons that environmental regulations are passed is because environmental goods are public goods (or common property resources) that are exploited in the market if they are not regulated. The government steps in to correct this market failure, thereby improving the quality of life for the impacted society. Laws that had been passed are expected to have improved the local area and made it a more desirable place to live. Houses in that area are now perceived as being of higher quality, and the demand for these houses should increase. In fact, if the demand did not increase, one might wonder why the government would enact such a law.[2]

As exhibit 5 illustrates, a decrease would be expected in the supply of housing due to the increase in the price of inputs, such as land. The shift from S1 to S2 with a corresponding increase in price from P1 to P2 shows this. In addition, an increase in the demand for housing would be expected as the quality of the house's neighborhood improves. The shift from D1 to D2 with a corresponding increase in price from P2 to P3 demonstrates this. Clearly, house prices will increase due to the regulations. What is not as clear, however, is what will happen to the quantity of housing seen in the market. Whether the decrease in supply is greater or less than the increase in demand is largely an empirical question.

Air Regulations

Few of the federal regulations discussed above are directly targeted at housing developers. The regulations could, however, have an indirect effect. The CAAA regulations on mobile source polluters increase the price of new automobiles. If this makes public transportation, and thus houses located closer to public transportation, more desirable, an increase in demand for housing in these locations could occur (Freeman, 1992). The regulations on stationary source polluters should not have an impact on housing unless they restrict large developments in areas where the standards for air quality are currently being exceeded.

Water and Wetlands Regulations

[Public health]?

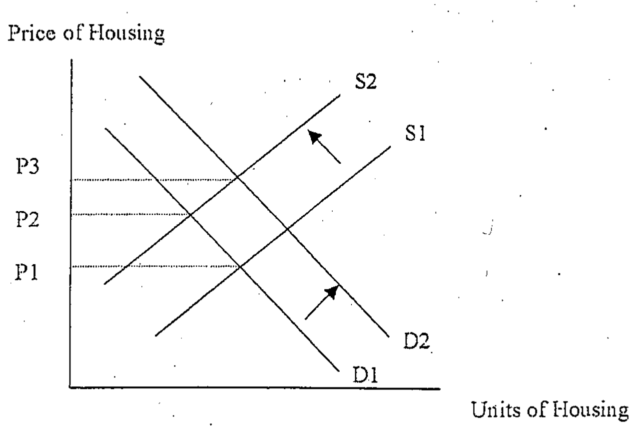
The laws that regulate water quality, especially those that focus on water treatment plants, can generate costs to the suppliers of housing if the increased costs of water treatment are passed on to the housing market. The costs could be passed to the developers of new housing or to the current residents through higher taxes. Wetlands preservation laws focus on developers of housing; by requiring a thorough review before being allowed to develop the property, the costs to the suppliers of housing are increased. The increased uncertainty of whether the permit will be granted may affect the price of properties that contain wetlands, but this should, in theory, decrease the price of that land because increased costs of developing the land would be capitalized into the price of the land.

Endangered Species Act

The ESA could also affect the housing market. If the ESA removes a significant amount of land from possible development, the price of remaining developable land should increase, thus increasing the cost of supplying housing in those areas. When this occurs, the housing market would be expected to adjust by using less land per housing unit over time, which would help mitigate the cost increase. The Endangered Species Act (ESA) could decrease the prices of those lands removed from development because the potential uses of the land would be reduced. Because that land would not be an input to the housing market, changes in its prices are not considered in this article.

Exhibit 5

The Housing Market



A004735

Coastal Zone Regulations

Coastal zone regulations should decrease the supply of land available for development for housing, thus increasing the price of the land available for housing projects. Developers would attempt to pass this cost increase to the purchasers of housing. Thus, land similar to that removed from potential development should be impacted and experience a price increase.

Toxic Waste Regulations

Efforts by the EPA to clean up toxic waste sites through the Superfund are likely to increase house prices in the area surrounding the site; as a nearby dangerous property is cleaned, demand for houses in that area should increase. Of course, the length of time that it takes to clean the site will affect how quickly local house prices should increase. The legal liability involved with purchasing or developing such a site, even after it is cleaned, reduces the likelihood that such properties will be redeveloped. Current changes to the regulations are meant to make the program "faster, fairer and more efficient" (Smith and Garcia, 2002: 162). If these changes are successful, the regulations should lead to an increased supply of land, which should decrease the cost of supplying housing.

In the case of brownfields, the federal, state, and local governments generally have attempted to speed up the process through reforms that are intended to "expedite site clean-ups by addressing remedy selection issues and setting risk-based clean-up priorities" (Smith and Garcia, 2002: 164) and to reduce the legal uncertainty. These reforms are aimed at encouraging the redevelopment of these properties, especially in the inner urban core. As with Superfund, redeveloping these properties should affect local house prices and may increase the supply of housing in the area.

Growth Controls

Because smart growth policies vary across locales, predicting their general impact on the housing market is difficult. Urban growth boundaries will limit the supply of developable land and could lead to a decrease in the supply of land. Policies focused on the local quality of life should increase demand for housing in the area. The interaction of these forces will determine the final outcome in the market.

In theory, who will bear the final costs of these regulations should be clear. If the laws put restrictions on the use of some land (for example, ESA), the price of that land will fall; this will cause economic harm to owners of that land. Neighboring land may increase in value due to either the reduction in the amount of land available for development or the perception by purchasers that the area has become more desirable. Owners of these types of properties will experience a gain due to the laws. For regulations that increase the cost of developing land (for example, the Clean Water Act), if the costs are anticipated, they will be capitalized into the price of the land. Therefore, the sellers of that land will receive a lower price for their property. Developers should pay the same in total (land plus costs); thus, the price of housing should not be impacted. If the costs are not anticipated, developers will have higher total costs and will attempt to share those costs with those who purchase homes.

The Impact of Environmental Regulations on Housing: Empirical Results

Any environmental regulation that restricts the supply of land to the housing market will increase the cost of housing by decreasing the supply of housing at any given price. Surprisingly few empirical studies, however, attempt to quantify the magnitude of that shift. Some studies state that the impact is present but make no attempt to measure the increase while controlling for other possible sources of change (for example, Braconi, 1996).

One of the earliest studies to attempt to quantify the impact was by James and Muller (1977), who examined the effect of required environmental impact reviews (EIRs) on local housing costs in Florida and California. As mentioned above, these reviews are required at the federal level under the National Environmental Policy Act (NEPA); some states also passed legislation mandating the consideration of environmental impacts from development. James and Muller looked at San Diego, California, and Broward County, Florida, in part because the programs were quite different in the two states and also because these areas were rapidly growing.

The authors measured two types of costs due to EIRs: (1) the cost of undertaking the review and (2) the cost of "requirements imposed on the developers in order to protect the public interest" (James and Muller, 1977: 284). The first costs were those of preparing the review, public assessment of the review, and the delays due to the review process. After interviewing developers and public officials, the authors estimated that these costs were $192 per housing unit in Florida and $115 per housing unit in California (assumed to be 1975 dollars). The second costs were "the costs of altering the physical characteristics of new residential developments to comply with public requirements arising from the EIR process" (James and Muller, 1977: 289). This included costs due to projects being rejected as well as projects that were required to change in some way. James and Muller used a survey by the Center for Urban Policy Research to estimate that the increases in costs were $194 per unit in Florida and $50 per unit in California (again assumed to be 1975 dollars). The authors did not attempt to quantify the benefits from the EIRs, but did mention that in San Diego, a "majority of the officials contacted in the course of the study thought that EIRs had a significant positive influence on environmental quality in the state," although the public officials in Florida felt that, "EIRs had no effect or only a small effect on their land use decisions" (James and Muller, 1977: 296). James and Muller argued that the benefits were likely to be received by existing local residents, and the costs were likely to be borne by developers and purchasers of new housing units. Of course, as the price of new housing increases, the demand for existing houses increases; thus, the price of existing houses also increases. Whether this relationship is seen as a cost or a benefit to current residents is not clear.

Peiser (1981) studied local land development regulations (including environmental laws) in Dallas and Houston, Texas. These two cities were chosen because they were similar in many ways, yet faced different regulatory requirements. Peiser considered five different types of regulations on developments: utilities, land use controls, subdivisions, roads, and the environment. The relevant environmental regulations included federal Environmental Impact Statements, flood plain permits, coastal areas, and wetlands, with the latter two relevant only in Houston. Peiser examined two developments, one in each city, and found that costs in Dallas were approximately $1,000 per lot (in 1981 dollars) higher than in Houston. Since the author did not break out his cost estimates, how much of that $1,000 is due to environmental regulations is not determinable. Because Houston has more environmental requirements, however, one could assume that those costs are relatively low.

In a 1984 study by Frech and Lafferty, the impact of the California Coastal Commission (CCC) on house prices was estimated. The CCC was created to protect and preserve the environmental resources of the coastal area in California. The authors argued that the CCC would impact house prices through two channels: the reduction of available land for residential development should increase the price, as would the increase in local amenities, such as open space. The authors believed that the former effect would be uniform over their study area because they were looking at only a small coastal area where building extends only 13 miles inland. The latter effect should, in their opinion, be stronger closer to the coastline.

The authors estimated a hedonic regression of the sales price of the house as a function of its characteristics. They included categorical variables based on distance from the coast and an interaction variable that measures the amount of land used for agriculture if the property was in the coastal zone and was sold after the CCC was created; the latter variable takes on a value of zero if the house was not in the coastal zone or was sold prior to the CCC's existence.[3] Using sales data from 1966 to 1975, the authors found that prices did increase for houses close to the coast (by $2,882 to $5,040, in 1975 dollars), while those further inland (0.5 to 13 miles) experienced a smaller price increase ($989 to $1,700, in 1975 dollars). Frech and Lafferty argued that the difference between the two was due to amenity effects. The authors then stated that because "much of the price rise occurred as far as 13 miles inland...most of the price rise is attributable to the reduction of area-wide residential land, rather than improved amenities" (Frech and Lafferty, 1984: 120). Frech and Lafferty went on to point out that the benefits of the increased prices were received by current homeowners and owners of developed land.

In a study of the impact of coastal area building restrictions in Maryland, Parsons and Wu (1991) estimated the decrease in the value of properties that were no longer able to be developed. They first estimated a hedonic regression using data from a developed coastal area. This regression equation was then used to predict the value of "lost amenities" to houses that could not be built in the coastal areas, and, thus, must be built further inland. The authors calculated that houses that would have been built on the waterfront would lose an average of $96,672 in value (in 1983 dollars), while those that would have been built further away would lose an average of $447 in value (in 1983 dollars). This study showed that land that was restricted in its use (rather than restricted in supply) fell in price as predicted. The authors did not attempt to estimate the benefits from the coastal zone restrictions.

Beaton (1991) examined the impact of land use regulations on the prices of vacant land in Pinelands, New Jersey. As he made clear, zoning changes can affect both the supply and the demand sides. Beaton used the repeat sales approach to estimate the price effect of growth management policies while holding other characteristics constant over time. The data he used were sales prices of parcels in the area from 1965 through 1986. Beaton stated that from 1966 through 1972, "economic development was the dominant theme for local planning," and that 1972 through 1981 was a period in which the environmental issues became more important (Beaton, 1991: 13). He found that the values of parcels zoned for residential development increased due to the policies that controlled growth and development. In looking at vacant land, Beaton found that parcels in more restrictive zones fell in value, and the value of those parcels in less restrictive zones fell and later increased after the restrictions were put in place.

Beaton and Pollock (1992) examined the impact of Maryland's environmental protection legislation on housing values using a hedonic regression technique. The legislation, passed in 1986, reduced densities in some areas and controlled "development-related runoff, erosion, and habitat disturbance" in other parts of the Chesapeake Bay area (Beaton and

A004738

Pollock, 1992: 3). In 1988, Maryland also enacted wetlands development legislation that further increased the review process for developments in this same area. The laws "grandfathered in" existing development and phased in the implementation of the law. Using a data set of sales that took place between 1981 and 1986, the authors ran hedonic regressions that controlled for various parcel attributes including whether it was located in an area under the new regulations. Beaton and Pollock reported finding that no "significant" drop occurred in values of vacant land, and those areas with access to employment and recreation saw price increases for both vacant and residential land. Thus, land prices did increase in this area after regulation.

In a paper prepared for a HUD conference, Braconi (1996) presented an overview of the impact of environmental regulations on housing. He reviewed the laws established by NEPA, wetlands regulations, coastal zone management, the Clean Air Act, CERCLA, radon regulations, asbestos regulations, historic preservation requirements, unfunded mandates, and lead paint regulations. These regulations impact the cost of building new housing, financing costs experienced by homeowners, and operating expenses, and Braconi discussed each of these in turn. He argued that the increase in house prices between 1963 and 1993 was due, at least in part, to the increase in environmental regulations. He provided only anecdotal evidence, however, of the impact of specific regulations on housing prices.

In a response to Braconi's paper, Evans (1996) pointed out that few environmental regulations existed before 1972; therefore, regulations cannot be blamed for the price increases from 1962 to 1972, and that the increases in house prices also could be due to sociodemographic changes, such as an increase in population.

Guttery, Poe, and Sirmans (2000) studied the impact of wetlands regulations on residential sales prices in Baton Rouge, Louisiana. As discussed above, the costs of complying with these regulations can include delays, preparing the environmental impact report, and meeting the mitigation requirements (Guttery, Poe, and Sirmans, 2000). These costs are placed on the permit applicants (often developers), but economic theory suggests that the applicants will attempt to pass these costs on to the purchasers of the property. The study proposed to test this possibility by examining the sales prices and characteristics of 328 multifamily housing units in the study area between 1983 and 1988. This time period was selected because the regulations on wetlands went into force in 1986; thus the sample included units sold before and after the regulations. The results of the hedonic regression showed that sales prices of wetlands property fell by 10.5 percent, relative to nonwetlands property, after the regulations were put in place. The authors argued that this was due to the restrictions put on the development of the land. One could interpret this result as due to a demand shift in that wetlands properties are now less desirable, causing the prices to fall. The purchasers knew that extra costs would be involved in developing the property, and those costs were capitalized into the reduced sales price.

To estimate the impact of environmental regulations on housing production costs, the amount of land removed from the market must be estimated. If this amount is large relative to the remaining developable land, the regulations could have a significant effect on the housing market. Landis (2001) estimated the impact of various kinds of restrictions on the availability of land in California by combining various data sets in a geographic information systems framework. He reported that in 1996, California had "3.5 million acres of urbanized land, 32 million acres of public or physically undevelopable land, and nearly 25 million acres of potentially developable raw land" (Landis, 2001: 9). Landis estimated that slightly more than 17 million acres were "developable and accessible" (within 6.2 miles of a major roadway), and that slightly less than a million acres were mapped wetland areas. Thus, only 5 percent of the "developable and accessible" land in California is undevelopable due to wetland restrictions. Another 1.8 million acres are a "highly suitable habitat for eight or more threatened and endangered...species," and thus could be removed from the market under the ESA rulings. Landis interpreted these numbers to mean that environmental constraints (which he defined as "prohibitions on wetlands, flood zones, and prime and unique farmland development") would "slightly reduce the state's ability to accommodate projected household growth through 2010...Only Orange and Los Angeles Counties would encounter land capacity limits" (Landis, 2001: 19).

In an undated research report, Crellin examined the impact of the ESA on property values. Using property transaction in three counties in Washington—from 1986 through 2002 for Clallam County, from 1995 through 2001 for Clark County, and from 1986 through 2001 for Snohomish County, Crellin estimated separate hedonic models for single-family homes, condominiums, commercial properties, and land. In all cases (except for unplatted land in Clallam County), Crellin found that properties located in ESA-designated areas fell in value by between 1.4 and 19.9 percent. In theory, one would expect undeveloped land that has restrictions placed on it to decrease in value, but Crellin provided no explanation as to why existing structures would decrease in value. Regardless, his empirical model did not provide a convincing test of the hypothesis. Crellin's data are countywide, yet he did not control for any town or neighborhood characteristics; perhaps his indicator variable of ESA restrictions picked up those factors. In addition, Crellin controlled for changes over time through the use of a linear time trend; other researchers (for example, Kiel, 1995) have shown that including data before the restrictions were put in place as well as after is important, and that a more general form for the time trend should be used.

Analysis of the Current Empirical Literature

The studies discussed above use either case studies or regression analysis in their attempts to measure the impact of regulations on housing prices. When using case studies, one is often forced to rely on information from surveys of the relevant parties, such as housing developers. These individuals may not report costs accurately because either they did not have an incentive to take the time to correctly calculate the prices or had a political incentive to overstate the costs.

Economists generally prefer to use what are called *revealed preference* models, where the actions of individuals are observed in the market, rather than reported in a survey situation—which is called a *stated preference*. Regression analysis on housing prices is an example of this revealed preference approach. Data are taken from actual transactions made by individuals who are utility or profit maximizing.

The hedonic method (Rosen, 1974) assumes that the housing market is in equilibrium so that the price that is observed is where housing supply is equal to housing demand in the relevant market. The technique requires the researcher to include as explanatory variables all the characteristics of the house that influence its sales price. Thus, a typical hedonic regression is as follows:

$$P_i = \beta_0 + \beta_1 H_i + \beta_2 N_i + \varepsilon_i$$

where P_i is the sales price of the i^{th} house, H_i contains information on the characteristics of the house (such as number of bedrooms), N_i contains information on the neighborhood in which the house is located (such as quality of the local school), and ε_i is the unobservable stochastic random error. The estimated βs, thus, are the marginal impact of a unit change in the characteristics on the price of the house; they are the marginal prices of the included characteristics determined in the housing market.

Hedonic regressions can be used to estimate the prices of environmental characteristics in a house's neighborhood if the quality can be quantified and included in the regression. Although an individual does not directly purchase, for example, air quality, if the individual considers local air quality when purchasing a house, a measure of local air quality should be included in the hedonic regression. Its estimated coefficient then represents its marginal price as determined in the housing market. A large number of studies used this approach when valuing environmental goods; see Boyle and Kiel (2001) for a survey of these studies.

Thus, the studies reviewed above that use the hedonic approach are in good company.[4] The hedonic studies cited in Boyle and Kiel (2001), however, assume that the increase in price is due to a shift in demand; higher environmental quality makes the house more desirable so that the demand increases, making the price increase. Most of the studies reviewed above assume that the increase in price is due to a decrease in supply; higher environmental standards increase input costs and decrease supply, thus increasing the price. Frech and Lafferty (1984) conducted the only study that attempted to model the two shifts separately (although they use a single hedonic regression) by explicitly including characteristics that should impact demand, but not supply, and characteristics that should do the reverse.

The prices estimated in the hedonic regression are the result of the housing market being in equilibrium. If, however, the researcher was interested in knowing the impact of demand and supply separately, a second stage must be considered. As Rosen (1974) discussed, the marginal prices estimated in the hedonic regression could be used to estimate the marginal willingness-to-pay (demand) and supply functions in a second stage. The issue in the second stage becomes one of econometrically identifying the demand and supply functions.

The focus in the economics literature has been on the estimation of the demand function in the second stage, often because knowing the demand function allows the researcher to estimate the social benefits from the regulation in question. As Freeman (1992) made clear, two potential problems exist in this second stage. The first is that the demand function uses the price from the hedonic regression as its dependent variable; that price is an estimated price, not an observed price. If the second stage uses the same data that were used in the hedonic regression, the results for the demand regression will be the same as those for the hedonic regression. The second problem is that the price and quantity of the environmental good are both endogenous in the hedonic regression. Thus "demand shifters," such as income, are correlated with observed choices, and it becomes difficult econometrically to separate the shifters from the demand equation; see Freeman (1992) for a discussion of this issue. The difficulties with estimating the supply function are the same.

Several studies have used Rosen's (1974) approach in an effort to estimate the demand for air quality; see Zabel and Kiel (2000) for a brief review. Researchers attempted to identify the second stage demand equation by making strict assumptions on the demand equation, such as its functional form, by using data from multiple markets or from a market over time. In general, the results were mixed, underlining the difficulty in estimating a second stage demand equation given prices estimated with a hedonic regression.

In Which Direction Should the Literature Go?

Clearly the literature has yet to fully answer the question of the impact of environmental regulations on the housing market. If the question of interest is, "Do current environmental regulations make housing less affordable?" it would be sensible to break the question into two separate parts: (1) do current regulations increase the price of housing through changes in the supply and/or the demand, and (2) does the price increase so much as to render housing unaffordable? If the answers to these questions are "yes," the decision to be made is whether regulations can be changed in such a way that the price impact can be minimized, if regulations should be removed, or if housing costs should be subsidized for (certain) consumers who are greatly impacted by the regulations.

The first consideration is the question whether regulations increase housing prices through changes in supply and/or demand. To be able to separate the two is important because in the case of supply decreases, a decrease in the quantity of housing in the market is seen; with demand increases, an increase is seen. Thus, the availability of housing is determined by which type of shift occurs in the market, or if both, which shift is greater.

The supply of housing, as discussed above, is impacted by the supply of inputs to housing. An examination of the literature does not indicate how large the changes are in the supply of developable land when environmental regulations are imposed. The research that Landis (2001) performed is important and should be carried out in other localities. The decrease in available land may be so small in most areas that housing prices are not impacted by these rules. This hypothesis can be tested by estimating hedonic regressions on house prices in areas where the regulations have been imposed. The regressions must cover long periods of time, extending from well before the regulations were considered until after they have been enacted.[5] This will enable the researcher to determine the impact of the regulation on the market while carefully controlling for other possible impacts. Cross-sectional studies, or those that do not cover a long enough time span, cannot segregate the regulation's effects. Of course, if an increase in house prices is captured by the hedonic regressions, some of this price increase could be due to increased demand for housing near the restricted area if owners view the restrictions as increasing the quality of the housing.

A similar hedonic regression approach could be used to examine the impacts of changes in other supply costs due to environmental regulations. If changes in the costs of water treatment lead to increased costs to developers, the amount of the cost increase could be estimated in the hedonic regression. Again, having a long time series of data would be important to consider the problem; cross-sectional data would not be useful because other changes could not be controlled.

Another approach would be to estimate the second stage hedonic regressions that would then separate the price changes seen in the housing market into supply effects and demand effects. This technique is not used often because it requires identification of each equation that must be used by looking at multiple housing markets or finding instruments for supply and/or demand shifters. An example of this technique is in Witte, Sumka, and Erekson (1979). The authors developed a unique data set that consisted of a sample of rental properties in North Carolina in 1972. They had information on the rent charged, characteristics of the unit and its neighborhood, and characteristics of both the renter and the landlord. These data enabled the authors to identify the supply and demand equations given the marginal prices estimated in a first stage hedonic rent regression.

To use this technique to study the impact of regulations on house prices, data sets will need to be developed. Although existing data sets have information on the occupant (for example, American Housing Survey), obtaining information on the landlord or the developer of the unit would be difficult. The benefits from estimating the second stage regressions would appear to be worth the effort of putting together such a data set because it would likely provide the clearest answer to the question under consideration.

Another option is to develop more comprehensive models of urban areas. An example of such a model was developed by Riddel (2001). She pointed out that changes in environmental amenities will impact not only the housing market, but also potentially related markets, such as the labor market. If these changes take time to move through the various markets, cross-sectional hedonic regressions will not capture all the price changes.

Other researchers looking at the "quality of life" have modeled housing markets and labor markets simultaneously (for example, Blomquist, Berger, and Hoehn, 1988). The argument for doing this is that positive externalities (including environmental goods) make an area more desirable to workers who are therefore willing to work for a lower wage. As more workers move in to take advantage of the externality, the demand for local housing increases, thereby increasing house prices. Thus, a more "desirable" area will see lower than expected wages and higher than expected house prices.

Riddel (2001) criticized the use of house price hedonic models in estimating the prices of environmental goods because they explicitly ignore the labor market.[6] She, therefore, developed a multimarket model in which prices and quantities in the markets were assumed to vary over time.

