Water recycling 2000

California's plan for the future

by the State Water Conservation Coalition
Reclamation/Re-Use Task Force
and
the Bay Delta Reclamation Sub-Work Group

Printed by the WateReuse Association

September 1991

Major funding for the State Water Conservation Coalition
provided by the William & Flora Hewlett Foundation
with additional funding from:
Bank of America
Pacific Telesis
Southern California Edison

September 1991

WATER RECYCLING 2000: CALIFORNIA'S PLAN FOR THE FUTURE

by the
State Water Conservation Coalition
Reclamation/Reuse Task Force
and the
Bay Delta Reclamation Sub-work Group

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

Tables

Figures

September 1991

EXECUTIVE SUMMARY
WATER RECYCLING 2000: CALIFORNIA'S PLAN FOR THE FUTURE

by the
State Water Conservation Coalition
Reclamation/Reuse Task Force
and the
Bay Delta Reclamation Sub-work Group

This report is the result of two years of work by technical experts, water industry representatives, elected officials, and others to quantify the potential that exists for increasing the use of recycled, or reclaimed, water by the year 2000. The information has been developed as input for the State Water Resources Control Board (State Board) Bay Delta Process.

This document has been circulated as widely as possible through its draft stages to solicit comments from those agencies contributing to the estimates of potential for reclamation by the year 2000 and from those that would be affected by the recommendations. These include state and local regulatory agencies, sanitary agencies, water agencies, and public interest groups and others connected with the Bay Delta Process or with an interest in reclamation.

This document should not be considered as the "last word" in reclamation. As conditions change, an acceleration of the removal of barriers to using more recycled water may occur. This document reflects the contributing parties' best attempt at the time to anticipate changing conditions and to recommend proactive solutions.

Individual chapters of this report are summarized below.

INTRODUCTION

This report is a joint effort of the State Water Conservation Coalition's Reclamation/Reuse Task Force and the Bay Delta Reclamation Sub-work Group. The Coalition, which was initiated in March 1989 by the Committee for Water Policy Consensus and the Southern California Water Committee, formed the Task Force in July 1989. Some months earlier, the State Board had established the Sub-work Group. The Sub-work Group, chaired by the Department of Water Resources (DWR), prepared an August 1989 report to the State Board on Potential Water Reuse in California.

During late 1989 and early 1990, both the Task Force and the Sub-work Group independently developed information on the potential for increasing the use of reclaimed water by the year 2000. Although some individuals belonged to both groups, the efforts were considered complementary rather than duplicative. The Task Force emphasized political actions to encourage reclamation, and the Sub-work Group focused on technical issues, refining the data submitted to the State Board in August 1989.

Both groups identified the need for a comprehensive data base. To avoid duplication, the groups conducted a cooperative statewide survey in the summer and fall of 1990 to identify reclamation potential. The survey asked water agencies and others to indicate reclamation potential by the year 2000 by project stage: planning, design, and construction. Survey respondents also were asked to rate several constraints to reuse. These constraints fell into four basic categories: funding (capital, operations and maintenance, and energy costs), regulatory, institutional, and "other."

As survey results were developed and constraints to reuse were evaluated, the interrelationship of technical and political issues/solutions became more clear. Thus, the two groups combined their individual efforts into an expanded report.

This report defines reclamation as: "The process of augmenting the long-term dependable yield of the state's water supply by recapturing or treating wastewater or other non-potable water for beneficial uses; its transportation to the place of use; and its actual use." The report addresses the reclamation and reuse of municipal and industrial wastewater. For reclamation potential to be fully defined, future surveys must be expanded to address 1) incidental/indirect reuse, 2) reuse of agricultural wastewater, 3) groundwater cleanup, and 4) brackish water desalting.

EXISTING REUSE

Reclaimed water has been intentionally used as a nonpotable water supply source in California for nearly a century. Although there have been severe constraints to overcome in implementing reclamation projects, reuse has significantly increased in the past 15 years, reflecting a growing awareness of its importance in overall water resources management.

In 1989, reuse of municipal wastewater in California accounted for approximately 325,000 acre-feet per year. This reuse fell into seven categories, the largest being agricultural reuse, which in 1989 accounted for more than half (55%) of the state's reuse. The balance was provided by groundwater recharge (21%), landscape irrigation (15%), wildlife habitat (5%), industrial use (2%), recreational impoundment (1%), and other (1%).

Another type of reuse is incidental reuse, which occurs when wastewater is discharged into a stream or impoundment as a means of disposal. The impact of this disposal may be beneficial to the extent that it recharges an aquifer or serves beneficial needs downstream. Estimates of incidental reuse are not included in this report because the amount cannot be reliably quantified at this time.

PROJECTED REUSE

The reuse potential estimates presented in this report are derived from fresh water displaced projections from the statewide survey as adjusted by the members of the Survey Team. The adjustments are based on the best professional judgment of the members of the Task Force and the Sub-work Group, and a specific rationale is provided.

Under existing conditions and constraints, the reliable estimate of additional fresh water to be displaced by the year 2000 to augment the dependable yield of the state's water supply is 244,100 acre-feet per year. The table below presents a regional breakdown of the 244,100 acre-feet. These estimated reuse figures serve as a recommendation to the State Board for consideration in the Bay Delta Process.

Table 1-1
ESTIMATE OF ADDITIONAL FRESH WATER
TO BE DISPLACED BY REGION BY THE YEAR 2000

Region	Area	Additional Fresh Water Displaced by Year 2000 Since December 1989 (Acre-Feet/Year)
1	North Coast	1,200
2	San Francisco Bay	22,800
3	Central Coast	20,900
4	Los Angeles	49,400
5	Central Valley	16,600
6	Lahontan	500
7	Colorado River Basin	1,100
8	Santa Ana	74,800
9	San Diego	56,800
	TOTAL	**244,100**

The report further identifies this potential by type of use, type of use per region, project stage, and project constraint.

If all implementation constraints identified are resolved, a reliable estimate of additional fresh water displaced by the year 2000 would be 474,300 acre-feet/year. This estimate could be considered a goal for agencies statewide to strive for in attempting to resolve constraints.

Survey respondents also were requested to provide an estimate of the amount of reclaimed water deliveries expected by the year 2000. Such estimates include deliveries to beneficial uses such as environmental enhancement and recreation that, under most circumstances, would not have received fresh water in lieu of reclaimed water. Reclaimed water deliveries expected under existing conditions and constraints total 393,400 acre-feet per year. Based on the submittals of survey respondents and with removal of all constraints, the ultimate potential deliveries for these projects could approach 826,300 acre-feet/year.

POLICY ISSUES AND APPROPRIATE POLITICAL ACTIONS

This report contains more than 70 recommendations/implementation strategies to promote increased water reclamation. Action areas are in six categories: political will, benefit cost analysis, funding issues, regulatory issues, institutional issues, and other (legal and public acceptance). Key recommendations are highlighted below.

Political Will

To maximize reclaimed water use, policy makers in all levels of government must have a strong commitment to reclamation. To develop statewide programs of political support, the Governor should consider appointing a blue ribbon panel of experts from the public, private, and academic sectors to assess the organizational framework needed at the state level to develop, consolidate, and implement reclamation policy.

Benefit Cost Analysis

One theme of this report is that reclamation should be evaluated from a statewide as well as a local perspective in order to clarify the issue of "who benefits and who pays." Facilities plans should provide economic as well as financial analyses; the State Board and DWR should provide assistance to local agencies in developing the mechanisms to perform such analyses. The State Board also should encourage cooperative agreements between regions with high and lower incremental water costs.

Funding Issues

Funding is identified in the survey as the Number 1 barrier to developing water reuse in California. The federal, state, and local governments can take several steps to help defray the financial burden (both in capital financing and in O&M/energy costs) of implementing reclamation projects. Although in some cases further studies are needed, possibilities include: 1) bond laws and metering and pumping charges to fund grants and loans, 2)

inclusion of reclamation in the State Water Project, 3) water rate structures to encourage the use of reclaimed water, and 4) establishment of a statewide power authority to provide blocks of power at low rates to reclamation projects.

Regulatory Issues

Several constraints to reclamation derive from policies, procedures, and other activities of regulatory agencies. Specific issues include health criteria, federal Clean Water Act and California Water Code definitions, need for timely and consistent regulatory agency review, source protection constraints, and need for specific planning mandates. Recommended actions include revision of Title 22, designation of reclaimed water as a resource, amendments to the California Water Code to encourage broader reuse, and establishment of mandatory reclamation ordinances to prohibit the use of potable water for non-potable uses where reclaimed water is available at a reasonable cost and meets human health and environmental requirements for the intended use.

Institutional Issues

Implementation of reclamation projects requires the involvement, approval, and support of a number of agencies, including state and local health departments and Regional Water Quality Control Boards. Further cooperation among these groups would greatly assist in implementing reclamation projects. The State Board should consider establishing a work group to evaluate the feasibility of a formal mechanism to expedite reclamation projects. Such a group would need to include representatives from the appropriate state, regional, and local regulatory health and water quality agencies as well as local water and wastewater agencies, because no reclamation project can be implemented without their support.

Other Issues

Additional constraints to the development and implementation of water reclamation projects include issues surrounding legal responsibilities and public acceptance. An independent group, such as the WateReuse Association of California, should establish a Review Task Force to identify legal issues affecting reclamation and to recommend solutions. In the area of public education, greater efforts should be made to inform the general public about reclamation, including establishing public advisory committees to bring the public into the planning phase of reclamation projects.

September 1991

CHAPTER 1 - INTRODUCTION

This chapter: 1) discusses the report purpose, 2) describes the formation of the State Water Conservation Coalition's Reclamation and Reuse Task Force and the Bay Delta Reclamation Sub-work Group, and 3) traces the activities leading to the preparation of this Joint Report.

PURPOSE

The purpose of this report is to provide information for the State Water Resources Control Board (State Board) Bay Delta Process. This report provides a political, institutional, and financial framework for the enhancement of water reclamation and the use of reclaimed water throughout California. The report estimates potential reclamation by the year 2000 and recommends actions that the State Board can take to make this "new" supply available. The estimates came from projects that fit the following definition and may be revised by adding other projects.

In this report, reclamation is defined as:

> "The process of augmenting the long-term dependable yield of the state's water supply by recapturing and treating wastewater or other non-potable water for beneficial uses; its transportation to the place of use; and its actual use."

This report focuses only on the reclamation and reuse of municipal and industrial wastewater. In order for reclamation potential to be fully defined, future surveys must be expanded to address:

- incidental/indirect reuse
- reuse of agricultural wastewater
- groundwater cleanup
- brackish water desalting

In some cases, agencies other than the State Board will be the appropriate ones to carry out report recommendations. However, the point of view expressed refers to actions that the State Board can either take itself or encourage others to take to increase the use of reclaimed water in California.

FORMATION OF TWO RECLAMATION WORK GROUPS

This section describes the formation of the two groups who co-authored this report.

State Water Conservation Coalition's Reclamation/Reuse Task Force

In a March 1989 joint effort, the State Water Conservation Coalition (Coalition) was initiated by the Committee for Water Policy Consensus (CWPC) and the Southern California Water Committee to determine "reasonable and practical programs which can be implemented and appropriate amounts of water that can be conserved and used more efficiently statewide."

In order to offer specific recommendations to the State Board, the Coalition formed four technical task forces. These task forces, working under the direction of the Coalition, were charged (letter dated 7/3/89, Appendix A, Exhibit 1) with gathering relevant information and data and formulating conclusions and recommendations for adoption by the Coalition in the areas of: Urban Conservation, Agricultural Conservation, Reclamation and Reuse, and Voluntary Water Transfers and Exchanges. Each task force was to prepare a report for review, comment, and adoption by the Coalition.

In forming the Reclamation/Reuse Task Force, the Coalition recognized the importance of broadly based and balanced statewide input and review. Members of the Task Force are listed in Appendix A, Exhibit 2.

A working statement (Appendix A, Exhibit 3) was circulated and adopted by the Coalition. This statement defines water reclamation as "the process of treating wastewater or other nonpotable water for allowable beneficial uses, transporting it to use areas, and applying it to actual use, thereby augmenting the State's reliable water supply." In order for water suppliers, wastewater treatment agencies, and others to implement or fully cooperate in the development of water reclamation projects, several conditions are identified. These are listed in Appendix A, Exhibit 3.

The statement also declares that the use of reclaimed water which meets the identified conditions is a conservation Best Management Practice when it augments existing water supplies.

Public outreach was an important part of the Task Force's activities. Presentations were made and comments solicited from environmental and other groups that are not members of the Coalition or its sponsors. A presentation and discussion of the Working Statement was made to the State Board by Coalition Co-chairs John Flynn and Sunne McPeak on 7/17/90, and presentations of the Working Statement and report outline were made by Task Force members to the CWPC Bay Delta Work Group on 9/18/90, to the Environmental Coalition of Southern California on 10/2/90, and to the San Francisco Estuary Project Flows Subcommittee on 10/24/90.

Bay Delta Reclamation Sub-work Group

In the spring of 1989, as part of the Bay Delta Process, the State Board established a number of work groups to address major issues. The Reclaimed Water Sub-work Group (Sub-work Group), chaired by the Department of Water Resources (DWR), was to produce a report estimating potential reclaimed water use. The members of the Sub-work Group and interested parties regularly informed are listed in Appendix A, Exhibits 4 and 5, respectively.

The Sub-work Group met several times during the spring and summer of 1989 and submitted a preliminary report to the State Board on August 1, 1989.[1] The 1989 report concluded that there is considerable interest in and potential for reclamation in California. As a follow-up to the 1989 report, the Sub-work Group initiated a second report, which was to focus on reclamation by the year 2000.

EVOLUTION OF A JOINT REPORT

The Sub-work Group and the Task Force have several members in common. Two reclamation reports were originally envisioned: the Sub-work Group report would focus on technical issues; the Task Force report would emphasize political actions to encourage reclamation/reuse.

Both groups identified the need for a comprehensive data base presenting statewide reuse potential by the year 2000 as a framework for the technical and political discussions. To avoid duplication, the groups agreed to conduct a cooperative survey. Members from both groups comprised a Survey Team, which compiled and analyzed information in the summer and fall of 1990.

As survey results were developed and constraints to reuse were evaluated, the interrelationship of technical and political issues/solutions became more clear. Thus, in December 1990, the two groups proposed combining their individual efforts into an expanded report. Two reasons were 1) to avoid confusion that might be caused by the publication of separate reports and 2) to more effectively address the full range of issues preventing better use of this reclaimed water.

---

[1]"Potential Water Reuse in California," memorandum to Jerry Johns, SWRCB, from Bay-Delta Reclamation Sub-work Group #3, August 1, 1989.

CHAPTER 2 - EXISTING REUSE

Reclaimed water has been intentionally used as a nonpotable water supply source in California for nearly a century. Although there have been severe constraints to overcome in implementing reclamation projects, reuse has significantly increased in the past 15 years to more than 320,000 acre-feet per year, reflecting a growing awareness of its importance in overall water management.

This chapter identifies the types of water reuse occurring in the state. Quantity information for each reuse type is presented first on a statewide basis and then by regions corresponding to Regional Water Quality Control Board (Regional Board) jurisdictions. Information is provided for reuse of treated municipal wastewater only. Reuse of agricultural drainage water is being addressed by other work groups.

TYPES OF REUSE

Existing reuse practices can be grouped into seven categories: agricultural irrigation, groundwater recharge, landscape irrigation, wildlife habitat enhancement, industrial use, recreational impoundments, and miscellaneous uses. Each of these categories is described below. Incidental reuse is also defined.

Agricultural Reuse of Treated Municipal Water

Agricultural irrigation includes irrigation of both food and non-food crops such as pasture, orchards, vineyards, nursery, and sod crops. As shown in Table 2-1 in the next section, agricultural reuse of treated municipal wastewater is the largest single reuse application in terms of volume of reuse.

Groundwater Recharge

Groundwater recharge is the second largest reuse application in terms of volume of reuse. Reclaimed water is either injected into aquifers through wells (currently practiced to prevent seawater intrusion) or allowed to percolate into aquifers from spreading basins for eventual use as domestic, agricultural, or industrial supply.

Landscape Irrigation

Landscape irrigation includes irrigation at parks, playgrounds, golf courses, roadside and highway landscaping, cemeteries, and other areas. It is the largest reuse application in terms of the number of customers served and ranks third in terms of volume of reuse.

Wildlife Habitat Enhancement

Wildlife habitat enhancement includes development and maintenance of wetlands and marshes, but does not include the filling of duck ponds for duck hunting clubs.

Industrial Use

The most significant industrial applications are for process water and cooling, but reclaimed water is also used for washdown water and for soil compaction and dust control at construction sites.

Recreational Impoundments

Reclaimed water is used to fill and maintain recreational lakes and duck club ponds. Impoundments are categorized as restricted or nonrestricted, depending upon the potential for human contact with the reclaimed water.

Other

This category includes applications such as toilet flushing and fire protection.

Incidental Reuse

Incidental reuse occurs when wastewater is discharged into a stream or impoundment as a means of disposal, such as occurs along the Santa Ana River. The impact of this disposal may be beneficial to the extent that it recharges an aquifer or serves beneficial needs downstream. The amount of incidental reuse occurring in the state cannot be reliably quantified at this time. Therefore, estimates are not included in this report.

QUANTITIES OF REUSE

Table 2-1 estimates the amount of reuse which occurred in California during 1989 for the seven reuse application categories discussed above.

Table 2-1
REUSE OF MUNICIPAL WASTE WATER IN CALIFORNIA - 1989
(Acre-Feet/Year)

Reuse Category	SWRCB 1987 Survey	Additional Reclamation 1987-1989	Total	Percent of Total
Agricultural Irrigation	168,000	5,000	173,000	53
Groundwater Recharge	39,000	31,000	70,000	21
Landscape Irrigation	40,000	14,000	54,000	16
Wildlife Habitat	10,000	8,000	18,000	6
Industrial Use	6,000	-	6,000	2
Recreational Impoundment	2,000	-	2,000	1
Other	2,000	-	2,000	1
TOTAL	267,000	58,000	325,000	100

The primary source of information for Table 2-1 is a State Board Office of Water Recycling report titled "California Municipal Wastewater Reclamation in 1987." This survey identifies the number and location of projects in operation in 1987, the level of reclaimed water treatment for each, and the quantity and reuse application.

Information was developed to update the 1987 SWRCB survey to account for additional reclamation implemented through 1989. This information is included in Table 2-1.

Summary information from Table 2-1 was broken down to illustrate the corresponding amount of reclamation by type of use for 11 regions of the state (Figure 2-1) and is presented in Table 2-2. Note that information corresponds to the jurisdictional boundaries of Regional Boards with the exception of Region 5, which is divided into three zones.

By using the information in Table 2-2 and the potential reuse estimates in Chapter 3, strategies can be developed for each region that anticipate and plan for the best use of this resource.

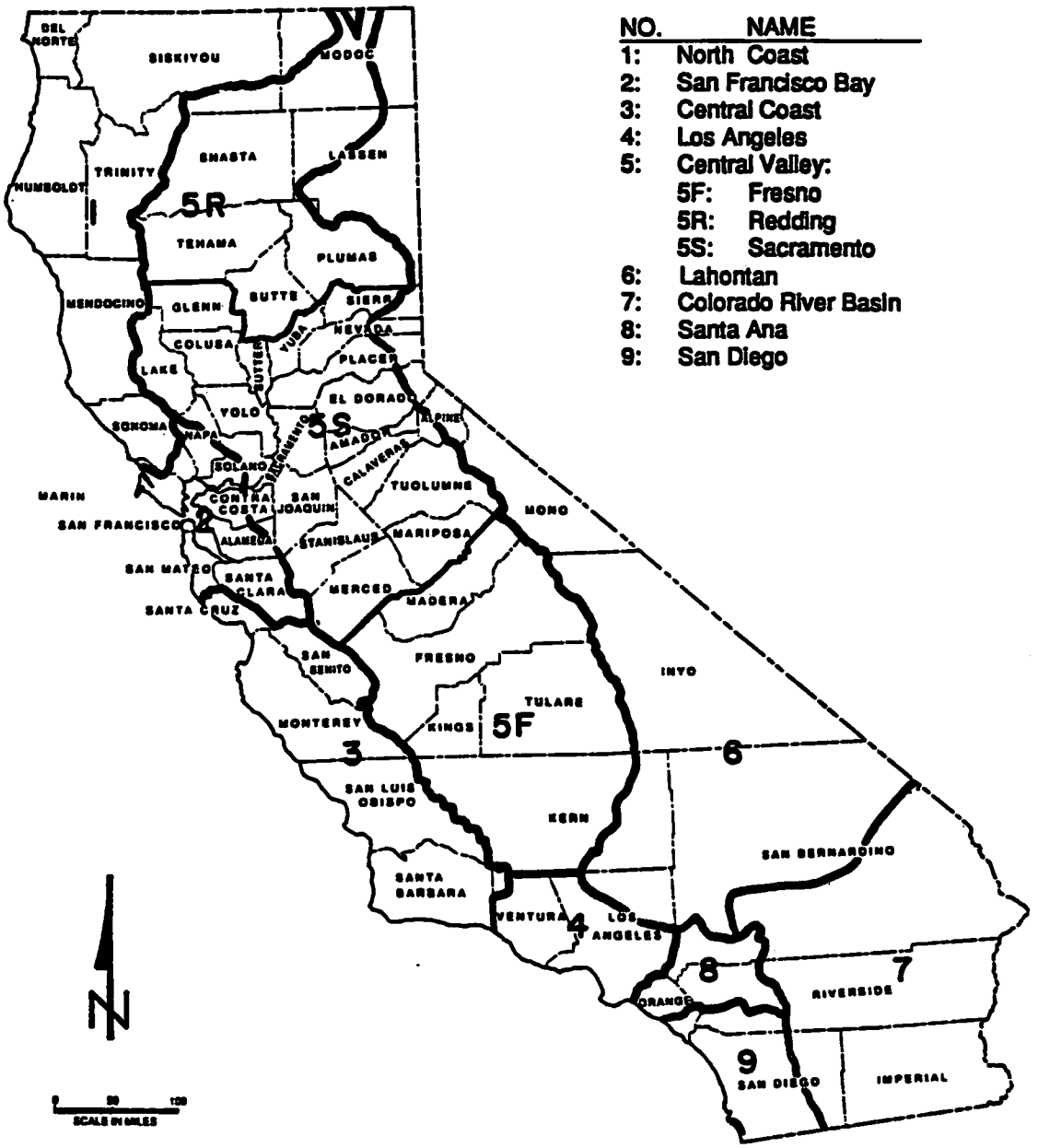

Figure 2-1. CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD REGIONS

September 1991

Table 2-2
1989
AMOUNT AND TYPE OF REUSE
IN EACH WATER QUALITY CONTROL BOARD REGION
Acre-Feet
(Percent of Regional Total)

Region	Agricultural Irrigation	Groundwater Recharge	Landscape Irrigation	Wildlife Habitat
1	10,976 (78%)	0 (0%)	1,471 (10%)	1,669 (12%)
2	7,945 (35%)	0 (0%)	1,715 (8%)	12,940 (57%)
3	5,744 (84%)	0 (0%)	1,107 (16%)	0 (0%)
4	4,332 (5%)	55,940 (65%)	20,283 (24%)	0 (0%)
5F	82,946 (100%)	0 (0%)	51 (0%)	0 (0%)
5R	589 (74%)	0 (0%)	110 (14%)	0 (0%)
5S	29,870 (93%)	0 (0%)	590 (2%)	1,008 (3%)
6	9,197 (52%)	0 (0%)	6,136 (36%)	2,015 (11%)
7	5,838 (55%)	0 (0%)	4,778 (45%)	0 (0%)
8	13,130 (34%)	9,645 (25%)	13,382 (35%)	0 (0%)
9	2,354 (18%)	4,000 (32%)	5,178 (41%)	0 (0%)
USE TOTAL	172,921 (54%)	69,585 (21%)	54,801 (17%)	17,632 (5%)

Table 2-2
(continued)
1989
AMOUNT AND TYPE OF REUSE
IN EACH WATER QUALITY CONTROL BOARD REGION
Acre-Feet
(Percent of Regional Total)

Region	Industrial	Recreational Impoundment	Other	Regional Totals
1	0 (0%)	0 (0%)	0 (0%)	14,116 (100%)
2	0 (0%)	0 (0%)	0 (0%)	22,600 (100%)
3	0 (0%)	0 (0%)	0 (0%)	6,851 (100%)
4	5,325 (6%)	0 (0%)	92 (0%)	85,972 (100%)
5F	0 (0%)	0 (0%)	0 (0%)	82,997 (100%)
5R	92 (12%)	0 (0%)	0 (0%)	791 (100%)
5S	218 (1%)	0 (0%)	390 (1%)	32,076 (100%)
6	226 (1%)	0 (0%)	0 (0%)	17,574 (100%)
7	0 (0%)	0 (0%)	0 (0%)	10,616 (100%)
8	173 (0%)	700 (2%)	1,691 (4%)	38,721 (100%)
9	0 (0%)	1,120 (9%)	0 (0%)	12,652 (100%)
USE TOTAL	6,034 (2%)	1,820 (1%)	2,173 (1%)	324,274 (100%)

CHAPTER 3 - PROJECTED REUSE

The purpose of this report is to provide input to the State Board on future water reclamation development in California for consideration in the Bay-Delta Proceedings. This chapter focuses on the collection and evaluation of data and presentation of results. The results should provide the State Board with a reliable projection of the reclaimed water supply potential by 2000 that is capable of augmenting the long-term dependable yield of the state's water supply.

