CHAPTER 6: SURVEILLANCE AND MONITORING

6.1 REGIONAL MONITORING PROGRAM

The effectiveness of a water quality control program requires information supplied by comprehensive surveillance and monitoring of water, sediment, aquatic resources, and the human activities that have the potential to impact beneficial uses. The following section describes the monitoring programs that together provide high quality, comprehensive scientific information on water quality in the Region. The Water Board uses information produced by the programs described below to satisfy the requirements of Sections 104, 106, 208, 301, 303, 304, 307, 308, 314, and 402 of the federal Clean Water Act and applicable portions of the state's Porter-Cologne Water Quality Control Act.

The Regional Monitoring Program forms the core of water quality, sediment quality, and tissue (including bivalves and fish) monitoring in the Estuary. Historically, water quality in the Region was tracked by Water Board and State Water Board research and monitoring programs and numerous studies carried out by other interested state, federal, and local agencies.

From 1989 to 1992, the Water Board developed and implemented pilot programs for the San Francisco Estuary Regional Monitoring Program (RMP), through the Bay Protection and Toxic Cleanup Program (BPTCP) and U.S. EPA grants. In 1993, the RMP was formally established to provide integrated, comprehensive, and systematic information on water quality in the Region. Its goal is to evaluate the effectiveness of the Water Board's water quality program in meeting Basin Plan objectives, including protection of beneficial uses in the Estuary.

The Regional Monitoring Program's specific objectives are to:

1. Describe the distribution and trends of pollutant concentrations in the Estuary;
2. Project future contaminant status and trends using best understanding of ecosystem processes and human activities;
3. Describe sources, pathways, and loading of pollutants entering the Estuary;
4. Measure pollution exposure and effects on selected parts of the Estuary ecosystem (including humans);
5. Compare monitoring information to relevant benchmarks, such as total maximum daily load (TMDL) targets, tissue screening levels, water quality objectives, and sediment quality objectives; and
6. Effectively communicate information from a range of sources to present a more complete picture of the sources, distribution, fate, and effects of pollutants and beneficial use attainment or impairment in the Estuary ecosystem.

Every five years, an outside group of scientific experts reviews the RMP to assure it is fulfilling its objectives and providing useful and timely information regarding the Estuary. In 2002, the RMP status and trends component was revised to incorporate probabilistic monitoring. The 2002-2004 sample locations shown in Figure 6-1 were selected according to a probabilistic design. Each year sites are randomly selected and will be in different locations than shown in Figure 6-1. The list of parameters is presented in Table 6-1.

The RMP participants, including dredgers, stormwater agencies, and municipal and industrial dischargers that hold Water Board permits for waste discharge into the Estuary, fund the RMP as a requirement of their permits. The San Francisco Estuary Institute (SFEI), an independent nonprofit organization, administers and manages the program under a Memorandum of Understanding with the Water Board.

The RMP, through SFEI, produces an Annual Monitoring Report that summarizes the current state of the Estuary with regard to pollution, a summary report (Pulse of the Estuary), a quarterly newsletter, technical reports that document specific studies and synthesize information from diverse sources, and journal publications that disseminate RMP results to the world's scientific community.

6.2 SURFACE WATER AMBIENT MONITORING PROGRAM

In January 2000, the Surface Water Ambient Monitoring Program (SWAMP) was proposed in a Report to the Legislature to integrate existing water quality monitoring activities of the State and Regional Water Boards, and to coordinate with other monitoring programs. Water Code Section 13192 required the State Water Board to assess and report on the state monitoring programs and prepare a proposal for a comprehensive monitoring program. Water Code Section 13191 requires the State Water Board to convene an Advisory Group to assist in the evaluation of program structure and effectiveness, as it relates to the implementation of the requirements of Clean Water Act Section 303(d), applicable federal regulation, and monitoring and assessment programs.

Ambient monitoring refers to any activity in which information about the status of the physical, chemical and biological characteristics of the environment is collected to answer specific questions about the status and trends in those characteristics. For the purposes of SWAMP, ambient monitoring refers to these activities as they relate to the characteristics of water quality.