Riddel's model included the housing market, the labor market, and the apartment/rental market, and allowed environmental externalities to be endogenous. Because the author was considering the case of open space purchases by the local government in Boulder, Colorado, this environmental good was considered to be a function of the number of households and the level of taxes (used to purchase the good).

→ not subject to direct manipulation by the modeler. Caused by the variables in the model.

Riddel used a dynamic modeling approach to estimate the model using data from 1981 through 1995 and found that the 15,000 acres of open space purchased during her sample period led to an increase in housing prices of 3.75 percent (due to changes in demand as well as in supply). She also reported a 3.3-percent increase in jobs and a slight increase in total housing stock. It appears, although Riddel did not state it this way, that the shift in demand for housing was slightly greater than the shift in supply. Thus "the positive implicit price of open space clearly expresses the value of the program to residents" (Riddel, 2001: 511). Riddel's model did not lead to a separate specification of supply and demand functions, but her results do let us see which of the two shifts dominated by reporting the change in the total quantity of housing due to the program.

Research such as Riddel's (2001) that uses multimarket models should be encouraged. It may avoid some of the econometric complications involved in estimating the second stage regressions in the hedonic framework, and the data requirements might be less restrictive. Both approaches will enable researchers to better understand the impacts of changes in supply and demand due to environmental regulations.

Ongoing concerns exist about the impact of the delays and litigation due to uncertainty created by the regulations. If unanticipated, the delays can lead to increased costs to developers. If fully anticipated, the expected costs would be capitalized into the price of the land affected by the regulations. An interesting line of research would be to examine those areas where the regulatory process has strict timelines that should reduce the delays as well as the uncertainty; the laws should have a smaller impact on these land prices than in areas without such timelines. If, indeed, such timelines do minimize the effect, such an approach should be encouraged nationally. Examining areas where insurance markets might be used to share the costs of uncertainty would also be of interest; for instance, some insurance markets exist for brownfields properties.

When we have determined the extent to which environmental regulations affect the price of housing, we can then ask whether the increase makes housing unaffordable. As Bogdon (2001) pointed out, affordability is easy to define, but difficult to measure. She considered several measures of affordability in the rental market by looking at both the demand and supply side of the market. On the demand side, one could examine the percentage of income spent on housing by households with different levels of income or the income necessary for a household to rent a unit that meets some standard of quality. These measures indicate the importance of household income to affordability measures. On the supply side, one could look at vacancy rates at different rent levels or at the availability of units renting at or below the fair market rate set by HUD.

Bogdon also looked at measures of affordability for homeowners, particularly first-time buyers. Common measures include the National Association of REALTORS®' affordability index, which is the ratio of the median family income to the income needed to buy the median price house, or the National Association of Home Builders' housing opportunity index, which looks at the distribution of house prices.

Bogdon discussed the need for local authorities to "track affordability measures on a regular basis, compare current and past numbers and use this information to plan policy changes if affordability problems worsen" (Bogdon, 2001: 325). When considering environmental regulations, comparing measures of housing affordability before and after the laws are in place would be important. Given the estimated price increases, will housing affordability problems arise in the area?

Conclusions

Surprisingly little is known about the impact of environmental regulations on the price and quantity of housing in the United States. Most, if not all, economists would say that the increase in the price of inputs, along with any increase in delays and/or uncertainty, would decrease the supply of new housing to the market, thus increasing the price of new housing. And most, if not all, economists also would say that improvements in the environment due to regulation should increase the demand for housing in areas that have experienced the improvement, which would increase price. Many economists have estimated the price increase, with some attributing the increase to changes in supply and others to changes in demand. Why these impacts have not been separated is curious.

It is clear, however, that environmental regulations do increase the price of housing. By how much Whether that increase is good or bad will depend on one's perspective. An increase in the price of housing due to an improvement in the local environment is beneficial to a homeowner in that area; when a Superfund site is cleaned and property values increase, local residents whose investment asset increases in value see this to be good. The price increase, however, makes it more difficult for outsiders to purchase homes in those areas. The issue becomes one of affordability. On the other hand, imagining policymakers refusing to undertake improvements in the environment simply because they would make housing less affordable is difficult; policymakers could improve the environment and then subsidize new owners if that was their concern.

Instead, it seems reasonable to undertake a cost-benefit analysis whereby the costs of the program, including the decrease in the supply of housing, are measured against the benefits of the program, including the increase in the demand for housing. If the benefits are greater than the costs, the program should be considered. In the housing market viewed in isolation, this would mean an increase in the quantity of housing. Of course, we do not want to consider any market in isolation. Rather, social costs and social benefits in all markets that are affected should be examined. This will require the development of more sophisticated models, which will demand more data. The author of this article recommends this as the direction to take.

Acknowledgments

The author would like to thank Kasie Blanchette for research assistance and Michael Schill, Jeff Zabel, the referees, and discussants for helpful comments. All remaining errors are hers.

Author

Professor Katherine A. Kiel is an associate professor in economics at the College of the Holy Cross. She received an A.B. from Occidental College and a Ph.D. in economics from the University of California at San Diego. Her current research focuses on the impact of various kinds of pollution on house prices, with some of her research funded by the U.S. Environmental Protection Agency. She has published in the areas of real estate price indices, racial discrimination in the housing market, and the demand for environmental quality in the United States, with her work appearing in the Journal of Environmental Economics and Management, Land Economics, *the* Journal of Urban Economics, *and other peer-reviewed journals.*

Notes

1. A full discussion of current state and local environmental regulations is beyond the scope of this article.

2. It is also possible that the benefits from the regulation are felt nationally, whereas the costs of the regulation are felt only locally. I thank a referee for making this point.

3. The hedonic regression technique will be discussed below. See Freeman (1996) for an excellent discussion of the approach.

4. Or repeat sales analysis, which is a variant of the hedonic technique.

5. To carry out such research, datasets on housing transactions and housing characteristics in the affected area over the relevant time periods would have to be obtained.

6. Riddel (2001) also points out that the assumption required by hedonic models that the housing market be in equilibrium is often inappropriate.

References

Beaton, W. Patrick. 1991. "The Impact of Regional Land-Use Controls on Property Values: The Case of the New Jersey Pinelands," *Land Economics* 67 (2): 172–194.

Beaton, W. Patrick, and Marcus Pollock. 1992. "Economic Impact of Growth Management Policies Surrounding the Chesapeake Bay," *Land Economics* 68 (4): 434–453.

Blomquist, Glenn C., Mark C. Berger, and John P. Hoehn. 1988. "New Estimates of Quality of Life in Urban Areas," *American Economic Review* 78 (1): 89–107.

Bogdon, Amy S. 2001. Monitoring Housing Affordability. In *Land Market Monitoring for Smart Urban Growth*, edited by Gerrit J. Knaap. Cambridge, MA: Lincoln Institute of Land Policy.

Boyle, Melissa A., and Katherine A. Kiel. 2001. "A Survey of House Price Hedonic Studies of the Impact of Environmental Externalities," *Journal of Real Estate Literature* (9) 2: 117–144.

Braconi, Frank P. 1996. "Environmental Regulation and Housing Affordability," *Cityscape* 2 (3): 81–106.

Burby, Raymond J., et al. 2001. "Urban Containment Policy and Exposure to Natural Hazards: Is There a Connection?" *Journal of Environmental Planning and Management* 44 (4): 475–490.

Callan, Scott J., and Janet M. Thomas. 2004. *Environmental Economics and Management: Theory, Policy and Applications*, 3rd ed. Mason, OH: South-Western.

Crellin, Glenn E. n.d. "Assessment of Endangered Species Act Enforcement on Real Property Values: A Case Study of Three Washington Counties." http://www.realtor.org/Research.nsf/files/Crellinfinal2.pdf/$FILE/Crellinfinal2.pdf.

Evans, Brock. 1996. "An Environmentalist's Response to Environmental Regulation and Housing Affordability," *Cityscape* 2 (3): 107–114.

Frech, H.E., III, and Ronald N. Lafferty. 1984. "The Effect of the California Coastal Commission on Housing Prices," *Journal of Urban Economics* 16: 105–123.

Freeman, A. Myrick, III. 1992. *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington DC: Resources for the Future.

Guttery, Randall S., Stephen L. Poe, and C.F. Sirmans. 2000. "Federal Wetlands Regulation: Restrictions on the Nationwide Permit Program and the Implications for Residential Property Owners," *American Business Law Journal* 37 (2): 299–341.

James, Franklin J., and Thomas Muller. 1977. "Environmental Impact Evaluation, Land Use Planning, and the Housing Consumer," *American Real Estate and Urban Economics Association Journal* 5 (3): 279–301.

Kiel, Katherine A. 1995. "Measuring the Impact of the Discovery and Cleaning of Identified Hazardous Waste Sites on House Values," *Land Economics* 74 (4): 428–435.

Knaap, Gerrit J., ed. 2001. *Land Market Monitoring for Smart Urban Growth*. Cambridge, MA: Lincoln Institute of Land Policy.

Landis, John D. 2001. "Characterizing Urban Land Capacity: Alternative Approaches and Methodologies." In *Land Market Monitoring for Smart Urban Growth*, edited by Gerrit J. Knaap. Cambridge, MA: Lincoln Institute of Land Policy.

Parsons, George R., and Yangru Wu. 1991. "The Opportunity Cost of Coastal Land-Use Controls: An Empirical Analysis," *Land Economics* 67 (3): 308–316.

Peiser, Richard B. 1981. "Land Development Regulation: A Case Study of Dallas and Houston, Texas," *American Real Estate and Urban Economics Association Journal* 9 (4): 397–417.

Riddel, Mary. 2001. "A Dynamic Approach to Estimating Hedonic Prices for Environmental Goods: An Application to Open Space Purchase," *Land Economics* 77 (4): 494–512.

Rosen, S. 1974. "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *Journal of Political Economy* 82 (1): 34–55.

Salama, Jerry J., Michael H. Schill, and Martha E. Stark. 1999. *Reducing the Cost of New Housing Construction in New York.* A Report to The New York City Partnership and Chamber of Commerce, The New York City Housing Partnership and The New York City Department of Housing Preservation and Development. New York: New York University School of Law, Center for Real Estate and Urban Policy. http://www.law.nyu.edu/realestatecenter/CREUP_Papers/Cost_Study_1999/NYCHousingCost.pdf.

Smith, Jennifer Esway, and Margot W. Garcia (2002). "From Superfund Site to Developable Property: The Case of Rentokil," *Journal of Environmental Planning and Management* 45 (2): 157–179.

Steiner, Frederick. 2001. "Identifying Environmental Constraints to and Opportunities for Development." In *Land Market Monitoring for Smart Urban Growth*, edited by Gerrit J. Knaap. Cambridge, MA: Lincoln Institute of Land Policy.

Tietenberg, Tom. 2001. *Environmental Economics and Policy*, 3rd ed. Boston, MA: Addison Wesley Longman, Inc.

U.S. Environmental Protection Agency (EPA). 2001a. "Critical Pollutants—National Trends" [part 1 of 3]. In *National Air Quality and Emissions Trends Report 1999.* http://www.epa.gov/air/airtrends/aqtrnd99/pdfs/Chapter2a.pdf.

———. 2001b. "Critical Pollutants—National Trends" [part 3 of 3]. In *National Air Quality and Emissions Trends Report 1999.* http://www.epa.gov/air/airtrends/aqtrnd99/pdfs/Chapter2c.pdf.

———. 2000. "Wetlands," In *2000 National Water Quality Inventory.* http://www.epa.gov/305b/2000report/chp5.pdf.

———. n.d. "Brownfields Cleanup and Redevelopment: About Brownfields." http://www.epa.gov/swerosps/bf/about.htm.

———. n.d. "Endangered Species." http://www.epa.gov/ebtpages/ecosspecieendangered-species.html.

Witte, Ann D., Howard J. Sumka, and Homer Erekson. 1979. "An Estimate of a Structural Hedonic Price Model of the Housing Market: An Application of Rosen's Theory of Implicit Markets," *Econometrica* 47 (5): 1151–1173.

Zabel, Jeffrey E., and Katherine A. Kiel. 2000. "Estimating the Demand for Air Quality in Four U.S. Cities," *Land Economics* 76 (2): 174–194.

Role of Science and Engineering in Decision-Making Within the State and Regional Water Boards

September 2005

Prepared by:

William A. Vance, Ph.D.

Consultant to the
State Water Resources Control Board
Sacramento, CA 95812

A004748

Role of Science and Engineering in Decision Making Within the State and Regional Water Boards

Index

Acronyms and Terms

ACL	Administrative Civil Liabilities
Anadromous	Migrating from the sea to fresh water to spawn
Benthic	Collection of organisms living on or in sea or lake bottoms
BU	Beneficial Use, 28 BUs of water have been defined by the State and Regional Boards (Table 2 p. 40).
CAO	Cleanup and Abatement Order
CDO	Cease and Desist Order
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CTR	California Toxics Rule
CWA	Clean Water Act
GAMA	Groundwater Ambient Monitoring and Assessment
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Water Quality Control Board, nine such regions are established in California
SCCWRP	Southern California Coastal Waters Research Project
SFEI	San Francisco Estuary Institute
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
UAA	Use Attainability Analysis, determines if a beneficial use can be attained
WDR	Waste Discharge Requirements, “permit” conditions under Porter-Cologne
WQO	Water Quality Objective, the State’s version of the federal water quality standard

Executive Summary

The primary purpose of State Water Resources Control Board and the nine Regional Water Quality Control Boards is to preserve and protect the beneficial uses of all waters of the State. This includes all ground water, more than 1.6 million acres of lakes, 211,000 miles of rivers and streams, more than 1.3 million acres of bays and estuaries, 1,609 miles of coastline, and the first three miles of ocean off of our coastline. The California Legislature found that "activities and factors which may affect the quality of the waters of the State shall be regulated to attain the highest water quality that is reasonable . . . (and) that the state must protect the quality of waters in the state from degradation inside or outside the boundaries of the state." How we use water, or expect to use water in the future determines its beneficial uses. A designated beneficial use determines the quality of water that must be maintained for that use. Protecting water quality and preventing degradation in order to preserve beneficial uses of water relies heavily on science and engineering. Protecting water quality also depends on an equitable system for allocating water resources, which is carried out by the State Water Resources Control Board's water rights program. This report discusses the role of science and engineering (technology) in decision-making at the water boards in implementing federal and state laws along with their implementing regulations, and water board plans and policies.

Laws, Plans, and Policies

There are four laws, fourteen water quality control plans, and eighteen formal State Board policies that govern the activities of the water boards. Two laws, the federal Clean Water Act and the California Water Quality Control Act (Porter-Cologne), are summarized with respect to the authorities and responsibilities delegated to the water boards. The Ocean Plan is briefly reviewed to illustrate the water quality objectives (criteria) used to protect ocean water quality, how permit conditions for effluent discharges are determined, and how to monitor for compliance with permit conditions. The Bay-Delta Plan is discussed in the context of water rights. The Plan contains flow and flow-dependent objectives to protect the beneficial uses of the Delta and Suisun Marsh from salinity. The flows necessary to achieve these protections are determined using hydrologic, hydrodynamic, water quality, and fishery models. Because the flow objectives can only be met through the control of water diversions, the plan is implemented through flow conditions applied to diversions granted in water right permits. These permits have wide-ranging impacts on major water projects and reservoirs that divert or release water flowing to the Bay-Delta.

The Porter-Cologne requirement for Regional Boards to prepare Basin Plans is discussed. Basin Plans must: designate existing and potential beneficial uses of surface and ground waters; include water quality objectives that establish limits or levels for pollutants that are protective of beneficial uses; and contain implementation programs with a description of the actions necessary to achieve the water quality objectives. Because each of these components is based on science and engineering and Basin Plans are regulatory in nature, they must undergo external scientific peer review.

The Porter-Cologne Water Quality Control Act requires the State Board to formulate and adopt policy for water quality control. Four of the 18 policies adopted to-date that strongly affect the science and engineering used in decision-making are discussed in the report. The *"Policy for Implementation of the Toxic Standards for Inland Surface Waters, Enclosed Bays and Estuaries in California"* contains water quality criteria adopted by U.S. EPA for California (the California Toxics Rule). These criteria, along with the technical procedures, algorithms, and statistics contained in the policy document, are used to establish permitted effluent discharge limits. The mandate of the Legislature to "protect the quality of waters in the state from degradation" takes form in the State Board's anti-degradation policy, *"Policy with Respect to Maintaining the High Quality of Waters in California."* The federal anti-degradation policy applies only to surface waters, while the State policy includes groundwaters. The impact of both policies occurs whenever a water quality objective or standard is proposed for change. Any proposed change must undergo an anti-degradation analysis that includes scientific determinations of the potential degradation that could occur, an engineering analysis to determine what technologies could be used to minimize any degradation, and social and economic analyses of any benefits that would accrue to the people of the State if a small amount of degradation is allowed.

The federal Clean Water Act requires each state to identify waters within their borders that are not attaining water quality standards or objectives. The process for identifying and listing impaired waters is contained in the State's *"Water Control Policy for Developing California's (federal) Clean Water Act Section 303(d) List."* The policy document provides detailed guidance on the review and evaluation of field measurements, data, and information used to decide which water bodies can be placed on, or removed from the 303(d) list. Determining whether a water body or a river/stream segment meets any one of eight listing criteria relies heavily on science.

The significance of a water body, stream, or river segment being placed on the §303(d) list of impaired water bodies is that a total maximum daily load (TMDL) and its implementation plan are also required under the Clean Water Act §303(d). A TMDL is a numerical calculation of the amount of a pollutant that a water body can assimilate and still meet standards. A TMDL includes one or more numerical targets that represent attainment of the applicable standards in addition to the allocation of the target load among the various sources of the pollutant (dischargers and runoff). Determining the loading capacity of any water body for a given pollutant and assigning responsibility for reducing the load is done using methods based on science and engineering. The scientific basis of a TMDL must undergo external scientific peer review.

Water Quality Standards

Water quality standards (termed "objectives" in California) are established to protect the beneficial uses designated for each water body or segment identified in a basin plan. Twenty-nine beneficial uses have been defined by the State and Regional Water Boards. Protecting each designated beneficial use of water is achieved through a numerical and/or narrative water quality objective. The criteria used to evaluate water quality are established in federal water quality standards and their equivalent state-adopted water quality objectives. U.S. EPA identifies 126 priority toxic pollutants in the California Toxics Rule and provides numerical criteria for 108 of these. (A toxic pollutant can have one or more water quality objectives depending on the number of beneficial uses to be protected, e.g., there can be one for consumption (drinking), body contact (swimming), and one for aquatic organisms.) Additional pollutants and water quality objectives are contained in the California Ocean Plan and the water quality control plans adopted by the State Water Board and Regional Water Boards in their regional Basin Plans. Narrative water quality objectives are used for those waste constituents without numeric criterion. An example of a narrative objective would be 'no toxic substances in toxic amounts shall be permitted.' Toxicity can be measured using bioassays. Toxicity bioassays have the advantage of directly assessing the biological effects of all effluent constituents, including the interactive effects of multiple chemicals. Under this example of a narrative toxicity objective, the water boards essentially regulate almost every substance discharged to waters of the state whether or not its chemical structure or identity is known.

Assessing Water Quality

Adequate and accurate monitoring and assessment are the cornerstones to preserving, enhancing and restoring water quality. The information gathered from monitoring activities is critical to protect the beneficial uses of water, to develop water quality standards, conduct federal Clean Water Act assessments and to determine the effects of pollution and pollution prevention programs. Surface water monitoring and assessment activities are conducted as part of the Surface Water Ambient Monitoring

Program (SWAMP). "Ambient monitoring" collects information about the status of the physical, chemical, and biological characteristics of water quality that can be used to measure overall quality of water resources, temporal trends (degradation or improvement), and overall effectiveness of prevention, regulatory, and remedial actions. SWAMP integrates the existing water quality monitoring of the SWRCB and the RWQCBs and coordinates with monitoring programs of other agencies, dischargers, and citizen groups. The data collected includes: chemical pollutants; toxicity; bacterial indicators; contaminants in fish/shellfish tissue; biological assessment (living organisms); habitat (ecological) assessment; and other field data. The program evaluates, processes, formats, and assures the quality of these data for input into a database that can be integrated into statewide database. Science plays a major role in all of these activities.

The Groundwater Ambient Monitoring and Assessment (GAMA) Program is a comprehensive assessment of statewide groundwater quality. The program is designed to help better understand and identify risks to groundwater resources. Identifying these risks is important because the amount of water stored in California's aquifers is far greater than that stored in the state's surface water reservoirs. To the extent groundwater basins become unusable due to impacts to water quality, additional pressure is placed on limited surface water supplies. When groundwater supplies become contaminated, it takes longer, is more difficult and can be more costly to cleanup than surface water supplies. The GAMA Program has two components: one for public and one for private drinking water wells. GAMA is unique because the water quality data collected include analyses at very low levels for more than 250 chemical pollutants that are not normally monitored by the Department of Health Services. Analyses of these data provide an early indication of potential water quality problems and can also be used to identify the natural and human factors affecting groundwater quality. From the age-dating of groundwater to the detection and identification of endocrine-disrupting contaminants, science, engineering and research are at the heart of GAMA programs. This program permits a better understanding of the susceptibility of groundwater to contamination and allows for long-term management and protection of California's groundwater resources based on sound science.

Water Rights

Competing interests for available water resources in California led to a system for establishing water rights dating back to 1872. Today, the State Water Resources

Control Board is the state agency with the primary responsibility to administer water rights. The California Legislature put both water quality and water rights under the State Water Board in recognition of the inseparable nature of quality and quantity. Water rights are granted in the form of permits and licenses for specific volumes (flows), locations, times, and uses. The State Board is required to maximize the beneficial uses of the state's water resources and at the same time protect their public trust uses (e.g., commerce, navigation and fisheries), the environment, and the public interest. The state retains authority over all waters of the state and regulates their use.

This report includes three examples of where and how science is used in water rights decisions. The first is a discussion of water rights considerations when diverting water from the Russian River stream system and the factors that affect its salmonid fishery. The second is a discussion of water rights issues in the licensing decisions by the Federal Energy Regulatory Commission for three types of hydropower projects. The last is a discussion of water rights under the Bay–Delta Water Quality Control Plan, particularly with respect to flow-dependent objectives to protect the beneficial uses of the Delta and the Suisun Marsh from salinity. Understanding the competing needs of the environment, fisheries, farming, and society are critical to making decisions on diverting water for their uses. These must be based on sound science and engineering practices.

Implementation

The implementation of federal and state water quality laws, water quality plans, and policies is, for the most part, carried out by the Regional Water Quality Control Boards. The nine Regional Boards contributed 27 examples of where, what, and how science and engineering were used in their decision-making activities. These activities include permitting, enforcement, basin planning, developing Total Maximum Daily Loads (TMDLs) and water quality objectives (WQOs), remediation and other projects. They highlight the scientific disciplines and types of engineering used and whether these informed or determined or the decision. The reader is encouraged to see Appendix A for the examples. Spreadsheet formats are included for quick review.

Recommendations

Each of the Regional Boards, Division of Water Rights, Surface Water Ambient Monitoring Program (SWAMP) and the Groundwater Ambient Monitoring and Assessment (GAMA) Program submitted general and specific suggestions and recommendations on how to improve the science and engineering used by the water boards in decision-making. These are presented in Section IV of this report.