DATA COLLECTION

The reclamation projections in this report were developed to update estimates presented in an August 1989 report[2] and to refine the data in response to a State Board directive.[3] The report authors acknowledge the cooperation of the California Association of Reclamation Entities of Water (CAREW), whose 1989 reclamation survey was an integral part of the August 1989 report and subsequent update efforts.[4]

A statewide water reclamation survey was undertaken to update and expand upon the 1989 data. A questionnaire was developed that requested the following basic information:

- Reclaimed Water Delivered
- Quantity of Fresh Water Displaced
- Project Status
- Type of Reclaimed Water Use
- Project Implementation Constraints
- Project Costs

A Survey Team was designated by the two groups to conduct the survey and validate results. The Survey Team distributed the questionnaire to an extensive statewide mailing list and conducted an intensive telephone follow-up effort to ensure results were representatives of the reclamation potential statewide.

Appendix B includes a copy of the questionnaire (Exhibit 1), a list of responding agencies (Exhibit 2), and a list of assumptions made when collecting and analyzing the data (Exhibit 3). Summary information from the survey is presented in this chapter.

---

[2]"Potential Water Reuse in California," memorandum to Jerry Johns, SWRCB, from Bay-Delta Reclamation Sub-work Group #3, August 1, 1989.

[3]"Urban Waste Water Reclamation Sub-work Group Progress Report," memorandum to Keith Watkins, Chairperson, Bay-Delta Reclamation Sub-work Group #3, from Jerry Johns, SWRCB, October 6, 1989.

[4]In the fall of 1990, CAREW merged with the Association of Water Reclamation Agencies (AWRA). The new organization is the WateReuse Association of California.

Survey respondents were requested to provide estimates on future reclaimed water deliveries and quantities of fresh water displaced. Projected reclaimed water deliveries include all deliveries that serve beneficial uses, including those that replace the need for additional potable water supplies and uses that would not, under most circumstances, have received fresh water if reclaimed water were not available. This latter type of use includes environmental enhancement, recreation, stream discharges, and certain cases of groundwater recharge. The amount of fresh water displaced by these uses may be indeterminable or substantially less than the deliveries. With uses such as landscape irrigation, the difference between reclaimed water delivered and fresh water displaced may be smaller. In an area with limited disposal capability, the reclaimed water deliveries may be utilized to irrigate agricultural lands which would not be irrigated if other disposal methods were available. In response to the State Board's request for a reliable projection of future reclaimed water supplies that can augment the state's water supply, it is recommended, based on the examples above, that the State Board utilize the quantity of reclaimed water supply that displaces fresh water and not total reclaimed water deliveries.

In responding to the survey, agencies provided information from their perspective and understanding of the questions. This produced some inconsistencies in the responses, but did not greatly influence the results. Inconsistencies in results suggest that appropriate education of the agencies responding would benefit future surveys that are undertaken. Another survey limitation is that construction costs for treatment may or may not include disposal costs as well as the reclaimed water treatment costs. This precludes developing a dependable unit cost estimate for reclaimed water development.

DATA EVALUATION METHODOLOGY

To provide the State Board with a reliable reclaimed water supply figure that considers existing conditions and constraints, the survey results were evaluated based on the status of the project and the implementation constraints yet to be resolved. Survey respondents were requested to specifically identify if their project was either in planning, design, or construction and what implementation constraints remained. Due to the uncertainty in resolving these constraints, a reduction factor was applied, based on the project status, to obtain a more reliable projection figure. The main reasons for a reduction are 1) the project might not be implemented by 2000 and 2) the project may not operate at design capacity by 2000. The question of whether a project will be implemented by 2000 has the greatest influence on the adjustment.

The adjustments are based on the best professional judgment of the members of the two groups. The group members recognize that, historically, projects do not deliver their design capacity when first implemented. Also, a project may not progress from one phase to another as scheduled because of various constraints. For example, the Los Angeles Greenbelt Project was in the latter stages of the planning phase in 1984. However, due to a lack of public acceptance and regulatory approvals, the project was still in the design

phase at the time of the survey (summer 1990). Although the ultimate capacity of this project is more than 1,600 acre-feet per year of reclaimed water, the use is expected to be well under the ultimate capacity in the year 2000.

The rationale of the adjustments for each project stage is presented below.

Projects Under Construction

These projects are estimated to be on line by 1992. The survey results indicated an uncertainty in fully implementing all of the construction projects by the year 2000. Funding remained the Number 1 constraint for over 50 percent of the projects under construction. Several other responses also listed funding as a constraint, but not the greatest one. (A more detailed discussion of the constraints follows later in this chapter and in Chapter 4.) An additional 25 percent of the projects still needed to overcome regulatory constraints as their top priority, and 15 percent indicated institutional and user constraints remained the top priority. Many of the construction projects still have multiple constraints to resolve. In addition, reclaimed water markets may not be fully developed when a project is under construction, and proper incentives to promote reclaimed water use may not be in place by the year 2000.

Therefore, the potential reclaimed water use from the projects in the construction stage was reduced by 20 percent.

Projects in Design

These projects are estimated to be on line by the year 1995. In general, projects in design are less certain to be implemented than those under construction. The survey indicated that 35 percent of the design projects had funding as the Number 1 constraint. Regulatory constraints were Number 1 for 25 percent of these projects, and institutional and user agreements were listed for another 20 percent. Also 5 percent of the design projects designated public acceptance as the Number 1 constraint. Many of the design projects listed multiple constraints with various priorities.

The potential reclaimed water use from projects in design was reduced by 40 percent. This reduction consists of the 20 percent reduction assigned to construction projects, plus an additional 20 percent due to the factors identified in the above paragraph.

Projects in Planning

These projects are estimated to be on line by the year 2000. In general, planning projects are the most speculative and, therefore, the least likely to be implemented. The survey responses indicated funding as the greatest constraint to implementing 50 percent of these projects. Regulatory issues were the Number 1 constraints for nearly 30 percent.

Constraints involving institutional issues and user agreements were designated for 25 percent, and public acceptance was listed as the greatest constraint for 5 percent. (Several survey responses indicated multiple Number 1 ranked constraints; therefore, the summation of the percentages listed above is greater than 100 percent.)

The potential reclaimed water use from projects in planning was reduced by 60 percent. This reduction consists of the 40 percent assigned to design projects plus an additional 20 percent. The survey also requested the respondent to estimate a planning project's likelihood for completion. If the respondent's estimate was less than 40 percent, the lower estimate was used.

The following example is presented to illustrate how the Team developed the estimate of fresh water displaced quantities. Contra Costa Water District (CCWD) has a landscape irrigation project currently in the planning stage. CCWD estimates that 10,000 af/yr of fresh water would be displaced by this project and that the project has a 70 percent probability of success. The agency's fresh water displaced estimate was reduced to the lower resulting quantity using 1) the planning stage percent adjustment (a reduction of 60 percent) or 2) CCWDs project success estimate (70 percent). Therefore, the 60 percent reduction was used, as follows:

Fresh Water Displaced = 10,000 - 10,000 x 0.6
Fresh Water Displaced - 4,000 ac-ft/yr

Conceptual Projects Envisioned But Improbable With Current Constraints

Survey respondents were not asked to list conceptual projects, and the projections for water reclamation potential given in this report do not include them. The survey design assumed that any project not at the planning stage now could not be delivering reclaimed water by the year 2000.

SURVEY RESULTS AND PROJECTED REUSE NUMBERS

This section presents the survey results in both tabular and graphic form. As discussed in previous sections, the State Board has requested an estimate on the amount of fresh water to be displaced by future reclaimed water uses by year 2000. Therefore, the following graphs and tables are based on estimates of fresh water displaced as derived from the survey. Estimates of reclaimed water deliveries derived from the survey are presented at the end of this section. Additional supporting data including a summary of results are in Appendix C. It should be noted that the fresh water displaced figures for year 2000 are additional supply estimates and do not include existing reuse.

Fresh Water Displaced

Table 3-1 below estimates the additional amount of fresh water which will be displaced by reclamation projects by the year 2000. These estimates are presented by Regional Board jurisdiction and were derived using the process described earlier in this chapter. These estimated reuse figures serve as a recommendation to the State Board for consideration in the Bay Delta Process.

Table 3-1
ESTIMATE OF ADDITIONAL FRESH WATER TO BE DISPLACED PER REGION BY THE YEAR 2000

Region	Area	Additional Fresh Water Displaced By Year 2000 Since December 1989 (Acre-Ft./Yr.)
1	North Coast (NC)	1,200
2	San Francisco Bay (SF)	22,800
3	Central Coast (CC)	20,900
4	Los Angeles (LA)	49,400
5	Central Valley (CV)	16,600
6	Lahontan (L)	500
7	Colorado River Basin (CRB)	1,100
8	Santa Ana (SA)	74,800
9	San Diego (SD)	56,800
TOTAL		244,100

Of the nine regions listed in Table 3-1, six (San Francisco, Central Coast, Los Angeles, Central Valley, Santa Ana, and San Diego) currently draw some portion of their water supply from the Delta. Even so, it would be inaccurate to assume that reclaimed water produced in these regions will reduce the amount of water withdrawn from the Delta for the following reasons:

- The majority of projects are being built in areas experiencing increases in population and water demand. Reclaimed water will be used to offset future demand so that increased diversion from the Delta can be minimized. However, in few if any cases will reclamation projects enable water suppliers to reduce current diversions from the Delta.

- Many water suppliers which use water from the Bay Delta system also use water from other sources (e.g., groundwater or local reservoirs).

- Because of the complexity of water rights, one agency's reduced diversion of water from a river tributary to the Delta does not assure that the water released will ever reach the Delta. If a downstream diverter has water rights to all water which reaches them, water released by an upstream diverter may never reach the Bay-Delta system.

Figure 3-1 on the following page depicts the amount of fresh water displaced per region. Figure 3-2 presents the amount of fresh water to be displaced by reclaimed water use during the next ten years, according to the year project deliveries are estimated to begin. As shown on the graph, close to 80% of the total projected fresh water displaced during the next decade will occur within the first 5 years. This equates to approximately 200,000 acre-feet per year of reclaimed water being available to augment future water supplies by 1995.

Figure 3-3 shows the types of fresh water use to be displaced by additional reclaimed water development by the year 2000. The graph shows that landscape irrigation is predicted to use the greatest additional amount of reclaimed water at close to 140,000 acre-feet per year. When existing reuse is combined with predicted amounts, agricultural irrigation remains the number one use of reclaimed water by the year 2000.

Figure 3-4 depicts the type of fresh water use to be replaced by reclaimed water development on a regional basis. The graph can provide an indication of the type of use to occur in each region and the estimated amount of fresh water to be displaced. In Region 5 (Central Valley), the main use is agricultural irrigation, whereas in Region 9 (San Diego), landscape irrigation is the highest projected use.

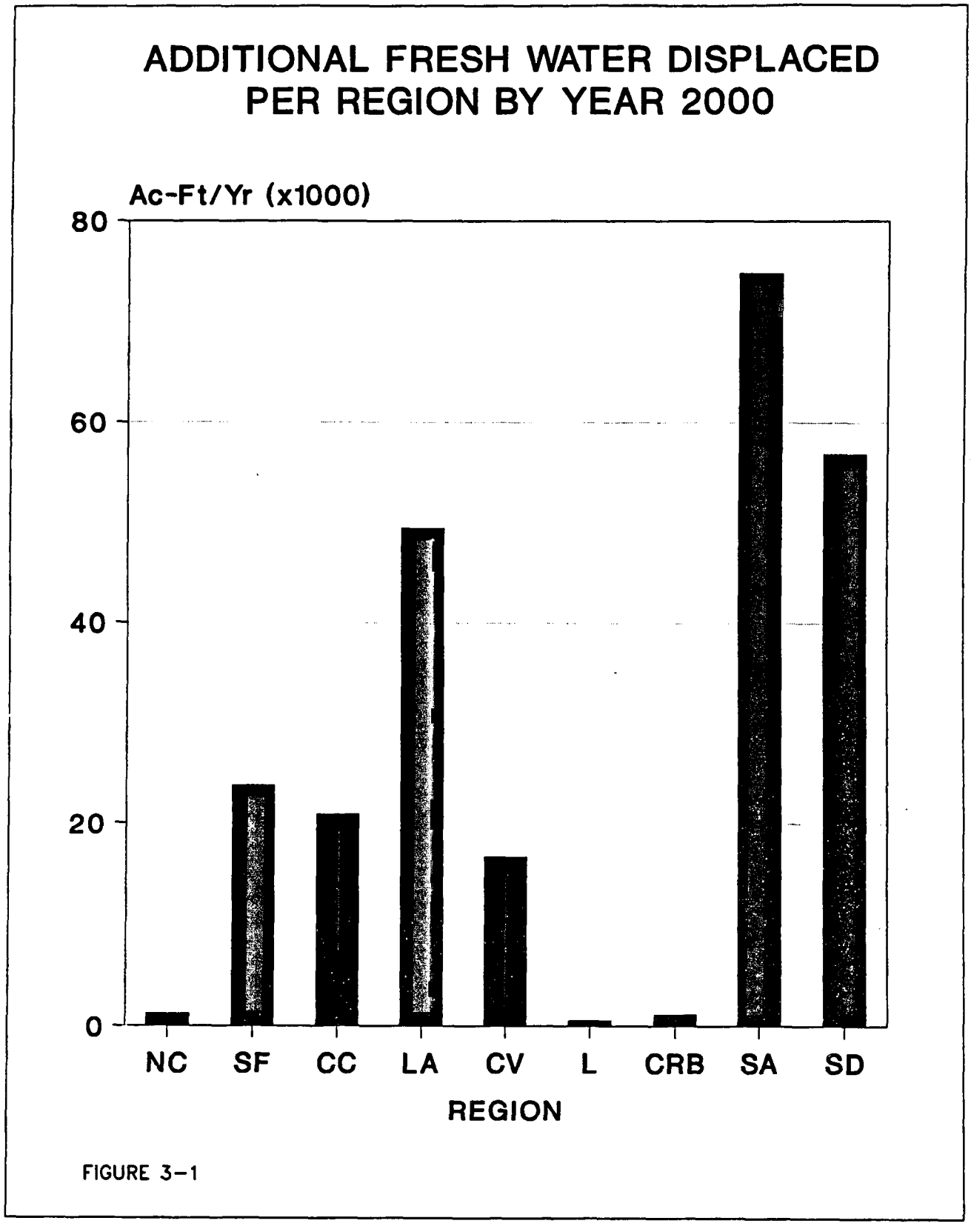
ADDITIONAL FRESH WATER DISPLACED
PER REGION BY YEAR 2000
Ac-Ft/Yr (x1000)
80
60
40
20
0
NC
SF
CC
LA
CV
L
CRB
SA
SD
REGION

FIGURE 3-1

ADDITIONAL FRESH WATER DISPLACED PROJECTED THROUGH YEAR 2000

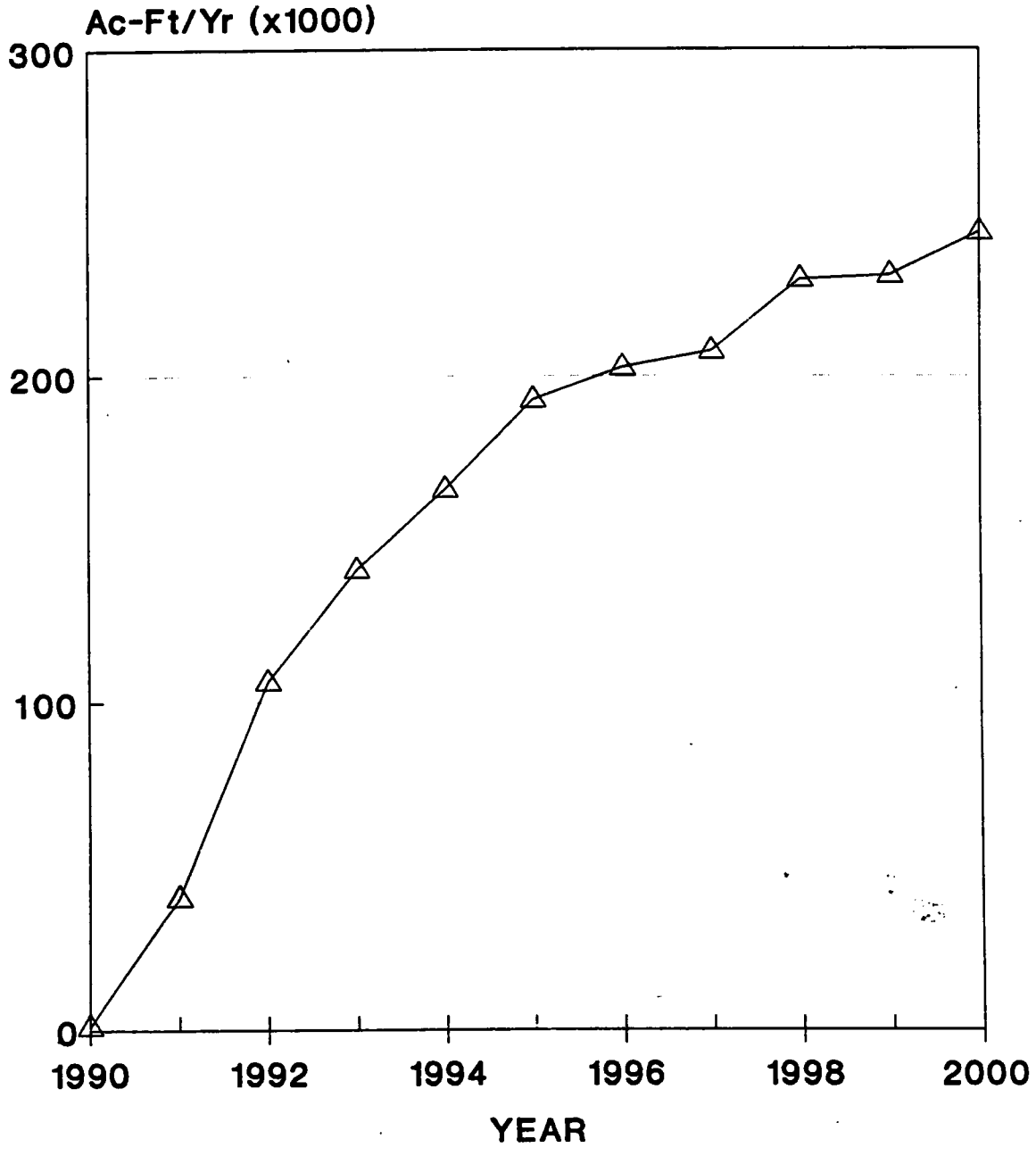

FIGURE 3-2

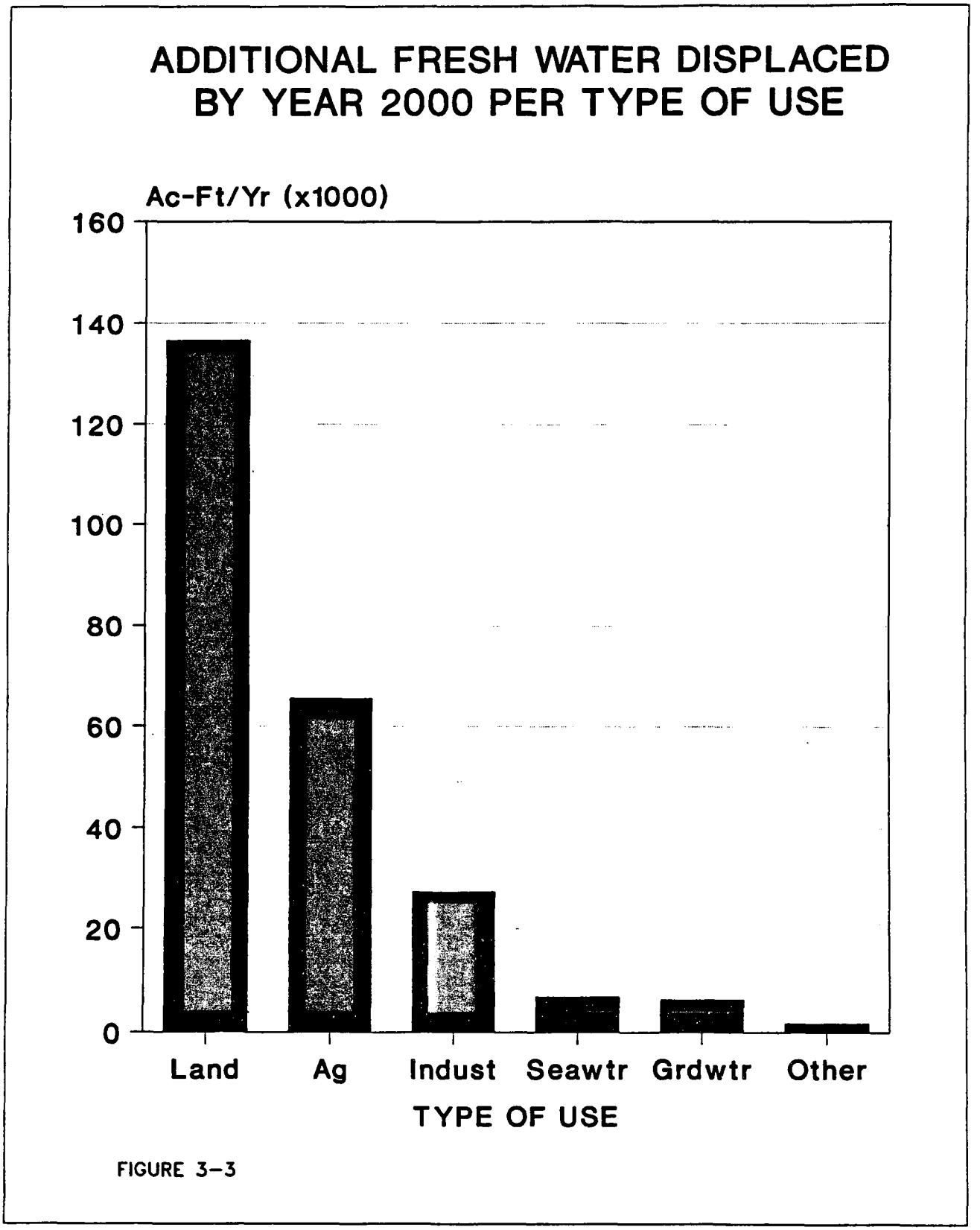
ADDITIONAL FRESH WATER DISPLACED
BY YEAR 2000 PER TYPE OF USE
Ac-Ft/Yr (x1000)
160
140
120
100
80
60
40
20
0
Land
Ag
Indust
Seawtr
Grdwtr
Other
TYPE OF USE