SWAMP is a statewide monitoring effort designed to assess the conditions of surface waters throughout the state of California. The State Water Board administers the program. Responsibility for implementation of monitoring activities resides with the nine Regional Water Boards that have jurisdiction over their specific geographical areas of the state.

In the Region, SWAMP is targeted to water bodies not monitored by the RMP. The numerous water bodies of the Region are listed in Table 2-1. SWAMP includes physical, chemical, and biological monitoring. SWAMP's focus is on water quality assessment in watersheds. SWAMP is intended to fulfill water quality assessment reporting requirements under Clean Water Act Section 305(b), and to support Clean Water Act Section 303(d) impairment decisions in cases where there is adequate information available to meet data requirements in the State Water Board's 303(d) Listing Policy, established in September 2004. The 305b and 303d requirements for the Estuary are met through the RMP, described in Section 6.1 Regional Monitoring Program.

In 1976, the state initiated the State Mussel Watch and State Toxic Substances Monitoring Programs to regularly monitor the concentration of pollutants in the tissue of aquatic organisms. Tissue levels reflect exposure over much longer periods of time than instantaneous water column samples and provide a field-based estimate for exposure of people, fish, and wildlife to pollutants in the food chain.

The Mussel Watch Program uses resident and transplanted bivalves to monitor pollutant levels at coastal reference stations and selected sites in bays and estuaries to confirm potential toxic substance pollution. The location of bivalve sampling stations in the Region are summarized in Figure 6-2 and Table 6-2. Periodic monitoring of bivalve tissue conducted by the National Mussel Watch administered by the National Oceanic and Atmospheric Association (NOAA) and international surveys complements information from the State Mussel Watch Program.

The Toxic Substances Monitoring Program used resident fish and other aquatic organisms to monitor pollutant levels in freshwater systems throughout the state. The location and sampling history of Toxic Substances Monitoring stations in the region are summarized in Figure 6-3 and Table 6-3.

The State Mussel Watch and State Substances Monitoring Programs have been incorporated into SWAMP. The Toxicity Testing Program and Coast Fish Contamination Program have also been incorporated into SWAMP.

6.3 SACRAMENTO-SAN JOAQUIN RIVERS AND NORTHERN SAN FRANCISCO BAY ESTUARY WATER QUALITY SURVEILLANCE

Water flowing into the San Francisco Estuary from the Sacramento and San Joaquin rivers is regularly monitored by numerous agencies and programs, including the Sacramento Coordinated Water Quality Monitoring Program (in the Sacramento metropolitan area), the Department of Water Resources, the Central Valley Regional Water Quality Control Board, and the Interagency Ecological Studies Program. Conventional water quality parameters, water and suspended material chemistry, and toxicity are sampled at a network of stations located throughout the Delta and into San Pablo Bay. In addition, phytoplankton, benthic community, and beneficial use surveys are regularly conducted in this area.

The primary goals of these efforts are to: (a) assure riverine water quality meets applicable standards; (b) identify changes in water quality potentially related to the operation of the State Water Project; and (c) develop technical information that can be used to estimate mass loading of pollutants to the Estuary from riverine sources.

6.4 GROUNDWATER MONITORING NETWORKS

Groundwater monitoring networks are established in several basins in the Region. At present, there are monitoring networks in the Livermore-Amador Valley by Zone 7, Niles Cone by the Alameda County Water District (ACWD), Santa Clara Valley by the Santa Clara Valley Water District (SCVWD), Half Moon Bay Terrace by the Coastside County Water District and the Montara Water and Sanitation District), San Francisco's Westside Basin by the San Francisco Public Utilities District (SFPUC), and Napa Valley by the Napa Valley Flood Control and Water Conservation District. In order to find out the most current status of these networks, local water management agencies should be contacted directly.

In addition, the U.S. Geological Survey (USGS) and the Department of Water Resources (DWR) maintain regional monitoring networks. Typically, monitoring is conducted at least

annually for general mineral quality and water levels. This well data may be of use to determine the general potability of groundwater and the status of sea water intrusion control.