In general, the Regional Boards acknowledge their limitations in scientific expertise and make four proposals to address this issue. The first would have the state set up "blue ribbon" science panels that would provide advice and guidance on complex scientific issues. The second would create a science advisory panel that would provide technical review, comment, and suggestions on Regional Board field studies and interpretation of data (*note: this is not intended as a substitute for formal peer review of the scientific basis of a rule or regulation*). The third would create a pool of in-house experts that would be available to any of the Regional Boards on an as-needed basis (i.e., for expertise not currently available, e.g., economic analysis, risk assessment). The fourth would set up an expeditious mechanism for consulting or contracting with experts in other state, federal, or local agencies on highly technical issues or projects. The commonality of these recommendations is creating a means or mechanism that will enable the Regional Boards to obtain scientific advice and recommendations from technical experts not readily accessible today. It is recommended that the water boards evaluate the feasibility and cost-effectiveness of hiring versus contracting for scientific expertise and advice under one or more of these four proposals. It is recognized that the issues confronting the water boards change over time. Therefore, an analysis of current needs versus long-term needs will be necessary to make decisions regarding potential long-term investments in technical expertise and infrastructure.

In general, the Regional Boards, Division of Water Rights, SWAMP, and GAMA acknowledge the need for more scientific data and information to better inform and support their decisions. The data needs relate to water quality and quantity from a spatial and temporal perspective that can be addressed through directed surface and groundwater monitoring on a seasonal basis. The informational needs relate to better understanding the complex interrelationships between water and California's ecosystems and fisheries, especially anadromous species. There is also a need to prioritize water quality problems for the effective allocation of resources in finding solutions and implementing changes. These needs might be met through a research and monitoring program that collects, analyzes, and interprets water quality and quantity data from an ecological perspective and also meets the informational needs of State and Regional Water Board programs.

A specific recommendation with board-wide application would help address a need for determining water quality objectives and effluent limitations. The sciences of toxicology and risk assessment are used to derive acceptable levels of pollutants in the water column and sediments to protect biota, ecosystems, and people. Because there is a very limited number of numerical water quality objectives compared to the number and types of pollutants that can affect multiple beneficial uses, it might be both useful and cost-effective to have expertise on staff to help develop these numbers. These scientists could be part of the pool of scientists available to each of the Regional Boards. They would serve to develop water quality criteria and objectives.

A specific recommendation with broad application relates to continuing education and professional self-improvement. Greater access to professional society journals (the "literature"), either through libraries or the Internet, was viewed as helping scientists and engineers to stay current in their areas of specialization. A subscription to *Ingenta*, an on-line service providing access to 4,500 journals and abstracts from 20,000 journals, was recommended. Photocopies of journal articles could be procured through a general service contract with the University of California system. This would complement the "classroom" activities of the Water Board Training Academy by allowing individuals to read technical articles when they have time available at their workplace.

This Page Intentionally
Left Blank

Role of Science and Engineering in Decision-Making Within the State and Regional Water Boards

I. BACKGROUND

The impetus for this report originates in a letter from the Secretary of Cal/EPA to the Legislature indicating his intent to "institute an evaluation process using the University of California to understand the current role that science plays in the decisions reached within the boards, departments and offices at Cal/EPA." In a March 23, 2005 memorandum to the Chairman of the State Water Resources Control Board, the Secretary asked that the Board work with Agency to address a number of technical and policy issues. The first of these is to "assure the appropriate integration of science in decision making, including policies, regulations, basin plans, and permits." It is the purpose of this report to show examples of where, what, and how science is used not only in decision-making, but also in implementing policies and regulations, preparation of basin plans, and writing permit conditions.

Science and Engineering

This report considers science and engineering as equally important in decision-making. Science includes, but is not limited to technical disciplines such as chemistry (organic, inorganic, physical), biochemistry, biology, bacteriology, microbiology, toxicology, analytical chemistry, geochemistry, geology, hydrology, meteorology, oceanography, limnology, agricultural engineering, physics, ecology, mathematics, and statistics. Engineering includes, but is not limited to specialties such as chemical, civil, environmental, fluid dynamics, mechanical and structural engineering, all of which rely on mathematics, statistics, and computer modeling. The importance of engineering is made clear in the State Board's policy for implementing the California Toxics Rule with regard to permit limitations, "regardless of which method is used for deriving water quality-based effluent limitations, the calculated water quality-based effluent limitations shall be compared to the technology-based effluent limitations for the pollutant, and the most protective of the two types of limitations shall be included in the permit" (cf. p. 11). Technology results from sound engineering.

Decision Making

A wide array of decisions is made by State and Regional Water Board members, executive officers, and professional staff. Decisions that most impact the regulated community and public are permit decisions and water rights decisions. Decisions that affect water board staff and the regulated community can be found in laws, regulations, water quality control plans, and board policies - many of which provide guidance for implementing federal and state programs. The drafting of these documents relied on technical input from scientists and engineers, but final versions were responsive to the comments and concerns of the public, interest groups, politicians, and stakeholders. In many cases, these documents direct or guide the decisions and actions of the water boards. How science and engineering affect decision-making is briefly discussed below.

Science and engineering can affect decisions in essentially two ways. They can either inform or determine a decision. By "informing" a decision, it is meant that science and engineering are considered along with economics, societal needs (e.g., water for new housing developments), environmental laws (e.g., Endangered Species Act), implementability (e.g., feasibility, time, and resources needed), and water rights. Considerations other than science and engineering are not unique to water board decisions. For example, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, or "Superfund" Law) specifically requires U.S. EPA and delegated states (e.g., California) to consider nine criteria when selecting a remedy, only two of which are human health ("overall protection of human health and the environment") and engineering ("reduction of toxicity, mobility, or volume through treatment" [technologies]). In passing laws, both Congress and the Legislature develop language that is often a compromise of competing interests. A decision that does not entirely rely on scientific recommendations and/or engineered technological solutions does not mean that the science and engineering was unsound, but rather that other considerations, individually or collectively took precedence. An informed decision is also one in which science and engineering provide a framework or boundaries that exclude options that either won't work, are not cost effective, or take too long to implement. These considerations are of no less importance than the ones that determined the decision.

Science that "determines" a decision is often imbedded in health criteria (human and ecological) and physical (e.g., temperature and pH) or biological (e.g., availability of oxygen) characteristics of water. Even these have an element of judgment used in their determination. For example, observations and experimentation that determine the concentrations of pollutants that adversely affect aquatic organisms or the human health of those consuming or coming into contact with water have uncertainty. The uncertainty arises in the measurements and the natural variation that occurs in populations. These are often accounted for by including a margin of safety (sometimes referred to as safety factors or uncertainty factors) when deriving a single value that best represents the experimental data and/or population. Judgment enters into the equation in determining the margin of safety. The margin of safety may be established in law, implementing regulations, policies, or board decisions. But, the end result, the numerical standard, determines a decision when no other considerations modify the value. Where, when, and how standards are applied can be discretionary, but the health standards themselves remain primarily science-based. However, when establishing or changing a water quality objective, the State's Porter-Cologne Act requires that economics also be "considered." How economic considerations affect a water quality objective are subject to public review and comment and independent external scientific peer review.

Defensible Science

Regulatory decisions must be defensible, i.e., they must be able to withstand legal challenge. Accordingly, the science and engineering upon which regulatory decision-making is based must also be defensible. Science and engineering are evolving. Our knowledge is rapidly expanding in almost every area of science due to advances in technology and the financial and human resources invested in research. Still, decision-makers often want and need more complete information to make better decisions. So, how do the water boards decide when they have enough information to make a decision? The courts and the Legislature have indicated that certainty is not required to make a decision with regard to protecting human health and the environment. The standard of review in support of administrative regulations, whether they involve science or not, generally requires a court to uphold such regulations unless they are not supported by substantial evidence. "Substantial evidence" may be less than clear and convincing evidence and is defined as enough relevant information and reasonable inferences to support a conclusion, even if other conclusions might also be reached. Nevertheless, water board staff strive to provide decision-makers with clear and convincing scientific evidence and conclusions along with the best engineering practices and designs.

The quality of science and engineering used by the water boards is critical to good decision-making. To ensure quality, water board staff evaluate the rigor of the science (data quality and reliability), how it was developed, and other information supporting any scientific interpretation or conclusion drawn from the data. To ensure that the science is sound, the water boards make extensive use of external scientific review and formal scientific peer review. Many of the water boards utilize science review panels and science or technical advisory committees whenever broad decisions are made involving scientific or engineering expertise. The public and other interested parties are also invited to comment. External scientific peer review is addressed in Health and Safety Code (HSC) §57004. Under this statute, the water boards are required to "submit the scientific portions[1] of a proposed rule[2], along with a statement of the scientific findings, conclusions, and assumptions on which the scientific portions of the proposed rule are based and the supporting scientific data, studies, and other appropriate materials, to the external scientific peer review entity for its evaluation." This applies to many aspects of Basin Plans (see p. 9 this report) and Total Maximum Daily Loads (TMDLs, see p. 15 this report). In conducting this formal peer review, the water boards utilize Cal/EPA's contract with the Office of the President of the University of California to identify qualified peer reviewers. This peer review process helps to ensure that the scientific findings relied upon by the water boards will represent the prevailing view of the scientific community at the time a decision is made or a rule is promulgated.

Scope

This report attempts to demonstrate the extensive use of science and engineering in the decision-making processes of the State and Regional Boards. To provide context, the first part of the report briefly describes the roles of the State and Regional Boards in protecting water quality, the laws, plans, and policies that mandate or guide their decisions and actions, and the water quality standards they must enforce. The second part of the report provides examples of where, what, and how science has been used in decision-making by the nine Regional Water Quality Control Boards and the water rights and water quality programs. The last part of the report summarizes the recommendations from the regional boards for improving the science and engineering they rely upon to make decisions. A desired outcome of this report is that it provide impetus for: enhancing research and monitoring programs; further improving staff capabilities; and, finding ways to expand and share the technical expertise available within the water boards.

---

[1] "those foundations of a rule that are premised upon, or derived from, empirical data or other scientific findings, conclusions, or assumptions establishing a regulatory level, standard, or other requirement for the protection of public health or the environment."
[2] "a regulation" or "a policy adopted by the State Water Board pursuant to Porter-Cologne Water Quality Control Act ... that has the effect of a regulation and that is adopted in order to implement or make effective a statute."

II. INTRODUCTION

The primary purpose of the water boards is to preserve and protect the beneficial uses of all the waters of the State, including surface and ground waters, enclosed bays and estuaries, and the ocean. The State Board has the added responsibility to ensure the equitable distribution of water to meet the historical, present, and future needs of the people and environment of California. No other natural resource is as critical to human health and welfare, preserving habitat and ecological diversity, and ensuring viable populations of wildlife and aquatic life as is water. Without water, there would only be desert.

The State and regional water boards receive their authority and mandates to preserve and protect the beneficial uses of water through federal (Clean Water Act) and State law (Porter-Cologne Water Quality Act). The State and regional water boards are required by Porter-Cologne to develop plans for water quality control. The State Board is required by Porter-Cologne to develop policy for water quality control. Table 1 (see p. 35) lists the laws, plans, and policies that govern and direct the responsibilities and activities of the State and regional water boards. These provide the major framework for decision-making.

A. LAWS

1. Federal Clean Water Act

There are two laws that particularly affect the water boards. The oldest is the federal Water Pollution Control Act of 1948, which after extensive amendment in 1972, became the federal Clean Water Act (CWA). The amendments established two goals: zero discharge of pollutants by 1985; and, water quality that is both "fishable" and "swimmable" by mid-1983. To achieve its objectives, the CWA embodies the concept that all pollutant discharges into the nation's waters are unlawful, unless specifically authorized by a permit. The CWA uses both water quality-based standards and technology-based numerical effluent limitations in permits for specific pollutants from certain sources to protect water quality. The CWA requires each state to establish water quality standards for all surface water bodies in the state. [FR1]These standards backup federally established technology-based requirements.

The CWA established the National Pollutant Discharge Elimination System (NPDES) for industrial and municipal dischargers. Permits are the CWA's principal regulatory tool. Violators are subject to civil suit by US EPA in U.S. District courts, administrative civil penalties, and criminal penalties for "knowing endangerment." Third party lawsuits are also allowed. Permits specify the control technology applicable to each pollutant (e.g., best available technology (BAT) for heavy metals, pesticides, and other organic chemicals), effluent limitations (mass and/or concentration), and a deadline for compliance. Dischargers are required to maintain records and conduct effluent monitoring. NPDES permits must be renewed every five years, a feature which allows updates based on better science and technology and/or new water quality standards.

Sec. 303(d) of the federal CWA and Title 40, CFR Sec. 130.7 require the states to identify waters within their borders that are not attaining water quality standards. Impaired water bodies must be restored by limiting the aggregate discharges of individual pollutants such that the assimilative capacity (the "total maximum daily load [TMDL]") of the water body for each pollutant is not exceeded. Pollutant loadings from point source discharges are controlled primarily through permit limitations while pollutant loadings from nonpoint sources are controlled primarily by management measures.

2. *"Porter-Cologne Water Quality Control Act" (1969, with amendments through January 1, 2005)*

In 1969, the California Legislature passed and the Governor signed into law the Porter-Cologne Water Quality Control Act. Porter-Cologne is the principal law governing water quality in California. The Legislature found that "activities and factors which may affect the quality of the waters of the State shall be regulated to attain the *highest water quality reasonable*, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible (§13000)." The Legislature declared "that the State must be prepared to exercise its full power and jurisdiction to protect the quality of waters in the State from *degradation* originating inside or outside the boundaries of the State (§13000)." The Act establishes a comprehensive program to protect water quality and the *beneficial uses* of water. Unlike the Clean Water Act, Porter-Cologne applies to both surface water and ground water. Porter-Cologne designated the State Water Resources Control Board (State Water Board)[3] as the statewide water quality planning agency, and also gave planning and permitting authority to the nine semi-autonomous Regional Water Quality Control Boards (Regional Water Boards)[4]. Porter-Cologne was amended (§§ 13370-13389) to

[3] The State Water Board was established in 1967 by legislation combining the State Water Quality Control Board and the State Water Rights Board.
[4] The Regional Water Boards were established in 1949 by the Dickey Water Pollution Act.

authorize the State to implement the provisions of the federal CWA, including the provisions establishing the National Pollution Discharge Elimination System.

The State Water Board is responsible for developing State *policy* for water quality control (e.g., the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California) and *statewide water quality control plans* (e.g., the Ocean Plan), while the Regional Water Boards are required to develop, adopt, and implement *regional water quality control plans* (basin plans) which address all areas in a region and conform to State water quality policy. These *plans*, both statewide and basin, include (1) designation or establishment of *beneficial uses*[5] of the water body to be protected, (2) establishment of *water quality objectives*[6], and (3) implementation plans that control non-point and point sources of pollution in order to achieve the water quality objectives protecting each designated beneficial use. Regional Boards have the primary responsibility for implementing the provisions of both statewide and basin plans.

Porter-Cologne (§13260) requires any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of waters of the state, to file a *report of waste discharge* with the applicable Regional Water Board. No discharge may take place until the Regional Water Board issues waste discharge requirements (WDRs), or a waiver of the WDRs. Waste discharges to land include municipal waste water and landfill disposal. The issuance of WDRs and waivers to WDRs is a major statewide permitting activity of the RWQCBs, along with federal NPDES permitting.

3. Other laws that affect the water boards include a California law that address underground storage tank leak prevention standards and the federal Resource Conservation and Recovery Act (RCRA), which addresses hazardous waste cleanups.

---

[5] "beneficial uses" include, but are not limited to: domestic, municipal, agricultural and industrial supply; power generation; recreation: aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. Such uses may be past, present and probable future beneficial uses of water. A water body may have one or more designated beneficial uses.

[6] "water quality objectives" (WQO) are the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specified area. WQOs have three parts: (a) a criteria or standard to be met (typically from the California Toxics Rule or Ocean Plan); (b) beneficial use (what use the WQO is intended to protect); and (c) meets the State's anti-degradation policy.

B. WATER QUALITY CONTROL PLANS

As stated above, Porter-Cologne designated the State Water Board as the statewide water quality planning agency, and also gave planning and permitting authority to the nine Regional Water Boards. There are 14 water quality control plans, four are statewide plans that include the Ocean Plan, the Thermal Plan, the Bay-Delta Plan and the Nonpoint Source Pollution Control Plan. The remaining 10 water quality control plans are Basin Plans developed by each of the Regional Water Boards (the Central Valley RWQCB has two Basin Plans because of its geographic size and major watersheds). Each plan relies heavily on science and engineering in its development and each undergoes extensive public review and input as well as external scientific peer review. The brief summaries of the Ocean Plan and the requirements for basin planning provided below demonstrate the role of science in water quality control plans.

1. Ocean Plan

The first Ocean Plan was adopted in 1972 and has been amended six times (most recent is 2005). The first Ocean Plan predates the federal requirements for ocean planning and protection of ocean waters. The heart of the plan consists of water quality objectives (WQOs). Currently, there are 21 numerical WQOs for protection of marine aquatic life, 20 numerical noncarcinogen WQOs and 42 numerical carcinogen WQOs for protection of human health. There are bacterial "objectives" (for total coliforms and fecal coliforms) that address "water-contact" (e.g., swimming) and shellfish harvesting. There are physical "objectives" (narrative objectives) for floating materials (particulates, grease, and oil), discoloration, attenuation of light transmission, and deposition of solids that would degrade benthic communities. There are chemical "objectives" that include dissolved oxygen, pH, sulfides, organic materials, nutrients, and the 83 numerical WQOs referenced above. There are biological "objectives" for non-degradation of marine communities (vertebrate, invertebrate, and plants); for non-degradation of marine sources of food for humans affecting taste, color and odor; and prohibition of bioaccumulation of organic materials in marine sources of food for human consumption (fish, shellfish). There is a prohibition of discharge of radioactive waste that would degrade marine life. There are specific effluent limitations for grease and oil, suspended solids, settleable solids, turbidity, and pH. There is also a prohibition on the discharge of any waste into 34 Areas of Special Biological Significance.

The RWQCBs implement the Ocean Plan to meet WQOs by issuing National Pollutant Discharge Elimination System (NPDES) permits (these permits also serve as Waste Discharge Requirements in fulfillment of the State Water Code). The permits specify limits on the amount (concentration and total mass) of effluents that can be discharged. The Plan is prescriptive in how limits are established and how to quantitatively account for dilution credits and mixing zones. The Plan specifies when to conduct acute and chronic toxicity testing and what species or organisms to use to measure toxicity.

To determine compliance with discharge limits, the Plan specifies how monitoring is to be conducted and how often. This includes specifying the analytical methods that can be used, calibration of analytical instruments, and reporting of analytes above and below the method detection limit. Methodolgy for meeting toxicity criteria objectives of Table B in the Plan are also speicified. All the foregoing are based on science (organic, inorganic, physical and analytical chemistry; toxicology; statistics, and engineering) in addition, state-certified analytical laboratories must be used. Where analytical monitoring may not be adequately measuring effluents (evidence for being above the limit, but not quantitatively measured), there are provisions for a Pollutant Minimization Plan or Toxicity Reduction Requirements.

An April 2005 amendment to the Ocean Plan removed the option for permit holders to self-certify that they are not discharging pollutants other than those in their permits. Dischargers must now do an analysis of all listed pollutants (Ocean Plan Table B) to determine which ones might reasonably be expected to appear in the waste stream and thus require monitoring. This "reasonable potential analysis" uses a "scientifically defensible statistical method that accounts for the averaging period (daily, weekly, monthly, etc.) of the WQO, accounts for and captures the long-term variability of the pollutant in the effluent, accounts for limitations associated with sparse data sets, uncertainty associated with censored data sets and assumes a lognormal distribution of facility-specific effluent data." This amendment to the Ocean Plan improves the scientific basis for determining which effluents need permit limitations and therefore require monitoring.

2. *Basin Planning*

The Porter-Cologne Water Quality Control Act requires the Regional Boards to develop and adopt Basin Plans that conform to State water quality policies and address all areas (water bodies [streams, rivers, lakes, reservoirs], watersheds, and groundwater) in their region. Porter-Cologne requires several key elements in all Basin Plans. First, Basin Plans must designate existing and potential (beneficial) uses of surface and groundwaters of the State. Porter-Cologne identifies a dozen beneficial uses (see footnote 5 on p. 7) while the federal CWA identifies six, including the "fishable/swimmable" goals for protection and propagation of fish, shellfish, wildlife, and recreation in and on the water. Second, Basin Plans must establish water quality objectives for pollutants or characteristics that are protective of the designated beneficial uses. In establishing water quality objectives, the water boards must comply with antidegradation provisions of federal and state law (see p. 13). Third, Basin Plans must contain implementation programs to achieve the water quality objectives including a description of the actions necessary to achieve the objectives, a time schedule for the actions to be taken, and monitoring activities to determine compliance with the objectives.

The first Basin Plans were developed in the early 1970's. Scientific surveys collected information on fisheries, land use, geography, precipitation, and wildlife for the larger surface water bodies in each region. These surveys also collected technical information on groundwater resources, including hydrology and water quality. Because of the large number of water bodies, not all waters were surveyed initially and beneficial uses were not systematically designated for these. However, to fulfill the federal CWA requirement that the State designate uses for <u>all</u> waters of the United States, the first basin plans relied on a "tributary rule" that allows waters (e.g., streams) flowing into water bodies that have a designated beneficial use(s) to have the same beneficial use(s) as the receiving waters. Subsequent to the development of the first basin plans, the State and Regional Boards have approved standard definitions for 29 beneficial uses (see Table 2, p. 37). Most water bodies now have their individual existing or potential beneficial uses identified and adopted into basin plans. It is important to appreciate that a designated "beneficial use" plays a critical role in determining which standards are applied to a water body and are included in the permit conditions (WDRs and NPDES) to protect that beneficial use.

The second key element of Basin Plans is that they must include water quality objectives (WQO) that establish limits or levels for pollutants or characteristics that are protective of the beneficial uses and comply with antidegradation statutes and policy. By law, objectives to protect beneficial uses must be based on sound and peer-reviewed scientific rationale. U.S. EPA provides technical guidance for developing water quality criteria (objectives). Numerical values are available for 105 of U.S. EPA's 126 priority pollutants published in the California Toxics Rule (40 CFR Part 131 [2000]). The water boards have adopted numerical water quality standards for three pesticides (diazinon, chlorpyrophos, and tributyltin), ammonia, bacteria, nutrients, salt, dissolved oxygen, sediment and others not included on U.S. EPA's list. The California Ocean Plan identifies 30 pollutants with objectives not included in U.S. EPA's list. Water quality objectives must also meet the State's anti-degradation policy (see p. 13 for discussion of this policy). These water quality objectives undergo thorough peer review (as prescribed in California Health and Safety Code §57004), CEQA review, stakeholder review and comment via workshops and hearings, Water Board adoption, approval by the Office of Administrative Law, and finally U.S. EPA approval. This extensive review of the science supporting the water quality objectives is necessary because they are used to protect beneficial uses that include human consumption of the water itself and the fish and shellfish harvested from fresh and marine waters. WQOs also protect aquatic life and their ecosystems.

The third key element of Basin Plans is that they must contain implementation plans or programs to achieve the water quality objectives. Implementation includes: (a) a description of the actions necessary to achieve the objectives; (b) a time schedule for the actions to be taken; and (c) monitoring activities to determine compliance with the objectives. Water quality objectives can be achieved through issuance of discharge permits that specify waste discharge requirements (WDR permits). For example, such permits include those for point sources discharging to navigable waters (NPDES permits), discharges to groundwater, discharges for irrigated agricultural return flows, or by prohibitions of discharge. Board adoption of total maximum daily loads (TMDLs) and their implementation plans would also achieve WQOs. The time required to achieve WQOs can be dependent upon the concentration or amount of pollutant to be removed and the technologies used. To measure progress towards achieving an objective or effluent limit, permits typically include compliance monitoring as a condition of permitting the discharge. Developing a compliance monitoring plan requires knowledge of the principles of analytical chemistry, toxicology (bioassays), statistics, and a myriad of laboratory methods, including quality assurance and quality control.

Given the technical complexity and importance of the basin plans, it is important to note that prior to approval by the State Board they must go through a public review and comment process and the scientific portions must undergo external scientific peer review (in accordance with HSC §57004). Basin Plans must also be periodically reviewed. This is typically accomplished during the Triennial Review of the state's water quality standards required by the federal CWA. These reviews help to ensure the quality and currency of the science and engineering used.

