Appendix III - Cost Analysis

SUMMARY - Infiltration Trenches and Sand Filters

	Infiltration Trench Construction	Infiltration Trench Maintenance ($ mill/year)	Austin Sand Filter Construction	Austin Sand Filter Maintenance ($ mill/year)	Delaware Sand Filter Construction	Delaware Sand Filter Maintenance ($ mill/year)	Total Construction Costs ($ million)	Total Maintenance Costs ($ million)
EPA	729	146	743	37	442	22	1913	205
FHWA	709	NR	143	NR	590	NR	1442	
Caltrans	6,535	118	6267	75	12005	152		

Assumptions

60% of the urbanized portion of the watershed to be treated with structural BMPs.
 30% treated by infiltration trenches and 30% treated by sand filters.

The urbanized portion of the San Gabriel River Watershed subject to the TMDL is assumed to be 212,193 acres.
See table below

Total area to be treated:
　　　Infiltration trences:　　　　　　**63,658** (urbanized portion of watershed multiplied by 30%)
　　　Sand filters:　　　　　　　　　**63,658** (urbanized portion of watershed multiplied by 30%)

Low FHWA estimate of Austin Sand Filter cost was reported based on a drainage areas > five acres.

Cost of Caltrans Infiltration trench includes biofiltration strip pretreatment.

Reach	Total (acres)	Open Space and Water (acres)	Urbanized (acres)
Estuary	3,047	116	2,931
Reach 1	15,230	37	15,192
Coyote Creek	123,902	27,857	96,046
Reach 2 and Above	294,532	196,508	98,023
Total	436,711	224,518	212,193

Total Maximum Daily Loads for Metals and Selenium
San Gabriel River and Impaired Tributaries

May 4, 2006

EPA and FHWA Infiltration Trench Cost Estimates

	FHWA*				EPA **				
BMP	Cost per device	Number of acres served	Number of Devices Needed	Total FHWA Construction Cost	Cost per device	Number of acres served	Number of Devices Needed	Total EPA Construction Cost	EPA Estimated Maintenance $/year
Infiltration Trench	$ 55,657	5	12,732	$ 708,597,351	$57,234.80	5	12,732	$ 728,689,374	$ 145,737,875

Urbanized portion of SGR Watershed is assumed to be 212,193 acres
Total area to be treated = **63658** (urbanized portion of watershed multiplied by 30%)

*For FHWA Calculations: C = 1317.1$V^{0.63}$ per device   (Young et al., 1996, Schueler, 1987)

        C=   1688 $V^{0.63}$ per device, adjusted from 1996 to 2005 dollars

    where, V = storage volume in cubic meters

    Assume   **0.5 inches runoff**

          0.0127 meters runoff

          5 acre drainage area

          20235 sq meter drainage area   1 acre = 4,047 square meter

          1 runoff coeficient   1 inch = 0.0254 meter

    Then,   V =   257 cubic meters   1 cubic foot = 0.0283168 cubic meters

**For EPA Calculations: C = \$5/ft^3 (SWRPC, 1991; Brown and Schueler, 1997)

        C= \$ 6.31 /ft^3, adjusted from 1997 to 2005 dollars

        C= \$ 223 /m^3

    Assume V=   257 cubic meters produced by 5 acre drainage area and 0.5 inches runoff

    Maintenance is 20% of construction cost

Size Constraints:

1300 square feet of trench bottom area is needed to treat 0.5 inches of runoff per acre.

    For five acres: 6500 square feet of trench bottom area

Total Maximum Daily Loads for Metals and Selenium
San Gabriel River and Impaired Tributaries

May 4, 2006

Caltrans Infiltration Trench and Biofiltration Strip Cost Estimates

BMP	Drainage Area (acre)	Avg. Adjusted Const. Cost*	Cost per Acre	Number Needed for urbanized portion of watershed	Total Construction Cost	Maintenance $/year*
Infiltration Trench + Biofiltration Strip	1.7	$ 177,567	$ 102,656	36,802	$ 6,534,840,166	$ 117,995,013

Urbanized portion of SGR Watershed is assumed to be 212,193 acres
Total area to be treated = **63658** (urbanized portion of watershed multiplied by 30%)

 ***Adjusted from 1999 to 2005 dollars**

Total Maximum Daily Loads for Metals and Selenium
San Gabriel River and Impaired Tributaries