The Water Board is integrating the locations of monitoring well networks into its groundwater geographic information system. The water quality data generated from the networks will assist Water Board staff in the refinement of beneficial use designations for groundwater basins.

The State Water Board has contracted the USGS and Lawrence Livermore National Laboratory (LLNL) to implement the Groundwater Ambient Monitoring and Assessment (GAMA) Program. The primary objective of the GAMA Program is to comprehensively assess statewide groundwater quality and gain an understanding about contamination risk to specific groundwater resources. The Groundwater Quality Monitoring Act of 2001 (Sections 10780-10782.3 of the Water Code) resulted in a publicly accepted plan to monitor and assess the quality of all priority groundwater basins that account for over 90 percent of all groundwater used in the state. The plan prioritizes groundwater basins assessment based on groundwater use.

The GAMA Program monitors groundwater from public supply wells for a broad suite of chemicals at very low detection limits, including exotic chemicals such as wastewater chemicals and pharmaceuticals. Monitoring and assessments for priority groundwater basins will be completed every ten years, with trend monitoring every three years. Monitoring reports for data collected in the Region are available at the State Water Board website.

6.5 COMPLIANCE MONITORING

A second component of the state's water quality surveillance and monitoring program relates specifically to discharges of pollutants at individual point and nonpoint sources. All entities holding Water Board discharge permits must conduct regular sampling and analysis of waste released to surface and groundwaters. They must also analyze material to be dredged. The specific chemical and physical parameters, types (i.e., toxicity tests, bioaccumulation studies, waste stream sampling, etc.), frequency, and other information requirements are determined on a case-by-case basis according to the nature of the discharge and potential environmental effects. Each permit issued by the Water Board describes the specific compliance monitoring requirements for that permit holder. Monitoring data collected by point source dischargers and nonpoint pollution control programs are used to:

- Determine compliance with and provide documentation to support enforcement of permit conditions;
- Support derivation of effluent limitations and wasteload allocations; and
- Provide information needed to relate receiving water quality to mass emissions of pollutants by dischargers.

Self-monitoring data are often supplemented by information obtained by Water Board staff during site inspections (including waste analyses) and through special studies, such as those characterizing the variability of the discharge, pollutant levels in nearby receiving water and biota, and characterization of pollutant loads attributable to urban runoff.

6.6 COMPLAINT INVESTIGATION

The Water Board encourages members of the public to alert it to pollutant discharge or nuisances that may impact water quality. Staff respond to each complaint, document the observed conditions, and take any necessary follow-up actions to institute appropriate corrective measures.

6.7 BIENNIAL WATER QUALITY INVENTORY

The Water Board prepares a biennial report on water quality (as required under Section 305(b) of the Clean Water Act, PL 92-500). This report includes (a) a description of the water quality of major navigable waters in the state during the preceding years; (b) an analysis of the extent to which significant navigable waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allow recreational activities in and on the water; (c) an analysis of the extent to which elimination of the discharge of pollutants is being employed or will be needed; and (d) an estimate of the environmental impact and the economic and social costs necessary to achieve the "no discharge" objective of PL 92-500, the economic and social benefits of such achievement, and an estimate of the date of such achievement. Recommendations as to the programs that must be undertaken are provided, along with estimates of the cost.

6.8 OTHER MONITORING PROGRAMS

In addition to the state's surveillance and monitoring program, several other agencies in the Bay Area monitor water quality, including local city and county offices, federal agencies, and water supply districts. Local universities also conduct research and monitoring activities. All of these programs provide additional information and data that enhance the state's efforts.