Extensive Administrative Records are compiled for all Basin Plan amendments to support approval of their regulatory provisions by the Office of Administrative Law and U.S. EPA. A careful review of these records demonstrates the use of sound science and engineering in development and amendment of Basin Plans.

C. WATER QUALITY CONTROL POLICIES

Section 13140 of the Porter-Cologne Water Quality Control Act states that "the state board shall formulate and adopt state policy for water quality control." To date, the State Board has formally adopted 18 policies related to water quality control (see Table 1, p. 35). Most of these policies incorporate science and engineering. As examples of the use of science and engineering in policy decision documents, four of the 18 are discussed below.

1. State Implementation Policy: "*Policy for Implementation of the Toxic Standards for Inland Surface Waters, Enclosed Bays and Estuaries in California*" (April 2000)

The water quality standards that the State Board and Regional Boards must meet are contained in the National Toxics Rule and the federal California Toxics Rule (both found in the Code of Federal Regulations). The Regional Boards may also adopt numerical and/or narrative water quality objectives to maintain the beneficial uses of water bodies. The State's implementation policy (SIP) for these rules and basin plan objectives is contained in the "*Policy for Implementation of the Toxic Standards for Inland Surface Waters, Enclosed Bays and Estuaries in California.*" A brief summary of the SIP and the role of science is provided below.

The federal CWA requires that states adopt numeric criteria for pollutants for which it (the federal CWA) has issued criteria guidance, as part of the states' own water quality standards. Because of lawsuits, the US EPA promulgated a list of criteria pollutants in 2000 known as the California Toxics Rule (CTR). The federal toxics criteria for 126 priority pollutants apply to California's inland surface waters, enclosed bays and estuaries for all purposes and programs under the CWA. These are the minimum water quality standards that must met by dischargers and permittees.

The state regulates discharges of toxic pollutants to inland surface waters, enclosed bays, and estuaries under the authority of California's Porter-Cologne Water Quality Control Act and the federal CWA. Regulation is by issuance of NPDES permits. Permits specify effluent limitations in order to meet water quality criteria/objectives in the CTR (California) and National Toxic Rule (applicable to all states). The procedures, algorithms, and statistics for determining effluent limits (maximum observable effluent concentrations, or MECs) are prescribed in the SIP. The procedures are based on sound science and engineering practices. Please see Appendix C – 2 on p. 58 for a summary of the science and engineering used in the SIP guidelines for determining effluent limits in discharges and determining compliance with effluent limits in permits.

Adoption and amendment of statewide plans and policies are documented in extensive Administrative Records that cover the full public participation process and science, engineering, and economic considerations. The extent of documentation is exemplified by the 20 file boxes of documents supporting adoption of the State Implementation Policy that are available for public review.

2. Anti-degradation: *"Policy with Respect to Maintaining High Quality of Waters in California" (State Board Policy 68-16)*

Both State policy and federal law address the issue of anti-degradation of water quality (see also Appendix C - 4). State policy adopted in 1968 states that existing high water quality will be maintained until it can be demonstrated that any change: (1) will be consistent with the maximum benefits to the people of the state; (2) will not unreasonably affect present and anticipated beneficial use of such water; and (3) will not result in water quality lower than prescribed in existing policies and water quality control plans. The State's anti-degradation policy applies to both surface and ground waters and to both existing and potential beneficial uses. The intent of the policy is to preserve the existing high quality of water where it is better than a water quality objective or standard. It is not routinely allowed to discharge pollutants up to the limits of a water quality objective or standard. The water may not be degraded unless there is a greater benefit to society in exchange for a small amount of degradation that does not adversely affect its beneficial use(s).

Federal anti-degradation rules apply to surface water quality existing as of November 1, 1975 (California's benchmark date is 1968 and also applies to groundwater). Federal rules restrict some categories (tiers) of water from any degradation whatsoever. These tiers include protection of water quality supporting existing uses and water quality that is necessary to maintain "outstanding national resource waters," such as those in National Parks or wildlife refuges. The federal government has designated Lake Tahoe and Mono Lake as outstanding national resource waters. It is only other waters that are better than necessary to maintain fish and allow water contact by people that may be degraded and only to the extent to allow important social or economic development.

The significance of the State and federal antidegradation policy and rules is that any change to a water quality objective or standard must undergo an antidegradation analysis. Such analysis would include scientific determinations of the potential degradation that could occur, an engineering analysis to determine what technologies could be used to minimize any dedgradation, and the social and economic analyses of any benefits that would accrue to the people of the State.

3. Impaired Waters: *"Water Quality Control Policy for Developing California's Clean Water Act §303(d) List"* (September 2004)

Sec. 303(d) of the federal CWA and Title 40, CFR Sec. 130.7 require the states to identify waters within their borders that are *not* attaining water quality standards. Water bodies are listed due to deleterious impacts from a pollutant or pollutants and *de*listed when evidence reveals that such impacts have ceased or never existed. Placing a water segment on the list of impaired water bodies (the 303(d) list) follows a formal process outlined in *"Water Control Policy for Developing California's Clean Water Act §303(d) List."* This policy document provides detailed guidance on the review and assessment of supporting data and information used to decide which candidate water bodies are placed on or removed from the CWA §303(d) list.

Determining whether a water body or a river/stream segment meets the criteria for listing relies heavily on science. It requires collection of field data on the pollutants of concern or characteristics that are believed to be impaired. Complete background information (metadata) for field data (i.e., when, where measurements were taken, number of samples, detection limits, etc.) and detailed quality assurance and quality control information about sampling and analysis of all numeric data are needed to demonstrate current water quality. Data collection, sampling and analysis rely on chemistry, analytical chemistry, and statistical analyses of the quantitative, spatial, and temporal data. The results of the analyses of the field data are then compared to the water quality standards (WQOs) established to protect the beneficial uses of the water segment or body. The WQOs include the numeric values for aquatic and human health protection listed in the California Toxics Rule, State-adopted WQOs for bacteria (where recreational uses apply), and WQOs adopted in Basin Plans.

Seven other criteria exist for listing, a few are briefly described here. Listing can occur if there are health advisories (e.g., fish consumption advisories issued by OEHHA or DHS) or shellfish harvesting ban (issued by DHS). Health advisories and harvesting bans are based on health risk assessments of the toxicity of the pollutants of concern, the bioconcentration of the pollutant in fish and shellfish, and studies of fish consumption by recreational fishermen – all are science-based. Listing can occur for water or sediment toxicity alone where the toxicity testing (i.e., bioassays) can be performed with fish, shellfish, or other biota follows specified technical guidelines and statistical analyses. Under the antidegradation principle, if at least a three-year trend of quantitative data shows degradation of water quality, but not yet exceeding a WQO, the water body still may be listed. Listing can occur for "nuisance", i.e., odor, taste, excessive algae growth, foam, turbidity, oil, trash, and color using quantitative data that meets specified requirements. Adverse biological responses in fish or birds, such as fish kills or bird die-offs, reduction in growth, reduction in reproductive capacity, abnormal development, or histophathological abnormalities observed by specialists such as wildlife biologists, ecologists, and toxicologists are a basis for listing. All of the foregoing causes for listing have technical and/or scientific criteria that must be met before the water segment can be a candidate for listing. Because most of this policy document is based on science, it was subjected to formal external scientific peer review in accordance with §57004 of the H&SC prior to adoption and approval by the State Board.

4. Total Maximum Daily Load *"Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options"* (June 16, 2005)

The significance of a water body, stream, or river segment being placed on the CWA §303(d) list of impaired water bodies is that a total maximum daily load (TMDL) and its implementation plan are also required to be established by Clean Water Act. This is a major technical, administrative, and stakeholder participation program implemented by the regional water quality control boards (please also see Regional Board write-ups in Appendix A - 6 through A - 10 of this report). To be enforceable, a TMDL must be adopted into a Regional Basin Plan, after which it becomes, in effect, a water quality standard. The science and engineering considerations made in development of a TMDL are briefly described below.

A TMDL is a numerical calculation of the amount of a pollutant that a water body can assimilate and still meet standards. A TMDL includes one or more numerical targets that represent attainment of the applicable standards, considering seasonal variations and a margin of safety, in addition to the allocation of the target load among the various sources of the pollutant. In practice, a RWQCB must first determine the loading capacity of the water body, e.g. the amount (mass or concentration) of mercury that can enter a river segment (including the water column and sediments) *before* fish would become unsafe to consume (i.e., a fish consumption health advisory would be issued). Determination of loading capacity requires data on hydrology, flow rates and volumes, solubility of mercury, conversion of mercury to methyl-mercury (chemistry and biochemistry), and bioconcentration rates (biochemistry) in fish (species dependent) in order to address loading capacity (LC). Once the LC is calculated, it is necessary to identify (through sampling and analysis or engineering calculations) all the point ("end-of the-pipe") and nonpoint source (e.g., surface runoff, soil erosion) contributions of mercury to the water segment. Each source is then assigned a load allocation (nonpoint sources) or *waste* load allocation (point sources) and an implementation plan is developed to meet the water quality objective. To achieve TMDLs and individual load and waste load allocations, the water boards use regulatory tools such as waste discharge requirements (WDRs, including compliance monitoring), waivers of waste discharge requirements, enforcement actions, and interagency agreements. (For more discussion of the science involved in developing a TMDL for mercury, please see Appendix item A – 9 "Mercury in Cache Creek and Bear Creeks.")

Basin plans amendments, including TMDLs, must undergo a thorough public hearing process and must be approved by a RWQCB, the SWRCB, Office of Administrative Law, and U.S. EPA Region 9. The scientific basis of a TMDL is peer reviewed in accordance with HSC §57004. An excellent summary of the development of a TMDL for sedimentation/siltation of the Alamo River and the role of science can be found in appendix item A - 7. The nine major tasks in developing a TMDL are clearly described. The Administrative Record for each TMDL is available for public review.

D. WATER QUALITY STANDARDS (OBJECTIVES)

The State's water quality objectives (WQOs) are equivalent to the criteria established for federal water quality standards. Criteria are typically numeric ambient water concentrations needed to protect a designated use and the "use", i.e., they go together. State water quality objectives are established to protect the *beneficial* uses designated by a Regional Board for each water body or segment identified in their Basin Plan. Twenty-nine beneficial uses have been defined by the State and Regional Water Boards (see Table 2, p. 37). Water quality objectives are established through a public participation and scientific process. The water quality objectives are then codified in State regulations and are subject to U.S. EPA approval. Protecting the beneficial uses of water and preventing nuisance (e.g., foul odors) are achieved through *numerical* and/or *narrative* objectives/criteria. U.S. EPA identifies 126 priority toxic pollutants that threaten water quality in the California Toxics Rule. Additional water quality objectives are contained in the California Ocean Plan (see p. 8) and other water quality control plans adopted by the State Water Board and the nine Regional Water Boards in their regional Basin Plans.

Narrative water quality objectives are used for waste constituents without numeric criterion. An example of a California narrative toxicity objective is "all waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." The equivalent narrative in the federal CWA reads: "it is the national policy that discharge of toxic pollutants in toxic amounts be prohibited (§101(a)(3))." Two approaches to determining compliance with this narrative objective can be taken. First, try to identify numerical limits (published concentrations in water that are associated with toxic effects) for identifiable waste constituents, or use bioassays to determine toxicity levels. To help identify numerical limits, the Central Valley Regional Water Quality Control Board (Region 5) has developed an on-line searchable database containing over 820 chemical constituents and water quality parameters to be used in applying *narrative* water quality objectives. Where numerical effluent limits cannot be identified, toxicity can often be assessed using bioassays. For example, assessment of toxicity to aquatic life can be done using bioassays with indicator species that include vertebrates (e.g., fathead minnow), invertebrates (e.g., water flea), and/or aquatic plants (e.g., alga). Toxicity bioassays have the advantage of directly assessing the biological effects of all effluent constituents, including the interactive effects of multiple chemicals.

Toxicity assessments are required in permits for all discharges that will cause, have reasonable potential to cause, or contribute to chronic (long-term) toxicity. When a discharge is found to cause or contribute to chronic toxicity in the receiving water body, a toxicity reduction evaluation (TRE) is required. If the toxic component is known, then the TRE can be initiated immediately. If the toxicity component is unknown, a Toxicity Identification Evaluation (TIE) may be needed. Once the source of toxicity is identified, the discharger is required to take all reasonable steps necessary to eliminate toxicity. Toxicity testing helps to control chemicals that are not on the priority pollutant lists and consequently *greatly increases* the number of chemicals and substances the Regional Boards must regulate. Including toxicity effluent limits and requiring toxicity monitoring (bioassays) as permit conditions requires an understanding of biology, chemistry, toxicology, sampling and analysis, and interpretation of test results. This can be considerably more complex than pollutant-specific monitoring.

D. MEASURING WATER QUALITY

Assessing water quality relies on water sampling and analysis and the data these produce. Two relatively new state programs, the Surface Water Ambient Monitoring

Program and the Groundwater Ambient Monitoring and Analysis Program, are at the center of providing data on ambient water quality. They can tell us the status of water quality, whether we are making progress in achieving water quality objectives, and where research is needed to address emerging issues. State fiscal constraints have limited the amount of data that has been collected to a fraction of what is needed, including the staff expertise needed to analyze the data. With adequate funding, these two programs would provide the core of a statewide water quality assessment program that is critical to protecting the state's water resources.

1. Surface Water Ambient Monitoring Program

The Surface Water Ambient Monitoring Program (SWAMP) was established under Water Code §13192 (AB 982) as a statewide effort administered by the SWRCB to assess the conditions of surface waters throughout the state. "Ambient monitoring" collects information about the status of the physical, chemical, and biological characteristics of water quality that can be used to measure overall quality of water resources, temporal trends (degradation or improvement), and overall effectiveness of prevention, regulatory, and remedial actions. Responsibility for implementation of monitoring activities resides with the nine Regional Boards. Monitoring conducted by SWAMP is done through contracts with the California Department of Fish and Game, the U.S. Geological Survey, and other entities.

SWAMP integrates the existing water quality monitoring of the SWRCB and the RWQCBs and coordinates with monitoring programs of other agencies, dischargers, and citizen groups. SWAMP creates an ambient monitoring program that addresses all 190 hydrologic units of the State using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized and integrated data management. Monitoring "waters of the state" includes 11,000 miles of rivers and streams, over 10,000 lakes, over 1,300,000 acres of bays and estuaries, and 1,609 miles of coastline. The data collected includes: chemical pollutants; toxicity; bacterial indicators; contaminants in fish/shellfish tissue; biological assessment (living organisms); habitat (ecological) assessment; and other field data. Evaluating, processing, formatting, and assuring the quality of these data for input into a database that can be integrated into statewide database (California Environmental Data Exchange Network [CEDEN]) has been a major effort of SWAMP in the absence of a fully funded water quality monitoring program. A sub-set of the regional monitoring data is incorporated into the Environmental Protection Indicators for California (EPIC) report on the status of the environment. Regional monitoring data also helps to assess program performance and support federal CWA § 305(b) reporting requirements on the area or percentages of the State's surface waters that fully or partially support their beneficial uses (e.g., that they are safe to swim, drink, and consume the fish).

Please see Appendix D-1 on page 64 for further discussion of where, what and how science and engineering are used in the SWAMP program.

2. Groundwater Ambient Monitoring and Assessment

The Groundwater Ambient Monitoring and Assessment (GAMA) Program is a comprehensive assessment of statewide groundwater quality. The program was developed in response to the Groundwater Quality Monitoring Act of 2001 (AB 599, codified in CWC Sec. 10780-10782.3) which mandates monitoring and assessment of the quality of groundwater used as a public water supply. The program is designed to help better understand and identify risks to groundwater resources. The importance of groundwater is that it supplies about 30 percent (about 16 million acre-feet) of the water for urban and agricultural use in average rainfall years, but can increase to 40 percent when surface supplies are reduced during drought years. The amount of water stored in California's aquifers is far greater than that stored in the state's surface water reservoirs, although only a portion of groundwater can be extracted economically and practically. To the extent groundwater basins become unuseable due to impacts to water quality, additional pressure is placed on limited surface water supplies. When groundwater supplies become contaminated, it takes longer, is more difficult, and can be more costly to cleanup than surface water supplies. It can take decades for the water cycle to displace contaminated groundwater with clean water and only a few years for surface water.

The GAMA Program has two components: the California Aquifer Susceptibility (CAS) Assessment which addresses public supply drinking water wells and the Voluntary Domestic Well Assessment Project which addresses private drinking water wells. A key aspect of the GAMA Program is interagency (SWRCB/RWQCB, USGS, DWR, DHS, LLNL) collaboration and cooperation with local water agencies and well owners. The GAMA Program is important because the data collected during the studies include analyses for chemical constituents and pollutants not normally monitored. These data are especially useful for providing an early indication of potential water quality problems and can also be used to identify the natural and human factors affecting groundwater quality. An understanding of these factors is important for the long-term management and protection of California's groundwater resources.

GAMA Program components rely heavily on science, from initial study design, sampling and analyses, and data interpretation, to final publication and posting of results to an on-line database (GeoTracker). Of the 476 groundwater basins and sub-basins in California, 116 have been identified as priority basins. Collectively, these include more than 75% of public water supply wells. While the California Department of Health Services requires monitoring of public water supply wells for 101 Title 22 constituents, GAMA, in conjunction with USGS, monitor for a much broader suite of 334 constituents (e.g., nutrients, trace elements, pesticides and pharmaceuticals ["emerging contaminants" acting as endocrine disrupters]) with many at much lower detection limits. Endocrine disrupting compounds (EDCs) are being detected with an EDC microarray gene chip (a collaborative effort with UC Davis and Lawrence Livermore National Laboratory). To determine the susceptibility of aquifers to contamination, the GAMA Program is age-dating water by measuring naturally occurring isotopes (e.g., tritium/helium-3). The age of groundwater is the time since the water was recharged and isolated from the atmosphere. Groundwater that has been recharged in the last 50 years is considered more susceptible to contamination from various land-use activities and would be a priority for pollution prevention or abatement activities.

For more information on the GAMA Program, please see Appendix D-2 on page 68.

E. WATER RIGHTS

Competing interests for available water resources in California led to a system for establishing water rights dating back to 1872. Since that time, the water rights program has existed under a variety of administrative programs including the Office of the State Engineer, Department of Water Resources, and the State Water Rights Board. Today, the State Water Resources Control Board is the state agency with the primary responsibility to administer water rights. The California Legislature put both water quality and water rights under the State Board in recognition of the inseparable nature of quality and quantity. In its simplest terms, a water right is the right to divert water from its natural location or course for a specific beneficial use, such as agriculture or power generation. Water rights are granted in the form of permits and licenses for specific volumes (flows), locations, times, and uses. The State Board is required to maximize the beneficial uses of the state's water resources and at the same time protect their public trust uses (e.g., commerce, navigation and fisheries), the environment, and the public interest. Thus, the state retains authority over all waters of the state and regulates their use. Water is a shared resource, with large numbers of users entitled to some share of the common pool. While water rights are property rights, the "property" is the right to use, not ownership of the water itself. If the water is not used, or is wasted, the right to use can be lost. This prevents those with senior rights from depriving those with junior rights to water that would otherwise go unused or wasted.

The relationship between water quantity and water quality can be critical to fisheries, ecosystems, and habitats. For example, water quantity determines the depths of rivers and streams. Water depth and temperature are critical to fish migration and availability of shallow gravel spawning beds. Lakes with drastically altered shorelines from water diversion (e.g., Mono Lake) do not provide adequate feeding and nesting habitats for migratory birds. Issuing water rights permits that include diversion limits and flow objectives requires an understanding the complex relationships between water and the environment. The studies of these relationships are based on science.

1. Water rights permitting activities

The Division of Water Rights undertakes a variety of water right permitting activities. Following the adoption of the Water Commission Act of 1913, the State legislature determined that anyone who seeks to appropriate water from surface streams or subterranean streams coursing through known and definite channels in the State of California must acquire a water right permit.

In its review of a water right application, the State Water Board is statutorily required to make certain findings and to consider certain impacts of the project being proposed. First, the State Water Board must determine that there is unappropriated water available to supply the project. The State Water Board must determine that approval of the proposed project will not injure any other legal user of water. In addition, the State Water Board must consider the impacts of issuing a permit on water quality, fish and wildlife and other public trust uses, and on the public interest. Other water users and the public are notified of any pending application and are allowed to file protests against the proposed water supply project for any of the aforementioned reasons.

In the process of making required findings under the Water Code and under the California Environmental Quality Act (CEQA), the State Water Board reviews all scientific information which it has available. This information typically includes precipitation data, water use data, biological and archeological surveys, and studies on fisheries, invertebrates and other species. For some projects, either because they are in biologically sensitive areas or because they are in areas where there is significant use and limited supplies, the State Water Board may have sufficient information available. If not, the State Water Board may require that scientific studies be conducted in order to be able to make the required findings. In most cases, science informs the State Water Board's water right actions and, conversely, the State Water Board's actions often drive the collection and production of scientific information.

Examples of some of the considerations that need to be made in water rights decisions can be found in the water right applications to divert water from the Russian River stream system. There are a number of factors that affect the salmonid fishery on the Russian River and other coastal streams. These factors include water flow and temperature, the condition of spawning and rearing habitat (shade, cover, gravel beds, presence of deep pools, etc), fish passage, predation, ocean harvest, toxics and other pollutants, and food supply. Of these factors, the ones that are most controllable by the State Water Board are streamflow (within the limits of natural hydrologic variation), including ensuring that adequate flows are provided to "cue" fish migration, and fish passage (i.e., on-stream dams). The State Water Board, in cooperation with the California Department of Fish and Game (DFG) and the National Marine Fisheries Service, has developed draft guidelines to protect salmonids in the Russian River and other northern California coastal watersheds from the impacts of water diversions. Scientists from the University of California participated in the development of the draft guidelines. The State Water Board is in the process of developing a policy document to inform current pending water right applicants as well as any potential water right applicants of the conditions that are necessary to protect anadromous fisheries (freshwater-ocean-freshwater life cycle) in the Russian River and the other coastal streams. Because the proposed policy document is based on science, it will be peer reviewed in accordance with HSC § 57004.

For further discussion of the role of science in water right decision-making, please see Appendix item A – 28.

2. Water Quality Certifications for Hydropower Projects

The Division of Water Rights issues water quality certifications for hydropower projects subject to licensing decisions by the Federal Energy Regulatory Commission (FERC). The Clean Water Act requires that every applicant for a federal license or permit to conduct an activity that may result in a discharge into navigable water provide the licensing or permitting federal agency with certification that the project will be in compliance with specified provisions of the Clean Water

Act, including water quality standards and implementation plans promulgated under the Clean Water Act. In California, the State Water Board's Division of Water Rights is responsible for issuing the required water quality certification primarily because in-stream beneficial uses require the maintenance of adequate stream flows as well as limitations on the discharge of waste.

Hydropower projects fall into three categories: (1) "storage" projects impound water behind a dam, forming a reservoir and generate power when releases from the dam are run through turbines in a powerhouse located near the base of the dam; (2) "run of the river" projects typically use relatively low dams where the amount of water running through the powerhouse is determined by the water flowing in a river or alternatively involve the diversion of all or most of the flow in a river through a series of penstocks which discharge the water past turbines and back into the river; (3) "pumped storage projects" use off-peak electricity to pump water from a lower reservoir to an upper reservoir. During periods of high electrical demand, water is released back into the lower reservoir to generate electricity.

The dams and powerhouse operations that are a necessary element of hydropower plants cause direct environmental impacts. The impacts of a particular project depends on many factors, such as the location of the dam, the design of the facility, and steps taken to modify the operation of the facility. Modifying the operation of a hydropower facility can significantly reduce impacts of hydropower facilities on such things as stream flow, water quality, fish passage, cultural resources, and recreation.