FIGURE 3-3

ADDITIONAL FRESH WATER DISPLACED BY YEAR 2000 PER TYPE OF USE PER REGION

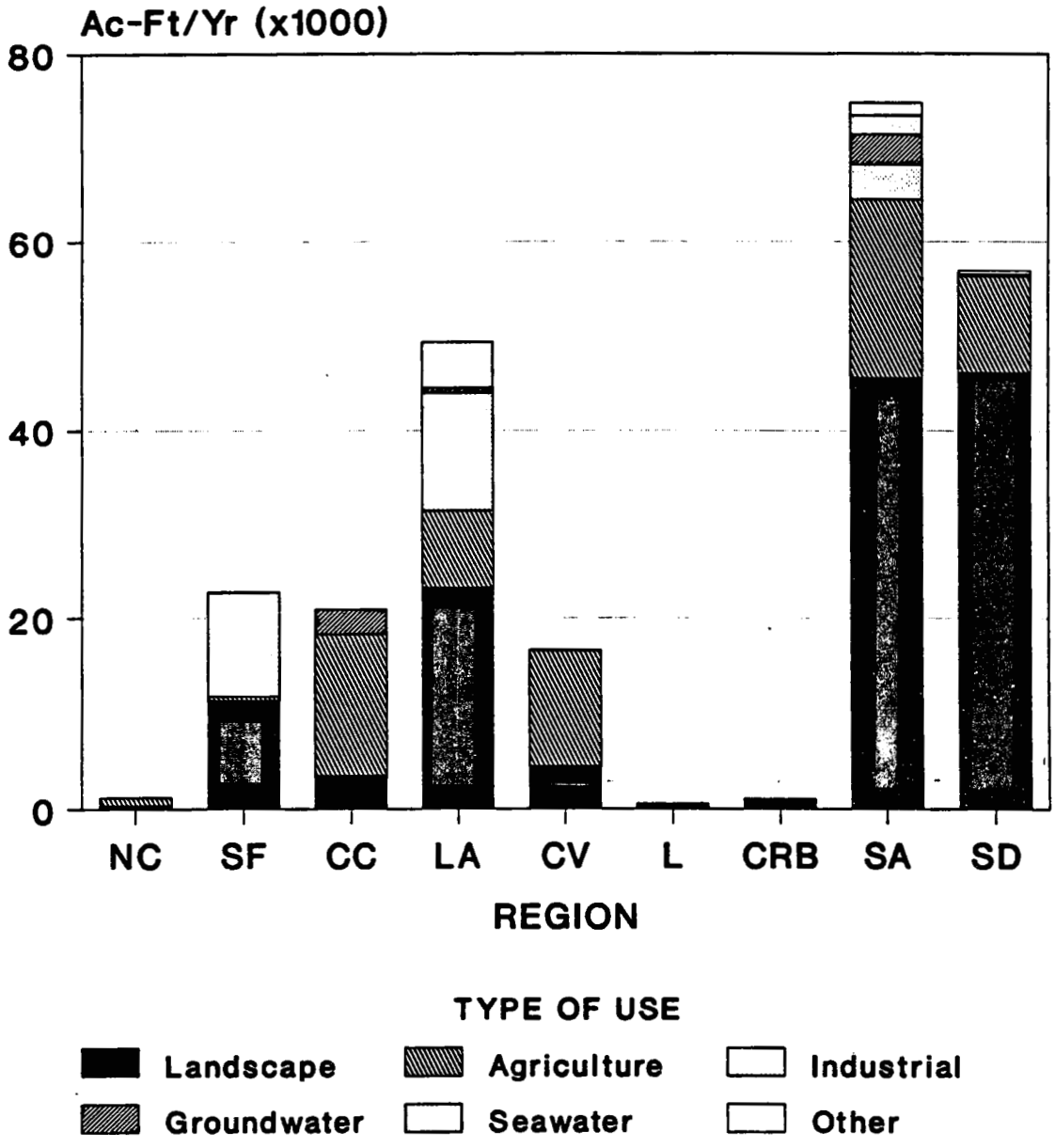

FIGURE 3-4

Project Stage Per Region

Figure 3-5 shows a regional breakdown of reclamation projects by stage, either construction, design, or planning. The survey results estimated 165 projects in differing phases of implementation throughout the state. Most of these projects are still in the planning phase. The majority of projects in the design and construction stages are located in Southern California in Regions 4, 8, and 9 (Los Angeles, Santa Ana, and San Diego, respectively). Projects in planning are fairly evenly dispersed throughout the state with all regions represented.

In Figure 3-6, the project stage is displayed by the anticipated amount of fresh water to be displaced by reclaimed water use by year 2000 according to region. In comparing this graph with Figure 3-5, project stages are not displayed in certain regions, because the project will not displace fresh water. For example, in Figure 3-5, both construction and planning projects are identified in Region 1. However, only projects in the planning stage are expected to replace fresh water; therefore, construction projects are not included for Region 1 in Figure 3-6.

Constraints

Survey participants were also asked to identify key factors which they thought could limit their ability to build reclamation facilities. The eight categories participants were asked to rank included capital funding, operations and maintenance funding, energy costs, user agreements, regional board approval, health agency approval, institutional factors, and public acceptance.

In Figure 3-7, the eight constraints listed in the survey have been grouped into four categories. The funding category includes capital funding, O&M funding, and energy costs. Regulatory includes Regional Board approvals and health agency approvals. The institutional category includes institutional issues and user agreements. The final category is public acceptance. As shown in the figure, obtaining funding is the number one constraint that must be overcome to produce the largest amount of reclaimed water.

Figure 3-8 provides a summary of the respondents' number one constraints as a function of project stage. It was hypothesized that agency concerns might vary depending upon the project stage at the time of the survey. Regardless of stage, funding concerns were paramount, with 46% of all participants citing this as their number one concern. Regulatory issues emerged second with 27% of all participants ranking this as their number one concern.

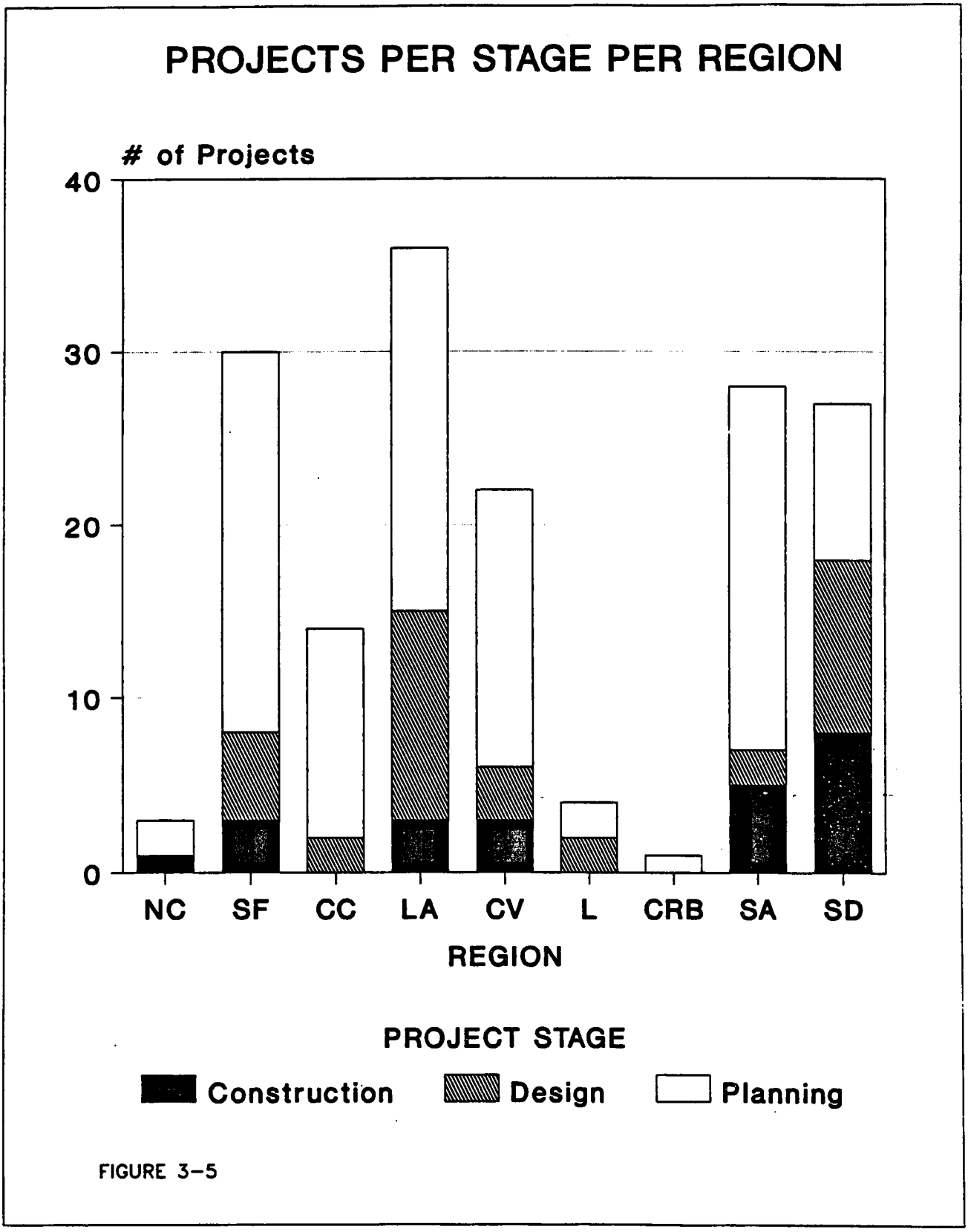
PROJECTS PER STAGE PER REGION
# of Projects
40
30
20
10
0
NC
SF
CC
LA
CV
L
CRB
SA
SD
REGION
PROJECT STAGE
Construction
Design
Planning

FIGURE 3-5

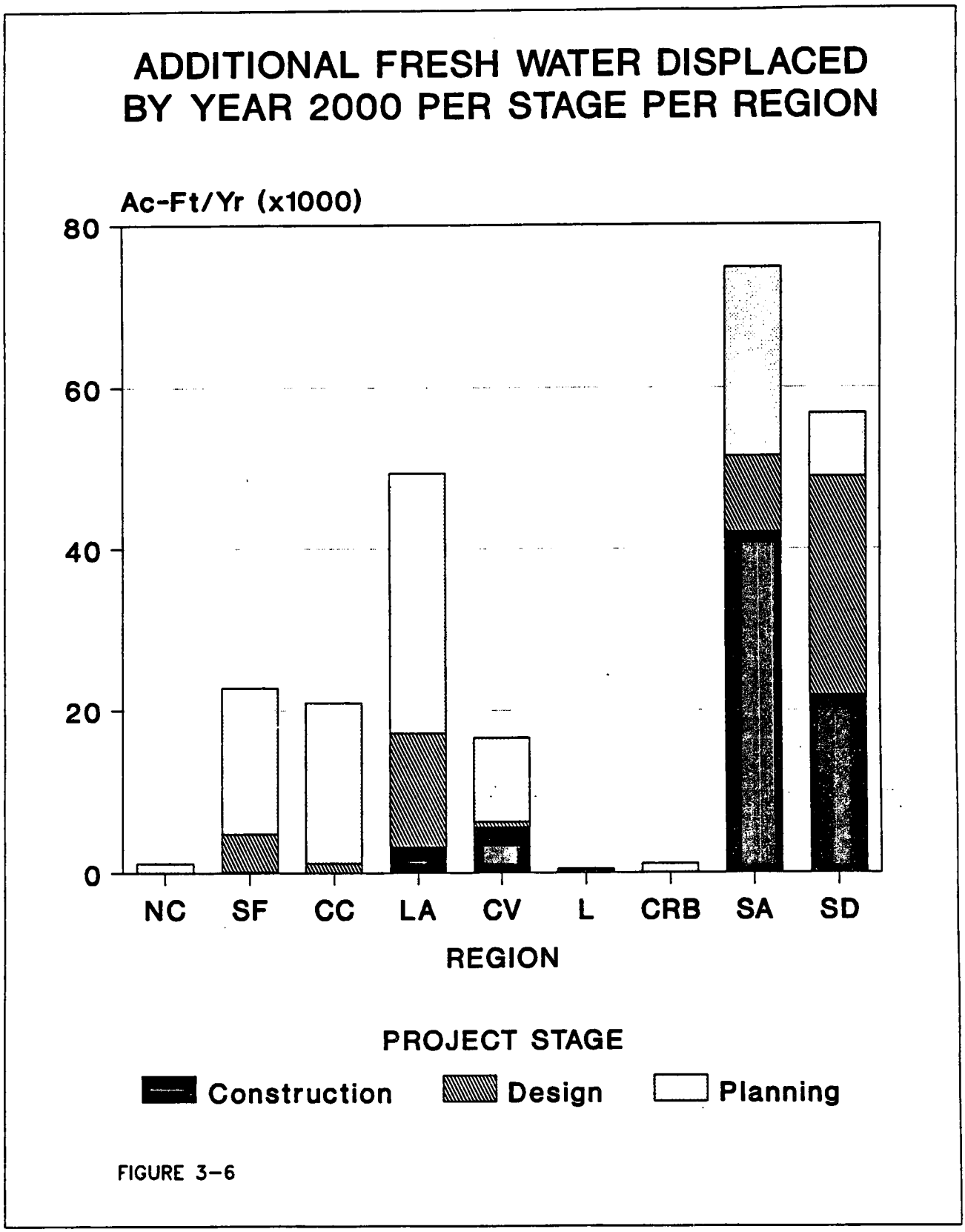
ADDITIONAL FRESH WATER DISPLACED
BY YEAR 2000 PER STAGE PER REGION
Ac-Ft/Yr (x1000)
80
60
40
20
0
NC
SF
CC
LA
CV
L
CRB
SA
SD
REGION
PROJECT STAGE
Construction
Design
Planning

FIGURE 3-6

ADDITIONAL FRESH WATER DISPLACED BY YEAR 2000 PER CONSTRAINT

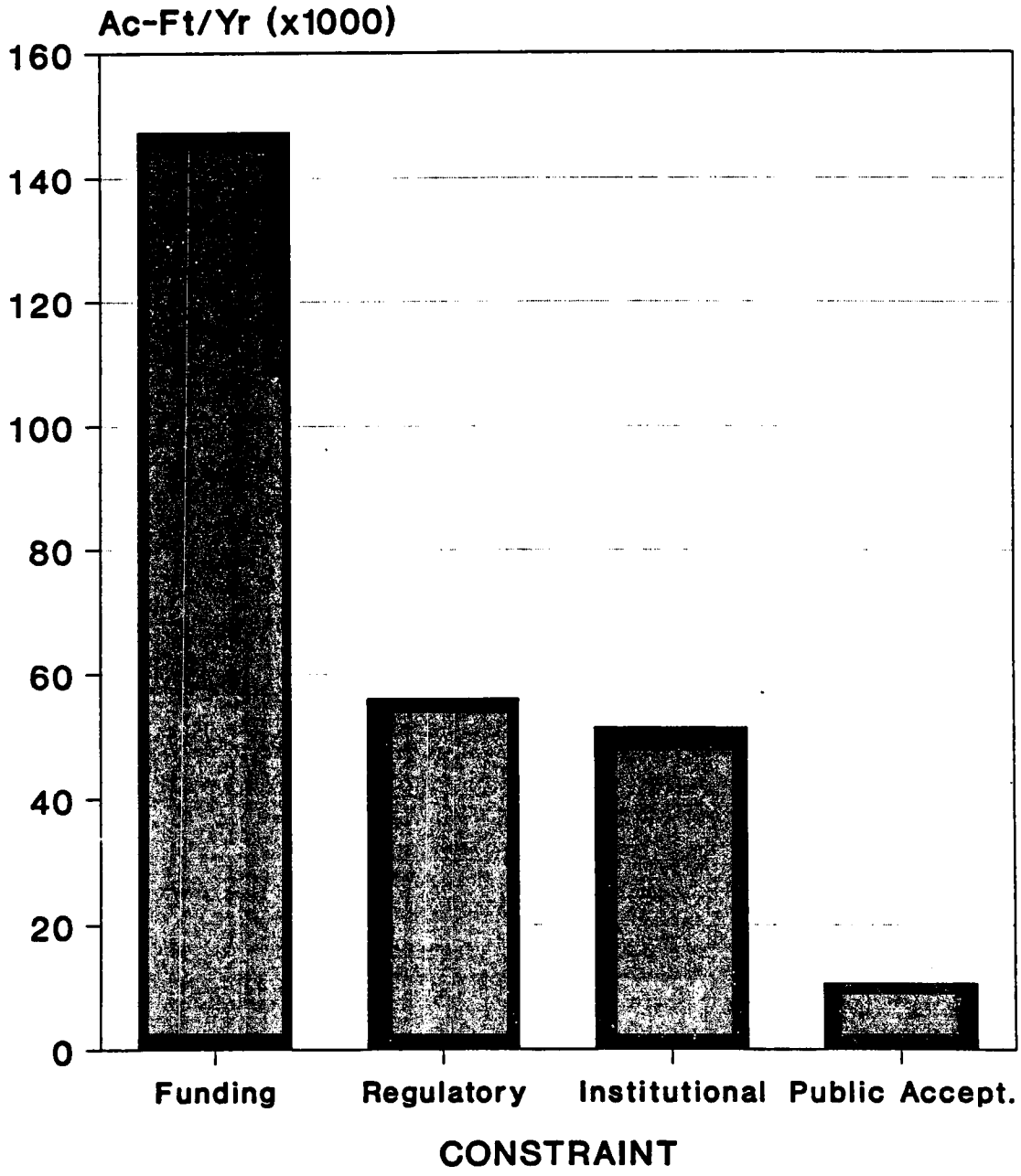

FIGURE 3–7

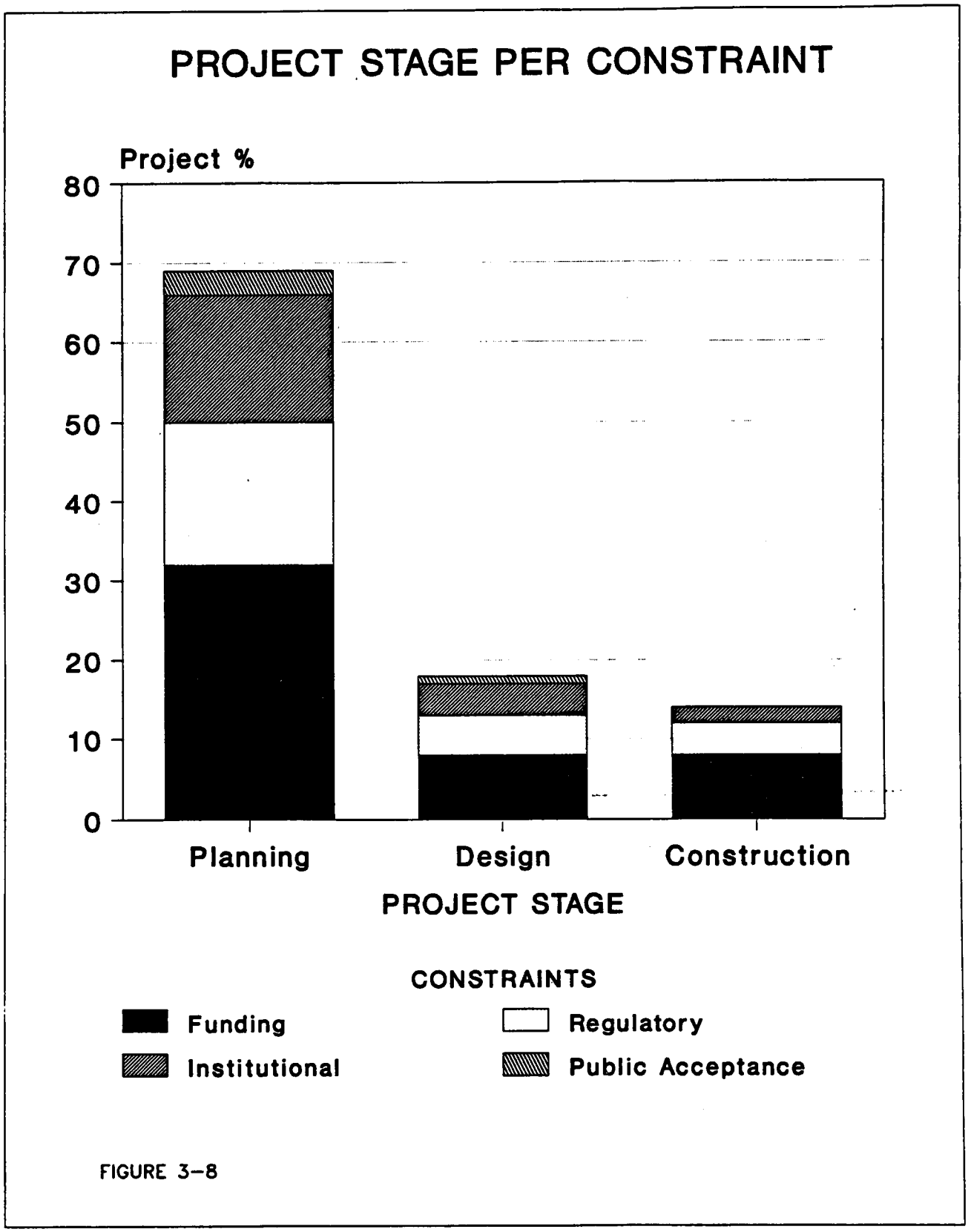
PROJECT STAGE PER CONSTRAINT
Project %
80
70
60
50
40
30
20
10
0
Planning
Design
Construction
PROJECT STAGE
CONSTRAINTS
Funding
Regulatory
Institutional
Public Acceptance

FIGURE 3–8

There appeared to be no strong shift from funding concerns to regulatory as a function of project stage. Projects in the construction stage did not show a shift from funding to regulatory concerns when compared with projects in the planning phase. The three primary areas of concern were funding, regulatory and institutional, in that order. This trend remained constant regardless of project stage.