May 4, 2006

SAND FILTERS COST ESTIMATES

From CalTrans BMP Retrofit Study

Filter Type	Drainage Area (acre)	Adjusted Const. Cost *	Cost Per Acre	Number Needed for urbanized portion of watershed	Total Const. Cost Based on CalTrans estimate	CalTrans Estimated Maintenance $/year*	EPA Const. Cost/ acre **	Total Const. Cost Based on EPA estimate	EPA Estimated Maintenance $/year	FHWA Const. Cost/ acre (< 2 acres) ***	FHWA Const. Cost/ acre (> 5 acres) ****	Total Const. Cost Based on FHWA estimate (< 2 acres)	Total Const. Cost Based on FHWA estimate (> 5 acres)	FHWA Estimated Maintenance $/year
Austin	1.5	$ 247,219	$ 166,744	21468	$ 5,307,271,733									
Austin	1.7	$ 314,857	$ 182,026	18401	$ 5,793,693,768									
Austin	2.7	$ 381,909	$ 140,503	11710	$ 4,472,059,381									
Austin	2.7	$ 259,097	$ 95,321	11710	$ 3,033,968,479									
Austin	0.7	$ 271,838	$ 366,697	42936	$ 11,671,595,169									
Avg Austin	1.9	294,983.97	$ 190,258	21245	**$ 6,266,891,818**	**$ 74,981,037**	$ 23,333	**$ 742,668,869**	**$ 37,133,443**	$ 21,200	$ 4,505	**$ 674,782,100**	**$ 143,391,196**	not reported
Delaware	0.7	$ 279,610	$ 377,181	42936	**$ 12,005,288,406**	**$ 151,536,478**	$ 13,874	**$ 441,586,895**	**$ 22,079,345**	$ 18,550	NA	**$ 590,434,337**	**NA**	not reported

Urbanized portion of SGR Watershed is assumed to be 212,193 acres
Total area to be treated = **63658** (urbanized portion of watershed multiplied by 30%)
Area to be treated by Austin Filters = **31829** (Half of the 30% to be treated by Austin)
Area to be treated by Delaware Filters = **31829** (Half of the 30% to be treated by Delaware)
*Adjusted from 1999 to 2005 dollars
**High end of EPA range (U.S. EPA 1999) used to estimate cost of Delaware. Costs adjusted from 1997 to 2005 dollars
*** Per impervious acre for facilities serving less than two acres. Costs adjusted from 1994 to 2005 dollars
**** Per impervious acre for facilities serving greater than five acres. Costs adjusted from 1994 to 2005 dollars
   (Construction cost estimates exclude real estate, design, and contingency costs. (Schueler, 1994).)
EPA maintenance costs = 5% constrcution costs

1 acre = 4,047 square meter
1 inch = 0.0254 meter
1 hectare = 2.47105 acres

Austin size constraints:
Full sedimentation design requires 100 sq feet to treat 0.5 inches of runoff per impervious acre
   For 50 acre area: 5000   sq feet

Delaware size constraints (size and shape flexible b/c below ground):
Assume a storage depth of 3 ft.
 Then 150 sq ft req'd for sediment chamber and 200 sq ft for sand filter area to treat 0.5 inch runoff per impervious acre
   For 50 acre area: 17,500   sq feet

Consumer Price Index - All Urban Consumers

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
1994	152.2	152.2	152.5	152	151.4	151.3	151.7	152
1995	154.3	154.5	154.6	154.7	155.1	154.8	154.5	154.4
1996	155.7	156.2	157.3	157.7	157.5	156.7	157.6	157.3
1997	159.1	159.2	159.8	159.9	159.5	159.4	159.5	159.7
1998	161	161.1	161.4	161.8	162.3	162.2	162.1	162.6
1999	164.2	164.6	165	166.6	166.2	165.4	165.8	166.3
2000	167.9	169.3	170.7	170.6	171.1	171	171.7	172.2
2001	174.2	175.4	176.2	176.6	177.5	178.9	178.3	178.4
2002	178.9	180.1	181.1	182.2	182.6	181.9	182.2	183
2003	185.2	186.5	188.2	187.6	186.4	186.3	186.3	186.9
2004	188.5	190.1	191.5	191.9	193.3	193.7	193.4	193.1
2005	195.4	197.4	199.2	201.1	201.5	200.7	201.4	203.1
2006	206	207.5						

http://data.bls.gov/PDQ/servlet/SurveyOutputServlet

Sep	Oct	Nov	Dec	Annual	HALF1	HALF2
152.7	153.4	152.9	153.4	152.3	151.9	152.7
154.6	155.2	154.4	154.6	154.6	154.7	154.6
158.2	158.8	158.4	158.3	157.5	156.9	158.1
160.5	161.1	160.7	161.2	160	159.5	160.5
162.6	163.2	163.4	163.5	162.3	161.6	162.9
167.2	167.2	167.1	167.3	166.1	165.3	166.8
173.3	173.8	173.5	173.5	171.6	170.1	173
178.8	178.3	178.1	177.1	177.3	176.5	178.2
183.4	183.7	184	183.7	182.2	181.1	183.3
188.2	187.8	187.1	187	187	186.7	187.2
194.5	196.3	196.9	195.2	193.2	191.5	194.9
205.8	206.9	205.6	203.9	201.8	199.2	204.5