Hydropower facilities have the potential to dewater entire stream reaches. Peaking power operations can cause downstream stretches to alternate between no water and surges of water that cause scouring and cause deposition of sediments downstream. In addition, varying the depth of water can strand fish and wildlife. Varying streamflow volumes also disrupt flow triggers that affect the migration of anadromous fish. Storage of water behind a dam can warm waters, further degrading habitat conditions for cold water fishes. Dam operations can also affect the amount of dissolved gases in the river.

The State Water Board, in fulfilling its water quality certification authorities, has broad authority to require scientific studies to determine the effects of power project operations on water quality, including the physical parameters of flow and temperature. The State Water Board also uses the results of these studies to inform its decisions. For instance, in the case of Pacific Gas and Electric Company's Rock Creek-Cresta project on the North Fork of the Feather River, the State Water Board's involvement resulted in:

- Adoption of an ecosystem approach that includes streamflow regimes to balance sediment transport and channel bed material mobilization and distribution, which contribute to diverse aquatic and riparian habitat.

- Construction of several trout spawning habitat measures to improve trout habitat.

- Improvements to riparian habitat by better managing cattle grazing, including improved cattle fencing and an extensive cattle grazing rotation program.

- Implementation of real-time water quality monitoring and establishment of a process to secure improvements if necessary.

For further discussion of the role of science in water rights decision-making, please see Appendix A – 29.

3. Water rights under the Bay-Delta Plan

The Bay-Delta Plan is a formal water quality control plan adopted by the State Board. The plan identifies the beneficial uses of the waters of the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, includes numeric and narrative objectives to protect those beneficial uses, and specifies a program of implementing the objectives. The Bay-Delta Plan supplements the other water quality control plans that cover the Bay-Delta Estuary; together they include all necessary elements of water quality control plans in accordance with State and federal requirements.

The Bay-Delta Plan was first adopted in 1978 and was last amended in 1995. The plan contains flow and flow-dependent objectives to protect the beneficial uses of the Delta and the Suisun Marsh from salinity (from saltwater intrusions and agricultural drainage) and operational objectives to protect the beneficial uses from adverse impacts of operating the California Department of Water Resources' State Water Project and the U.S. Bureau of Reclamation's Central Valley Project (water projects). The plan also contains a dissolved oxygen objective to protect fish, primarily salmonids, from impediments to migration that result from low oxygen levels in the lower San Joaquin River.

Because the flow objectives can only be met through the control of water diversions, the plan is implemented through flow conditions applied to water right permits, including those held by the Department of Water Resources (DWR), U.S. Bureau of Reclamation (USBR), and others. The State Water Board's Division of Water Rights administers these water rights permits. The permitted flow conditions affect operations of the State's Oroville Reservoir and the federal government's Shasta, Folsom, New Melones, and Friant Reservoirs. They also affect operations of the State's Harvey O.Banks Pumping Plant and the federal government's Tracy pumping plant. The export pumps are also subject to operational objectives that, for instance, control the number of days that the USBR's Cross Channel Gates must be closed to prevent migrating salmonids from straying into the Central Delta, where mortality is higher. Other operational objectives specify how much water may be diverted at the pumps as a percentage of river flows. These objectives protect both salmonids and Delta smelt, which are protected under the Endangered Species Act.

Flow objectives in the plan are intended to provide adequate water levels in the Delta, to ensure that appropriate low-salinity habitat is provided for fish and wildlife and that water levels are adequate for Delta agriculture, and also to ensure that adequate fresh water is provided to repel salinity from San Francisco Bay. The flows necessary to achieve these protections are determined using hydrologic, hydrodynamic, water quality, and fishery models. The current version of the plan is based on 72 years of precipitation data for the Central Valley. Fishery and wildlife needs are based on numerous ecological studies to assess factors that affect protected species. Scientific research on issues such as land use, fate of return flows from agricultural irrigation, the effects of irrigation water and soil salinities on crop production, food preferences of fish and wildlife species, food web interactions, particle tracking, geomorphology, the effects of introduced species on native species, the effect of water temperature variations on life stages of various fishes, the effect of fish entrainment (in the pumps) on population numbers, salmonid migration, and numerous other topics have informed the State Water Board in its activities and decisions in establishing appropriate flow objectives.

The Bay-Delta Plan includes a requirement for ongoing studies to provide physical, chemical and biological data to determine compliance with the water quality objectives in the plan, to evaluate the response of the aquatic habitat and organisms to the objectives, and to increase understanding of the large-scale characteristics and functions of the Delta estuary ecosystem to better predict system-wide responses to management options (i.e., altering flows). These studies are conducted under the direction of the Interagency Ecological Program, of which the State Water Board is a participant. Other studies are conducted under the direction of the CalFed Science Program, the San Francisco Estuary Institute's San Francisco Estuary Regional Monitoring Program (RMP) and monitoring efforts conducted by other agencies. These ongoing studies are used to inform current and future reviews of the Bay-Delta Plan.

For additional discussion of water rights decisions in the Bay Delta Plan, please see Appendix A – 30.

III. IMPLEMENTATION (Regional Board Examples)

The implementation of federal and state water quality laws, water quality plans, and policies is, for the most part, carried out by the regional water quality control boards. Each of the nine regional boards contributed examples of where, what, and how science and engineering were used in their decision-making activities. These activities include permitting, enforcement, basin planning, developing TMDLs and WQOs, remediation and other projects. They highlight the scientific disciplines and types of engineering used and whether these determined or informed the decision.

The regional board examples are presented in two formats. Most use a narrative description while others use a table with key headings of where, what, and how science and engineering are used and recommendations for improving the science. The write-ups include comments on where the regional boards acquire scientific data and external technical expertise. This is often through contracts and consultation with research organizations such as the Southern California Coastal Water Research Project, San Francisco Estuary Institute, Moss Landing Marine Laboratory, Granite Canyon Laboratory, Scripps Institute of Oceanography, and Lawrence Livermore National Laboratories. The regional boards also establish technical advisory committees, technical review panels, independent scientific review panels, technical workgroups and steering committees to provide input into and review of the science and engineering used by regional board staff.

The following discussions or the role of science and engineering in decision-making at the water boards are available in Appendix A:

A. Permitting
   1. NPDES
      a. City of San Diego's Point Loma Treatment Plant (A – 1)
      b. Ventura Water Reclamation Facility (A – 2)
      c. Power Plants in Coastal Waters (A - 3)
   2. Waste Discharge Requirements
      a. Watershed-wide WDRs for Timber Harvests (A - 4)
   3. Waivers to WDRs
      a. Irrigated Lands Conditional Waivers (A – 5) 53
B. TMDLs
   1. Pathogens in the New River (A - 6)
   2. Silt in the Alamo River (A - 7)
   3. Nutrients in the Indian Creek Reservoir (A - 8)
   4. Mercury in Cache and Bear Creeks (A - 9)
   5. Update of Bacteria Objectives for Santa Monica Bay (A - 10)

C. Enforcement Actions
   1. ACL -- Construction stormwater permit violations (A - 11)
   2. CDO – Sewage Discharges at Eagle Lakes (A - 12)
   3. CAO – Cleanup of marine sediments San Diego Bay (A - 13)
   4. CAO -- Cleanup of perchlorate in groundwater (A - 14)
   5. CAO -- Cleanup of copper and zinc, Peyton Slough (A - 15)

D. Basin Planning
   1. Establishing Beneficial Uses for Wetlands (A - 16)
   2. De-designating MUN use for saline waters (A - 17)
   3. Total Dissolved Solids & Nitrogen Management (A – 18)

E. Water quality objectives
   1. Water quality objectives for diazinon (A- 19)
   2. Site specific objectives for copper & nickel (A - 20)
   3. Identifying numerical water quality *limits* (A - 21)

F. Remediation Projects
   1. *In-situ* groundwater remediation for Cr(6+), Hinkley (A - 22)

G. Projects (other)
   1. Modeling MTBE at LUFT sites (A - 23)
   2. Regional Monitoring Program (A - 24)
   3. Environmentally safe discharge of brine (A - 25)
   4. Preventing vapor intrusions at cleanup sites (A - 26)
   5. Huntington Beach Bacterial Pollution (A – 27)

IV. RECOMMENDATIONS

1. The state should foster, promote, fund and streamline a process to set up blue ribbon science panels that would provide advice and guidance to the Regional Boards on complex scientific issues. One suggestion is to set up a special contract and fund for science review panels *(a separate and distinct activity from that of external scientific peer review under HSC 57004).* (Region 1)

2. Recommend that a pool of in-house experts be made available for use by any of the regional boards. For example, experts in economic analyses (impacts of permit conditions and monitoring requirements), risk assessment, and GIS mapping. *(Could be patterned after how legal counsel is provided to the Regional Boards. Science experts could be housed in a research division.)* (R- 9)

3. Develop a comprehensive soil guidance document to aid staff in making decisions regarding sediment/soil cleanup levels that are protective to groundwater and surface water. *(This would be for the mutual benefit of all the Regional Boards, possibly developed by in-house specialists (research division?) or under contract to outside scientists.)* (R-2)

4. In the absence State and regional board expertise, it would be very helpful to have formal policy that would authorize the Boards to require dischargers to fund escrow accounts to contract with independent scientists. This would allow the Boards to get critical scientific information needed for decision-making (e.g., design and interpretation of field studies, engineering tests and analyses). *This was meant for highly specialized areas of science and engineering that would not otherwise be cost-effective to have on staff.* (R-3)

5. Regional boards do not have specialists in risk assessment or toxicology. It would be useful to establish a mechanism (e.g., memorandum of agreement, interagency agreement, contract resources) to allow regional boards to consult or contract with experts in other state, federal or local agencies. *This recommendation was made in the context of establishing site-specific objectives that are less stringent than federal or state objectives but would not produce sediment or water column toxicity within the receiving waters (e.g., an estuary).* (R-4)

6. The regional boards do not have the resources to allow for peer-review of the technical merit of proposed scientific studies, or for the evaluation of the data or conclusions from such studies. It would be helpful to create an advisory panel for this purpose. *The "peer review" referenced here is not the University of California peer review under HSC 57004. The water boards are looking for technical review, comment, and suggestions on their field studies and the interpretation of their data. This is similar to recommendation #1.* (R-4)

7. The Enclosed Bays and Estuaries Policy (SIP) does not describe a precise method by which enhancement of an estuary should be demonstrated. It is recommended that a method be established to ensure consistency among boards. (R-4)

8. Best management practices (BMPs) and treatment measures designed to address unreasonable or unlikely storm events are not cost-effective. More monitoring and modeling work is needed to optimize "design" storms used in developing best management practices (BMPs) and other treatment measures used in TMDL implementation plans. *This recommendation was made in the context of updating bacteria objectives to protect the "recreational water contact" beneficial use.* (R-4)

9. A five-year cycle of review and update of permits and waste discharge requirements based on current water quality limits would help improve protection of water quality. (R-5)

10. U.S. EPA methodology for deriving toxicity water quality criteria requires data from eight identified families of aquatic organisms. Without data from even one these families, the methodology cannot be applied and criteria cannot be derived. (R-5) *Alternative testing protocols should be developed, or review and approval of available data and its interpretation by a panel of expert scientists should be allowed.*

11. Methodologies are available for deriving criteria for water column toxicity (e.g., from diazinon), but are not readily available for deriving criteria for sediment toxicity. Sediments accumulate less soluble pollutants, typically organics (e.g., pyrethroids). Methodologies for deriving sediment criteria are needed. (R-5)

12. We need a better understanding of how to most effectively reduce the methylmercury levels in water. Whether it is by controlling inorganic mercury, interrupting mercury-to-methylmercury transformation, or increasing the rate of methymercury degradation. Further research is critical to protecting wetland restoration projects and reducing mercury levels in fish. (R-5)

    We also need a better understanding of how to interpret the levels of total (mass) and dissolved (concentrations) mercury found in waste discharges (e.g., from aggregate mining operations) to land to determine their potential for long-term impacts on water quality. (R-5)

13. Review of annual monitoring reports from both coalition and individual discharges is required under the irrigated lands conditional waiver program ("Ag Waivers") to determine whether water quality objectives are being exceeded. While annual monitoring reports are providing much needed baseline data, if information from other agencies and programs were accessible in a one-source database, the reviews would be much improved and could recommend better management and implementation plans. (R-5) *This recommendation supports the need to enhance the Surface Water Monitoring and Assessment Program (SWAMP).*

14. Review of scientific and technical information contained in coalition, water district, and individual watershed evaluation reports (WERs, submitted under the Ag Waiver program) is used to develop and evaluate the most appropriate monitoring and reporting program plans (MRPPs) to be submitted by the discharger. Adequate geographical information system (GIS) services are needed to verify information in the WERs. (R-5)

15. State-of-the-art science continues to demonstrate the importance of wetlands in removing pollutants from stormwater and protecting downstream water quality and beneficial uses. More research and monitoring are needed to develop numerical chemical and biological water quality standards for these waters. While the SWAMP has developed a strategy for the needed monitoring, it is under-funded. (R-6)

16. There is an ongoing need for training to ensure that regional board staff activities regarding wetlands are based on the best available science. (R-6)

17. Ground water investigations should incorporate monitoring wells designed and located for the purpose of delineating and quantifying ground water

pollution. Using domestic wells is unreliable because they often lack sanitary seals and no screening at discrete ground water depths. Better funding is needed for the Groundwater Ambient Monitoring and Assessment Program and SWAMP so as to provide more reliable scientific data. (R-6)

18. Professional scientists and engineers practice "continuing education" (similar to that required of physicians to maintain certification), by attending workshops, conferences, professional society meetings, and training classes. There are also technical publications that serve the professional scientist and engineering communities. Resources (time and money) should be made available to water board scientists and engineers for continuing education (e.g., subscriptions to professional journals, technical books, library cards, and Internet access to journal article services [e.g., Ingenta]). (R-6)

19. The State Water Board's Sources of Drinking Water Policy should be revised to: (a) provide more specific science-based direction regarding the suitability of geothermal and inland saline water bodies for municipal drinking water use; and (b) provide an opportunity for the Regional Boards to take categorical actions to de-designate waters currently designated for MUN (municipal and domestic supply) beneficial uses in accordance with the revised policy without having to undertake multiple Use Attainability Analyses (UAAs). (R-6) *The primary benefit of revising the Sources of Drinking Water Policy to provide more specific science-based guidance would be that the RWQCBs would not have to repeat the UAA analysis required by U.S. EPA for every water body that would be appropriately de-designated.*

20. The State Board's *Water Control Policy for Developing California's Clean Water Act Section 303(d) List* (Sep 2004) ("Listing-Delisting Policy") should be revised to acknowledge that waters designated for MUN (or other) beneficial uses that are subject to natural contamination shall not be listed as impaired when a scientific weight-of-evidence approach indicates that the exceedance of relevant criteria is due to natural causes. (R-6)

21. Facilitate accessing scientific literature, libraries, etc. Recommend reimbursement for copying technical articles and library use. (R-7)

22. More resources for water quality sampling and analysis, SWAMP, and TMDL contracts. Streamline the state contracting process. (R-7)

23. The methods utilized in the revision of the TDS and Nitrogen Management Plan for the Santa Ana River Basin relied heavily on computer models and statistical programs. The use of these scientific and engineering tools is contingent on the availability of sufficient and high quality data. The Regional Board needs access to these computer tools including appropriate software programs and high power computers to run complex computer programs. (R-8)

24. We would benefit from a better understanding of the effects of flow diversions and dam construction on geomorphology, and the interactions of flow rate, water temperature, pollutants, food web, and introduced species on the beneficial uses of water. (WR)

25. We would benefit from more information on how water supply and quality affect crop production, industrial processes, and other uses of water, including drinking. (WR)

26. Aquatic habitat, riparian zones, and stream flows vary seasonally. Our water rights decisions could be improved if we better understood the many interrelated factors that affect the environment individually and in combination. More environmental data that could be integrated into a seasonal model would be helpful. (WR)

27. Understanding the life stages of fish dependent of water flows is essential to understanding where, when, and how much water (and its quality, e.g., temperature) is needed. Our water rights decisions could be improved if we better understood the life stages of the species that utilize the rivers under study (WR)

28. Increase the resources allocated to monitoring and assessment. When the SWAMP program was originally designed it was envisioned to provide information for all the Water Boards' decision-making needs. In a report to the Legislature, it was estimated that the program would cost between $59 and $115 million per year and include 87 to 132 staff positions. The current program is funded at $3.4 million and 17 staff positions or approximately 7 percent of what is needed. (SWAMP)

29. Promote the coordination of monitoring activities and comparability of data among other agencies and monitoring entities. Hundreds of agencies and entities collect water quality information, but differences in design, analysis,

quality assurance and data management make it difficult to use data collected by different groups. At the staff level, many agencies are beginning to work toward data comparability and data integration through the California Environmental Data Exchange Network hosted by the Department of Water Resources. This type of collaboration is supported at the Water Boards, but needs to be supported by other agencies interested in water quality. (SWAMP)

30. Sources for continued funding of the GAMA Program need to be identified. (GAMA)

Table 1

Laws, Plans, and Policies Governing the Activities of the Water Boards

Laws (4)

- Federal Clean Water Act
  - o Implementing regulations
    - Adopt water quality standards for surface waters
      - Designates beneficial uses
      - Requires numeric or narrative criteria to protect
      - Antidegradation [40 CFR 131.12]
    - California Toxics Rule
    - Impaired water bodies (Sec. 303(d)) and TMDLs
- California Porter-Cologne Water Quality Control Act *(Calif. Water Code, Div. 7, Water Quality, contained in 24 chapters, last revised January 1, 2005)*
  - o Implementing regulations
  - o Authorizes State Board to adopt state water quality control plans
  - o Requires State Board to adopt water quality control policies
  - o Requires Regional Boards to adopt basin plans
- Chapter 6.7 Health & Safety Code (and Implementing Regulations at Title 23, California Code of Regulations, Chapter 16)
  - o Underground Storage Tank Leak Prevention Standards
- Resource Conservation and Recovery Act (RCRA) Cleanups

Water Quality Control Plans (14)

- Regional Water Quality Control (Basin) Plans (10)
  - o Designate beneficial uses to be protected
  - o Establish water quality objectives (WQOs)
  - o Implementation program to achieve WQOs
- Water Quality Control Plan for Ocean Waters of California, *aka* the "Ocean Plan"
- Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California, *aka* the "Thermal Plan"
- Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, *aka* the "Bay-Delta Plan"
- Plan for California's Nonpoint Source Pollution Control Program

Policies (17)

- State Policy for Water Quality Control
- Water Quality Control Policy for Developing California's Clean Water Act Sec. 303(d) List of impaired water bodies
- Policy for implementation of the Toxic Standards for Inland Surface Waters, Enclosed Bays and Estuaries in California *(aka State Implementation Policy or SIP)*
- Water Quality Control Policy for Guidance on Development of Regional Toxic Hot Spot Cleanup Plans *(aka Consolidated Toxic Hot Spots Cleanup Plan)*
- Statement of Policy with Respect to Maintaining High Quality of Waters in California *(aka Antidegradation Policy)*
- Water Quality Control Policy for the Enclosed Bays and Estuaries of California
- Water Quality Control Policy for the Use and Disposal of Inland Waters Used for Power Plan Cooling
- Policy with Respect to Water Reclamation in California
- Policy on Disposal of Shredder Waste
- Policy Regarding the Underground Storage Tank Pilot Program
- Sources of Drinking Water Policy
- Pollutant Policy Document for the San Francisco Bay/San Joaquin Delta Estuary
- Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Sec. 13304 *(aka Containment Zone Policy)*
- Policy for Regulation of Discharges of Municipal Solid Waste
- Water Quality Enforcement Policy
- Brownfields Policy
- Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program, May 2004. Groundwater Cleanup and Containment Zone Policy, Resolution 92-49.
- Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options. June 16, 2005

TABLE 2

STANDARD BENEFICIAL USE DEFINITIONS

The following are the beneficial uses (BU) for surface and groundwaters that have been adopted by the regional boards in basin plans and have been approved by the State Board. Not all of the beneficial use definitions listed below are appropriate for each basin. The uses and their definitions and abbreviations are to remain standard for all basins.

Municipal and Domestic Supply (MUN) - Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water.

Agricultural Supply (AGR) - Uses of water for farming, horticulture or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

Industrial Process Supply (PRO) - Uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND) - Uses of water for industrial activities that do not depend primarily on water quality, including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Ground Water Recharge (GWR) - Uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting saltwater intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH) - Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

Navigation (NAV) - Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Hydropower Generation (POW) - Uses of water for hydropower generation.

Water Contact Recreation (REC-1) - Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Non-Contact Water Recreation (REC-2) - Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Commercial and Sport Fishing (COMM) - Uses of water for commercial or recreational collection of fish and shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

Aquaculture (AQUA) - Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Warm Freshwater Habitat (WARM) - Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Cold Freshwater Habitat (COLD) - Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Inland Saline Water Habitat (SAL) - Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) - Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Marine Habitat (MAR) - Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

Wildlife Habitat (WILD) - Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Preservation of Biological Habitats of Special Significance (BIOL) - Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

Rare, Threatened, or Endangered Species (RARE) - Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.

Migration of Aquatic Organisms (MIGR) - Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Spawning, Reproduction, an/or Early Development (SPWN) - Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Shellfish Harvesting (SHELL) - Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial or sport purposes.

Additional Beneficial Use Definitions Adopted By Individual Regional Boards and Approved By The State Board

North Coast Regional Board (Region 1):
Native American Culture (CUL) – Uses of water that support the cultural and/or traditional rights of indigenous people such as subsistence fishing, basket weaving and jewelry material collection, navigation to traditional ceremonial locations, and ceremonial uses.

Subsistence Fishing (Fish) – Uses of water that support subsistence fishing. *Note: no waters have been designated as such to date (Aug 2005).*

Los Angeles Regional Board (Region 4):
Wetland Habitat (WET) - Uses of water that support wetland ecosystems, including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife, and other unique wetland functions which enhance water quality, such as providing flood and erosion control, stream bank stabilization, and filtration and purification of naturally occurring contaminants.

Lahontan Regional Board (Region 6):
Flood Peak Attenuation/Flood Water Storage (FLD) - Beneficial uses of riparian wetlands in flood plain areas and other wetlands that receive natural surface drainage and buffer its passage to receiving waters.

Water Quality Enhancement (WQE) - Beneficial uses of waters that support natural enhancement or improvement of water quality in or downstream of a water body including, but not limited to, erosion control, filtration and purification of naturally occurring water pollutants, streambank stabilization, maintenance of channel integrity, and siltation control.

Santa Ana Regional Board (Region 8):
Limited Warm Freshwater Habitat (LWRM) - Waters support warm water ecosystems which are severely limited in diversity and abundance as the result of concrete-lined watercourses and low, shallow dry weather flows which result in extreme temperature, pH, and/or dissolved oxygen conditions. Naturally reproducing finfish populations are not expected to occur in LWRM waters.

VI. Acknowledgements

This report relied on contributions from State and Regional Water Board staff and program managers who have intimate knowledge of where, what, and how science and engineering are used in their daily work and decision-making. Their individual and collective efforts must comply with the many laws, plans and policies that govern the water boards. Their expertise, creativity, and adaptability allow them to respond to emerging issues that require new science and engineering to address. Their abilities are reflected in the quality of work presented to their respective boards, the policies and resolutions adopted by their boards, and the comments received from external scientific peer reviewers. Their abilities are also reflected in the complex permit conditions and monitoring requirements that are approved by their boards and Executive Officers. The use of sound scientific principles and practices is prevalent among water board staff. Science and engineering are the foundation of their mission to protect the current and future beneficial uses of California's surface and ground waters.