Fresh Water Displaced Per Constraint By Region

Figure 3-9 shows the amount of fresh water displaced by reclaimed water projects based on the constraint identified by the agency to developing their reclamation project. This graph can provide information on the constraints that involve the largest amount of reclaimed water production per region. In Region 4 (Los Angeles), most of the potential reclaimed water use is tied to resolving institutional issues; whereas, in Regions 8 and 9 (Santa Ana and San Diego, respectively), resolving funding concerns is tied to the greatest amount of potential reclaimed water use.

Projected Reclaimed Water Supply Goal

The survey results were adjusted to produce a reliable estimate on the amount of fresh water than can be displaced by reclaimed water under existing conditions and constraints. If all implementation constraints identified, such as lack of financing, regulatory approval and institutional conflicts, were resolved, the amount of additional fresh water displaced projected by 2000 could approach the actual amount surveyed. This projection could be considered a statewide goal and motivation to resolve constraints. Table 3-2 lists the reliable estimate to be utilized in the Bay Delta Process and the projected reclaimed water goal. As shown in the following table, the reliable estimate of the additional fresh water displaced by the year 2000 is 244,100 acre-feet per year. Before the projected goal of 474,300 acre-feet per year can be achieved, all future and existing constraints listed by respondents will need to be resolved.

Projected Reclaimed Water Deliveries

Survey respondents were also requested to provide an estimate of the amount of reclaimed water deliveries (not just fresh water displaced) expected by year 2000. Reclaimed water delivery estimates include deliveries to beneficial uses such as environmental enhancement and recreation that, under most circumstances, would not have received fresh water in lieu of reclaimed water. Reclaimed water deliveries expected under existing conditions and constraints total 393,400 acre-feet per year. Based on the submittals of survey respondents and with removal of all constraints, the ultimate potential deliveries for these projects could approach 826,300 acre-feet per year.

ADDITIONAL FRESH WATER DISPLACED BY 2000 PER CONSTRAINT

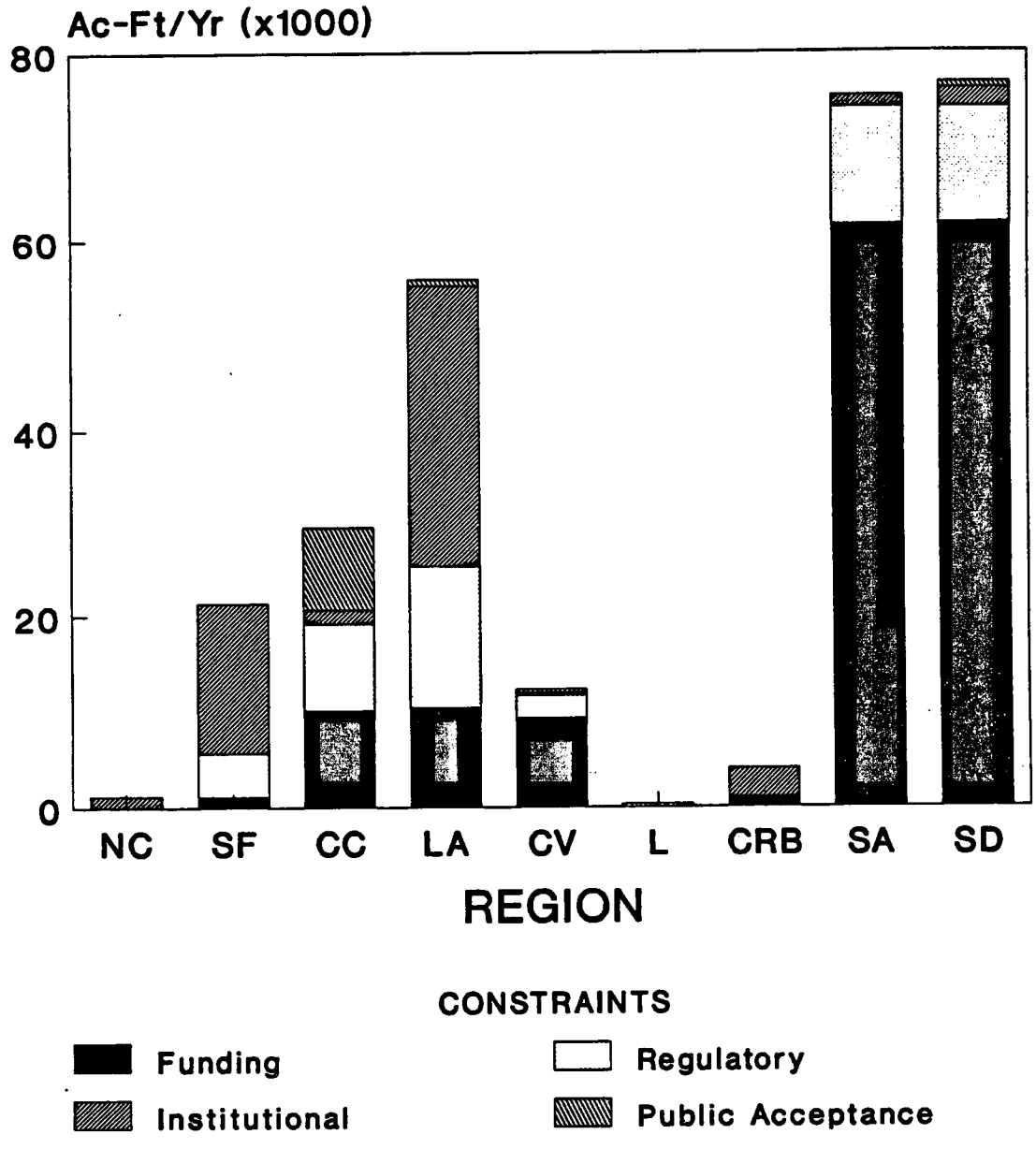

FIGURE 3-9

September 1991

Table 3-2
ESTIMATE AND GOAL OF ADDITIONAL FRESH WATER TO BE DISPLACED BY REGION BY THE YEAR 2000

Region	Area	Additional Fresh Water Displaced by Year 2000 Since December 1989 (Acre-Feet/Year)	Projected Goal of Add'l Fresh Water Displaced by Year 2000 (Acre-Feet/Year)
1	North Coast	1,200	3,000
2	San Francisco Bay	22,800	53,200
3	Central Coast	20,900	51,300
4	Los Angeles	49,400	108,100
5	Central Valley	16,600	34,300
6	Lahontan	500	1,600
7	Colorado River Basin	1,100	2,800
8	Santa Ana	74,800	127,800
9	San Diego	56,800	92,200
	TOTAL	**244,100**	**474,300**

CHAPTER 4 - POLICY ISSUES AND APPROPRIATE POLITICAL ACTIONS

This chapter suggests political actions that can be taken to promote more water reclamation and gives an overview of the benefit cost analysis for reclamation. Additional recommendations are then categorized according to the constraints described in Chapter 3.

POLITICAL SUPPORT

The use of reclaimed water as a component of California's water supply is becoming increasingly prominent. There is a need to assure a dependable water supply to serve the state's growing population, maintain and strengthen the economy, and protect the environment. The challenge facing government today is to meet the needs of these often competing interests in a timely, cost-effective, balanced, and productive manner. Reclaimed water is an important reliable water resource able to augment existing supplies and in turn assist government in meeting future demands.

To assure that reclaimed water is evaluated as rigorously as other water supply projects in statewide water resources planning, state and federal agencies should adopt policies that identify reclaimed water as an important resource. By identifying reclaimed water as a resource, agencies can protect its source quality and expand its uses.

In order to develop and implement successful programs and policies that maximize reclaimed water development, policy makers in all levels of government must have a strong commitment to reclamation. With this "political will," many of the solutions to implementation constraints can be accomplished. Achieving these identified solutions would resolve political and institutional constraints, secure additional state funding, ensure coordinated policy among state and county health officials, and enact appropriate legislation to further promote and facilitate the use of reclaimed water.

Education is the key to assisting officials in developing a "political will" to support water reclamation. With an understanding of water reclamation, officials can effectively support reclaimed water development. This section provides recommendations and implementation strategies to educate policy makers, either appointed or elected. (The last section of this chapter discusses acceptance by the general public.) Table 4-1 summarizes recommendations and implementation strategies to develop political support, with detailed information on implementation following the table.

Table 4-1
SUMMARY OF POLICY ISSUES

Description	Recommendation	Implementation
Political support	Develop statewide programs of political support.	The Governor should consider appointing a Blue Ribbon Panel.
		The State Board and/or DWR should consider dedicating additional staff and funding.
		WateReuse should sponsor seminars tailored to policy makers.
	Develop local programs of political support.	Local officials should establish water reclamation programs, dedicate staff, and communicate support through speaking engagements, etc.

Implementation Strategy - Governor's Actions

The Governor should consider appointing a Blue Ribbon Panel of experts from the public, private, and academic sectors to assess the organizational framework needed at the state level to develop, consolidate, and implement reclamation policy.

Implementation Strategy - DWR and/or State Board Actions

To effectively and consistently inform policy makers on the benefits of water reclamation, the State Board and/or DWR should consider dedicating additional staff and resources to provide information for policy makers at both the local/regional and state level. As an example, presentations could be conducted at a League of Cities conference or to other similar organizations. In addition, staff within DWR would assist local agencies in expediting the implementation of water reclamation projects.

Implementation Strategy - WateReuse Actions

Many of the members of WateReuse are agencies that have implemented successful water reclamation projects and could provide valuable information to policy makers on reclaimed water. WateReuse organized a one-day event where members met with legislators in Sacramento to educate them on water reclamation. Events similar to this and seminars tailored towards policy makers can help to develop political support for water reclamation.

Implementation Strategy - Local Officials' Actions

To provide technical guidance to policy makers and expedite development of reclamation projects, local officials should establish water reclamation programs. Policy makers committed to the development of water reclamation should communicate their support to other officials. Officials supporting reclaimed water should volunteer to speak at conferences and seminars on the importance of water reclamation development. Through active communication among officials, a political awareness can form that will promote water reclamation development throughout the state.

BENEFIT COST ANALYSIS FOR RECLAMATION

One theme of this report is that reclamation should be evaluated from a statewide perspective as well as a local perspective. When a project is evaluated from both perspectives, the issue of "who benefits and who pays" is clarified. Rational project planning provides a basis for determining project beneficiaries. Equitable funding arrangements are based on the principle that the beneficiary pays.

Benefit cost analyses for reclamation are complex. Table 4-2 summarizes key issues, and a general discussion is provided below. Subsequent sections address these issues by specific constraint, such as funding, regulatory, and institutional.

Rational Project Planning

Monetary costs and benefits of water reclamation must be determined in the planning process. However, perceptions of costs and benefits differ among agencies, and estimates of monetary values can be difficult to obtain.

Table 4-2
SUMMARY OF COST BENEFIT ANALYSIS ISSUES

Description	Recommendation	Implementation
Rational Project Planning	Provide economic as well as financial analyses in facilities plans.	Local, regional, and state plans should include good economic and financial analyses.
	Provide assistance to local agencies to analyze costs and benefits.	The State Board and DWR should provide assistance to local agencies.
Funding Equity	Provide external financial assistance in reclamation projects.	(Refer to next section.)
	Create institutional changes to provide financial feasibility.	(Refer to next section.)
	Encourage cooperative agreements between regions with high and lower incremental water costs.	The State Board should encourage cooperative agreements which can increase the amount of water available to regions facing high incremental water costs.

It is common in water resources economics to separate monetary analysis into two categories: economic analysis and financial analysis. It is useful to apply the principles of these analyses to water reclamation.[5] The role of an economic analysis is to determine whether a proposed project is justified in monetary terms, that is, to answer the question: "Should it be done?" If total benefits exceed total costs, a project is considered justified. Equally important, however, is the question, "Can it be done?" Financial analyses look at

[5]Mills, Richard A., and Takashi Asano, "The Economic Benefits of Using Reclaimed Water," Journal of Freshwater, Volume Ten, 1986/87, pp. 14-15.

the distribution of the costs and benefits, the flexibility of setting water prices, and the ability to raise capital and operating revenues to make a project financially feasible.

Economic and financial feasibility do not always exist together for the same project. In some cases, a reclamation project may appear to be economically feasible from the broad regional or statewide perspective, yet financially infeasible from the local perspective. Retail water agencies in California which rely extensively on wholesale water suppliers provide a good example of the possible divergence of economic and financial feasibility. Wholesale water prices are basically set at the average cost of their existing sources of supply and are much lower than the cost of new water development. Local agencies are not inclined to invest in water reclamation projects that cost more than the prices they pay wholesale suppliers for fresh water, even though a water reclamation project may be less costly than new water development from the statewide perspective.

Environmental impacts also have economic costs and benefits. These impacts are generally identified and included in an environmental mitigation plan. The benefits and costs of environmental impacts are frequently excluded from the project economic analysis. While monetary estimates of environmental benefits and costs are difficult to make, recognized methods exist for making them. Methods to estimate these values may require surveys and additional time and expense during planning. Such analyses should be considered in cases where environmental enhancement and recreational opportunities play a predominant role in the justification of the proposed project. In cases where the estimates are not made, the nature of the environmental benefits and costs should be described. For example, wetlands created by a reclamation project may create recreational opportunities and habitat that provide economic values. A detailed description of these amenities should be provided even though the estimates of their values are not made.

Another economic and financial issue is that costs associated with wastewater treatment and disposal may be borne by sewer users even though some of the facilities are constructed to create an additional water supply. This applies to pretreatment as well as the level of treatment provided at the plant. In order to assure that effluent can be reclaimed, the wastewater treatment agency may need to incur additional pretreatment costs (e.g., monitoring and controlling industries and residences that discharge brine and potentially prohibiting such discharges). Some additional costs also may be borne by dischargers (e.g., industries which are not allowed to discharge brine into the system and consumers prohibited from using water softeners). A project may not be financially feasible if a mechanism cannot be found to share these treatment and monitoring costs with the water supply beneficiaries.

Displacement of fresh water by reclaimed water may reduce revenues that a water purveyor receives from sale of fresh water, which may require the water rate to be increased in order to cover fixed costs. At the same time, reclaimed water can provide a drought-resistant revenue source.

With many groundwater recharge projects, a limited or unclear relationship exists between the reclaimed water injected and the amount of potable water demand displaced. For example, if groundwater replenishment using highly treated reclaimed water is used to protect potable groundwater supplies by creating a barrier to seawater intrusion, there may not be a one-to-one or even a clearly definable quantitative relationship between the amount of reclaimed water injected and the amount of groundwater protected for potable use. If protecting groundwater is viewed as a benefit, the analysis should consider costs associated with the protection and use of that groundwater. (Benefits may include increased operation of the groundwater basin as a storage reservoir.)

Other common situations in California which also illustrate the disparity between economic and financial feasibility are listed in Table 4-3.

Table 4-3
SITUATIONS WHICH COULD DETER RATIONAL PROJECT PLANNING

Situation	Planning Implications
Water may be treated and delivered by an organization in one geographical area and used by an organization in another geographical area.	Costs accrue to one organization, and the benefits accrue to another.
An organization which already has sufficient supply to meet its own needs might displace some of its demand with reclaimed water, making fresh water available for another organization in a different geographic area.	An organization which uses the reclaimed water may not be the organization which benefits most from the product.
Reclaimed water from a single wastewater source may be used by a number of water distributors.	The water may have a different level of benefit to each of the distributors.
Water reuse may reduce the required system peaking capacity of the potable water system, with associated savings in water treatment plant costs, transmission lines, distribution lines, and local storage.	Costs accrue to one organization, and the benefits accrue to another.

Perhaps the most important aspect of a reclamation project benefit cost analysis is the estimation of the project benefit. The potential economic benefit of a reclamation project is approximately evaluated by comparing it to the costs that would be associated with producing the same amount of water through a fresh water development project (e.g., a dam or reservoir). The cost of producing reclaimed water should be compared not with the current price of producing water from current sources, but with the incremental cost of obtaining water from other sources. This comparison may be distorted if the mechanism used to calculate the incremental cost of fresh water understates the environmental, social, and recreational costs of developing that resource.

From a statewide perspective, the incremental cost of water is generally defined as the cost that will be associated with fresh water projects which are the most likely next source of fresh water supplies. However, care must be exercised in accepting the costs estimates associated with these fresh water projects. As discussed above, such estimates may not reflect a true valuation of the environmental costs associated with fresh water development projects. Generally, the estimates reflect the engineering costs of the physical project, along with any required environmental mitigation costs. Frequently, they do not reflect the complete social costs of the project. Many environmental and recreational costs that are incurred by the public in terms of lost opportunities are not mitigated when dams and reservoirs are constructed. These costs are hidden since they do not require an expenditure of funds beyond those imposed by the environmental mitigation. Thus, any estimates of alternative fresh water supplies should be carefully examined before being used in comparison with a reclamation and reuse project.

Good economic and financial analyses identify project benefits and costs, ability to repay, and beneficiaries. This information is critical if a project is to be paid for by those who truly benefit from it. The issue of funding equity requires the identification of local, state, and national beneficiaries where appropriate. Additional funding sources should follow from such identification.

Recommendation

There is a great need for good economic and financial analyses in facilities plans. Economic analyses can demonstrate the justification for projects which have not been or are not presently perceived as viable. The distribution of costs and benefits needs to be identified so that institutional arrangements can be developed to allocate capital funds and project revenues providing project feasibility.

Implementation

The State Board and DWR should explore ways to increase assistance to local water and wastewater treatment agencies to assist in coordinated analysis of local, regional, and statewide costs and benefits, as well as financing options. These two agencies should consider participating in identifying projects that are cost-beneficial from a regional and state perspective, but may not be financially feasible at the local level.

Funding Equity

Through rational planning, projects can be identified that cross institutional and geographic boundaries. As noted in Table 4-3, examples can be found where project costs are incurred in one locale, but the benefits accrue to another. Appropriate institutional arrangements would allow for the costs to be borne by the beneficiaries. These arrangements would allow equitable funding in situations such as those described in Table 4-3 and elsewhere in this chapter.

Recommendation

Institutional changes are needed so that projects cost effective at a regional or state level are financially feasible.

Implementation

The State Board should encourage cooperative agreements whereby regions and districts with high incremental water supply costs assist in financing the reclamation of water in regions with lower incremental water costs, where such agreements can increase the amount of water available to the regions facing high incremental costs. This policy should be put in place in cases where such agreements can 1) increase the amount of water available to the regions facing high incremental costs and/or 2) increase the amount of water available to the regions facing high incremental costs without reducing the quality of the water used by either jurisdiction for the affected purposes.

FUNDING ISSUES

Funding is identified in the survey as a significant barrier to developing reuse in the state. Currently, the relative financial viability of reclamation is improving as the incremental costs of developing alternative fresh water supplies escalate in areas where demand is outpacing supply. However, because of the monetary disparities described above, most reclamation projects must receive external financing support, even in areas where the incremental cost of water is high.

This section suggests policy changes which, if implemented, would increase funding for reclamation projects. Reclaimed water projects are expensive; therefore, federal, state, regional, and local financial assistance will be beneficial. Increased financial assistance to reclamation projects is warranted due to the state's limited reliable water supplies and the ability of reclaimed water to augment those supplies for non-potable uses.

Table 4-4 summarizes general funding issues and associated recommendations and implementation strategies. More detailed information is provided in the following subsections on capital financing and operations and maintenance/energy costs.

Table 4-4
SUMMARY OF FUNDING ISSUES

Description	Recommendation	Implementation
Capital Funding	Increase federal financial support for development of reclamation projects.	Congress should provide the USBR with appropriations for the development of reclamation in California.
	Increase state financial support for development of reclamation projects.	The state legislature should pass bond laws and metering and pumping charges to provide grants and loans.
		DWR should at a minimum encourage economically and financially justified water reclamation projects as part of the State Water Project's Local Projects Program.
	Develop regional financial support for subregional and local subregional reclamation projects.	Regional water agencies should provide capital financing assistance through increases in revenues.
	Develop local financial incentives to increase reclaimed water use.	Local agencies should provide water rate structures to encourage the use of reclaimed water.
		Local and regional agencies should examine the feasibility of privatization.
O&M/Energy Costs	Develop programs to help defray some of the O&M costs of reclamation projects.	The state legislature and regional water agencies should create rebate programs for agencies that develop reclamation projects.
	Develop low cost power supplies for reclamation projects.	The state should establish a statewide power authority to provide blocks of power at low rates to reclamation projects.

Capital Financing

The capital cost for water reclamation and reuse projects can be categorized into two major components: treatment costs and distribution costs. The former may include the capital costs of facilities providing upstream wastewater treatment, filtration, demineralization, trace organic removal, and nutrient removal. Distribution costs may include booster pumping, transmission, distribution, seasonal and regulating storage, and special direct use and monitoring equipment.

Reclaimed water project costs will vary by location. Some locations have indirectly benefitted from tertiary filtration treatment requirements imposed on inland wastewater treatment plants by Regional Boards. In these cases, the costs for projects are primarily the costs of distribution. Other locations have had to install additional wastewater treatment facilities to meet the appropriate reclaimed water quality requirements. In these cases, the water reuse project incurs both the additional reclamation treatment cost and the cost of distribution.

Progress in reclamation can be accelerated by the availability of additional funds. Progress also will be affected by the manner in which these funds are made available to local agencies (e.g., the efficiency with which loan programs are administered and the size of the loans approved).

Federal Funding

Recommendation. The federal government should financially encourage and support the development of reclamation projects through specific appropriations to the U.S. Bureau of Reclamation (USBR).

Implementation. Congress should provide the USBR with authorization and appropriations for the development of reclamation in California.

Currently, legislation is being considered in Congress that directs the Secretary of the Interior to undertake a program to investigate and identify opportunities for reclamation and reuse of wastewater. Senate Bill 485 (S.B. 485) would authorize investigations to identify potential uses of reclaimed water, current reclamation technology, and measures to stimulate demand for reclaimed water. Funding up to 50 percent may be available for studies to determine the feasibility of specific reclamation projects. The bill authorizes a feasibility study for a water reclamation and reuse system in southern California, a study of the potential of demonstration facilities for water reclamation in the San Diego and San Jose areas, and funding for the design and construction of the West Basin Reclamation Project in the Los Angeles area.