FIGURES

TABLES

Table 6-1 Parameters Analyzed for in the Regional Monitoring Program

Conventional Water Quality Parameters
Conductivity
Dissolved Ammonia
Dissolved Nitrate
Dissolved Nitrite
Dissolved Organic Carbon
Particulate Organic Carbon
Dissolved Oxygen
Dissolved Phosphates
Dissolved Silicates
Hardness (when salinity is < 5 parts per thousand)
pH
Phaeophytin
Salinity
Temperature
Total Chlorophyll-*a*
Total Suspended Solids

Sediment Quality Parameters
% clay (< 4 µm)
% silt (4 µm–62 µm)
% sand (2 mm > 62 µm)
% gravel (> 2 mm)
% solids
Depth
Hydrogen Sulfide *(QAQC measurements)*
pH (porewater, interstitial sediment)
Total Ammonia *(QAQC measurements)*
Total Organic Carbon
Total Sulfide *(QAQC measurements)*
Total Nitrogen

Bivalve Tissue Parameters
% Lipid
% Moisture
Bivalve Percent Survival
Growth - Change in Internal Shell Volume (mean, std. dev)
Dry Flesh Weight (mean and std error)

Toxicity Tests—Water and Sediment
Episodic Aquatic Toxicity – (*Ceriodaphnia, Menidia,* Mysid) % Survival
Sediment Toxicity – (Amphipod) % Survival
Sediment Toxicity – (Bivalve) % Normal Development

Trace elements analyzed in water, sediment, and tissue samples:
Target Method Detection Limits (MDLs) are in parentheses following the reporting units.

	Water (Dissolved and Total)	**Sediment** (dry weight)
Lab(s)	BRL/UCSCDET	BRL/CCSF/ UCSCDET
Aluminum (Al)*	-	mg/kg (200)
Arsenic (As)	µg/L (0.1)	mg/kg (0.2)
Cadmium (Cd)*	µg/L(0.001)	mg/kg (0.001)
Cobalt (Co)*	µg/L(0.001)	
Copper (Cu)*	µg/L (0.01)	mg/kg (2)
Iron (Fe)*	µg/L(10)	mg/kg (200)
Lead (Pb)*	µg/L (0.001)	mg/kg (0.5)
Manganese (Mn)*	µg/L (0.01)	mg/kg (20)
Mercury (Hg)	µg/L (.0001)	mg/kg (0.00001)
Methylmercury (MeHg)	ng/L (0.005)	µg/kg (0.005)
Nickel (Ni)*	µg/L (0.01)	mg/kg (5)
Selenium (Se)	µg/L (0.02)	mg/kg (0.01)
Silver (Ag)*	µg/L (0.0001)	mg/kg (0.001)
Zinc (Zn)*	µg/L (0.005)	mg/kg (5)

- Parameter is not sampled for the matrix.

* Near-total instead of total concentrations are reported for water. Near-total metals are extracted with a weak acid (pH < 2) for a minimum of one month, resulting in measurements that approximate bioavailability of these metals to Estuary organisms.

Trace organic parameters (lab; reporting units) – in water (AXYS & CDFG; pg/L), sediment (EBMUD; µg/kg), and bivalve tissue (CDFG-WPCL; µg/kg) samples:
Organochlorines analyzed by GC-ECD will be determined using two columns of differing polarity.

Polynuclear Aromatic Hydrocarbons (PAHs)
(Target MDLs: water – 200 pg/L, sediment and tissue – 5 µg/kg; water PAHs reported in ng/L)

1-Methylnaphthalene
2,3,5-Trimethylnaphthalene
2,6-Dimethylnaphthalene
2-Methylnaphthalene
Biphenyl
Naphthalene
1-Methylphenanthrene
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Phenanthrene
Benz(a)anthracene
Chrysene
Fluoranthene
Pyrene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(k)fluoranthene
Dibenz(a,h)anthracene
Perylene
Benzo(ghi)perylene
Indeno(1,2,3-cd)pyrene
Dibenzothiophene

Alkylated PAHs
C1-Chrysenes
C2-Chrysenes
C3-Chrysenes
C4-Chrysenes
C1-Dibenzothiophenes
C2-Dibenzothiophenes
C3-Dibenzothiophenes
C1-Fluoranthene/Pyrenes
C1-Fluorenes
C2-Fluorenes
C3-Fluorenes
C1-Naphthalenes
C2-Naphthalenes
C3-Naphthalenes
C4-Naphthalenes
C1-Phenanthrene/Anthracenes
C2-Phenanthrene/Anthracenes
C3-Phenanthrene/Anthracenes
C4-Phenanthrene/Anthracenes