In the preparation of this report, no one in Cal/EPA or any of its boards, departments or offices asked or directed that any topic be included, excluded, or revised. The organization, drafting, and preparation of the report were done by the consultant and reflect his interpretation and understanding of water board programs and activities. Protecting the beneficial uses of California waters is an extremely complex task and not every subject or issue was included in this report, to do otherwise would take several years and require much more text to complete. Consequently, the report provides a general overview with a few specific examples of the role of science and engineering in decision-making. The report provides enough information to demonstrate the wide use of science and engineering among the water boards and would be a place to start if a more in-depth review is required.

References

Belitz, K, Dubrovsky, NM, Burow, K.; Jurgens, B, and Johnson,T, "Framework for a Ground-Water Monitoring and Assessment Program for California" U.S. Geological Survey Water-Resources Investigations Report 03-4166, 2003.

Copeland, C., "Clean Water Act" A Summary of the Law," Congressional Research Service (CRS) Report for Congress, 11 pp. January 20, 1999.

Moran, JE, Hudson, GB, Eaton, GF, and Leif, R, "Ambient Groundwater Monitoring and Assessment: A Contamination Vulnerability Assessment for the Sacramento Area Groundwater Basin" Lawrence Livermore National Laboratory, UCRL-TR-203258, no publication date given.

San Francisco Estuary Institute (SFEI), "Pulse of the Estuary, Monitoring and Managing Water Quality in the San Francisco Estuary," SFEI Contribution 78, San Francisco Estuary Institute, 85 pp, 2005.

SWRCB, "Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List," 28 pp., September 2004.

SWRCB, "Water Quality Control Policy for Addressing Impaired Waters: Regulatory Structure and Options," 9 pp. with attachments, draft March 2, 2005.

SWRCB, Notice of Public Solicitation of Water Quality Data and Information – 2004 Clean Water Act Section 303(d) List, letter from Executive Officer SWRCB to Interested Parties dated April 30, 2004.

SWRCB, "Porter-Cologne Water Quality Control Act" with additions and amendments, 123 pp., January 1, 2005.

SWRCB, "Water Quality Control Plans and Policies," Administrative Procedures Manual, Ch. 8, 101 pp. including charts and appendices, August 27, 2001.

SWRCB, "Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California," 33 pp. plus appendices, April 2000.

SWRCB, "A Comprehensive Groundwater Quality Monitoring Program for California," A.B. 599 Report to the Governor and Legislature, March 2003.

SWRCB, "Proposal for a Comprehensive Ambient Surface Water Quality Monitoring Program," A.B. 982 Report to the Legislature, November 2000.

SWRCB, "Statement of Policy with Respect to Maintaining High Quality of Waters in California" Resolution No. 68-16, 2 pp., October 28, 1968.

SWRCB, "Adoption of the Proposed Amendments to the California Ocean Plan" Resolution No. 2000-108 (addresses water quality objectives), 39 pp., November 16, 2000.

U.S. EPA, "Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule", Code of Federal Regulations, Title 40, Part 131, *Federal Register* **65**: 77, pp. 31682 – 31719, May 18, 2000.

USGS and SWRCB, "Ground-Water Ambient Monitoring and Assessment Program" Fact Sheet (2 pp.), August 2004.

Vassey, S. , "Antidegradation," article for NPDES Permit Writers' Training Manual, 8 pp., March 1997.

_____, "Federal Water Pollution Control Act (Clean Water Act)", summary found at the Center for Wildlife Law, Institute of Public Law, University of New Mexico School of Law Web site, 7 pp., (http://ipl.unm.edu/cwl/fedbook/fwpca.html)

_____, "A Framework for Science and Technology Advice: Principles and Guidelines for the Effective Use of Science and Technology Advice in Government Decision making", Government of Canada publication available on-line at http://www.ic.gc.ca/cmb/welcomeic.nsf/f4ac20f45980b8e685256fc800678feb/85256a5d006b97208525690d00799e59!OpenDocument, 18 pp., May 11, 2005.

This Page Intentionally
Left Blank

Policy Update 20

April 2005

New Approaches to Affordable Housing: Overview of the Housing Affordability Problem

By Chris Fiscelli
Project Director: Adrian T. Moore

OVERVIEW OF THE HOUSING AFFORDABILITY PROBLEM

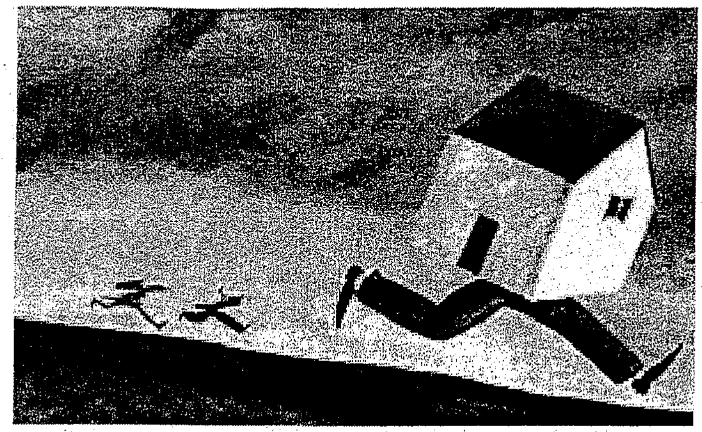
Housing has long been one of the staples of American society and the United States' economic prowess has afforded its citizens an abundance of safe and decent housing. The national homeownership rate as of Q1, 2004 is 68.6 percent, according to realtor.com. But, this success is tempered by the fact that some Americans are finding it increasingly difficult to afford housing in their communities. Housing prices are growing faster than incomes in some areas, in severe cases, pricing low-income buyers out of the market. The real estate boom of the last few years has caused housing prices to skyrocket, making it difficult for low- and middle-income families in many areas to purchase a home. Unfortunately, most of the political remedies aimed at making housing more affordable to these families don't consider the real world functioning of housing markets and wind up making the problem worse. "Affordable housing" is now in the lexicon of seemingly every state, city, and housing advocacy group. The issue has gained political momentum in state and local government debates. This year California Gov. Arnold Schwarzenegger specifically mentioned affordable housing as an important issue he would address to enhance California's economic competitiveness, as did the governors of New Jersey, Hawaii, Oregon, and perhaps others. Local politics, particularly in high-cost areas around the nation as diverse as Madison, Wisconsin and Ft. Lauderdale, Florida, are inundated with affordable housing debates and with various candidates using the housing issue to appeal to voters and get a leg up in elections.

The National Low Income Housing Coalition released a report called "Out of Reach" identifying affordability issues. Sheila Crowley, the president of the organization, stated, "The gap between what people earn and what their housing costs are is stark." Echoing the rhetoric of most of the affordable housing community, the premise is simply that not enough low-cost housing exists. The political response to date has been largely to subsidize rental housing development, mandate "for-sale" units to be sold below market to income-restricted populations, or in some cases, to control appreciation through government intervention. However, these policy responses rely on false premises, do not holistically attack the problem, and do not consider other solutions or unintended consequences. This policy brief explores housing affordability problems, evaluates current policies designed to increase affordability, and offers a new paradigm and new approaches for housing affordability.

Is Housing Affordable?

Housing affordability is largely a function of income. One of the best available measures for determining affordability is the Housing Opportunity Index (HOI). This index simply states the percentage of homes sold in a given area that would have been affordable to a household with the area's median income. Affordability is defined as a house payment no greater than 28 percent of gross household income. Housing advocates have further defined affordability to include rental affordability (rent payment not exceeding 30 percent of household income). The nationwide HOI as of Q4, 2004 is 52.0 (the most recent data) implying that households earning the national median income can afford nearly one-half of all houses sold. HOIs in the 1990's have been hovering in the 50s and mostly 60s implying that there has been no dramatic shift in the last decade although he index has exhibited significant decline recently. However, aggregate HOI data do not tell the whole story. HOIs in selected markets are extremely low, particularly the West Coast and parts of the Northeast. Many of the California markets are below 30, for example. The data indicate that the perception of widespread housing unaffordability is largely exaggerated, but that selected markets are experiencing unacceptably wide gaps in housing prices and income.

Aside from affordability data, there is also a widespread perception that specific classes of workers cannot afford housing in their respective communities. These include teachers, police and firefighters, and other civil servants. While there are no available comparative data on teacher or civil service compensation vs. housing prices, some data are available on teacher salaries. The link can then be made to median home prices. According to the National Education Association, the average teacher's salary was $41,724 in 1999-2000. State ranges were relatively tight compared to regional home price variation, varying from $55,693 in California to $32,414 in South Dakota. Comparing this average to the national home price median of $187,500, aggregate teacher and civil service incomes appear to be adequate on a nationwide basis. The key to applying these



data is recognizing that home prices have a much greater geographic variance than teacher and other civil service salaries. Consequently, people in these professions are punished in high-cost markets. Like housing affordability in general, the problem turns out to be more a regional or market-by-market situation rather than a nationwide phenomenon.

Further confounding an accurate assessment of the housing affordability situation is the fact that many homeowners have significant equity in their homes while they may have modest incomes. This situation tends to occur in high-cost areas where homeowners may have purchased their homes before recent price increases and are actually living in homes they would not be able to afford on their current income if they had to purchase them today. While no data exist to measure this phenomenon, it would follow that the greater it exists, the more overstated the housing affordability issue is.

AN ASSESSMENT OF CURRENT HOUSING POLICIES

The policy response to housing affordability issues has been mostly a federal, state, and municipal one despite evidence that the issue is one of a market-by-market or regional nature. While there are a variety of housing initiatives at all levels of government, this paper will focus on a select few that appear to be gaining momentum as possible solutions to housing unaffordability.

The Low-Income Housing Tax Credit

The Low-Income Housing Tax Credit (LIHTC) program provides federal tax credits to developers/investors who

A004807

construct rental housing that has a low-income component. This means that the apartment complex is market-rate, but developers/investors can receive a tax credit if a select percentage of units (usually 10 - 20 percent) are reserved for low- or moderate-income households (definition of low to moderate income has a range from 30-120 percent of the area's median income). The rent of that unit is then fixed according to the household income based on household size, essentially ensuring that the household pays no more than 30 percent of its gross income on rent.

The LIHTC program has spawned an entire industry of sorts. With state credits now available in some cases, private developers and non-profit housing associations actively seek low-income housing development opportunities. Tax credits are frequently sold or syndicated by third parties to raise equity in projects. The demand for tax credits is so great that it has become quite competitive with many developers vying for a limited number of tax credits.

While this supply-side solution has resulted in the development of several "affordable" units housing a number of low- to moderate-income residents, the program does not necessarily distribute benefits according to need. By definition, a great many people with low-moderate incomes could qualify for the affordable units, but they either have no knowledge of the program or no supply suiting their needs. Some households with the greatest needs may be on a waiting list. Furthermore, it is clear that apartments would have been constructed without the LIHTC as (1) most of the units are market-rate and (2) developers look to vacancy and local economic trends to determine if there is sufficient market support for their projects. The LIHTC simply provides tax credits to investors to rent to the same population that would have been rented to prior to the LIHTC.

In fact, the entire concept of subsidizing rental housing construction is questionable because the lack of supply is not the problem. Apartment vacancy rates are currently quite high in many markets (nationally about 7 percent), indicating that there is actually an oversupply of multifamily rental housing in some markets, but stable overall. Supply will always follow (if legally allowed) if demand is present. Therefore, it follows that a better use of public resources would be to focus on the individual or household need, not the supply of rental housing.

Inclusionary Zoning

Inclusionary zoning is a relatively new term used to describe a concept now being advocated in California and increasingly in other areas of the country. It calls for a state or municipality to ensure that a percentage (likely 10-20 percent) of all rental and "for-sale" units constructed are "affordable." Presumably, the implementation mechanism for rental housing would be the LIHTC or some variation of it while the implementation mechanism for the "for-sale" housing would be a mandate to sell a percentage of homes in a project at below-market rates. The rental housing aspect of this policy simply amplifies all of the shortcomings of the LIHTC described earlier. The effect on the "for-sale" component of the housing market is similar and discussed below.

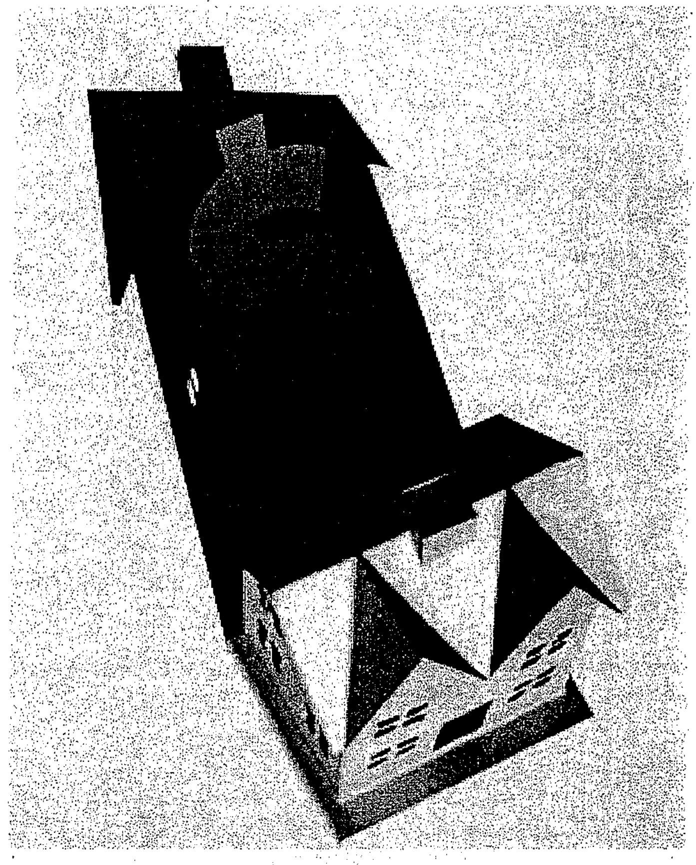
The HOIs in the high-cost markets signal that home prices should be the primary concern. For example, in the San Francisco Bay area, the average rent for a two-bedroom apartment is currently $1,565 per month (excludes lower rents in Oakland and the South Bay) while the median home price is $656,700, resulting in a $3,356 monthly payment (assumes 10 percent down, 5.5 percent 30-year fixed-rate loan, APR). Using the household median income of $86,100 and the 28 percent rule, it is evident that the median earner can afford the median rent, however he cannot afford the median-priced house.

Although the for-sale component of inclusionary zoning attacks the correct problem, it does so crudely and with numerous drawbacks. The primary problem with mandating that a portion of new housing be affordable to lower-income populations is determining where the burden will fall. Clearly, homebuilders are under great pressure to achieve a certain rate of return. If the projected loss on the "affordable" units does not allow that required rate of return to be met, the project will be abandoned. Addi-

tionally, the primary method available to compensate the developer for this loss is to sell the market-rate homes for a higher price to at least offset the loss on the subsidized r "affordable" units. In doing so, the cost of this policy is borne by the buyers of new market-rate housing. In effect, the problem of one person's affordable housing issue is being transferred to many others, essentially worsening the problem.

In some instances, "density bonuses," or rewards given for constructing housing with a higher density, are granted to developers to make up for lost revenue, but there are problems with this approach to compensating developers for providing low-income housing. First, the initial allowable density was likely artificially restricted through zoning and the land purchase price may have a density bonus factored into the price. In this way, density bonuses try to solve a problem created by regulation with more or "counter"-regulation. Second, the developer may believe that the project is not suited to higher density and therefore, chooses not to "capitalize" on the additional allowable density.

Given this example, it seems as if the policy response of rental subsidies does not attend to the real problem of out-of-reach for-sale housing in select cities. Inclusion-ry housing for rental housing only worsens the existing disconnect between problem and solution. In addition, there are several unintended consequences of the rental and "for-sale" strategy. One obvious example is that renters and homeowners barely qualifying for these subsidies are penalized. So, for some renters and homeowners, a small potential pay raise will result in the loss of the subsidy and a higher housing payment. This creates the peculiar situation of potentially being worse off after a pay raise. Another unintended consequence is the disruption of the housing ladder, a natural economic process. Typically, people rent when they are young. As incomes rise and family situations change, people tend to move up the housing ladder. Maybe they first seek a better apartment, then a starter home, then a bigger home, etc. Along the way, they make trade-offs regarding a number of factors—location, home size, community amenities, school districts, pricing, discretionary spending, etc. Subsidizing rents or houses in all communities breaks the housing ladder because it allows households to avoid these tradeoffs. For example, a lower-income family may find that it can live in a less expensive ty within the same metropolitan area, share a car or own



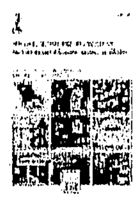
an older one, rent or buy a smaller residence, or lower discretionary spending. Subsidizing this household in a more upscale community essentially limits the family's housing choices because if and when they increase their income, they will have no option to increase their living standard. This is because the subsidy loss may likely be greater than the income gain. Thus, the only option may be to move down the housing ladder. It would seem that public policy should have the intent of doing precisely the opposite. Even worse, the subsidy can act as an enticement to earn less income or restrict one's income growth. The potential effects on economic growth could be devastating, not to mention the lack of personal incentives to increase one's income.

NEW PARADIGM FOR HOUSING AFFORDABILITY

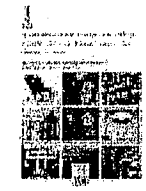
Housing policy is in dire need of a paradigm shift. Society has allowed homeless activists and other housing advocates to frame and define the policy agenda for hous-

A004809

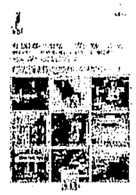
Empirical Research on Affordable Housing Mandates



Three Reason Foundation studies of affordable housing mandates (aka "inclusionary zoning," or "inclusionary housing") were conducted by Benjamin Powell and Edward Stringham of San Jose State University. In the San Francisco area study titled *Housing Supply and Affordability: Do Affordable Housing Mandates Work?* they found that few affordable units actually get built, totaling about 4 percent of the amount needed in the San Francisco Bay Area. The costs of the program are high, about $45 million per jurisdiction. In addition, the costs of the program are borne, to some degree, by other homebuyers in the range of $22,000 to $44,000 per unit in a typical Bay Area city. (http://www.rppi.org/ps318.pdf).



The second study titled *Do Affordable Housing Mandates Work? Evidence from Los Angeles County and Orange County* focused on Los Angeles and Orange Counties in Southern California. Results indicated that the 13 Los Angeles and Orange County cities using inclusionary zoning produced only 6,379 affordable units and that after passing an ordinance, the typical city produces less than eight affordable units per year. The cost of inclusionary zoning in the average jurisdiction is nearly $300 million annually. In addition, inclusionary zoning increased the cost of market-rate homes in a typical city by $33,000-$66,000 per unit. (http://www.rppi.org/ps320.pdf)



The third study, *Affordable Housing in Monterey County* analyzed the affordable housing element of the Monterey County General Plan Update. The authors identified the affordable housing contradictions in the original Monterey County General Plan Update such as restricting the supply of residential land and imposing price controls on new development and how that will likely make housing less affordable in the county. (http://www.rppi.org/ps323.pdf).

ng. Consequently, "affordable" has become the buzzword of choice as a euphemism for "subsidized." Furthermore, the debate has centered on the housing unit as a measure of affordability, when in fact the hard construction cost of a housing unit is not necessarily an indication of its value. The popular approach to addressing the housing affordability issue is increasingly inclusionary zoning. This term, itself, is a euphemism, crafted carefully to appear as an anecdote to the problematic exclusionary zoning. However, inclusionary zoning is simply a mandate to sell a fraction of housing units to select groups at below-market cost while exclusionary zoning relates to a much broader set of measures used by select municipalities to limit density, minorities, or unwanted land uses or businesses.

These new housing initiatives come on the heels of the LIHTC, various HUD programs, and Community Land Trust policies, all of which have had little effect on what is widely considered the "housing crisis." This paper has identified some of the shortcomings of these and similar approaches and will offer more economically viable pproaches that attack the problem at its core.

It is unclear whether housing policy should encourage homeownership or renting. While in a perfect world housing policy would be agnostic toward the housing type and ownership form, such perfections do not exist. The LIHTC essentially encourages renting while other parts of the federal tax code favor ownership, namely the mortgage interest deduction (MID). It should be noted, however, that Richard Green, a noted land economist, demonstrated that the MID is not significant enough to entice someone into a home purchase, but rather encourage them to make a bigger purchase than they might have without it. There are other arguments of a social nature that can be made in defense of encouraging homeownership, however, that is not the focus of this paper.

Given the shortcomings of current housing policy and the overall perspective of the housing issue, a new approach to housing policy is needed. Several policy options are outlined below that address the concerns of both low-income renters and low-moderate renters and homebuyers.

Policy Option #1: Modify explicit and implicit land use and growth controls to allow homebuilders and developers the opportunity to meet demand quicker.

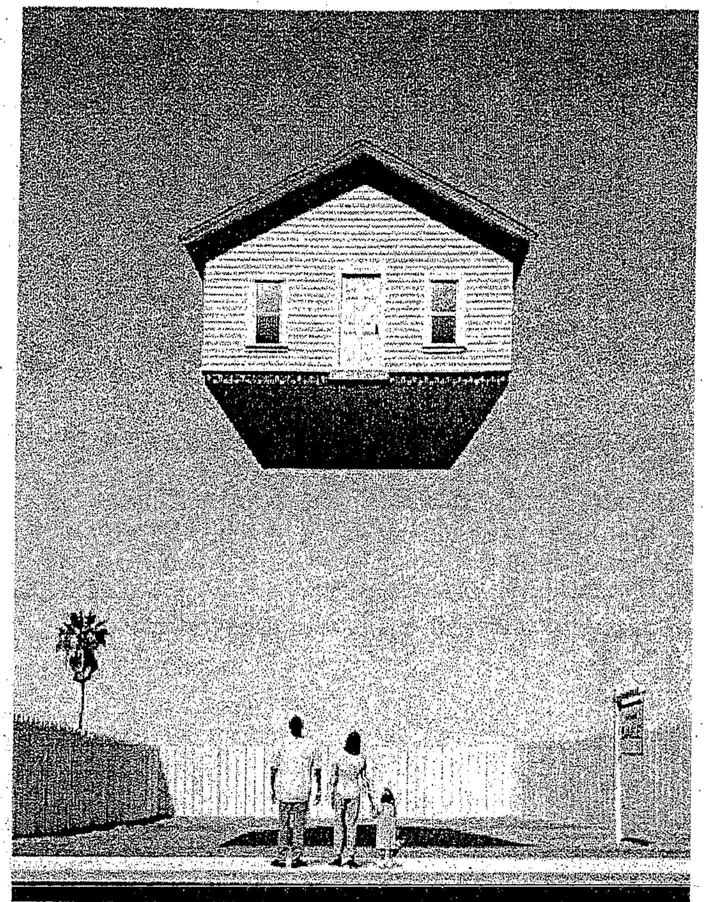
According to Edward Glaeser and Joseph Gyourko, Harvard and Wharton School professors who studied the sources of rising housing costs, land use controls are a significant contributor to high house prices. These land use controls include urban growth boundaries, growth moratoria, tangled and lengthy entitlement processes, and excessively high impact fees. There are also unstated controls that often limit housing. This list includes planning and architectural review and preferences for certain kinds of housing. In addition, it includes NIMBY (Not In My Back Yard) resistance to projects that may meet land use codes but are rejected due to community opposition. Loosening growth controls like boundaries or moratoria and streamlining the entitlement process would certainly result in increased "for sale" housing construction. The additional supply would almost certainly relieve pricing pressures evident in "high barrier to entry" markets.

Policy Option #2: Increase civil service compensation in select areas where incomes do not reflect high housing costs.

Areas with high housing costs have difficulty recruiting teachers and other critical workers such as police and firefighters whose compensation is not high enough to account for the high costs. Current solutions are limited to workforce housing construction and enhanced use of the LIHTC. However, given the shortcomings of such strategies previously discussed, housing policy for critical occupations needs to be retooled. The problem with larger government programs funding housing in these problematic local areas is that society at large is subsidizing a need that wealthier communities no longer have to meet. So, in effect, people with lower incomes end up subsidizing people with higher incomes because of their particular location and occupation decisions. Instead of supplying below-market housing, state and local governments should focus on increasing the compensation of these critical workers in select areas.