Federal funding of feasibility studies as suggested in S.B. 485 is advantageous to determine the possibilities of reclamation within a service area. For example, federal funding could be used to develop a regional project to deliver urban wastewater to agricultural regions. If S.B. 485 passed, federal funding may be appropriated to study the feasibility of a major wastewater distribution network which would collect treated wastewater from urban areas such as various reclamation plants in the Los Angeles area and deliver it to agricultural users in Riverside and Imperial counties. It is also conceivable that the USBR could be financially involved in a project which collects all wastewater from the San Francisco Bay Area and delivers it to the San Joaquin Valley for agricultural irrigation uses. If these projects proved feasible, Congress could appropriate in the USBR budget funding for 75 percent of the capital costs of the project. The state and local interests would fund the remaining 25 percent of the project costs. The support of the State Board, DWR, local agencies, agricultural interests, and legislators would be required to develop such a large scale project. The benefits would be statewide and nationwide because more water would be available for agricultural purposes. The use of more reclaimed water for agriculture would allow agricultural users to reduce their dependence on SWP surface supplies and make more of that water available for municipal and industrial uses.

State Funding

Recommendation. The state legislature should pass bond laws and a variety of water pumping and meter charges to provide grants and loans for reclamation development. In addition, DWR at a minimum should encourage economically and financially justified water reclamation projects as part of the State Water Project (SWP) Local Projects Program.

Implementation - State Bonds. In recent years, a total of $55 million in low interest state loans has been made available through the Clean Water Bond Law of 1984 and the Clean Water and Water Reclamation Bond Law of 1988. Loans are provided at one-half the interest rate paid by the state on the most recent sale of general obligation bonds. Repayments of the 1984 law go into a revolving fund for future loans. Up to $5 million in loan assistance can be provided for each project to be repaid over 20 years.

This report defines reclamation as a process whereby the state's reliable water supply is augmented. Continuing the policy of state funding of reclamation projects is correct in that all Californians will benefit from additional sources of water. The state legislature should approve legislation which allows the sale of bonds for the financing of water reclamation projects throughout the state. A portion of the funds raised by the sale of bonds could be for a state revolving loan program, and a portion could be for grants for smaller agencies who cannot afford loans. Both the loan and the grant program would be administered by the State Board.

The state legislature should pass bond laws to allocate millions of dollars for water reclamation projects. The State Board would be able to loan these funds to local agencies. Loans could be made for the full cost of design and construction of reclamation projects at an interest rate equal to one-half the rate that the state pays on general obligation bonds. The loan repayments would be used on a revolving basis to allow additional loans. A new bond law should contain sufficient funding to cover a five year or more period of demand. This would give agencies an incentive to invest in planning for reclamation projects because the availability of state funds would be assured for construction.

The state legislature should include financial provisions in the bond laws for the efficient administration of the state's funding programs. Without the resources to effectively administer programs, the development of reclamation programs will be hampered and delayed.

Implementation - Fee Systems. In the past, water reclamation bonds have been general obligation bonds financed by California's General Fund. Although this method of financing is theoretically feasible, there are many demands on the General Fund. Another financing method is to develop a revenue stream and then sell revenue bonds which are repaid with income from the revenue stream. The policy questions are: Who pays and how much?

We have already stated that all California benefits from the augmentation of the water supply that results from water reclamation. In California, the major water user is the agricultural sector of the economy, followed by the municipal and industrial sectors. Of course, other water users are fish and wildlife, recreation, and aesthetic values. This report focuses on municipal and industrial waste water reclamation. To the extent that reclamation can fill some of the demand for water in the growing municipal and industrial sectors, the other water users of the state benefit. Therefore, to raise revenue for reclamation, various fee systems on water delivery or pumping which ensure that all sectors of water use are assessed according to their relative demand for water are recommended. The following examples of fee systems could be considered for study. The studies should identify the legality and economic impacts of the fees.

- A charge on municipal and industrial use water meters could be used to develop a fund to provide grants to small agencies that cannot afford loans. This would require that municipal and industrial uses are metered. This fee would be perpetual in order to maintain a small grant program.

- A charge on water diversions and pumping volumes could be used in order to provide revenue for a reclamation revenue bond sale. Any such charge may consider the degree of benefit realized by the parties involved. The bond funds could support a reclamation revolving loan program.

- A charge on recreational and other beneficial water uses could help support a reclamation revolving loan program.

- A charge on agricultural water delivery could fund a statewide revenue bond for the construction of large conveyance and storage systems to take urban reclaimed water to agricultural areas. This charge could also be used for repayment of state revenue bonds to finance the non-federal share of the project. Financing for treatment costs could come from a revolving loan program. California agriculture benefits from a more reliable source of irrigation water by using reclaimed water, and urban users benefit from a more reliable source of drinking water because agriculture would be using less potable water.

State Water Project

DWR would appear to have the legal and contractual authority to incorporate reclamation projects as part of the SWP within its Local Projects Program. Because it would be comparing the cost of the reclamation project to the cost of expensive new fresh water supplies, not to the average price it sells the water for, DWR could have more financial incentive to participate in construction of local reclamation projects.

The SWP charges its contractors for water at a price reflecting an average or melding of the costs of all existing sources of water plus the cost of transporting the water to each contractor. The regional and local water suppliers add their costs of treatment and local distribution to the price charged to the water user.

The SWP is searching for new sources of water, most of which will cost significantly more than its existing facilities. The cost of these new water developments should be the benchmark to compare the cost of a water reclamation project within the SWP service area. However, a local agency considering constructing a reclamation project will compare its cost to the price it pays the SWP for water, not to the cost of new fresh water development. The cost of a reclamation project may fall in between the cost of a new water supply and the price charged for fresh water, i.e., too expensive, from the local agency's viewpoint. Therefore, DWR should at a minimum encourage reclamation projects as part of the SWP's Local Projects Program while retaining the final discretion for incorporating a local project into the SWP. In this way, the SWP can spread its capital investment in a water reclamation project among all water contractors that benefit from the displaced or delayed investment in expensive new fresh water projects.

Regional Funding

Recommendation

Large water agencies that provide regional service should financially support the development of subregional and local reclamation projects.

Implementation

Water developed through local reclamation projects displaces a demand for potable water, which can be used elsewhere in the service area, thereby providing a regional benefit. Large regional water agencies should provide assistance for capital funding to subregional and local agencies that develop reclamation projects which reduce a demand for potable supplies. Revenues may need to be increased to provide the capital assistance.

Another method to promote reclamation projects on a regional level is for large regional or county agencies to finance studies of the potential for reclaimed water in local areas. For example, the San Diego County Water Authority's Financial Assistance Program provides funds to assist agencies involved in water reclamation facilities planning, feasibility investigations, preliminary engineering studies, and related research projects.

Local Funding

Recommendation

Local agencies should examine potable water rate structures and make appropriate changes to encourage the use of reclaimed water.

Implementation

Because of the costs of advanced treatment, pumping, and dual distribution systems, the cost per acre-foot of producing and distributing reclaimed water frequently exceeds the cost of producing and distributing fresh water. However, it is generally not feasible to charge more for reclaimed water than for fresh water or to force new users to assume all of the incremental costs associated with development of water supplies. This problem can be solved by a combination of 1) external (e.g., state-level) financial support for local water reclamation projects and 2) spreading the cost for new projects across the local rate base so that users of fresh water help subsidize the development of non-potable sources. It is also appropriate for higher rates to be charged for potable water where reclaimed water is available and fresh water is being used for non-potable purposes (e.g., irrigation). The higher charges can provide financial support for reclamation projects, while providing an economic incentive for customers to finance internal plumbing changes needed to use reclaimed water.

In another approach, local agencies could work with developers of new communities to provide reclaimed water for landscaping and other approved uses. The costs could be shared by the local agency and the developer. For example, the local agency would pay for the treatment, and the developer would pay for the delivery and distribution systems.

Privatization is another possibility for developing reclamation projects. Costs would be covered by private companies that would sell the reclaimed water to areas that cannot get the water needed for landscaping, irrigation of crops, and other uses. Privatization becomes feasible when water is scarce, wastewater is relatively inexpensive, and there are strict regulations about the use of potable water for non-drinking purposes.

Operation and Maintenance (O&M)/Energy Costs

O&M costs primarily include the cost of energy associated with additional treatment and pumping. Water reclamation projects have historically been relatively small and geographically dispersed, unlike more conventional water supply projects, which are regionally planned. Consequently, these reclamation projects have had to purchase energy from public utilities at market rates. Compared to the major water supply projects, which have developed low cost power supplies, reuse projects have had to bear higher unit operation costs.

Recommendation - O&M Costs

Programs should be developed to help defray some of the O&M costs of water reclamation projects.

Implementation

As previously discussed, the state loan program should be expanded to include rebates to local agencies that develop reclaimed water projects that replace potable water demand. The rebates could be given for each acre foot of reclaimed water produced to offset project O&M costs. The amount of the rebate may be based on the avoided cost to the state of developing new water supplies.

Rebate programs also should be developed by large regional water agencies. For example, the Metropolitan Water District of Southern California (Metropolitan) established the Local Projects Program in 1981 to financially assist local agencies in the development of reclamation projects that reduce the demand on Metropolitan's imported supplies. Metropolitan contributes $154 per acre foot of reclaimed water produced and delivered by qualifying projects. Other regional agencies should implement similar programs for financial assistance.

Recommendation - Energy Costs

Low cost power supplies should be developed for reclamation projects.

Implementation

A state power authority should be formed to purchase large blocks of power at low rates for distribution to water reclamation projects throughout California.

REGULATORY ISSUES

Several constraints to reclamation derive from policies, procedures, and other activities of regulatory agencies. Key issues identified in the survey conducted for this report are summarized in Table 4-5. These specific issues are described later in this section. First, a philosophical overview is provided.

Water reclamation projects can get caught between sometimes conflicting intense public anxieties: fear of physical danger (i.e., that the world is not safe for humans or for parts of the ecosystem that support humans) and fear of scarcity (fear that there will not be enough water unless we conserve and reclaim it). The fear of physical danger is translated into protective legislation and regulations. The constraints associated with these protective mechanisms have been and will continue to be significant in their impact on water reclamation opportunities.

Within the water quality arena, there is another dilemma of competing values: consistency versus fairness. A frequently-mentioned barrier to reclamation planning is the shifting nature of the regulations that govern it and the inconsistent application of these regulations over time and in different geographical locations. To some extent, this variation may result from differences in local conditions and in the personalities and perspectives of regulatory staff in different localities.

Another significant factor, however, is the continuing expansion of both technical information on and public concern over possible water quality hazards. A project implemented at considerable cost at one point in time, with the approval of regulatory agencies, may not meet regulations set at a later time. Problems can emerge if communities are asked to abandon or revise at great expense projects that have been in place for years with no measurable ill effects on public health. Should consumers in different parts of the state to be exposed to different levels of risk?

Table 4-5
SUMMARY OF REGULATORY ISSUES

Description	Recommendation	Implementation
Health Criteria	Revise Title 22.	Revise criteria based on actual experience with a view towards maximizing use of reclaimed water.
	Develop guidelines.	Industry establish minimum quality requirements.
	Provide/revise local/regional plumbing codes.	Regulatory agencies apply guidelines in uniform manner.
Waste Discharges	Designate reclaimed water as a resource.	Revise federal Clean Water Act.
		Revise California Water Code.
Water Quality Control Plans for Inland Surface Waters and Enclosed Bays and Estuaries	Identify and establish distinct criteria for reclaimed water dominated water courses.	Revise federal Clean Water Act.
		Revise California Water Code.
Regulatory Project Approval	Coordinate timely and consistent reviews.	DOHS, Regional Boards, and county health departments provide sufficient staff and training.
		State Board provide staff to work concurrently with Regional Boards.
		Develop methods to streamline permitting.
Source Protection	Protect reclaimed water quality.	Enact state legislation prohibiting certain discharges into sewer systems.
		Develop local regulations.
Planning Mandates	Formalize/codify data-gathering efforts.	Update reclamation survey and urban water management plans.
	Encourage broader reuse.	Amend Section 13550 of Water Code and establish mandatory reclamation ordinances.
		Establish a work group to evaluate how to expedite projects.

To resolve these dilemmas, the same goals should be set for all projects, but pre-existing projects should be allowed to work toward those goals in a phased manner. Communities will be reluctant to develop reclamation projects if they must chase ever-escalating regulatory demands with the added risk that the projects built today may be declared obsolete tomorrow.

Health Agency Criteria

In California, many reclamation projects are currently operating successfully. DOHS and local health and regulatory agencies have been integrally involved in both the development and the operation of all these projects. The noticeable absence of health incidents is a tribute to the cooperative efforts of health officials, engineers, and plant operators.

In the past decade, there have been numerous improvements in the design and operation of reclamation facilities, as well as in health monitoring and analysis. For this reason, the DOHS is currently reviewing and revising the decade-old Title 22 Wastewater Reclamation Criteria regulations in an attempt to safely expand the range of possibilities for reuse.

Title 22 Criteria

Recommendations

- DOHS should encourage participation of professionals from both the water reclamation industry and health field in order to develop/revise regulations that protect public health and are attainable.

- DOHS should review and update its regulations periodically to reflect technological advances, new research efforts, and new uses.

Implementation

- DOHS should support research in specific areas of concern. One such area would be fate and transport of organics, particularly with respect to groundwater recharge with reclaimed water.

- The state, through legislation, should require DOHS to implement periodical review of regulations.

Guidelines

Recommendation

- Uniform guidelines for use of reclaimed water should be developed by the industry, in cooperation with regulatory agencies, specifying minimum standards to protect public health and to facilitate reuse. Such criteria should be based on experience gained to

date at water reclamation projects nationwide, listing appropriate practices "generally recognized as safe."[6]

Implementation

- WateReuse, the American Water Works Association (California-Nevada section), and other industry groups, in cooperation with health and regulatory agencies, should write and adopt guidelines.

Building and Safety, Planning, Plumbing Criteria

Local regulators in a variety of areas have tremendous influence on water reuse plans and prospects and will continue to do so as emerging uses of reclaimed water become more widespread. Often, personnel in these positions lack the necessary technical expertise and rely on their public health counterparts for leadership. Occasionally, preconceived and outdated notions about risks of use of reclaimed water are allowed to become major obstacles to project planning and implementation.

Recommendation

The ripple effect of the attitudes of public health agencies' personnel underscores the importance of an enlightened public health regulatory framework. It is recommended that an educational/promotional effort be launched, preferably by a fully staffed reclamation program at DWR and/or by professional associations. This effort should be aimed at all state and local regulatory agency personnel having direct and indirect jurisdiction over water reuse. It should be planned to convey effectively the safety record of the existing water reuse practices in this state, in addition to the results of the many studies and surveys conducted to date.

Reclaimed Water Discharges

In the California Water Code, reclaimed water is considered waste, and the use of reclaimed water is permitted analogous to a waste discharge. As stated in the Code, waste includes sewage and any and all other substances associated with human habitation or of human or animal origin.

---

[6]The Federal Good and Drug Administration uses the concept "**Generally Regarded as Safe,**" abbreviated as **GRAS**, to designate those foods, drugs, and practices it has determined to be safe because of the established record and accumulated experience. This concept is sound and can be used by other regulatory agencies in their determinations of safety of water reuse options. It would be particularly valuable where "proof of absence" of pathogens is a practical impossibility.

Recommendation

Reclaimed water supplies are an important element in meeting future water demands and should be designated as a resource rather than a waste. A separate classification for reclaimed water would acknowledge of the importance of this vital resource. The classification would emphasize the inherent benefits of reclaimed water that may not otherwise be considered if it is classified as a waste. Recognition of reclaimed water as a resource will improve public acceptance of water reclamation.

Implementation

With review and potential revisions to the federal Clean Water Act being considered in spring 1991, EPA's Region 9 should consider revisions to the Clean Water Act that would identify the beneficial uses of reclaimed water supplies instead of identifying these supplies solely as a waste discharge.

Such legislation is currently being considered by the State Board and others. The State Board should continue to support legislation that would designate reclaimed water as a resource and establish a classification within the Water Code for reclaimed water discharges.

Water Quality Control Plans for Inland Surface Waters and Enclosed Bays and Estuaries

Several existing water reclamation projects in the state presently support aquatic habitat solely as a result of the discharge of reclaimed water. Many other projects are being planned which will create reclaimed water dominated streams. The economic viability of each of these projects is closely tied to the use of these natural channels for conveyance of reclaimed water. The new projects are also expected to provide net benefits to fish and wildlife. Further environmental benefits may be realized by substituting these reclaimed water supplies for water that would otherwise be diverted from the Sacramento-San Joaquin Delta.

The State Board is currently formulating Water Quality Control Plans for Inland Surface Waters and Enclosed Bays and Estuaries[7]. These plans are being prepared in response to a federal Clean Water Act mandate requiring each state to adopt water quality objectives for inland surface water and enclosed bays and estuaries for those pollutants that could reasonably be expected to interfere with beneficial uses. Water quality objectives adopted could have a major impact on any existing or future reclaimed water discharges to inland waterways.

[7]During the preparation of this report, the State Board adopted these plans in April 1991.

Water quality criteria established in the Water Quality Control Plans should maintain the integrity of our public water supplies and provide aquatic protection consistent with current and historical beneficial uses. Water quality criteria should also provide the regulatory framework to allow transfers of reclaimed water to the market via natural stream channels.

Recommendation

The following basic recommendations are being offered to the State Board when formulating the Water Quality Control Plan for Inland Surface Waters:

- The State Board should establish a distinct set of criteria for reclaimed water dominated water bodies.

- The State Board should clearly define and identify reclaimed water dominated water bodies within the Water Quality Control Plans. It is recommended that existing and potential reclaimed water dominated water bodies be defined as water bodies which support aquatic habitat beneficial uses solely as a result of the discharge of reclaimed water or where the discharge of reclaimed water represents a significant portion of the medial dry weather flow.

- The State Board should recognize the net environmental benefit to surface and/or ground waters created by reclaimed water discharges to ephemeral streams. The importance of both water quality and quantity should be considered. Many in-stream fish and wildlife benefits would and will not exist under natural conditions without reclaimed water discharges.

- Consideration should be given to the economic and social impacts resulting from adoption of water quality criteria.

Implementation

With review of and potential revisions to the federal Clean Water Act being considered in 1991, the Environmental Protection Agency should consider specific standards for water courses dominated by reclaimed water and/or used to store and convey reclaimed water. Reclaimed water dominated water courses should be clearly defined and identified.

The State Board should incorporate the Clean Water Act revisions into the California Water Code specifically addressing Water Quality Control Plans and Basin Plans. Reclaimed water dominated water courses should be clearly defined and identified.

Regulatory Project Approval

Regulatory agencies such as the State Board, Regional Boards, DOHS, and county health departments are all decisive players in the planning and implementation of water reclamation projects. They examine possible impacts to public health, water quality, and the environment. Planning and implementation of water reclamation projects could entail numerous interactions with these agencies prior to project approval.

Recommendation

Regulatory agencies, in handling water reclamation project approvals, should strive for timely and consistent reviews essential to maximizing reclaimed water use.

Implementation

To maximize reclaimed water development in a consistent and expeditious manner, appropriate staff and resources should be allocated by federal, state, and local agencies to review, evaluate, and assist those agencies seeking to implement water reclamation projects.

State Water Resources Control Board

The State Board should dedicate staff to work concurrently with each Regional Board during the development of basin plans and granting of permits. This will reduce the review time needed by the State Board after the Regional Board has recommended an action. In addition, in administering the Water Reclamation Loan Program, the State Board and staff should expand existing steps to streamline the loan application review and approval process by standardizing the economic and financial feasibility analyses and working with local agencies to facilitate the standardized approach.

Regional Water Quality Control Board

Regional Boards should dedicate staff to review reclamation projects and develop methods to reduce the lengthy process of permit issuance in order to maximize reclaimed water uses. For example:

- The San Francisco Bay Regional Board issued Order 90-085 to allow certain pre-approved waste dischargers (treatment plants) to issue their own permits for the use of reclaimed water. Specific guidelines are included in the Order that were derived from Title 22 for use of reclaimed water in areas that have restricted public access.

- Several water districts have obtained "purveyor permits" through their respective Regional Boards which allow them to issue permits in compliance with Title 22 for the use of reclaimed water, thus eliminating the need to formally permit each reclaimed water user through the Regional Board.

State Department of Health Services

Interpretations of Title 22 are sometimes required for a variety of possible treatment designs or applications. To handle the work necessary to review proposed water reclamation projects, adequate DOHS staff and resources should be dedicated to ensure that the reviews are timely, well-reasoned, and consistent. (Consistency is defined as the approval of similar treatment processes for similar uses throughout the state. This requires that DOHS staff be given clear policy directives and clear operational guidance.) In addition, DOHS should develop guidelines for county health departments to apply state regulations uniformly. Their goal should be to encourage safe reclamation.

County Health Departments

Local county health departments should have the authority to enforce uniform DOHS regulations. Local producers and users of reclaimed water must foster a cooperative relationship with the county health agencies in order to ensure a successful reclamation project. The health agencies should dedicate sufficient staff and training to approving reclamation projects.

Source Protection

The quality of the influent to a reclamation plant is of primary importance to the production of a high quality effluent. High salinity influent will result in a saline reclaimed water with limited reuse potential. Total Dissolved Solids (TDS) concentrations in sewage are generally 300 mg/l higher in TDS than potable water after residential use. If TDS concentrations exceed 1,000-1,200 mg/l, the potential for reusing that water would be greatly reduced. Conventional treatment operations cannot reduce the additional TDS loads induced by industrial or point discharges to a level acceptable for unrestricted reclaimed water use.

As the use of reclaimed water for groundwater recharge becomes more widespread, source control will be increasingly important to address constituents of concern to health and regulatory agencies.

The quality of the source of influent water is dependent on: 1) the quality of the potable water served in the area, 2) the quality of the waste discharges to the reclamation plant's service area, and 3) the quality of other water that enters the sewer system, such as seawater or brackish groundwater.

A recent San Diego study concluded that approximately 50 percent (100 mg/l) of TDS in excess of that which can normally be attributed to typical domestic water use in San Diego, was from self-regenerating water softeners.[8] The high TDS levels result in greater capital costs and energy costs, which are eventually passed on to the end users of the reclaimed water system. Thus, TDS levels can jeopardize the economic feasibility of a proposed project.

Recommendation

- Waste discharges to the sewage system from industrial, commercial, or residential services should be restricted or prohibited if the discharge involved is found to be capable of causing substantial damage or harm to any user or potential users of reclaimed water within an area which has been planned for reclaimed water.

Implementation

- Modify industrial pretreatment programs, including improved monitoring and enforcement to protect wastewater which is or can be used as a source for reclaimed water.

- Separate treatment of industrial waste from domestic waste so that reclamation plans receive the highest quality wastewater.

- Enact state legislation which will prohibit certain discharges to the sewage system, such as brine discharge from automatic softeners to the sewer system, and also ban use of self-regenerating water softeners in areas either currently or potentially tributary to a water reclamation plant.