SYNTHETIC BIOCIDES
(Target MDLs: water – 2 pg/L, sediment and tissue – 1 µg/kg)

Cyclopentadienes
Aldrin
Dieldrin
Endrin

Chlordanes
alpha-Chlordane
cis-Nonachlor
gamma-Chlordane
Heptachlor
Heptachlor Epoxide
Oxychlordane
trans-Nonachlor

Dichloro-diphenyl-trichloroethane (DDTs)
o,p'-DDD
o,p'-DDE
o,p'-DDT
p,p'-DDD
p,p'-DDE
p,p'-DDT

Hexachlorcylohexane (HCH)
alpha-HCH
beta-HCH
delta-HCH
gamma-HCH

Other Synthetic Biocides
Chlorpyrifos (water only; CDFG-WPCL)
Dacthal (water only)
Diazinon (water only; CDFG-WPCL)
Endosulfan I (water only)
Endosulfan II (water only)
Endosulfan Sulfate (water only)
Hexachlorobenzene
Mirex
Oxadiazon (water only)

OTHER SYNTHETIC COMPOUNDS
[1]New analytes added in 2002.
[2]Not required by RMP but are expected to be analyze in the 2002 RMP samples.

Polychlorinated Biphenyls (PCB) Congeners (IUPAC numbers)
(Target MDLs: water – 2 pg/L, sediment and tissue – 1 µg/kg)
8, 18, 28, 31, 33, 44, 49, 52, 56, 60, 66, 70, 74, 87, 95, 97, 99, 101, 105, 110, 118, 128, 132, 138, 141, 149, 151, 153, 156, 158, 170, 174, 177, 180, 183, 187, 194, 195, 201, 203

Polybrominated Diphenyl Ethers[1]
(BDE-IUPAC No., Compound Name)
(Target MDLs: water – 1 pg/L, sediment and tissue – 1 µg/kg).

BDE 7	[2,4-DiBDE]
BDE 8	[2,4'-DiBDE]
BDE 10	[2,6-DiBDE]
BDE 11	[3,3'-DiBDE]
BDE 12	[3,4-DiBDE]
BDE 13	[3,4'-DiBDE]
BDE 15	[4,4'-DiBDE]
BDE 17	[2,2',4-triBDE]
BDE 25	[2,3',4-triBDE]
BDE 28	[2,4,4'-triBDE]
BDE 30	[2,4,6-triBDE]
BDE 32	[2,4',6-triBDE]
BDE 33	[2',3,4-triBDE]
BDE 35	[3,3',4-triBDE]
BDE 37	[3,4,4'-triBDE]
BDE 47	[2,2',4,4'-tetraBDE]
BDE 49	[2,2',4,5'-tetraBDE]
BDE 51	[2,2',4,6'-tetraBDE]
BDE 66	[2,3',4,4'-tetraBDE]
BDE 71	[2,3',4',6-tetraBDE]
BDE 75	[2,4,4',6-tetraBDE]
BDE 77	[3,3',4,4',-tetraBDE]
BDE 82	[2,2',3,3',4-pentaBDE]
BDE 85	[2,2',3,4,4'-pentaBDE]
BDE 99	[2,2',4,4'5-pentaBDE]
BDE 100	[2,2',4,4',6-pentaBDE]
BDE 105	[2,3,3',4,4',-pentaBDE]
BDE 116	[2,3,4,5,6-pentaBDE]
BDE 119	[2,3',4,4',6-pentaBDE]
BDE 120	[2,3',4,5,5'-PeBDE
BDE 126	[3,3',4,4',5-PeBDE]
BDE 128	[2,2',3,3',4,4'-hexaBDE]
BDE 138	[2,2',3,4,4',5'-hexaBDE]
BDE 140	[2,2', 3,4,4',6'-hexaBDE]
BDE 153	[2,2',4,4',5,5'-hexaBDE]
BDE 154	[2,2',4,4',5,6'-hexaBDE]

Trace organic parameters (lab; reporting units) – in water (AXYS & CDFG; pg/L), sediment (EBMUD; µg/kg), and bivalve tissue (CDFG-WPCL; µg/kg) samples:

Organochlorines analyzed by GC-ECD will be determined using two columns of differing polarity.