Policy Option #3: Encourage the use of market innovations such as location-efficient mortgages.

Not all efforts to increase housing affordability are initiated by the public sector. Fannie Mae, the nation's largest Government Sponsored Enterprise (GSE), agreed to pilot location-efficient mortgage (LEM) products. LEMs allow borrowers to increase their gross monthly income-to-mortgage payment ratio higher than the conventional loan



standard of 28 percent (36 percent total debt). In order to qualify, the borrower must live in a location the lender deems efficient in terms of auto commuting. The premise is that by lowering a household's automobile transportation costs, the family will have more money to allocate to their mortgage payment.

Fannie Mae sponsored a market test of the LEM, defined the guidelines of the current LEM mortgage product, agreed to invest at least $100 million in LEMs, and authorized lenders to issue LEMs in four metropolitan market areas: Chicago, Seattle, San Francisco Bay Area, and Los Angeles. (http://www.locationefficiency.com/)

LEMs are not a scalable option as of yet because they are still in trial form. However, they have the opportunity to offer homeownership to a number of households that typically would not be able to afford a house. The LEM concept is somewhat conducive to the highest-cost metropolitan areas as they also tend to be the most "location-efficient" as defined by Fannie Mae. These include the aforementioned pilot markets as well as higher-cost cities like New York City, Boston, Washington, D.C., and Portland.

Policy Option #4: Assist and leverage grassroot, volunteer organizations such as Habitat for Humanity (HFH).

Local affiliates of HFH have built 50,000 safe, affordable, decent homes for United States households alone. HFH builds simple, small homes and keeps them affordable by not making a profit and offering qualified households interest-free mortgages. Although HFH receives no direct public money, local governments can assist the local affiliates by providing land and infrastructure for housing construction. In this way, costs could be kept to a minimum for qualified homebuyers. (http://www.habitat.org/)

Policy Option #5: Use local flexible housing vouchers to EITC (Earned Income Tax Credit) eligible households.

Traditional HUD voucher programs like Section 8 paint a broad brush with little regard for regional variations in housing affordability. In addition, the program is known to be riddled with problems including bureaucratic mismanagement and the length of time required for landlords to get paid. However, keeping the concept intact but decentralizing the administration would be beneficial. Focusing vouchers on the EITC population has the benefit of targeting the appropriate population while retaining the incentive to work, something built into the EITC in its early inception. Simply expanding the program nationwide would provide extra benefits to all recipients, but in fact this paper has highlighted the fact that housing affordability is more of a local or regional problem than a national one. Local governments, through cooperative agreements or through their Metropolitan Planning Organizations (MPOs) could offer flexible housing vouchers to EITC-qualified households. Vouchers could be offered on a sliding scale to those in need and could be used for rental or mortgage payments. The local nature of the program should greatly reduce response time and encourage participation. This also allows local areas to assess the specific nuances of their housing situation and address them more effectively.

CONCLUSION

Housing affordability and availability issues are firmly planted on the radar of local and, increasingly, state officials. With housing prices continuing to rise, there will be no shortage of highly-charged political activism and rhetoric regarding housing for low- and moderate-income earners. But housing affordability is a regional or market-by-market problem and broad one-size-fits-all policies are ineffective, especially at the statewide level. Moreover, currently popular policies such as inclusionary zoning have too many unintended consequences and have the reverse effect of increasing housing prices.

A range of policy options can help increase the affordability of homes in a region. Policymakers should focus on these options that work within the realities of how housing markets work and the economics of homeownership.

ABOUT THE AUTHOR

Chris Fiscelli is a Senior Fellow at Reason Foundation. Currently a market analyst in the real estate industry, he formerly worked as a research and policy analyst for the Arizona Legislative Council conducting policy-related studies and analyzing a variety of policy issues for the state legislature. Mr. Fiscelli also worked in local government as a land use and economic development planner.

Mr. Fiscelli earned a Bachelor of Science in Land Use Planning from Eastern Michigan University. He also holds a Master of Science in Policy Analysis from Pennsylvania State University where he focused on urban development issues.

RELATED REASON STUDIES

Benjamin Powell and Edward Stringham, *Housing Supply and Affordability: Do Affordable Housing Mandates Work?* Reason Foundation Policy Study No.318, April 2004, http://www.rppi.org/ps318.pdf.

William Fulton, Chris Williamson, Kathleen Mallory, and Jeff Jones, *Smart Growth in Action: Housing Capacity and Development in Ventura County*, Reason Foundation Policy Study No.288, December 2001, http://www.rppi.org/ps288.pdf.

Sam Staley and Leonard C. Gilroy, *Smart Growth and Housing Affordability: Evidence from Statewide Planning Laws*, Reason Foundation Policy Study No.287, December 2001, http://www.rppi.org/ps287.pdf.

Howard Husock, *Repairing the Ladder: Toward a New Housing Paradigm*, Reason Foundation Policy Study No. 207, July 1996, http://www.rppi.org/ps207.pdf.

Downstream Economic Benefits from Storm-Water Management

John B. Braden[1] and Douglas M. Johnston[2]

Abstract: Using benefits transfer methods, this paper assesses the downstream economic consequences of development designs that promote greater on-site water retention. It concludes that on-site retention provides many services that are conceptually distinct but empirically intertwined. Flood mitigation and water quality protection are the most important of these services. For residential properties, the economic value of those services is on the order of 0–5% of market value depending on the difference that retention makes to downstream flood exposure. For water quality improvements, the increases range up to 15% of market value for waterside residences where clarity of the water quality is greatly improved. The increases are much less for improvements that are less visible, properties that are not developed, and properties not adjacent to the watercourse. Our best estimate of total benefits to property owners is 2–5% of property value on average for all properties in the flood plain. The public sector realizes additional benefits through smaller bridges, culverts, and other drainage infrastructure and through increased aquifer recharge. Cities and industries may avoid costly upgrades to waste water treatment facilities if low flows increase. It is difficult to generalize about the economic value of the latter effects.

DOI: 10.1061/(ASCE)0733-9496(2004)130:6(498)

CE Database subject headings: Stormwater management; Storm drainage; Economic factors; Flood damage; Water quality; Benefits.

Introduction

This paper applies benefits transfer methods to quantify the downstream economic consequences of stormwater management. This information is important in quantifying benefit–cost tradeoffs associated with stormwater management policies and design standards for new development. Estimates of the downstream costs can inform developers about the value of preventive measures and help public officials balance prevention and mitigation.

Managing stormwater is a major challenge in most urban areas (Schueler 1995; Arnold and Gibbons 1996). Buildings, roads, and compacted soils reduce absorptive capacity. In suburban areas, 20–50% of the land is impervious to precipitation. In inner cities and commercial zones, imperviousness can exceed 80%. According to Schueler (1994, 2003), the hydrologic functions of streams change with as little as 5–10% imperviousness, and they change profoundly when imperviousness approaches 25%.

The increased runoff exacerbates flooding and increases conveyance requirements. Less water is left in the soil to recharge aquifers, replenish wells, and maintain base stream flows. Faster runoff increases erosion, scours stream banks, and entrains more sediment, landscape chemicals, petroleum residues, pet wastes, and other anthropogenic detritus. A consequence is surface water quality that is less able to support beneficial uses.

For several decades, detention basins have been the customary prescription for managing stormwater. Recently, "low impact" or "conservation design" principles use measures, such as vegetated swales and constructed wetlands, to maintain a nearly natural water budget and improve water quality (e.g., Arendt 1996; Wilson et al. 1998; Hager 2003). However, our analysis of downstream economic effects is independent of the specific on-site management measures.

While many studies have considered specific physical and biological effects of altered hydrology, there has been no effort to synthesize those elements into an overall benefit measure or to facilitate their transfer by scaling them to local conditions.

Downstream Benefits of Stormwater Management

The magnitude of the offsite hydrologic benefits of stormwater management depends on the scale of analysis. Reduced infiltration on a small parcel would be almost undetectable in a large watershed draining hundreds or thousands of acres. The following discussion is limited to "nearby" downstream effects that are proportional in scale to the development parcel.

Stormwater management can produce the following types of downstream benefits: (1) Reduced frequency, area, and impact of flooding; (2) less costly public drainage infrastructure; (3) reduced pollution treatment; (4) reduced erosion and sedimentation; (5) improved water quality; (6) improved in-stream biological integrity and aesthetics; and (7) increased ground water recharge. With the exception of ground water recharge, these effects are concentrated in stream corridors and riparian zones. Streiner and Loomis (1995, p. 268) group the economic effects of stream corridor enhancement into two categories: (1) Reductions in property damages, including residential and public plantings, structures, landscaping and parks; and (2) restoration of the natural values of the stream itself, including more stable stream banks (which may

[1]Professor, Dept. of Agricultural and Consumer Economics, Univ. of Illinois, 1301 W. Gregory Dr., Rm. 431, Urbana, IL 61801. E-mail: jbb@uiuc.edu

[2]Associate Professor, Dept. of Landscape Architecture, Univ. of Illinois, 611 E. Loredo Taft Dr., Champaign, IL 61820.

Note. Discussion open until April 1, 2005. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on August 27, 2003; approved on April 8, 2004. This paper is part of the *Journal of Water Resources Planning and Management*, Vol. 130, No. 6, November 1, 2004. ©ASCE, ISSN 0733-9496/2004/6-498–505/$18.00.

interfere with natural processes), enhanced aquatic habitat through restoration of pool–riffle sequences, and more attractive ecosystems. Stormwater management in upstream areas can be part of a strategy for stream restoration.

Since the Federal Water Pollution Control Act was passed in 1972, the U.S. Environmental Protection Agency (USEPA) has been concerned about the effects of urban development on surface water quality. In 1990, the USEPA promulgated "Phase I" rules for sediment and erosion control at large construction sites (USEPA 1990). In 2001, it issued "Phase II" rules for smaller construction sites and other sources (USEPA 1999b). In its analysis of the Phase II proposal, the USEPA recognized the difficulty of attributing changes in water quality to specific stormwater management practices (USEPA 1999a, pp. 6–28, 6–41). The same observation applies to the *benefits* of water quality improvements—attribution to particular causes is difficult, and the benefits will vary from place to place.

The following sections outline how each type of impact can be valued economically. From the available literature, with due regard for the difficulty of assigning complex values to specific causal factors, we extract estimates of their respective economic values. We conclude with an effort to aggregate across the various categories, recognizing that the categories overlap and cannot simply be summed together.

Economic Criteria for Benefit Measurement

A few basic economic concepts are important to what follows. First, the relevant question is not whether development will occur, but what form it will take. Second, the correct economic measure of value is the maximum amount people are willing to pay for a good or service—called by economists, "willingness to pay" (WTP). The cost of providing a good or service is *not* the proper measure of value although, in some instances, it may be the only realistic alternative.

Third, apart from external effects that may accompany production or consumption, market prices provide a reasonable first approximation of the relative economic value of marginal increments of different goods and services. Fourth, marginal economic value, as reflected in price, is different from total value. The marginal value of a good or service generally declines as more of the good is consumed. This translates into a negative relationship between marginal value and quantity consumed (a "demand curve"). Total value is the sum of price points along that curve up to the last unit consumed —equivalent to the area under the curve. Most stormwater management decisions are marginal in nature—producing, for example, small changes in flooding, low flows, and other consequences downstream.

Fifth, the economic value of a good or service depends on the other choices available to consumers. For example, the value of a park may be affected by the nearby presence of other parks, or even movie theaters. Changes in upstream management of stormwater will be more valuable if there are fewer options for downstream mitigation. Sixth, the composite value of a good (such as a stream or lake) that encompasses several services valued by consumers (such as boating, swimming, water supply, and aesthetic pleasure) is usually less than the simple sum of the values of the individual service flows (Hoehn and Randall 1989).

Seventh, many environmental goods and services are not exchanged in markets. Special techniques can measure values not expressed in markets (e.g., Braden and Kolstad 1991; Freeman 2003). Most of the benefit estimates reviewed here are based on nonmarket valuation.

Finally, stormwater management measures are not easily translated into economic commodities. For example, they may shift the distribution of flooding without entirely eliminating floods. Most economic transactions, however, relate to definitive quantities of goods or services. Translation of probabilistic outcomes into economic values is a complex undertaking.

In what follows, we are not concerned with specific upstream management measures. We care only about the effects on stream flows. We look first to the marketplace for evidence of downstream value. We supplement with nonmarket valuation results where the market fails to provide useful information, and we adapt the value estimates to stormwater outcomes.

Economic Benefits by Type of Impact

This section provides an interpretive literature review on the benefits of surface runoff mitigation. It is similar in spirit to the work of Kalman et al. (2000) but with more attention paid to the transferability of benefit estimates. We emphasize studies published since 1990. Older studies generally use less reliable analytical methods and are less reflective of contemporary values.

Reduced Frequency and Extent of Flooding

The economic costs of flood damages have been estimated in many different ways, including the summation of expenditures on clean up and repair, analysis of premiums paid for flood insurance, estimation of price differentials for flood-prone properties, and contingent valuation of hypothetical flood states.

Expenditures on clean up and repair (e.g., U.S. Army Corps of Engineers 1994) are easy to understand and compelling, but they reflect the cost of flooding rather than the value of prevention. Most people prefer preventive measures or assured compensation to ad hoc measures taken after the fact. Flood insurance premiums capture the value that property owners attach to the assurance of compensation if and when they experience losses. Under federal law, developed properties located within the 100-year floodplain (land subject to a 1% average annual probability of flooding) must be insured against flood damages if purchased with a loan from a federally chartered institution (National Flood Insurance Act of 1968, 42 *U.S.C.*, Sec. 4001 et seq.).

The federal flood insurance program is designed to be actuarially fair—premiums exactly equal to the expected damage costs. More than 4 million flood insurance policies are in effect and total coverage exceeds $600 billion. The average annual flood insurance premium is approximately $400 per policy and the value of a covered property is $135,000 (Federal Insurance and Mitigation Administration 2000). Discounting at real rates of 2–5%, the average premiums and property values imply an average expected cumulative damage over the life of the property of 6–10% of property value. Exclusion from the 100-year floodplain means only a reduction of flood risk below 1% annually, not its elimination, so the simple actuarial calculation overstates the value of flood reduction. Insurance coverage excludes deductibles and the costs of settling claims, so the full costs would exceed the insured costs.

The third approach to valuing flood damages looks at the direct effects on property values. Buyers who are informed about flood exposures should pay less for flood-prone property by at least the present value of the anticipated damages. For example, compared to a property with similar qualities and amenities but safe from flooding, the price of a property expected to sustain \$50,000 in damage with a 1% probability should be discounted by the present value of the expected loss. At a 5% real rate of interest, the price discount would be \$10,000 ((\$50,000 $\times$ 0.01)/0.05).

Holoway and Burby (1990) and Chivers (2001) found that the prices of flood-prone properties are often not discounted as actuarial calculations indicate they should be. This "suggests that [even] compulsory insurance may fail to efficiently ration flood plain occupancy or to efficiently incorporate the social cost of flood plain occupancy into the decision calculus of home buyers" (Chivers and Flores 2002, p. 516). In other words, the systematic underestimation of flood damages may lead to too many buildings in the flood plain. Tobin and Montz (1994, 1997) found that properties with minor flooding recover their value more quickly and fully than those with extreme flooding.

Streiner and Loomis (1995) analyzed the property value effect of watershed protection measures, including flood protection, in 14 developing areas that have applied for California's Urban Stream Restoration Program. That program funds projects for flood mitigation and stream stabilization. (The "package" of treatments included various mixes of stabilization, clean up, clearing obstructions, revegetation, aesthetic improvements, and flood damage reduction. These dimensions were highly correlated in the projects considered, and their separate effects on value could not be distinguished.) Seven of the study areas were selected for the program and seven other similar sites were not. Using hedonic value estimation for real estate (Palmquist 1991), Streiner and Loomis (1995) concluded that flood damage reduction and stream stabilization *together* add 3–5% to mean residential property values. The high end of this range compares to the value calculated above for flood insurance using a 5% real discount rate. The low end may reflect a systematic underestimation of flooding or the fact that the projects reduce but do not eliminate flood risks. Unfortunately, the study did not provide information about the associated changes in expected flooding.

Thunberg and Shabman (1991) used contingent valuation methods to assess the willingness to pay for flood hazard reduction. They found that residents of a flood-prone area would pay significant positive amounts to mitigate community-wide effects (e.g., travel inconveniences and disruption of business activities) of flooding, in addition to the private property effects. They did not calculate a specific dollar amount.

Overall, the evidence suggests property value increases of 0–5% for marginal reductions in flooding. Properties that remain exposed to frequent profound flooding, or for which flood discounts are not apparent in the market, would gain the least. Those exempted from the 100-year floodplain, and hence federal insurance, as a result of stormwater management measures have the most visible consequence and stand to gain the most.

Smaller Drainage Infrastructure

Public drainage infrastructure consists of systems for collecting and conveying stormwater. It is usually designed to convey a peak flow of a specified probability. The design size increases with the scope of the protection. For example, a curb and gutter system that protects a neighborhood might be designed to fully convey the runoff from 80% of storm events while a bridge on a main thoroughfare serving a large region might be designed to accommodate the stream flow from 99% of storm events.

Retention of more water on-site means that design events produce less runoff and potentially lowers peak discharges. Smaller infrastructure can then provide the same level of protection from flooding. Reduced runoff volumes may also correlate with slower velocities, reducing the need for armoring to protect against channel scour.

Many factors affect the design of drainage infrastructure (Sample et al. 2003). We ignore aesthetic and corridor stability considerations and focus on peak flow conveyance costs. On-site construction costs for drainage (e.g., USEPA 1993; Center for Watershed Protection 1998) are much more commonly studied than downstream costs. The paucity of literature leads us to illustrate the size/cost trade offs using engineering costs of size differentials for culverts that convey flows under roads, railroads, and other crossings.

Standardized practices exist for iterative sizing of culverts (Federal Highway Administration 1985). We examine the costs for two round reinforced-concrete culverts ($n=0.012$), groove end with headwall (entrance loss coefficient $K_e=0.2$), allowable headwater depth of 1.22 m (4 ft), and 15.2 m (50 ft) in length. Each culvert is outlet-controlled pipe-full flow. Using a culvert nomography procedure (Center for Transportation Research and Education 2003), if the peak discharge is 2831.7 m^3/s (100 ft^3/s), the required culvert diameter is 1.07 m (42 in.). Some reports on conservation site design have claimed peak flow reductions in the range of 60% (Natural Resources Defense Council 1999). To be conservative, a 40% reduction in peak flow would reduce the required diameter to 0.76 m (30 in.). Published cost estimation data indicate that the material and installation costs would be 38% less for the smaller configuration (Get-A-Quote.Net 2003). Only construction costs (labor and materials) are included in these estimates. Additional factors, such as the costs for land, easements, engineering and design, are site specific, and probably do not scale proportionately with construction costs.

Reduced Pollution Treatment

Improved stormwater management can reduce the costs of pollution treatment in two ways. First, reducing peak runoff volumes can curtail storm sewer flows and related treatment and storage costs and overflow damages. The savings would be especially pronounced where storm and sanitary sewers are combined. Based on the cost analyses of Schueler (1987) and Heaney et al. (2002), Thurston et al. (2003) identified the costs of different methods for stormwater management with combined sewers in Cincinnati, OH. The modeled costs increased as storage and treatment volumes increased, especially if centralized storage and treatment were used. Decentralized stormwater management measures provided savings up to approximately 40% of flow volume.

The second type of treatment savings arises as a benefit of greater upstream infiltration. In some areas, the flow rate in the receiving water body is a limiting factor for effluent treatment requirements. With less dilution potential in the receiving water, more aggressive and costly treatment is necessary. Stormwater management measures that increase infiltration can increase the level and decrease the duration of low flows, thereby increasing the dilution capacity of the receiving waters and reducing treatment costs. The savings are particular to the location and to the type of effluent stream that is being treated. In this case, as with the preceding case of pollution due to stormwater, the benefits are difficult to generalize.

Reduced Erosion and Sedimentation

Soil erosion has effects both on and off site. On site, it impedes plant growth, forms surface gullies, and impairs landscape aesthetics (e.g., Crosson 1983). Off-site, eroded soil increases the turbidity of streams and lakes, degrading recreational usefulness, aesthetic values, and ecological functions. Sediment also increases water treatment costs, increases maintenance needs at hydroelectric plants, scours bridges and other structures, displaces the storage capacity of reservoirs, and impedes navigation. Sediment-clogged channels are more prone to flooding.

Urban erosion is characterized by a high rate of sediment delivery to streams (Novotny and Chesters 1989). Using benefits transfer methods in connection with an earlier study by Clark et al. (1985), Paterson et al. (1993) estimated the annual nationwide off-site damages due to erosion-related pollution from *urban sources alone.* They found quantifiable damages for the U.S. of between \$192 million and \$2.2 billion in 1990 dollar values, equivalent to \$317 million to \$3.6 billion in 2001 using the Consumer Price Index for adjustment (U.S. Department of Labor 2003).

Among the effects studied by Paterson et al. (1993) is water clarity. An hedonic study of lake water clarity in Maine found that shoreline property values increased by 10 to 15% when turbidity was reduced to permit a 1 m increase in the visibility of the water column (Michael et al. 1996). Greater visibility implies lesser concentrations of soil particles, algae, and other suspended solids. A Minnesota study found clarity to have an effect of nearly 5% per added foot of visibility on the appraised values of vacant shoreline lots (Steinnes 1992).

In addition to the benefits transfer analysis of overall erosion costs noted above, Paterson et al. (1993) used household surveys and engineering costing methods to estimate the benefits and costs associated with the federally mandated Phase I sediment reductions in North Carolina. (The Phase I regulations apply to large construction sites.) They surveyed urban households living on newly developed sites as well as those living "downstream." The mean WTP to maintain the Phase I rules was found to be \$20/year/household (\$28/year/household in 2001); the median WTP was \$10/year/household (\$14/year/household in 2001). The difference between mean and median indicates that a small number of respondents had a very high willingness to pay. This might be expected where the benefits of a program accrue disproportionately to one group, especially if that group is wealthy. Such a circumstance seems likely with urban streams, where waterside properties fetch premium prices.

These estimates presume that WTP remains constant as environmental quality changes. However, where Phase II sediment reductions follow on top of the Phase I reductions, the principle of diminishing returns suggest that their incremental value should be less.

Translating these impacts to percentages of property value would facilitate their extrapolation to other places and times. An average home in North Carolina, the area studied by Paterson et al. (1993), was valued at approximately \$130,000 in year 2001. [The average nominal housing price in the Southern United States in 2000 was \$128,300 (U.S. Census Bureau 2001)]. Assuming first that preferences were stable over the decade and second that the real discount rate is five percent, the mean WTP would be approximately 0.4% (median WTP would be 0.2%) of the year 2001 mean property value of all households. This is much below the results of the Maine lake clarity study, but it reflects an averaging over all households while the Maine study considered only waterside properties. The difference between mean and median values reported by Paterson et al. (1993) indicates a skewing of WTP, with most households willing to pay only a little while a small number are willing to pay a lot. Waterside households would capture a disproportionate share of the value and be more likely to express greater WTP. This is the population segment represented in the Maine study.

Improved Water Quality

Surface runoff entrains contaminants and conveys them to streams (Joint Task Force of the Water Environment Federation and American Society of Civil Engineers 1998). In addition to sediment, the runoff water can entrain landscaping chemicals, pet wastes, grease and oil products, and litter.

When surface waters percolate into the soil column rather than running off, many of these contaminates adhere to soil particles or are changed by microorganisms in the soil. This usually improves the quality of water entering surface bodies through connected aquifers.