- Maintain sewer distribution (collection) systems so that contamination from other sources (i.e., infiltration/inflow, seawater intrusion, etc.) is not allowed.

Planning Mandates

Data-Gathering Efforts

The information gathered through the statewide survey conducted for this report is vital for policy makers; however, the information changes rapidly. Also, the information will give a truer picture of the progress of reclamation efforts in California when it is compared with other data, such as the amount of wastewater produced, water conservation savings, population growth, etc.

---

[8]San Diego County Water Authority and City of San Diego Rancho Bernardo Water Softener Impact Study, Phase I (3/89) and Phase II (2/90).

Recommendation. State and local agencies should formalize/codify data-gathering efforts.

Implementation

- A state agency should be assigned to update the existing survey and expand it to include 1) incidental/indirect reuse, 2) reuse of agricultural wastewater, 3) groundwater cleanup, and 4) seawater desalting. This effort should be made every five years in parallel with the update of urban water management plans required by AB 797 (Chapter 1009) and AB 2661 (Chapter 355).

- The updated survey data should be incorporated into the DWR updates of the California Water Plan to enable the above-mentioned comparisons with population growth and other factors.

- The state should pass legislation requiring water utilities, as part of their five-year updates of Urban Water Management Plans, to include a Water Reclamation Master Plan that identifies: 1) high volume water users within potential service area, 2) planned high-rise office buildings, industries, and other high-volume water users, 3) water quality and quantity requirements of potential reclaimed water customers, and 4) cost of providing reclaimed water to potential customers.

Broadened Reclaimed Water Use

The California Water Code (Section 13550) states that the use of potable water for the irrigation of greenbelt areas is a waste or an unreasonable use of such water where reclaimed water of suitable quality is available.

Recommendation. State legislation should be passed to amend Water Code Section 13550 to include not only the irrigation of greenbelt areas, but all non-potable water uses that can be served with reclaimed water.

Implementation. To implement Section 13550 of the Water Code, the state should pass legislation requiring cities and counties to adopt in cooperation with the local water purveyor a Water Reclamation Ordinance. The legislation should instruct the DWR to draft a Model Water Reclamation Ordinance to be available for local use. If a city, county, or district has not adopted its own ordinance by January 1, 1993, the model ordinance would immediately go into effect at the local level.

The Model Reclamation Ordinance should include, but not be limited to, the following provisions:

- Identification of existing and future reclaimed water users.

- Prohibitions on the use of potable water for non-potable uses where reclaimed water is available at a reasonable cost and meets human health and environmental requirements for the intended use.

- Mandated installation of dual-distribution systems in new construction to allow for the use of reclaimed water for: 1) irrigation (e.g., cemeteries, golf courses, and parks) and 2) other non-potable uses (e.g., toilet flushing in non-residential buildings, industrial cooling tower make-up) where reclaimed water will be available for non-potable purposes.

- Mandated installation, beginning at the supply meter, of separated landscape irrigation system piping for new construction in urban area.

Additionally, the state should adopt legislation mandating that operators of publicly owned treatment works use best efforts to provide reclaimed water to interested potential users through the local water purveyor in a timely manner and upon terms and conditions which encourage the maximum use of reclaimed water in accordance with the legislative policy set forth in Water Code Section 13550.

Expedited Reclamation Projects

Management practices that can be applied at a general level to reclamation include conducting feasibility studies to determine the amount and type of reclamation that is economically feasible, safe, and appropriate for a specific area.

Reclamation programs are by nature site-specific. All feasible uses of reclaimed water should be studied in all parts of the state. However, a use that is feasible and appropriate in one part of California (i.e., groundwater recharge) may not be possible in another.

Implementation of reclamation projects requires the involvement, approval, and support of a number of agencies, including state and local health departments and Regional Boards. Further cooperation among these groups would greatly assist in implementing reclamation projects. It may be possible to develop a Memorandum of Understanding or similar vehicle to formalize this cooperation.

Recommendation. The State Board should consider establishing a work group to evaluate the feasibility of a formal mechanism to expedite reclamation projects. Such a group would need to include representatives from the appropriate state, regional, and local regulatory health and water quality agencies, potential users, and local water and wastewater agencies, because no reclamation project can be implemented without their support.

INSTITUTIONAL ISSUES

Some institutional issues have been touched upon in the recommendations above. Table 4-6 summarizes the institutional barriers to water reclamation and recommends actions to resolve the constraints.

Table 4-6
SUMMARY OF INSTITUTIONAL ISSUES

Description	Recommendation	Implementation
Interagency Coordination	Broaden the planning process.	Review existing laws.
	Establish "Just Compensation Agreements."	
Interdepartmental Lines of Responsibility		Restructure existing departments.
	Redefine responsibilities.	
Anti-Paralleling Laws	Enact legislation to remove conflicts.	Develop consensus for legislation.
Institutional Inertia	Educate public servants.	Provide advancement incentives.
Barriers to Export and Exchange Agreements	Facilitate multi-party projects.	Establish a study organization.

Interagency Coordination

The traditional perspective of a single-purpose agency and single-source funding is no longer viable, particularly when environmental impacts and their mitigation are considered. Some water reclamation projects will involve two or more cities or counties, either as users or producers of reclaimed water. In such instances, the geographic entities may not be able to work together without the assistance of a regional third party with an overview interest in implementation of water reclamation.

The most common example of interagency coordination is where the wastewater management agency which produces the reclaimed water is not the water purveyor within the reuse area. Effective communication and cooperation between both agencies regarding distribution of reclaimed water and providing service to the water customer is vital. It should begin early in the planning process, even before the public is involved. This would assure the water purveyor that its service is not duplicated, enable interagency agreement on project development and implementation, and help avoid unnecessary delays that could jeopardize a project.

Success of water reclamation, particularly in developing communities, depends on effective coordination between the land use planning agency and the water reclamation agency. Many existing water reclamation ordinances in Southern California now require that the land use planning agency mandate the use of reclaimed water as a condition of development approval.

Some of the major reclaimed water customers include parks departments and school districts. Effective communication and coordination between these water users and the reclaimed water purveyor is also necessary in maximizing reclaimed water use.

The cooperation and support of regional and state agencies is also key to the success of a water reclamation program. Comprehensive planning and the environmental review process involve input and feedback from local jurisdictions. The process contributes to the development of positive working relationships among the involved entities.

Recommendations

It is recommended that the laws protecting water purveyors against competition within their service areas be reviewed by the State Board or by DWR. If necessary, these laws should be amended so that they are not used to discourage water reclamation. Cooperative agreements with reclaimed water purveyors should be reached providing for "just compensation" for the water purveyor.

Planning should be initiated early, in tandem with environmental evaluation. The process should be open with solicitation of input from all potentially affected agencies and neighboring jurisdictions. It is recommended that planned projects be widely publicized at the earliest stages of conception. Open public meetings, widely advertised, and held at the earliest stages of planning, help bring public concerns and perceived impacts to the forefront of problem solving when change is relatively inexpensive.

Interdepartmental Lines of Responsibility

Very often, divisions of responsibility established long ago among different departments of a local jurisdiction become obstacles to implementation of water reuse projects. Typically, the department that handles wastewater management services perceives its role strictly to be limited to its legal obligation to treat and dispose of the wastewater effluent. That department does not want to be responsible for the treated water outside the boundaries of the treatment plant. On the other hand, the water utility for the same city is typically uninterested in any source of water that is not "pristine," or nearly so.

In vogue in today's emerging democracies is the Russian word *Perestroika*, meaning restructuring an existing, antiquated system to meet the needs and conditions of present-day realities. Recognition of the need for such restructuring is the first positive step toward solution of the problems created by a system which may be unresponsive to today's needs. Obviously, such restructuring is not expected to meet universal and immediate acceptance, particularly from those in the system most directly affected by the needed change. It is important to maintain clear communication with the persons affected and involved in the restructuring and to present the change as an opportunity for better service to the community.

Recommendations

In recent years, a few cities and counties have restructured their departmental responsibilities to take into account the need for a water reclamation function. The blurred divisions of labor in this area are gradually clearing. It is recommended that jurisdictions embarking on water reclamation begin to evaluate the possibility of redefining the responsibilities and authorities of their existing departments in regard to water reclamation. An analysis of the existing lines of responsibility can lead to identification of areas in which water reclamation often "falls through the cracks."

Anti-Paralleling Laws

State anti-paralleling laws are generally interpreted to prohibit a community desiring to distribute reclaimed water to users within its jurisdiction from competing with a private water utility which serves the same clients. This type of conflict has stymied numerous water reclamation projects in California.

Recommendation

It is necessary to amend the law and to provide for stronger language in favor of water reclamation, where appropriate. Protection of water suppliers which serve potable water from competition should be made consistent with reclaimed water service to non-potable water users.

Implementation

Water reclamation organizations should work with water suppliers statewide to develop a consensus for consistent legislation promoting water reclamation and protecting water suppliers from unfair competition.

Institutional Inertia

While water reclamation has a long history, it is a new endeavor for many water supply agencies. Water reclamation would represent a change: people and agencies tend to resist change. Major change elicits major resistance. This resistance may manifest itself as inertia tending to preserve the status quo.

Recommendation

It is recommended that agencies and departments with responsibility for water reuse develop new employee education programs which validate the necessity of water reuse and demonstrate support for recycling by all levels of responsibility. Such educational programs should be designed to discredit mistaken notions, perceptions and prejudices that might exist in the minds of employees in regard to water reclamation. These programs can also include the basic elements enumerated in this report to combat constraints to water reclamation under various conditions.

Implementation

Advancement incentives could be provided for managers and employees geared to their understanding and active pursuit of new water reclamation policies. Goals and objectives models could be provided for individual managers to adopt in the course of their job performance evaluation process.

Reclaimed Water Export/Exchange Opportunities

This section has been included to provide some thoughts on the concept of multi-party reclaimed water export/exchange projects and how these might be financed. It expands upon ideas previously introduced in the this chapter.

The components of reclaimed water exchange programs are: 1) a source of reclaimable wastewater, 2) irrigation, groundwater replenishment, industrial, recreation, or impoundment uses in which reclaimed water can be substituted for existing fresh water supplies, and 3) a fresh water purveyor which needs improved supply reliability and/or supply augmentation.

In the simplest cases, the components are met within the jurisdiction of one agency. In more complex situations, multi-party arrangements are necessary to provide the necessary components. Examples of potential reclamation exchange programs are:

- A multi-party project might have reclaimed water collected from one agency participating in the SWP and pumped to another agency participating in the CVP. The saved CVP water would then be pumped from the Delta for export to southern California via the SWP. Financing would be made by SWP contractors benefiting from the exchange.

- An inland wastewater agency that is facing difficulties in disposing of its treated wastewater, together with a neighboring water supply agency that has available groundwater storage capacity but insufficient water supply to support future water growth, would agree to a program where reclaimed water would be exported into the other agency for groundwater replenishment. This would reduce the disposal problem in the wastewater agency area and provide an additional water supply to the neighboring water agency.

- A water agency needing additional water supply could provide financing for a reclamation project in a neighboring agency that has surplus water in exchange for a portion of the surplus water.

Recommendation

The State Board should support the development of large reclaimed water projects through multi-party arrangements. Because of the institutional complexity of this nature, a study organization consisting of the State Board, DWR, USBR, and the appropriate local agencies should be formed.

User Agreements

Agreements between purveyors and users of reclaimed water are often complicated by some of the following:

- Interruptibility of supply
- Potable water back-up supply
- Reliability of water quality and guarantees
- Indemnification against third party lawsuits
- Price of reclaimed water, incentives for its use
- Cost sharing for on-site retrofit to meet requirements
- Collective bargaining with labor

- Discharge of effluent after reuse
- Responsibility for regulatory interface
- Signage at reuse site and public disclosures

Numerous agencies throughout the state have executed successful agreements with potential users, providing excellent models for emulation.

Recommendation

It is recommended that agencies negotiating agreements with new potential users of reclaimed water review the experience of similar agencies and in turn share their successes and failures with others. Professional water reuse associations should prepare compendia of sample agreements for use by suppliers and users of reclaimed water.

It is also recommended that the proposed State Office of Water Reclamation--if one is formed--provide an initial facilitation role, when requested, between users and purveyors of reclaimed water.

OTHER

Additional constraints to the development and implementation of water reclamation projects include issues surrounding planning efforts, legal responsibilities, and public acceptance. Table 4-7 summarizes the general issues and associated recommendations and implementation strategies for resolving these additional constraints. More detailed information is provided in the following subsections on coordinated planning, legal, and public acceptance.

Table 4-7
SUMMARY OF ADDITIONAL CONSTRAINTS TO RECLAMATION

Description	Recommendation	Implementation
Planning	Include the USBR in planning efforts.	Amend S.B. 485.
Legal	Resolve property rights and liability considerations.	Initiate a review of legal issues.
Public Acceptance	Educate the general public about reclamation.	Develop public education materials and conduct meetings, tours, etc.
	Include the general public in the planning phase of reclamation projects.	Form Public Advisory Committees.

Coordinated Planning

In addition to the state and local planning mandates discussed in the regulatory issues section, participation by the federal government could further the development and implementation of water reclamation programs.

Recommendation

S.B. 485 should be amended to include studies of potential reclamation projects throughout the state of California. The amended legislation should require the USBR to initiate planning activities for a "backbone" reclamation system for all of California. Local reclamation agencies, the DWR, and the USBR should work with the sponsors of the federal bills to implement the proper amendments.

Legal Issues

Two areas of legal concern with respect to water reuse are: property rights and liability considerations. The major legal question in water reuse is one of ownership: does the original owner retain ownership after this water has been used once? What rights do the downstream users have against an intervening reuse? Liability, as part of water reuse, relates to injury to person or property, breach of contract, quality of water, and default of expressed or implied warranty.

Recommendation

An independent group, such as the WateReuse Association of California, should establish a Review Task Force to identify legal issues affecting reclamation and to recommend solutions.

Public Acceptance

Professor William Bruvold of the University of California has studied public attitudes toward water reuse in California over the past two decades. His studies point out a steady shift toward increasing positive attitudes with respect to all uses of reclaimed water. This has been particularly true of the areas where use of reclaimed water has been an ongoing practice, such as in the Irvine Ranch Water District service area. The higher the level of education and familiarity with the subject, the more favorable has been the response.

Without public acceptance it would be difficult for any local government or special district to site, finance, construct, and operate a water reclamation project. Public acceptance is necessary for every aspect of a reclamation project, including:

- siting or treatment facility, delivery system, and application
- environmental impacts
- quality of reclaimed water and specific use
- safety of operation and protection of public health
- cost, cost allocation, and financing
- construction impacts

If any one aspect of the reclamation project is not acceptable to the public, full project implementation may be jeopardized.

Public acceptance is complicated by the fact that the public is not a single homogenous entity, but rather a variety of interest groups and community groups with specific and sometimes conflicting interests. One group may support an application of reclaimed water which does not allow for alternative siting or the treatment facilities, while another may not support the siting and may have concern about the construction aspects of the project. Both groups, however, may support the overall goal of reclaimed water development and use. These two groups can be reconciled, but the project will take longer to implement.

Successful water reclamation projects are one of the most effective ways to develop public acceptance. By actually seeing and learning about efficiently operated reclamation treatment plants and properly used reclaimed water, the public will gain a better understanding of and willingness to support current and future water reclamation projects.

Recommendations

Local entities interested in implementing a reclamation program should develop or participate in the development of public education programs aimed at the specific local community and its needs. The public education program should include:

- the need for augmenting water resources
- the economic and environmental benefits of reclamation
- the public health and safety precautions
- protections associated with reclamation

Public education should be supplemented by public involvement. Specifically, the public has to accept the financing of the project, the facility siting, and the use of the reclaimed water. The best way to ensure this acceptance is to involve the public in project development through citizen advisory committees, public workshops, public education programs, and the environmental review process.

APPENDICES

SOUTHERN CALIFORNIA WATER COMMITTEE, INC.

17752 SKYPARK CIRCLE • SUITE 120
IRVINE, CALIFORNIA 92714 • 714-261-7466

July 3, 1989

Theo Nowak
former General Manager
Chino Basin Municipal WD
1764 No. 1st Avenue
Upland, California 91786

Dear Theo:

The State Water Conservation Coalition (SWCC) is in the process of forming four technical task forces. At the Coalition's June meeting you were recommended for Convenor of the Reclamation/Reuse Technical Task Force. The purpose of this letter is to invite your participation on this task force.

Coalition members agreed to establish four technical task forces to compile relevant information, as follows:

- Urban Conservation (includes water metering)
- Agricultural Conservation
- Reclamation/Reuse
- Voluntary Water Transfers & Exchanges

The technical task forces will work under the direction of the SWCC; the SWCC will outline a scope of work and schedule for each task force with some task force involvement in shaping these elements. The policy deliberations will be done by the SWCC, with the task forces providing the technical information and data that will underpin the SWCC's eventual recommendations to the State Water Resources Control Board.

The SWCC currently envisions a three-part process for the technical task forces:

1. Gather relevant information and data. (We are not seeking to do new studies. Much data already is available. We anticipate that relevant information can be generated from literature searches and Department of Water Resources and other data sources. One of the keys will be to pull together and present the data in an organized and useful format so we may readily reach some conclusions and recommendations based on the data.)

2. Presentation(s) by technical forces to SWCC; discussion by SWCC of presentation(s); SWCC reaches preliminary conclusions, provides direction to technical task forces for additional information.

3. Technical task forces formulate draft conclusions, recommendations and proposed implementation ideas, reviews with SWCC; SWCC makes final conclusions and recommendations.

For your information, the SWCC's workplan ("Efficient Use of Water") and tentative "Timeline" are enclosed. Both documents, the timeline in particular, are subject to modification. The workplan gives an indication of how we will want relevant information gathered and organized, at least for the work of the three technical task forces where generating realistic and reliable ranges of numbers is most likely. (The examples now listed in various columns on the workplan are not exhaustive, they are merely a few suggestions to get us started.) We recognize that the work of the fourth task force (Voluntary Water Transfers & Exchanges) is not suited to generating a reliable range of numbers. We expect that this task force would focus instead on outlining some realistic guidelines or principles that would aid in the timely and equitable implementation of this element of efficient water use.

The SWCC is not able to offer financial remuneration for serving on the technical task forces. We are seeking foundation and other funding to help with travel costs. If your organization is not in a position to provide for your travel expenses, the SWCC hopes to have funding available within the next few months that will permit us to reimburse travel expenses for those who will need it.

Should you wish to discuss this technical task force invitation, please call the CWPC's Executive Director, Lori Griggs, at (415)682-6633, or call the SCWC's Executive Director, Joan Anderson, at (714)261-7466.

We hope you will agree to assist us in this important effort. All task force invitees have been invited to join us at the SWCC's next meeting, which is scheduled for Thursday, July 13, from 10:00 a.m. to 3:00 p.m. at the Sheraton Plaza La Reina Hotel near the Los Angeles International Airport. Lunch will be provided. The SWCC's regular meeting will take place in the morning; the afternoon session will focus on meeting with the technical task forces.

Thank you for your thoughtful consideration of this request.

Sincerely,

John K. Flynn

JOHN K. FLYNN
Supervisor, Ventura County
Chairman, SCWC
Co-Chair, State Water
Conservation Coalition

Sunne/JG

SUNNE WRIGHT McPEAK
Supervisor, Contra Costa County
Chair, CWPC
Co-Chair, State Water
Conservation Coalition

Enclosures

September 1991

APPENDIX A, Exhibit 2

TASK FORCE MEMBERS

Participants	Affiliation
Joan Anderson	Southern California Water Committee
Mahendra Ankhad	Contra Costa Water District
Richard Bell	Boyle Engineering
Melissa Blanton	Black & Veatch
Jeanne-Marie Bruno	Metropolitan Water District of So. Calif.
Cheryl Davis	San Francisco Water Department
Dana Friehauf	San Diego County Water Authority
Lyle Hoag	California Urban Water Agencies
Ronald L. Johnson	Marin Municipal Water District
Jim Kelly	Central Contra Costa Sanitary District
Mike Kiado	Department of Health Services
Peter MacLaggan	San Diego County Water Authority
John Morris (Convener)	Irvine Ranch Water District
Theo Nowak	So. Calif. Water Comm. Trustee
Steve Ott	L.A. Department of Water & Power
Michele Pla	San Francisco Clean Water Program
Douglas Reinhart	ASL Consulting Engineers
Martin Rigby	Orange County Water District
Peter Rogers	Department of Health Services
Bahman Sheikh	City of L.A., Dept. of Public Works
Richard Sykes	East Bay Municipal Utility District
Keith Watkins	Department of Water Resources
James Williams	City of San Jose-Office of Env. Mgmt.

STATE WATER CONSERVATION COALITION

Working Statement on RECLAMATION/REUSE

In recognition that developed water supplies are a limited resource, water suppliers in California support water reclamation projects as part of an expanding ethic for California water which encourages Californians to use water in an efficient and environmentally-sound manner.

Water Reclamation is the process of treating wastewater or other nonpotable water for allowable beneficial uses, transporting it to use areas, and applying it to actual use, thereby augmenting the State's reliable water supply.

Water suppliers in California have been leaders in efforts to achieve more efficient use of water and they recognize the necessity of additional achievements in water reclamation. The State Water Conservation Coalition recommends that water suppliers, wastewater treatment agencies and others implement or fully cooperate in the development of water reclamation projects under the following conditions:

- The reclaimed water is of adequate quality for allowable beneficial uses and is available for such uses;
- The water reclamation project provides a cumulative regional and statewide benefit comparable to project costs;
- Reclaimed water may be furnished to the user at a marketable price;
- Use of the reclaimed water meets all regulatory agency requirements; and
- The use of reclaimed water is consistent with downstream water rights and water quality objectives at the point of use.

In an effort to maximize reclaimed water use, the following solutions to project implementation constraints are recommended:

- Secure additional State funding for reclamation projects in the form of grants to projects that provide a statewide benefit so that they can be cost-effective locally;
- Provide appropriate State staff and resources to assist local water suppliers in implementing reclamation projects in a timely and efficient manner;
- Insure that funding agencies provide efficient and streamlined processes for administering reclamation funding programs;
- Resolve State Department of Health Services and County Health concerns regarding potential public health impacts;

(MORE)

- Insure coordinated policy among State Department of Health Services and County Health agencies regarding development and implementation of public health standards for reclamation;

- Enact appropriate legislation to promote and facilitate the use of reclaimed water, including the development of incentives for users.

- Develop guidelines for resolving local political and institutional issues; and

- Develop educational programs to encourage public acceptance of reclaimed water.

The use of reclaimed water, meeting the aforementioned conditions, is a conservation Best Management Practice (BMP) when it augments existing water supplies. Water suppliers, wastewater treatment agencies and other agencies responsible for water/land use planning shall implement water reclamation projects that meet the conditions listed above. Implementation will be accomplished through a variety of water reclamation practices and strategies. As defined here, these include, but are not limited to, conducting comprehensive reclamation feasibility studies, regional planning of reclamation projects, adopting measures to control inflow quality in all areas suitable for future reclamation, ordinances to mandate the use of reclaimed water and provisions requiring dual (potable water/reclaimed water) distribution systems in developing areas.