For valuation purposes, the multiplicity of contaminants is a complication. Studies of water quality benefits typically focus on one or a small number of water quality parameters (e.g., Jordan and Elnageeb 1993), on specific practices (e.g., Doss and Taff 1996; Earnhart 2001); or on regulatory classifications of beneficial use, such as fishability and swimmability (e.g., Carson and Mitchell 1993). Furthermore, the value of an improvement in water quality may depend on the starting point (Carson and Mitchell 1993). While most valuation studies of water quality focus on drinking water quality, we are more interested in in situ water quality.

The studies of turbidity by Michael et al. (1996) and Steinnes (1992) bear on visual water quality. They were reviewed above in connection with erosion. Steinnes (1992) also tested the property value effects of water depth and suspended organic matter, in addition to water clarity (Secchi disk depth), but only the clarity indicator had a statistically significant effect.

Brox et al. (2003) used a generalized concept of surface water quality improvement in their study of the Grand River in an urbanizing area of Southwestern Ontario, Canada. The Canadian conditions are comparable to many areas in the North Central U.S. Residents of the area were asked about their WTP to restore the river from an unspecified degraded state to a condition where it would meet provincial water quality standards. The household monthly mean WTP was \$8.29 in 1994 Canadian dollars (U.S. \$7.23/month in 2001 dollars)—approximately 0.2% of annual family income (Statistics Canada 1996).

Loomis et al. (2000) administered a contingent valuation survey to a small sample of Colorado residents about a program to restore water quality services in the South Platte River. The services of interest were waste water dilution, natural purification through streamside vegetation and wetlands, erosion control, and improved habitat for fish and wildlife. The mean WTP was \$252/household/yr in 1998, equivalent to approximately \$276/household/yr in 2001 dollars, or approximately 3% of the median property value in Colorado (U.S. Census Bureau 2001; OFHEO 2003). Most of the improvements were on-site rather than upstream.

Leggett and Bockstael (2000) used hedonic and spatial econometric methods to analyze the effect of localized improvements in fecal coliform counts on waterfront property values along Maryland's western shore of the Chesapeake Bay. High fecal coliform counts lead to restrictions on water contact. They found that re-

Table 1. Adjusted Annual Household Values for Best Estimate of National Water Quality Benefits[a]

Incremental improvement in use classification	Mean	Standard error	95% confidence interval
WTP (boatable)	\$126	\$11	\$104–148
WTP (fishable)	\$ 95	\$ 8	\$ 79–111
WTP(swimmable)	\$106	\$12	\$ 81–130
WTP (total)	\$328	\$26	\$278–378

[a]Adapted to 2001 dollars from Carson and Mitchell (1993) by using the U.S. Bureau of Labor Statistics Consumer Price Index annual series and rounding to whole dollars. The mean values for boatable, fishable, and swimmable quality are incremental and additive to the total willingness to pay (WTP) (remaining differences are due to rounding). The standard errors and confidence intervals are not additive.

ducing coliform to meet the state standard of 200 counts/100 mL would add approximately 6% to the value of homes in areas with excessive counts.

Carson and Mitchell (1993) studied the value of improvements in use *classification*, as established in the Clean Water Act. Table 1 summarizes their best estimates for a representative household at the national level, adjusted to 2001 dollars using the consumer price index (U.S. Department of Labor 2003). The mean estimate is equivalent to approximately 0.7% of year 2001 median annual household income (U.S. Census Bureau 2001, 2002). A present value of an infinite stream of these annual payments amounts to approximately 5% of the 2001 median house value of approximately \$134,000 (OFHEO 2003). The benefits would be higher for households with above-average incomes, more water-based activities, and greater support for environmental goals. The values reported in Table 1 are for national improvements while the work of Brox et al. (2003), Loomis et al. (2000), and Leggett and Bockstael (2000) relates to localized improvements. It makes sense that the more pervasive improvements would be more highly valued. For our purposes, however, the localized estimates are more useful.

Improved In-stream Biological Integrity and Stream Aesthetics

In-stream biological integrity refers to the capacity of a stream to support a diverse and stable community of species. Ecosystems are adapted to local hydrologic characteristics and can be disrupted by hydrologic changes (Postel and Richter 2003). The analyses of Streiner and Loomis (1995) and Loomis et al. (2000), discussed above, attempted to encompass the benefits of in-stream biological integrity as perceived by local residents, just as they attempted to represent the downstream aesthetic effects of improvements in the stability of the stream channel. To the extent that upstream improvements enable downstream efforts at stabilization and beautification to be more successful, such as reducing flood damage to planted trees, the aesthetic improvements are not strictly a result of the upstream actions. For these reasons, it is difficult to isolate downstream aesthetic benefits as a separate category and we do not assign specific value estimates to them.

Increased Ground Water Recharge

Closely related to the effect of surface development on low flows is the effect on supplies of ground water. Schueler (1994) indicates that surface runoff is linearly related to impervious coverage. As impervious area increases, ground water recharge decreases.

The effect of reduced recharge on ground water supplies varies from area to area depending on the geologic structure. The overall effect can be large. For example, the Chicago area is estimated to lose access to between 10.2 and 23.7 billion gallons annually due to accelerated runoff—amounts comparable to the water consumed annually by 280,000 to 650,000 people (American Rivers, the National Resources Defense Council, and Smart Growth America 2002). Small or near-surface aquifers are more immediately affected than large or deep aquifers.

Recharge water has value as both a source of future withdrawals and a contributor to higher well levels and pressures that help to reduce pumping costs, prevent intrusion, and maintain the aqueous structure of the geologic formation (National Research Council 1997). For valuation purposes, the consumptive and *in situ* functions are separable.

Value in use. In a well-developed and competitive market, the price of water should vary with supply and demand conditions and reflect marginal WTP. However, markets for *raw* water exist in few places, such as the arid western United States. Those that do exist are typically not competitive. In many places, raw water is freely used and effectively has a price of zero. The prices charged by water utilities reflect pumping and treatment costs. Thus, while the total value of *raw* water is great (as evidenced, for example, by price premiums for waterside properties), its marginal value in many places is zero.

Assigning value to recharge water is further complicated by time lags. Because of discounting, water that becomes available for use in a year or two is much more valuable than water that takes tens or hundreds of years to percolate through geologic strata to a useable aquifer. Added percolation due to stormwater management can shift water from the surface to the subsurface, thereby delaying recapture. There may also be differences between surface and groundwater in pumping costs and the costs of the treatment required to meet drinking water standards.

Value in situ. In addition to the direct market value of ground water, added water in aquifers may reduce pumping heads and increase well pressure. These effects are site specific. In an extensive review, the National Research Council (1997) did not place a specific economic value on in situ services. The value of those services seems likely to be less than the value of direct consumption.

In conclusion, the value of added water infiltration depends on the amount of water, site-specific aquifer conditions, and the prevailing value of water. In many places, raw water is essentially a free good at the margin, even though its total value is great, so incremental changes in the amount or timing of water availability also have zero economic value. The effects of stormwater management measures on water supply are highly site specific.

Interpretive Summary and Synthesis

The preceding discussion is summarized in Table 2. The rightmost column of Table 2 provides an assessment of the respective values of stormwater retention based on best professional judgment. Where possible, values are translated into percentages of property values. The translation uses an approximate property value of \$134,000, the approximate national average price for a dwelling in 2001 (OFHEO 2003).

Many of the value categories are intertwined. Some, such as

Table 2. Synthesis of Economic Values of Downstream Effects

Effects category	Economic valuation studies: Source	Methodology/application	Estimate ($ 2001)	Categorical synthesis
Reduced flood damage	FEMA (2003)	Average flood insurance premium/nationwide	5%–6% of property value	≤2% of value for properties receiving partial mitigation; 2–5% of value for removal from 100-year floodplain
	Streiner and Loomis (1995)	Hedonic property valuation/California urban stream restoration projects	3%–5% of property value[a]	
	Chivers (2001)	Hedonic property valuation/Flood exposure in Boulder, CO	Ephemeral effect on improved properties	
Smaller public drainage infrastructure	None	Construction and operation costs	None	Unquantified, but probably significant
Reduced sedimentation	Paterson et al. (1993)	Benefits transfer/nationwide	$317M–$3.6B/year	0.2–0.4% of property value, all households; more for waterside properties
		Contingent valuation/Phase I construction site rule in NC	$14–$28/household/yr	
		Abatement cost/Phase I construction site rules in NC	$453/treated ha/yr[b]	
Reduced pollution treatment	Sample et al. (2003) Schueler (1987)	Cost functions/best management practice costs for stormwater treatment	Site specific	Site specific
	None	Cost functions for point source effluent treatment	Industry specific	Industry specific
Improved water quality	Steinnes (1992)	Hedonic property valuation/incremental improvements in lake clarity affecting vacant lakefront lots in MN	5% increase in vacant lakefront property value/0.3 m increase in visibility	Inclusive of reduced sedimentation, 0.2%0.4% of average property value for *all* households in a watershed, including: 5% for *undeveloped waterside* properties; 10–15% for *waterside residential* properties
	Michael et al. (1996)	Hedonic property valuation/reduced turbidity in ME lakes	10–15% increase in lakefront residential property value/1 m increase in visibility	
	Brox et al. (2003)	Contingent valuation/restoration of river to provincial water quality standards in Ontario urbanizing area	$7.23/mo/household, equivalent to 0.2% of average family income	
	Loomis et al. (2000)	Contingent valuation/restoration of wastewater dilution, natural purification through streamside vegetation and wetlands, erosion control, and improved habitat for fish and wildlife in the South Plate River, CO	$ 276/yr/household, equivalent to 3% of median house value in CO	
	Leggett and Bockstael (2000)	Hedonic property valuation/impacts of reducing fecal coliform counts in Chesapeake Bay to meet state standards	6% of average property value for the 7% of all properties that are close to waters with excessive coliform (equivalent to 0.4% of all property values in MD study area)	
	Carson and Mitchell (1993)	Contingent valuation/incremental improvements to achieve Clean Water Act use classifications nationwide	$278–$378/yr/household, equivalent to 0.6%–0.8% of U.S. median annual household income and 4–6% of U.S. median house value	
Improved biological integrity and Aesthetics	Streiner and Loomis (1995) and Loomis et al. (2000)	See descriptions above	See descriptions above	See above
Increased ground-water recharge	*Use value* None	Price of potable water	Depends on years to availability and local prices	Site specific
	In-situ value NRC (1997)	N/A	Depends on aquifer structure	

[a]Includes reduced flood exposure, stream bank stabilization and revegetation, debris removal, improvements in fish habitat, additional buffer land around stream corridor, and aesthetic, educational and recreational features.

[b]Costs amortized over 20 years.

aquifer recharge, are not amenable to generalization. Others, such as infrastructure costs, have not been studied in ways that are useful for our purposes.

What does become clear is that flooding and water quality are important considerations in most places. Our best professional judgment is that flood damage mitigation is worth, on average, from 0–2% of the value of properties that would be in the 100-year floodplain with or without stormwater management measures but would experience less flooding as a result of upstream mitigation. The upstream flood mitigation is worth up to 5% of the value of properties that would otherwise be in the 100-year floodplain. These estimates are based largely on insurance calculations and they circumvent issues of incomplete information, faulty perception, and risk tolerance that lead people to behave in ways that are at odds with actuarial calculations.

Water quality, sedimentation, and aesthetic considerations are especially important to properties adjacent to water bodies. A number of studies indicate that aesthetic improvements to a stream or lake can add 3–15% to the value of adjacent land. The increases for undeveloped land are probably 5% or less while the increases for developed properties may be two to three times greater. (The addition of dwellings provides greater opportunity to experience directly the benefits of better water quality.) The benefits associated with water quality are tied to sensory effects. Visual clarity of the water column seems especially compelling. Coliform contamination that deters contact but does not affect appearance seems less consequential. General but ambiguously defined improvements in stream characteristics and ecosystem function are valued at the low end of the range.

The study by Streiner and Loomis (1995) is especially useful. In looking at actual market responses to a variety of stream corridor improvements (none of which related specifically to upstream measures), they found property price increases of 3–5%. This is on the low end of the range of other studies focusing on water quality. While the projects they analyzed were motivated in large measure by flood mitigation, their results should be placed in the context of other studies that find little or no market price response to flood mitigation. At the extreme, their estimates might reflect only aesthetic considerations and not capture any flood damage benefits, in which case adding flood reduction benefits based on actuarial calculations would produce a more complete estimate of social value.

We found no generalizable studies of the effect of stormwater discharges on public drainage infrastructure costs. Our culvert example, however, suggests that significant downsizing of conveyance infrastructure could have appreciable effects on those costs. The benefits would be especially great if the upstream measures preclude altogether the need for modifications to the channel or other downstream infrastructure. The incremental savings can be large.

Increased infiltration can increase low flows. The resulting aesthetic and water quality benefits are probably captured by the water quality estimates noted above. The presence of unique biota dependent on the stream could magnify these benefits. Low-flow augmentation can also be important to waste discharges. Their abatement costs are driven by ambient water quality conditions during low flow periods. The specific cost savings depend on which water quality parameters are limiting and the abatement options available to the dischargers.

Finally, increased percolation of stormwater should enhance aquifer recharge, providing more water for future withdrawals and increasing aquifer pressures. These benefits are higher where the marginal value of water is greater, percolation to an accessible aquifer is faster and does not simply offset reservoir storage, and threats to aquifer integrity are immediate.

Acknowledgments

This study was supported in part by Region 5 of the USEPA through Award No. X-97576401 to the Conservation Research Institute and through a Visiting Scholar appointment for Braden in Fall 2003. Additional support for Braden was provided by the Illinois Agricultural Experiment Station and Cooperative States Research, Education, and Extension Service, U.S. Department of Agriculture under Project No. 0305. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of the supporting agencies. The writers thank Tom Brody, Wayland Eheart, Ron Griffin, John Haugland, Dan Injerd, Greg Lindsay, Ari Michelson, Tom Price, Jim Van Der Kloot, and three anonymous referees for their suggestions, but they bear no responsibility for our conclusions.

References

American Rivers, the Natural Resources Defense Council, and Smart Growth America. (2002). *Paving our way to water shortages: How sprawl aggravates drought*, Washington, D.C.

Arendt, R. G. (1996). *Conservation design for subdivisions: A practical guide to creating open space networks*, Island Press, Washington, D.C.

Arnold, C. L., Jr., and Gibbons, C. J. (1996). "Impervious surface coverage." *J. Am. Plan. Assn.*, 62(2), 243–258.

Braden, J. B., and Kolstad, C. D., eds. (1991). *Measuring the demand for environmental quality*, Elsevier, Amsterdam, The Netherlands.

Brox, J. A., Kumar, R. C., and Stollery, K. R. (2003). "Estimating willingness to pay for improved water quality in the presence of item nonresponse bias." *Am. J. Agric. Econom.*, 85(2), 414–428.

Carson, R. T., and Mitchell, R. C. (1993). "The value of clean water: The public's willingness to pay for boatable, fishable, and swimmable water quality." *Water Resour. Res.*, 29, 2445–2453.

Center for Transportation Research and Education. (2003). *Iowa statewide urban design standards manual*, Iowa State Univ., Ames, IA ⟨http://www.iowasudas.org/design.cfm⟩ (Aug. 8, 2003).

Center for Watershed Protection. (1998). *Better site design: A handbook for changing development rules in your community*, Center for Watershed Protection, Ellicott City, MD.

Chivers, J. (2001). "Flood risk, property values, and information market failure." MS thesis, Department of Economics, Univ. of Colorado, Boulder, Colo.

Chivers, J., and Flores, N. E. (2002). "Market failure in information: The National Flood Insurance Program." *Land Econ.*, 78(4), 515–521.

Clark, E. H., Haverkamp, J. A., and Chapman, D. (1985). *Eroding Soils: The Off-farm Impacts*, The Conservation Foundation, Washington, D.C.

Crosson, P. R. (1983). *Productivity effects of cropland erosion in the United States*, Johns Hopkins, Baltimore.

Doss, C., and Taff, S. (1996). "The influence of wetland type and wetland proximity on residential property values." *J. Agric. Resour. Econ.*, 21(1), 120–129.

Earnhart, D. (2001). "Combining revealed and state preference methods to value environmental amenities at residential locations." *Land Econ.*, 77(1), 12–29.

Federal Emergency Management Administration (FEMA). (2003).

Federal Highway Administration (FHWA). (1985). *Hydraulic design of highway culverts, Rep. No. FHWA-IP-85-15*, Hydraulic Design Series No. 5, FHWA, Washington, D.C.

Federal Insurance and Mitigation Administration. (2000). *National Flood Insurance Program, Statistics by Fiscal Year*, Washington, D.C. ⟨http://www.fema.gov/nfip/statsfisc.htm⟩ (Dec. 12, 2002).

Freeman, A. M. III. (2003). *The measurement of environmental and resource values*, 2nd Ed. Resources for the Future, Washington, D.C.

Get a Quote.Net (2003). *CD Estimator-Heavy Illinois* ⟨http://www.get-a-quote.net⟩ (Sept. 2, 2003).

Hager, M. C. (2003). "Low-impact development: Lot-level approaches to stormwater management are gaining ground." *Stormwater*, 4(1), 12–25.

Heaney, J. P., Sample, D., and Wright, L. (2002). "Costs of stormwater control." *EPA 600-R-02-021*, U.S. Environmental Protection Agency, National Risk Management Research Laboratory, Washington, D.C.

Hoehn, J. P., and Randall, A. (1989). "Too many proposals pass the benefit cost test." *Am. Econ. Rev.*, 79(3), 544–551.

Holoway, J. M., and Burby, R. (1990). "The effects of floodplain development controls on residential land values." *Land Econ.*, 66(3), 259–270.

Joint Task Force of the Water Environment Federation and American Society of Civil Engineers. (1998). *Urban runoff quality management*, WEF Manual of Practice No. 23 and ASCE Manual and Report on Engineering Practice No. 87, ASCE, Reston, Va.

Jordan, J. L., and Elnagheeb, A. H. (1993). "Willingness to pay for improvements in drinking water quality." *Water Resour. Res.*, 29(2), 237–246.

Kalman, O., Lund, J. R., Lew, D. K., and Larson, D. M. (2000). "Benefit-cost analysis of stormwater quality improvements." *Environ. Manage. (N.Y.)*, 26(6), 615–628.

Leggett, C. G., and Bockstael, N. E. (2000). "Evidence of the effects of water quality on residential land prices." *J. Environ. Econ. Manage*, 39(2), 121–144.

Loomis, J., Kent, P., Strange, L., Fausch, K., and Covich, A. (2000). "Measuring the total economic value of restoring ecosystem services in an impaired river basin: Results from a contingent valuation survey." *Ecologic. Econ.*, 33(1), 103–117.

Michael, H. J., Boyle, K. J., and Bouchard, R. (1996). "Water quality affects property prices: A case study of selected Maine lakes." *Misc. Rep. No. 398* Maine Agricultural and Forest Experiment Station, Orono, ME.

National Research Council (NRC). (1997). *Valuing groundwater: Economic concepts and approaches*, National Academy Press, Washington, D.C.

National Resources Defense Council. (1999). "Stormwater strategies: Community responses to runoff pollution." New York ⟨www.nrdc.org/water/pollution/storm/chap11.asp⟩ (Aug. 8, 2002).

Novotny, V., and Chesters, G. (1989). "Delivery of sediment and pollutants from nonpoint sources: A water quality perspective." *J. Soil Water Conservat.*, 44(1), 568–576.

Office of Federal Housing Enterprise Oversight (OFHEO). (2002). "OFHEO house Price indexes: 2002 Q4, State-level indexes: North Carolina." Washington, D.C. ⟨http://www.ofheo.gov/house/hpi_hist_frame.html⟩ (March 28, 2003).

Palmquist, R. B. (1991). "Hedonic methods." *Measuring the demand for environmental quality*, J. B. Braden and C. D. Kolstad, eds. North-Holland, Amsterdam, 77–120.

Paterson, R. G. et al. (1993). "Costs and benefits of urban erosion and sediment control: The North Carolina experience." *Environ. Manage. (N.Y.)*, 17(2), 167–178.

Postel, S., and Richter, B. 2003. *Rivers for life: Managing water for people and nature*, Island Press, Washington, D.C.

Sample, D. J. et al. (2003). "Costs of best management practices and associated land for urban stormwater control." *J. Water Resour. Plan. Manage.*, 129(1), 59–68.

Schueler, T. R. (1987). *Controlling urban runoff: A practical manual for planning and designing urban BMPs*, Washington Metropolitan Water Resources Planning Board, Washington, D.C.

Schueler, T. R. (1994). "The importance of imperviousness." Watershed Protec. Techniques, 1(3), 100–111.

Schueler, T. R. (1995). *Site planning for urban stream protection*, Metropolitan Washington Council of Governments, Washington, D.C.

Schueler, T. R. (2003). "Ideal urban forms to minimize land-use impacts on aquatic ecosystems in the Great Lakes Basin." prepared for *Great Lakes Science Advisory Board (GLSAB) Workshop on Urban Land-use Impacts on Great Lakes Water Quality*, GLSAB, Toronto.

Statistics Canada. (1996). *1996 Census: Nation tables*. Ottawa, ⟨http://www.statcan.ca/english/census96/may12/t5can.htm⟩ (Aug. 8, 2003).

Steinnes, D. N. (1992). "Measuring the economic value of water quality: The case of lakeshore land." *Ann. Region. Sci.*, 26, 171–176.

Streiner, C. F., and Loomis, J. B. (1995). "Estimating the benefits of urban stream restoration using the hedonic price method." *River*, 5(4), 267–278.

Thunberg, E., and Shabman, L. (1991). "Determinants of landowner's willingness to pay for flood hazard reduction." *Water Resour. Bull.*, 27(4), 657–665.

Thurston, H. W., Goddard, H. C., Szlag, D., and Lemberg, B. (2003). "Controlling stormwater runoff with tradable allowances for impervious surfaces." *J. Water Resour. Plan. Manage.*, 129(5), 409–418.

Tobin, G. A., and Montz, B. E. (1994). "The flood hazard and dynamics of the residential land market." *Water Resour. Bull.*, 30(4), 673–685.

Tobin, G. A., and Montz, B. E. (1997). "The impacts of a second catastrophic flood on property values in Linda and Olivehurst, California." Natural Hazards Research and Applications Center, Univ. of Colorado, Boulder, Colo.

U.S. Army Corps of Engineers. (1994). "The Great Flood of 1993 Post-Flood Report: Upper Mississippi River and Lower Missouri River Basins." Northcentral Division, St. Paul, Minn.

U.S. Census Bureau. (2001). *Statistical Abstract of the United States, 2001*, Washington, D.C.

U.S. Census Bureau. (2002). "Historical income tables", *Table H-9* ⟨www.census.gov/hhes/income/histinc/h09.html⟩ (Feb. 13, 2003).

U.S. Department of Labor. (2003). "Consumer Price Index, All Urban Consumers—(CPI-U), U.S. city average." Bureau of Labor Statistics, Washington, D.C. ⟨ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt⟩ (Sept. 2, 2003).

U.S. Environmental Protection Agency (USEPA). (1990). "NPDES system." *55 Federal Register*, 48,602 USEPA, Washington, D.C.

U.S. Environmental Protection Agency (USEPA). (1993). *Costs of providing government services to alternative residential patterns*, U.S. Government Printing Office, Washington, D.C., Microfiche.

U.S. Environmental Protection Agency (USEPA). (1999a). "Chap 6: Costs and benefits of stormwater BMPs." *Preliminary data summary of urban stormwater best management practices*, Washington, D.C., *EPA-821-R-99-012*, ⟨www.epa.gov/OST/stormwater/⟩ (Aug. 19, 2002).

U.S. Environmental Protection Agency (USEPA). (1999b). "Stormwater phase II final rule." 64 *Federal Register*, 68,722, USEPA, Washington, D.C.

Wilson, A. et al. (1998). *Green development: Integrating ecology and real estate*, Wiley, New York.