In recognition of the commitment to water reclamation and because of the need for a dependable water supply for municipal and industrial uses, the State Water Conservation Coalition recommends that during the bay-delta hearing process the SWRCB use only reliable reclaimed water supply estimates. A reliable supply is the amount of reclaimed water delivered to the users. It is also recommended that the reliable supply figures be expressed in a range. The lower end of the range would represent those reliable projects estimated to deliver reclaimed water, on a yearly basis, given then existing conditions and constraints. The upper end would be a goal of those projects estimated to deliver reclaimed water assuming that many of the implementation constraints discussed above are overcome. The water suppliers will commit to efforts to go beyond the reliable projects to achieve the maximum reclaimed water use. Reclaimed water supply figures will be submitted to the SWRCB on a yearly basis based on hydrologic regions along with a breakdown on the proposed type of reclaimed water use.

The Coalition further recommends that the SWRCB and other state entities provide support and assistance to overcome current project implementation constraints and to assist in the resolution of future constraints so that the State can maximize reclaimed water production and augmentation of the State's water supply.

As approved, with revisions, by the
State Water Conservation Coalition:
2/8/90

September 1991

APPENDIX A, Exhibit 4
BAY DELTA RECLAMATION SUB-WORK GROUP
MEETING PARTICIPANTS

Keith Watkins - Chairperson
Department of Water Resources

Dave Abercrombie	San Francisco Clean Water Program
Carol Amenta	Las Virgenes Municipal Water District
Joan Anderson	Southern California Water Committee
Mahendra Ankhad	Contra Costa Water District
Peter Archuleta	Eastern Municipal Water District
Larry Attaway	State Water Resources Control Board
Harold Bailey	City of San Diego
John Barry	City of Oceanside
Richard Bell	Boyle Engineering
David Beringer	State Water Resources Control Board
Tom Berliner	San Francisco Public Utility Commission
James Blair	Metropolitan Water District
Melissa Blanton	Black & Veatch
Roberta Borgonovo	League of Women Voters
Jeanne-Marie Bruno	Metropolitan Water District
Gary Bryant	United States Bureau of Reclamation
Byron Buck	San Diego County Water Authority
Ted Bullware	City of Oceanside
Suzanne Butterfield	Department of Water Resources
Eric Clyde	James M. Montgomery Consulting Engineers
Warren Cole	Department of Water Resources
Judy Conacher	Eastern Municipal Water District
Ed Cummings	Contra Costa Water District
Larry Dale	State Water Resources Control Board
Cheryl Davis	San Francisco Water Department
Martha Davis	Mono Lake Committee
Thomas Dollente	Los Angeles Department of Water and Power
Bill Du Bois	California Farm Bureau
Gordon Enas	Department of Water Resources
Ken Erickson	Contra Costa Water District
John Farnkopf	Hilton, Farnkopf & Hobson
Mike Farro	State Water Resources Control Board
Jay Federmann	Department of Water Resources
Ron Ferguson	SRT Resources Development
Janet Flint	East Bay Municipal Utility District

APPENDIX A, Exhibit 4
Page Two

Mark Forbes	City of Fairfield
Tom Fox	East Bay Municipal Utility District
Donald Fpoelica	
Dana Friehauf	San Diego County Water Authority
David Fullerton	Bay Delta Hearing Project
Joy Gaines	Mojave Water Agency
John Gaston	American Water Works Association
Doug Gillingham	Boyle Engineering
Jim Graham	Las Virgenes Municipal Water District
Virginia Grebbien	Central and West Basin Water District
Lori Griggs	Committee for Water Policy Consensus
Loretta Hall	Fallbrook Sanitary District
Michael Hanemann	University of California, Berkeley
Richard Harasick	Los Angeles Department of Water and Power
Lloyd Hartwig	San Joaquin District - Dept. of Water Resources
Bill Hasencamp	City of Los Angeles
Ahmad Hassani	Metropolitan Water District
Jim Haupt	Department of Water Resources
Alex Hildebrand	South Delta Water Agency
Steve Homan	City of San Jose
Scott Humpert	State Water Resources Control Board
Bill Jacoby	San Diego County Water Authority
Lynn Johnson	State Water Resources Control Board
Feroze Kanga	Department of Water Resources
Steven Kasower	Department of Water Resources
Jim Kelly	Central Contra Costa Sanitary District
Leroy Kennedy	Turlock Irrigation District
Mike Kiado	Department of Health Services
Vern Knoop	Department of Water Resources
Karen Kubick	San Francisco Clean Water Program
David Leib	Contra Costa Water District
Roberta Lewis	United States Bureau of Reclamation
Norm Lougee	San Francisco Water Department
Lloyd Lunch	Department of Water Resources
Rich Luthy	Fairfield - Suisun Sewer District
Peter MacLaggan	San Diego County Water Authority
Pat Marion	California Green Industry Council
Scott Matyac	Department of Water Resources
Steve Metzler	East Bay Municipal Water District

APPENDIX A, Exhibit 4
Page Three

Kevin McDonnell	Marin Municipal Water District
Lloyd Mercer	State Water Resources Control Board
Jonas Minton	Department of Water Resources
Lawrence Michaels	
Joshua Milstein	San Francisco Public Utilities Commission
Richard Mills	State Water Resources Control Board
John Morris	Irvine Ranch Water District
Don Murakata	San Francisco Clean Water Program
Carol Nelson	Department of Water Resources
Steve Nelson	ERM - West
Charles Nichols	County Sanitation Districts of Orange County
Gene Novak	Chino Basin Municipal Water District
Theo Nowak	Consultant
Steve Ott	Los Angeles Department of Water and Power
Charles Pike	Department of Water Resources
Michele Pla	San Francisco Clean Water Program
Terry Powell	East Bay Municipal Water District
Ben Price	Fallbrook Sanitary District
Betsy Reifsnider	Mono Lake Committee
Doug Reinhart	ASL Consulting Engineers
John Renning	United States Bureau of Reclamation
Marty Rigby	Orange County Water District
Bob Rivet	City of San Jose
Barbara Saikis	Contra Costa Water District
Richard Satkowski	
Robin Saunders	City of Santa Clara
Joanne Schneider	State Water Resources Quality Control Board
Jim Sequeira	City of Sacramento
Bahman Sheikh	City of Los Angeles
Roger Shintaku	Santa Ana Watershed Project Authority
Brian Smith	San Joaquin District - Dept. of Water Resources
Polly Smith	League of Women Voters
Richard Sykes	East Bay Municipal Water District
John Tenero	Southern District - Dept. of Water Resources
Ron Theisen	Marin Municipal Water District
Ed Thornhill	Metropolitan Water District
Pete Uribe	Uribe & Associates
James Van Haun	Orange County Water District
Kurt Wassermann	State Water Resources Control Board

APPENDIX A, Exhibit 4
Page Four

Kurt Wattson	
Dave Whitridge	Consultant
Keith Whitman	Santa Clara Valley Water District
Dave Whitridge	San Diego Water Authority
Ed Winkler	Department of Water Resources
Rick Wood	City of Fairfield
Howard Wright	Southern California Water Resources
Ron Young	Irvine Ranch Water District
Bob Zettelmeyer	Department of Water Resources

September 1991

APPENDIX A, Exhibit 5
BAY DELTA RECLAMATION SUB-WORK GROUP
INTERESTED PARTIES REGULARLY INFORMED

	Assemblyman Filante's Office
	Department of Transportation
	Santa Ana Watershed Project
	Windsor County Water District
Michael Abramson	City of Daly City
Fred Adjarian	Rincon Del Diablo Muni. Water Dist.
Thomas Aldrich	Anheuser-Busch Companies
James Alverson	R. W. Beck & Associates
Wallace Ambrose	Greeley & Hansen
David Anderson	Executive
Lynn E. Anderson	Santa Barbara City Water Agency
Ralph Anderson	City of Carlsbad
Steven Andrews	Steven Andrews Engineering
Pervaiz Anwar	Brown & Caldwell
Steven Arakawa	Metropolitan Water Dist. of So. Calif.
Gary Arant	Valley Center Municipal Water District
Richard Arber	Richard P. Arber Associates
Gayla Argent	Argent Communications
Joan Arneson	Alex Bowle Law Corp.
Sushil Aurora	Division of Planning, DWR
Takashi Asano	State Water Resources Control Board
Richard W. Atwater	Central Basin Municipal Water District
Jean Auer	Comm. for Water Policy Consensus
JoAnn Auerswald	City of Barstow
Robert Ayers	
William Baber	Minasian Minasian et. al.
Ronald Bachmann	State Water Resources Control Board
John Badeauz	McMillan Communities
Susan Badgley	Arcade Water District
Richard Bailey	Engineering Services
Robert Baiocchi	California Sportfishing
Robert Baker	Central Contra Costa Sanitary District
Harold Ball	California Water Commission
Harold Ball	Helix Water District
Harvey Banks	
Connie Barker	Assn. of California Water Agencies
George W. Barnes, Jr.	Division of Planning, DWR
Richard H. Barnett	Casitas Municipal Water District
Robert Barrett	The Flora Hewlett Foundation

APPENDIX A, Exhibit 5
Page Two

Paul Bartiewicz	Calaveras County Water District
George Basye	Downey-Brand-Seymour & Rohwe
George R. Baumli	State Water Contractors
J. R. Baxter	Palmdale Water District
Gary Bedker	U.S. Bureau of Reclamation
David Behar	Bay Institute of San Francisco
Richard Bennett	East Bay Municipal Utility District
Dale Bergstedt	
Nathaniel Bingham	Pacific Coast Fishermen Federation
Thomas Birmingham	Kronick, Moskovitz, Tiedemann
Walter J. Bishop	East Bay Municipal Utility District
Rosalie Bock	Alameda County Water District
Frederick Bold, Jr.	Bold & Polisner
Max Bookman	Bookman-Edmonston Engineers, Inc.
Marcia Brockbank	San Francisco Estuary Project
Bert Brown	BBHI-PW-Pipe
Joseph Brown	Cupertino Sanitary District
Randall Brown	Division of Local Assistance, DWR
Art Bruington	Muni. Water Dist. of Orange County
Arthur R. Bullock	Rainbow Municipal Water District
Robert Burness	Sacramento County
Charles M. Burt	California Polytechnic State Univ.
Gerald Campbell	Boyle Engineering
Richard Campbell	
Gregory Cartrell	Contra Costa Water District
Paul Carber	Willdan Associates
Patrick Case	Enartec Consulting Engineers
James Castel	Penfield & Smith Engineers
Catherine	Kennedy/Jenks/Chilton, Inc.
Leonard Celoni	Oakley Water District
James Cervantes	Stone & Youngberg
H. K. Pete Chadwick	Department of Fish & Game
Francis Chung	Division of Planning, DWR
Thomas. N. Clark	Kern County Water Agency
Richard C. Clemmer	Metropolitan Water District
John Coburn	State Water Contractors
James Colbaugh	Las Virgenes Municipal Water District
Gordon B. Cologne	
Andrew Corrao	James M. Montgomery Engineers, Inc.
Frank Cotton	Santa Clara Valley Water District

APPENDIX A, Exhibit 5
Page Three

Kevin Covert	L.A. Department of Water & Power
Michael Cowan	U.S. Bureau of Reclamation
Steven Cowdin	Division of Planning, DWR
Gerald C. Cox	Div. of Operations & Maint., DWR
Edward A. Craddock	Division of Planning, DWR
Ron Crites	George S. Nolte & Associates
William H. Crooks	Regional Water Quality Control
C. W. Crowdre	Shell Oil Company
Larry Dale	University of California, Berkeley
Marie David	Georgetown Div. Public Utilities Dist.
David Dawdy	
Gary Decker	Otay Water District
Ladin Delaney	Regional Water Quality Control
Joseph Demersseman	Dominguez Water Corp.
Bill Dendy	Bill Dendy & Associates
Paul Degarabedian	The Aerospace Corp.
Edward Diamond	Division of Operations & Maint., DWR
Ronald Diaz	San Diego County
James Dixon	Sacramento County
Diana Dolinsek	City of Santa Rosa
Russell R. Dowers	Padre Dam Municipal Water District
Franklin D. Dryden	
Frank Dudek	Luke-Dudek, Inc.
Harrison Dunning	University of California, Davis
Leon Eddings	Las Gallinas Valley Sanitary District
Thomas Egidio	Vallejo Chamber of Commerce
Gary Eikermann	Nolte & Associates
Driss Elwardi	City of La Mesa
Dennis Erdman	Capistrano Vly. Wastewater Authority
Terry. L. Erlewine	San Joaquin District
C. Charles Evans	Montecito Water District
Farhad Farnam	Division of Planning
Helen Farnham	City of Sunnyvale
Carol Federighi	League of Women Voters
Steve Felte	Calaveras County Water District
Margaret Ferguson	Assn. of California Water Agencies
Robert Finn	Brown & Caldwell
John V. Foley	Moulton-Niguel Water District
Gregory L. Ford	East Bay Municipal Utility District
David Forkel	Delta Wetlands

APPENDIX A, EXHIBIT 5
Page Four

Lloyd Fowler	Fraser Engineering
Ann Fraser	Metropolitan Water Dist. of So. Calif.
Donald Froelich	Kern County Water Agency
Lloyd Fryer	Creegan & D'Angelo Engineering
Rene M. Fuog	Div. of Operations & Maint., DWR
Larry Gage	Modesto Irrigation District
Warren Gant	Southern California Water Committee
Joyce Garnet	Natural Resources Defense Company
Karen Garrison	Pacific Gas and Electric Company
Susan Gates	James M. Montgomery Engineers
Philip Gatsoulis	Leucadia County Water District
Joan Geiselhart	Regional Water Quality Control
Robert P. Ghirelli	Division of Planning, DWR
Ali Ghorbanzadeh	John Carrollo Engineers Inc.
Robert Gillette	Metropolitan Water Dist. of So. Calif.
Victor Gleason	Greeley & Hansen
Scott Goldman	ERM-West
Leslie Goodbody	Pacific Coast Fisherman Federation
Zeke Grader	Encino Water Pollution Control Fed.
Rick Graff	Environmental Defense Fund
Thomas J. Graff	Southland Sod Farms
Jurgen Gramckow	Carlsbad Municipal Water District
Robert J. Greaney	
Bailey Green	Contra Costa Water District
John Gregg	University of California, Davis
Robert Hagan	East Bay Municipal Utility District
Marcel Hall	University of California, Davis
Blaine Hanson	Reclamation District 2068
Mike Hardesty	California Municipal Utilities Assn.
Jerry Harrell	Los Angeles County Sanitation District
Earle Hartling	City of Suisun
Steven Hawkins	East Bay Municipal Utility District
Robert Helwick	Carlsbad Municipal Water District
John Henley	Rancho California Water District
John F. Hennigar	Department of Fish & Game
Perry Gerrgesell	
Michael Herz	U.S. Bureau of Reclamation
Derek Hilts	U. S. Bureau of Reclamation
Howard Hirahara	California Urban Water Agencies
Lyle N. Hoag	

APPENDIX A, EXHIBIT 5
Page Five

Raymond Hoagland	Division of Planning
Dale W. Hoffland	San Diego County
Dale K. Hoffman-Floerke	San Joaquin District
Thomas Holliman	Irvine Ranch Water District
Walter W. Hoye	L. A. Department of Water & Power
Tony Hui	James M. Montgomery Engineers
Kenneth Hume	John S. Murk Engineers, Inc.
Edward F. Huntley	Division of Planning
Ronald L. Hurlbut	City of Fairfield
Jose L. Hurtado	Ramona Municipal Water District
Michael Huse	City of Solana Beach
Nick Irias	East Bay Municipal Utility District
Farouk Ismail	State Water Resources Control Board
John Jamieson	City of San Jose
Gerald Johns	State Water Resources Control Board
Grace Johns	Spectrum Economics, Inc.
David L. Johnson	Marin Municipal Water District
James W. Johnson	City of Santa Rosa
Lynelle Johnson	Congressman Miller's Office
Mel Johnson	City of Sacramento
William Johnston	Modesto Irrigation District
William R. Johnston	Search II
Keith Jones	Woodward-Clyde Consultants
Joseph Kalak	Orange County Sanitation District
Joseph Karrur	City of Vista
Yosh Katsuraq	Katsura Consulting Engineers
David Kay	Southern California Edison Company
R. P. Kearny	Pacific Inter-Club Yacht Association
Gary Keefe	City of Lompoc
F. R. Kegel	Co-Op Extension, San Joaquin Valley
Barrett E. Kehl	South San Joaquin Irrigation District
Joan Kendrick	Water Market Update
John Kennedy	Brown & Caldwell
John Kennedy	San Diego Consultants
Joanne Kerbavaz	Department of Parks & Recreation
Joan B. Kerns	
Donald E. Kienlen	Murray, Burns & Kienlen
Leah Kirk	Inyo County Water District
Martin Kjelson	U.S. Fish & Wildlife Service

APPENDIX A, EXHIBIT 5
Page Six

Stephanie Knott	Uribe & Associates
William Koptionak	Almgren & Koptionak
Charles Kratzer	State Water Resources Control Board
John Krautkraemer	Environmental Defense Fund
Robert Krieger	Krieger & Stewart, Inc.
Jack Y. Kubota	Woodside/Kubota & Associates
Kenneth A. Kuney	Central Valley Eastside Project
David Landecker	
Tony Lauricha	San Marcos County Water District
Bach Le	Division of Planning, DWR
Susan E. Leavitt	Boyle Engineering Corp.
Clifford T. Lee	Attorney General's Office
Barbara Leidigh	State Water Resources Control Board
Michelle Leighton	San Joaquin Valley Drainage Project
Keith Lewinger	Otay Water District
Linda Lewis	City of Torrance
Michael Lewis	Suisun Res. Conservation District
George Link	Resources Management International
Arthur L. Littleworth	Best, Best & Krieger
George Lohnes	City of Escondido
Karl E. Longley	California State University, Fresno
Loring Lovell	Sarasota County
Gregory Luke	Luke-Dudek Civil Engineers, Inc.
Lawrence Lunardini	City of Sacramento
Samuel Luoma	U.S. Geological Survey
Gordon Lyford	U.S. Bureau of Reclamation
Steven C. Macauley	Division of Planning, DWR
William O. Maddaus	James M. Montgomery Engineers
Palmer Madden	McCutchen, Doyle, Brown & Ene
Carlos Madrid	Southern District, DWR
Fred Maerkle	Carlsbad Municipal Water District
Frank Maitski	City of San Diego
Patty Mallette	James M. Montgomery Engineers
Marangu Marete	Division of Planning, DWR
Barry Martin	City of Oceanside
Felix Martinez	Goleta Sanitary District
Dale Mason	
Roger Masuda	Griffith & Masuda
Deborah Maxon	Contra Costa Water District

APPENDIX A, EXHIBIT 5
Page Seven

Steven McAdam	San Francisco Bay Conserv. & Dev.
Gregory McBain	Engineering Science, Inc.
David McCollum	Olivenhain Municipal Water District
Edward E. McCombs	Las Virgenes Municipal Water District
Ray E. McDevitt	Hanson Bridgett Marcus Vlaho
Victor B. McIntyre	San Joaquin District, DWR
Robert McKinney	Casitas Municipal Water District
Glenn McPherson	Boyle Engineering
David Meith	Regional Water Quality Control
Mark Messersmith	Krieger & Stewart, Inc.
Dorothy Miller	Nevada Irrigation District
Raymond C. Miller	South Coast County Water District
Stephanie Miller	Marin Municipal Water District
Thomas Miller	Trinity County
Donald F. Mills	Boyle Engineering Corp.
William R. Mills Jr.	Orange County Water District
Eric Mische	Brown & Caldwell
Jack Moore	Solana Beach Sanitation District
Douglas Morgan	University of California, Santa Barbara
James M. Morris, Jr.	
William Moser	James M. Montgomery Engineers
Richard Moss	Pacific Gas & Electric Co.
Matt Mullan	San Francisco Water Department
Trish Mulvey	
Donald Murakata	City of San Francisco
John Murk	John S. Murk Engineers, Inc.
Rudy Mussi	Central Delta Water Agency
Cressey Nakagawa	
Barry Nelson	Save San Francisco Bay Association
Carl Nelson	City of Antioch
John Olaf Nelson	North Marin Water District
Randy Newhouse	City of Santa Rosa
Robert Nicklen	Regional Water Quality Control Board
Peter Nieblas	City of Vista
Dante J. Nomellini	Nomellini & Grelli Professional Corp.
Michael Nordstrom	Tulare Lake Basin Water Storage
Judy Nosecchi	City of Santa Rosa
Edward Nute	Nute Engineering
Kevin O'Brien	Downey, Brand, Seymour & Roher

APPENDIX A, EXHIBIT 5
Page Eight

George O'Hara	City of Los Angeles
Marian Otsea	Regional Water Quality Control Board
Robert Pace	Pacific Gas & Electric Co.
Joseph Palmer	City of Encinitas
Thomas R. Panella	Q.E.I., Inc.
Thomas E. Pape	Volt Energy Systems
Jerry Parker	Washington State University
Judy Parker	East Bay Municipal Utility District
James Pascanici	Channel Islands Beach CSD
Jason Peltier	Central Valley Water Project
Walter Pettit	State Water Resources Control Board
Daniel Phelan	Bay Area Industrial League
David Phillips	Aquatic Habitat Institute
Randy Piazza	City of Santa Rosa
Nicholas Pinhey	City of Merced
Richard Potter	
Terry Pritchard	Co-Op Extension, San Joaquin
Timothy H. Quinn	Metropolitan Water Dist. of So. Calif.
Daniel Rayburn	City of San Buenaventura
John H. Rayner	Kennedy/Jenks/Chilton, Inc.
George Ream	San Diego County
Gunther Redlin	Boyle Engineering Corp.
Terri Reynolds	Alternative Energy
Nereus L. Richardson	Orange County Water District
Thomas Richardson	Kennedy/Jenks/Chilton, Inc.
Steven Ritchie	Regional Water Quality Control Board
Millard Robbins, Jr.	Upper Occoquan Sewage Authority
James Robert	Metropolitan Water Dist. of So. Calif.
Michael Robinson	Fallbrook Sanitary District
Robert Roebuck	City of Santa Barbara
Ted Roefs	U.S. Bureau of Reclamation
Peter Rogers	Department of Health Services
Paul E. Romero	San Joaquin District, DWR
Maurice D. Roos	Division of Flood Management
Donald Rosenberg	Donald G. Rosenberg & Associates
William Rucker	Vallecitos Water District
Dwight Russell	Division of Local Assistance, DWR
Robert C. Sagehorn	Castaic Lake Water Agency
Thomas A. Salzano	Central Basin Municipal Water District
Eliseo Samaniego	State Water Resource Control Board

APPENDIX A, EXHIBIT 5
Page Nine

John Sanger	Pettit & Martin
Barbara Sarkis	Contra Costa Water District
Stephen Saugee	Hoopa Valley Tribe
Lonnie Schardt	Boyle Engineering Corp.
Nancy Schley	East Bay Regional Park District
Anne Schneider	Gruenich, Edison & Schneider
Mark Schneider	Encinitas Sanitation District
Adolf Schoepe	Fluidmaster, Inc.
Clifford Schulz	Kronick, Moskovitz, Tiedemann
David Schuster	State Water Contractors
Donald Schwartz	City of Santa Rosa
John Sciborski	Sonoma County
R. L. Shafer	San Joaquin Valley
Ali Shahroody	Stetson Engineers, Inc.
Ronald Sheets	Ojai Valley Sanitary District
Larry Sherburne	City of Santa Rosa
Gerald Shoaf	Redwine & Sherrill
David Simmons	Microphor Plumbing
David Simpson	U.S. Soil Conservation Service
Paul Simpson	Regional Water Quality Control Board
Lou A. Smallwood	Southern California Water Company
Dwight Smith	Rancho Santa Fe Community Services
Dwight Smith	San Diego County
Ronald Snedegar	Black & Veatch
James R. Snow	Div. of Operations & Maintenance
Lester A. Snow	San Diego County Water Authority
Stuart L. Somach	McDonough/Holland & Allen
Scott Steffen	Modesto Irrigation District
Byron Steinert	Westlands Water District
O. Stender	
David W. Stephens	MacDonald-Stephens Engineers, Inc.
Julian Stewart	Krieger & Stewart, Inc.
H. W. Stokes	Las Virgenes Municipal Water District
Gary Storms	
George Stragens	East Bay Municipal Utility District
Frederick Stumpf	San Joaquin District, DWR
Richard Sudak	Separation Processes, Inc.
William Sukenik	Kennedy/Jenks/Chilton, Inc.
Mike Sutliff	Central District, DWR
Jim Sutton	State Water Resources Control Board

APPENDIX A, EXHIBIT 5
Page Ten

Curtis Swanson	Central Contra Costa Sanitary District
Lawrence E. Swenson	Div. of Operations & Maint., DWR
Matt Tebbetts	John S. Murk Engineers, Inc.
John R. Teerink	Bookman-Edmonston Engineers, Inc.
Edward Terhaar	
Gerard Thibeault	Regional Water Quality Control Board
George Thomas	City of Santa Rosa
Gregory Thomas	Natural Heritage Institute
William Thomas	Heron, Burchete, Ruckert & Rot
James Thompson	Kronick, Moskovitz, Tiedemann
John R. Thornton	Camp, Dresser & McKee, Inc.
Gordon Tinker	Fallbrook Public Utility District
Susan Trager	Trager Law Offices
Rhodes Trussell	James M. Montgomery Engineers, Inc.
James Turner	U.S. Department of Interior
John Ullinskey	Greeley & Hansen
Cecil Urlich	Dames & Moore
Mark Van Camp	Murry, Burns & Kienlen
Peggy Varner-Hall	City of Santa Rosa
Jerry Vayder	Central District, DWR
Henry Venegas	L.A. Department of Water & Power
William Wade	Spectrum Economics
Kevin Walsh	Goleta Water District
Roger Walsh	San Diego County
Jon H. Walters	Nolte & Associates
William E. Warne	
Kayleen Warner	City of San Jose
Howard M. Way	John Carrollo Engineers
Ed Wells	Bartle Wells Associates
James Welsh	Bookman-Edmonston Engineers, Inc.
Sara West	West Directions
Mark Weston	City of Poway
Clint Whitney	
Robert Wilkinson	
Dexter Wilson	Wilson Engineering, Inc.
Thomas M. Wilson	Vista Irrigation District
Marvin Winer	Brown & Caldwell
John Winther	Delta Wetlands
John Wiper	Moulton Niguel Water District

APPENDIX A, Exhibit 5
Page Eleven

Roger Wolcott	Costa Real Municipal Water District
E. Woodward, Jr.	City of Santa Rosa
LaVon Wright	Environmental Protection Age
Patrick Wright	Washington State University
Tiffany Yelton	Kennedy/Jenks/Chilton, Inc.
David Yogi, Jr.	James M. Montgomery Engineers, Inc.
Young Yoon	Carmel Sanitary District
Michael Zambory	Division of Planning, DWR
Robert Zettlemoyer	Central Delta Water Agency
Ed Zuckerman	Feldman, Waldman & Kline
Tom Zuckerman	

September 1991

APPENDIX B - Exhibit 1

WATER RECLAMATION SURVEY

Please complete the survey by _____ on an individual project basis. Please attach additional comments if necessary. If you have any questions, please call _____ of _____ at _____.

1. Name of Responding Agency: _____

2. Project and Description: _____

3. Regional Water Quality Control Board responsible for permitting: _____
_____

4. Project Status: Please check the appropriate status for the project. If the project is in Planning, please provide an estimate in percent of the probability of operation by the year 2000.

Construction	_____		
Design	_____		
Planning	_____	% Probability	_____

5. Project Schedule:

Begin Construction	(yr)	_____
Begin Deliveries	(yr)	_____

6. Type and Quantity of Use: For each proposed use of the project deliveries, please estimate the quantity of reclaimed water to be delivered in the year 2000 and the quantity of fresh water displaced.

	Reclaimed Delivered Acre-Feet/Year	**Fresh Displaced Acre-Feet/Year**
Landscape Irrigation	_____	_____
Agricultural Irrigation	_____	_____
Industrial	_____	_____
Seawater Barrier	_____	_____
Groundwater Recharge	_____	_____
Other (indicate)	_____	_____

Comments: _____
_____

7. Constraints: Please rank which constraints potentially affect the completion of this project (1 = most significant, 2, 3, etc.). Please comment on the 3 most significant constraints:

Capital Funding	_____	Regional Board Approval	_____
O&M Funding	_____	Health Agency Approval	_____
Energy Costs	_____	Institutional	_____
User Agreements	_____	Public Acceptance	_____

Comments: 1. _____
2. _____
3. _____

8. Agencies a) producing the Reclaimed Water: _____
b) purveying the Reclaimed Water: _____ _____

9. Please check all sources of fresh water delivered within the purveying agency's service area:

State Water Project	_____	Central Valley Project	_____
Colorado River Aqueduct	_____	Los Angeles Aqueduct	_____
Mokelumne Aqueduct	_____	Hetch Hetchy Aqueduct	_____
Local Groundwater	_____	Local Surface	_____

Other (indicate)_____

10. Project Costs: Please provide estimated costs in 1990 dollars:

Capital of Treatment Facilities (include, if appropriate, planning, right-of-way, construction, and administration, etc.) $ _____
Capital of Distribution Facilities (include items as listed above) $ _____
1st Year Operation & Maintenance (including energy) $ _____/yr
Energy Cost $ _____/yr
Energy Use $ _____kwh/af

11. Contact Person: _____
Title: _____
Address: _____

FAX: _____

September 1991

APPENDIX B - Exhibit 2
List of Responding Agencies (Total 128)

1. Adamson Companies
2. Amador County Department of Water Resources
3. Beale Air Force Base
4. Bear Valley Community Services District
5. Big Bear Area Regional Wastewater Agency
6. Calaveras County Water District
7. California Correctional Institute
8. California Department of Forestry and Fire Protection
9. California Institute for Men
10. California Men's Colony
11. Cambria Community Services District
12. Coachella Valley Water District
13. Carlsbad Municipal Water District
14. Carmel Area Wastewater District
15. Central Basin MWD
16. CH2M Hill
17. Chino Basin Municipal Water District
18. City of Angels
19. City of Arcata
20. City of Barstow
21. City of Bishop
22. City of Burbank
23. City of Ceres
24. City of Corona
25. City of Dinuba
26. City of Escondido
27. City of Fairfield
28. City of Fresno
29. City of Glendale
30. City of Guadalupe
31. City of Hanford
32. City of Livermore
33. City of Lodi
34. City of Lompoc
35. City of Los Banos
36. City of Loyalton
37. City of Manteca
38. City of Modesto

APPENDIX B-Exhibit 2
List of Responding Agencies
Page Two

39. City of Oceanside
40. City of Palo Alto
41. City of Parlier
42. City of Pomona
43. City of Poway
44. City of Ridgecrest
45. City of San Clemente
46. City of San Diego
47. City of San Jose
48. City of San Luis Obispo
49. City of Santa Ana
50. City of Santa Barbara
51. City of Santa Clara
52. City of Santa Monica
53. City of Santa Rosa
54. City of Solvang
55. City of Taft
56. City of Visalia
57. City of Thousand Oaks
58. City of Tulare
59. City of Wasco
60. City of Windsor
61. City of Woodlake
62. Contra Costa Water District
63. County of San Luis Obispo
64. Daly City
65. Desert Water Agency
66. East Bay Municipal Utility District
67. Eastern Municipal Water District
68. El Toro Water District
69. Elsinore Valley Municipal Water District
70. Environtech Operating Services
71. Fairfield-Suisan Sewer District
72. Fallbrook Sanitary District
73. Irvine Ranch Water District
74. Groveland Community Services District
75. Irvine Ranch Water District
76. Jurupa Community Services District

APPENDIX B-Exhibit 2
List of Responding Agencies
Page Three

77. Kaiser Steel Resources, Inc.
78. Kern County Public Works
79. Lake Arrowhead Community Services District
80. Lake County Sanitation District
81. Las Virgenes MWD/Triunto CSD
82. Lockford Community Services District
83. Los Alisos Water District
84. Los Angeles Department of Water and Power
85. Mammoth County Water District
86. Marin Municipal Water District
87. Monterey County Flood Control and Water Conservation District
88. Moulton Niguel Water District
89. Mountain View Sanitary District
90. Mule Creek State Prison
91. Murphys Sanitary District
92. Napa Sanitary District
93. National Training Center, Fort Irwin, California
94. Novato Sanitation District
95. North Marin Water District
96. North River Sanitary District
97. Oakley/Bethel Island Waste Management Authority
98. Ojai Valley Sanitary District
99. Olivenhain Municipal Water District
100. Omi, Inc., Gilroy
101. Orange County Water District
102. Oro Loma Sanitary District
103. Otay Water District
104. Padre Dam MWD
105. Quincy Community Service District
106. Ramona Municipal Water District
107. San Bernardino Municipal Water Department
108. San Elijo Joint Powers Authority
109. San Francisco Clean Water Program
110. Sanitation District of Los Angeles County
111. Santa Margarita Water District
112. Selma Kingsburg Fowler County Sanitation District
113. Sewage Commission, Oroville Region
114. Sewer Authority, Mid-Coastside

APPENDIX B-Exhibit 2
List of Responding Agencies
Page Four

115. Shasta Dam Area Public Utility District
116. Shasta-Tehawa-Trinity Community College District
117. Sierra Conservation Center (State Prison)
118. Sonoma Valley County Sanitation District
119. South Coast Water District
120. Town of Yountville
121. Triunto County Sanitation District/Los Virgenes MWD
122. Tuolumne Regional Water District
123. Valley Center Municipal Water District
124. Ventura County Public Works Agency
125. Vista Irrigation District
126. Walnut Valley Water District
127. West Basin Municipal Water District
128. Western Hills Golf and Country Club
129. Yucaipa Valley Water District

September 1991

APPENDIX B - Exhibit 3
Data Analysis Assumptions

The committee received over 120 responses to the survey questionnaire. Due to the large number of respondents, some of the questions elicited a wide variety of answers which required adjustments to fit within the standard data base. Additionally, not every respondent had an answer for all questions, and this entailed the committee to arbitrarily assign an answer for conformance to the data base. The following is a list of the assignments and adjustments that were made by the committee in order to maximize the interchangeability of the data:

- Whenever the respondent did not provide a "begin deliveries" date for question No. 5, the following assignments were used:

Status	Year
Construction	1992
Design	1995
Planning	2000

- No answer provided to the percent probability for planning status projects - a 40% probability was assigned. If a respondent provided a percent probability below 40%, the lower percentage was used.

- More than one number one constraint identified on a particular response - no adjustment made. On sorts using the number one constraint, those projects having more than one number one constraint would be listed on the sort more than one time.

- Fresh water displaced - to determine the fresh water displaced, the following discount factors were applied*:

Status	Year
Construction	80%
Design	60%
Planning	40%

*See Chapter 3, Projected Reuse, for a detailed explanation of the discount factors.

September 1991

APPENDIX C

WATER RECLAMATION SURVEY RESULTS

This appendix contains the survey data used to prepare this report. The information in Tables 1 through 6 in this appendix correspond to the figures in Chapter 3 of the report. The exact figure numbers are identified below the table. The remaining Tables 7 through 11 include additional data derived from the survey results.

For complete details on how the survey results were gathered and evaluated, please refer to Chapter 3 of this report. The following is a brief discussion of the terms utilized in gathering and evaluating the survey results.

Projected Fresh Water Displaced Vs. Reclaimed Water Deliveries

As discussed in Chapter 3, survey respondents were requested to provide estimates on future reclaimed water deliveries and quantities of fresh water displaced. **Fresh water displaced** refers to the amount of fresh water that would otherwise be used to meet present or future non-potable demands if reclaimed water were not available. **Reclaimed water deliveries** include deliveries that serve all beneficial uses, including those that displace fresh water and other uses that would not, under most circumstances, have received fresh water if reclaimed water were not available. The latter type of use includes environmental enhancement, recreation, stream discharges, and certain cases of groundwater recharge. The amount of fresh water displaced by these uses may be indeterminable or substantially less than the deliveries.

For irrigation and industrial uses, the quantity of reclaimed water delivered will generally be greater than the quantity of fresh water displaced due to the differences in water quality between fresh water and reclaimed water. Reclaimed water contains higher concentrations of total dissolved solids, salts, and hardness than fresh water. Therefore, when irrigating, approximately 10 percent more reclaimed water needs to be applied to ensure the salts are leached from the plants' root zones. In industrial applications, such as cooling tower supply, the greater hardness requires reclaimed water to be used for fewer cycles to prevent scaling and damage to the equipment.

In response to the State Board's request for a reliable projection of future reclaimed water supplies that can augment the state's water supply, it is recommended, based on the examples above, that the State Board utilize the quantity of reclaimed water supply that displaces fresh water and not total reclaimed water deliveries.

The first six tables and Table 11 in this Appendix contain the fresh water displaced figures that were utilized in the report. Tables 7 through 11 contain reclaimed water delivery numbers.

Adjusted Vs. Unadjusted Survey Results

Chapter 3 describes how the projected fresh water displaced numbers and reclaimed water delivery numbers were adjusted to provide a more reliable projection for submittal to the State Board for consideration in the Bay/Delta proceedings. The unadjusted or "raw" data is the amount reported by survey respondents. Due to uncertainties about constraints and other factors which can prevent a project from going forward, the raw data is considered speculative and therefore less attainable than the adjusted reclaimed water use projections. Only if all existing and future project implementation constraints are resolved would the unadjusted amounts be realized. Therefore, the unadjusted figures could be considered a goal but are not appropriate for projecting future reclaimed water use potential. Table 11 summarizes the unadjusted and adjusted additional reclaimed water deliveries and fresh water displaced figures. All other tables in Appendix D contain figures that have been adjusted.

Table 1
ADDITIONAL FRESH WATER DISPLACED
PROJECTED THROUGH YEAR 2000

Year	Amount (Ac-Ft/Yr)
1990	1,217
1991	40,451
1992	106,108
1993	140,438
1994	165,008
1995	192,753
1996	202,625
1997	207,585
1998	229,657
1999	230,857
2000	244,121

(Figure 3-2)

Table 2
ADDITIONAL FRESH WATER DISPLACED BY YEAR 2000 PER TYPE OF USE PER REGION (Ac-Ft/Yr)

Region*		Landscape	Agriculture	Industry	Sea Water Barrier	Groundwater Recharge	Other	Totals
NC	1	400	800	0	0	0	0	1,200
SF	2	11,395	316	11,010	0	0	46	22,767
CC	3	3,514	14,808	0	0	2,588	0	20,910
LA	4	23,298	8,310	12,376	4,800	548	40	49,372
CV	5	4,494	12,122	0	0	0	16	16,632
L	6	524	0	0	0	0	0	524
CRB	7	1,120	0	0	0	0	0	1,120
SA	8	45,556	18,973	3,725	2,000	3,180	1,320	74,754
SD	9	46,159	10,124	240	0	0	320	56,843
Totals		136,460	65,453	27,351	6,800	6,316	1,742	244,122

* Regions represent Regional Water Quality Control Board jurisdictions:
1-North Coast, 2-San Francisco Bay, 3-Central Coast, 4-Los Angeles,
5-Central Valley, 6-Lahontan, 7-Colorado River Basin, 8-Santa Ana, 9-San Diego

(Figures 3-3, 3-4)

Table 3
NUMBER OF PROJECTS PER STAGE PER REGION

STAGE	NC	SF	CC	LA	CV	L	CRB	SA	SD	Total
Construction	1	3	0	3	3	0	0	5	8	23
Design	0	5	2	12	3	2	0	2	10	36
Planning	2	22	12	21	16	2	1	21	9	106
Totals	3	30	14	36	22	4	1	28	27	165

(Figure 3-5)

Table 4
ADDITIONAL FRESH WATER DISPLACED BY YEAR 2000 PER STAGE PER REGION (Ac-Ft/Yr)

STAGE	NC	SF	CC	LA	CV	L	CRB	SA	SD	Totals
Construction	0	113	0	3,147	5,520	0	0	42,066	21,863	72,709
Design	0	4,590	1,170	14,040	660	300	0	9,468	27,103	57,331
Planning	1,200	18,064	19,740	32,184	10,452	224	1,120	23,220	7,876	114,080
Totals	1,200	22,767	20,910	49,371	16,632	524	1,120	74,754	56,842	244,120

(Figure 3-6)

Table 5
ADDITIONAL FRESH WATER DISPLACED BY YEAR 2000 PER CONSTRAINT PER REGION (Ac-Ft/Yr)

	REGION									
CONSTRAINT	NC	SF	CC	LA	CV	L	CRB	SA	SD	Totals
Funding	0	1,901	10,162	10,280	9,334	0	1,120	61,101	43,724	137,622
Regulatory approval	0	4,608	9,028	14,987	2,358	300	0	12,451	12,299	56,031
Institutional	1,200	15,647	1,520	29,534	317	0	0	1,200	2,000	51,418
Public acceptance	0	0	9,080	700	299	0	0	0	620	10,699
Totals	1,200	22,156	29,790	55,501	12,308	300	1,120	74,752	58,643	255,770

(Figure 3-7, 3-9)

Table 6
PROJECT STAGE PER CONSTRAINT

	PROJECT STAGE %		
CONSTRAINT	PLANNING	DESIGN	CONSTRUCTION
Funding	31%	8%	8%
Regulatory approval	18%	5%	4%
Institutional	16%	4%	2%
Public acceptance	3%	1%	0%

(Figure 3-8)

Table 7
ADDITIONAL RECLAIMED WATER DELIVERED BY YEAR 2000 PER TYPE OF USE PER REGION (Ac-Ft/Yr)

Region		Landscape	Agriculture	Industry	Sea Water Barrier	Groundwater Recharge	Other	Totals
NC	1	400	5,755	0	0	0	0	6,155
SF	2	12,614	814	11,460	0	16,500	606	41,994
CC	3	3,948	16,328	0	0	3,220	40	23,536
LA	4	24,030	11,606	12,817	6,000	24,968	21,840	101,261
CV	5	4,789	16,310	240	0	0	686	22,025
L	6	2,154	300	0	0	0	120	2,574
CRB	7	4,480	0	0	0	0	0	4,480
SA	8	46,626	19,973	5,825	12,000	33,500	4,518	122,442
SD	9	45,481	10,124	240	0	10,850	2,320	69,015
Totals		144,522	81,210	30,582	18,000	89,038	30,130	393,482

Table 8
ADDITIONAL RECLAIMED WATER DELIVERED BY YEAR 2000 PER STAGE PER REGION (Ac-Ft/Yr)

STAGE	NC	SF	CC	LA	CV	L	CRB	SA	SD	Totals
Construction	555	113	0	3,147	5,755	0	0	54,414	26,849	90,833
Design	0	5,574	1,170	35,826	1,591	2,190	0	15,700	27,289	89,340
Planning	5,600	36,307	22,366	62,288	14,679	384	4,480	52,328	14,877	213,309
Totals	6,155	41,994	23,536	101,261	22,025	2,574	4,480	122,442	69,015	393,482

Table 9
ADDITIONAL RECLAIMED WATER DELIVERED BY YEAR 2000 PER CONSTRAINT PER REGION (Ac-Ft/Yr)

	REGION									
CONSTRAINT	NC	SF	CC	LA	CV	L	CRB	SA	SD	Totals
Funding	555	2,534	10,868	24,656	11,303	160	4,480	83,799	67,060	205,415
Regulatory approval	0	21,108	10,948	40,203	4,940	2,190	0	41,384	17,899	138,672
Institutional	5,200	16,707	1,520	54,744	379	0	0	1,200	9,200	88,950
Public acceptance	0	0	9,080	700	1,080	0	0	0	4,380	15,240
Totals	5,755	40,349	32,416	120,303	17,702	2,350	4,480	126,383	98,539	448,277

Table 10
REPORTED CAPITAL COSTS (a)

	Number of Projects Reporting Costs	Fresh Water Displaced (b) (Ac-Ft/Yr)	Reclaimed Water Delivered (b) (Ac-Ft/Yr)	Total Capital Costs (c) ($Mil)
Construction	21	72,709	90,500	389
Design	33	57,331	88,500	1,071
Planning	84	114,081	156,700	1,515
Totals	138	244,121	335,700	2,975

(a) Due to inconsistencies in cost figures submitted by survey respondents, a reliable unit cost per acre-foot cannot be derived.

(b) The amount of reclaimed water corresponds to the number of projects reporting costs.

(c) Capital costs may include treatment required for disposal. Operation and maintenance costs are not included.

Table 11
SUMMARY OF UNADJUSTED AND ADJUSTED AMOUNTS OF ADDITIONAL FRESH WATER DISPLACED AND ADDITIONAL RECLAIMED WATER DELIVERED BY YEAR 2000 BY REGION

Region		Unadjusted Reclaimed Water Delivered (a) (Ac-Ft/Yr)	Adjusted Reclaimed Water Delivered (b) (Ac-Ft/Yr)	Unadjusted Fresh Water Displaced (a) (Ac-Ft/Yr)	Adjusted Fresh Water Displaced (b) (Ac-Ft/Yr)
NC	1	14,694	6,155	3,000	1,200
SF	2	126,061	41,994	53,239	22,767
CC	3	57,866	23,536	51,300	20,910
LA	4	220,595	101,261	108,095	49,372
CV	5	46,677	22,026	34,263	16,632
L	6	5,170	2,574	1,620	524
CRB	7	11,201	4,480	2,800	1,120
SA	8	227,741	122,442	127,780	74,753
SD	9	116,235	69,015	92,192	56,843
Totals		826,240	393,483	474,289	244,121

(a) These figures are the amounts of reclaimed water reported by survey respondents given that all existing and future constraints are removed. These unadjusted figures are not appropriate for projecting future reclaimed water use. Refer to the adjusted numbers for a reliable projection.

(b) These figures are the adjusted amounts of reclaimed water reported by survey respondents and reflects existing implementation constraints. These figures are the reliable projections for consideration in the Bay/Delta proceedings.