Polynuclear Aromatic Hydrocarbons (PAHs) (Target MDLs: water – 200 pg/L, sediment and tissue – 5 µg/kg; water PAHs reported in ng/L)	**SYNTHETIC BIOCIDES** (Target MDLs: water – 2 pg/L, sediment and tissue – 1 µg/kg)	**OTHER SYNTHETIC COMPOUNDS** [1]New analytes added in 2002. [2]Not required by RMP but are expected to be analyze in the 2002 RMP samples.
		BDE 155 [2,2',4,4',6,6'-hexaBDE]
		BDE 166 [2,3,4,4',5,6'-hexaBDE]
		BDE 181 [2,2',3,4,4',5,6'-heptaBDE]
		BDE 183 [2,2',3,4,4',5',6-heptaBDE]
		BDE 190 [2,3,3',4,4',5,6-heptaBDE]
		BDE 203 [2,2',3,4,4',5,5',6]
		BDE 206 [2,2',3,3'4,4',5,5',6]
		BDE 209 [2,2',3,3',4,4',5,5',6,6'-decaBDE]

Table 6-2: Mussel Watch Program Monitoring Network

STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE	SAMPLING HISTORY
203.0	Tomales Bay / Shell Beach	38 07 03	122 52 25	1979-1982, 1991-1992, 1997-2000
203.1	Tomales Bay / Vincent Landing	38 13 08	122 56 39	1997-2000
203.2	Tomales Bay / Walker Ck Mouth #5	38 12 34	122 56 08	1999-2000
203.3	Tomales Bay / Walker Ck Mouth #1	38 12 30	122 55 43	1997-2000
203.4	Tomales Bay / Walker Ck Mouth #4	38 12 23	122 55 41	1998-2000
203.5	Tomales Bay / Walker Ck Mouth #2	38 12 22	122 55 51	1997-2000
203.7	Tomales Bay / Walker Ck Mouth #3	38 12 15	122 55 39	1997, 1999-2000
203.8	Tomales Bay / Marshall	38 09 05	122 53 19	1998-2000
203.9	Tomales Bay / Nicks Cove	38 11 57	122 55 16	1997-1998
204.0	Estero De San Antonio	38 16 11	122 58 47	1993
204.1	Tomales Bay / HP	38 12 27	122 56 34	2000
204.2	Tomales Bay / Hog Island	38 11 51	122 56 12	2000
204.3	Tomales Bay / Hamlet	38 12 23	122 55 35	1999-2000
204.4	Tomales Bay / Audubon	38 09 52	122 54 02	1999-2000
204.5	Tomales Bay / McDonald	38 10 48	122 54 33	2000
207.0	Point Reyes	37 59 35	122 59 16	1978-1979, 1991
208.0	Bolinas	37 54 37	122 41 00	1980-1981
210.0	Salmon Creek / Marshall-Petaluma Rd Brid	38 09 52	122 46 32	1999
210.1	Walker Creek / Mine Creek	38 09 47	122 46 57	1997
210.3	Walker Creek / Mid Stream	38 10 08	122 47 35	1997
210.5	Walker Creek / USGS Stream Gauge	38 10 32	122 49 15	1998
210.7	Walker Creek / Hwy 1	38 13 25	122 54 23	1998-1999
211.1	Lagunitas Creek / Bridge #1	38 02 59	122 45 36	1997
211.3	Lagunitas Creek / Bridge #2	38 01 45	122 44 14	1997
220.0	Napa River / Tubbs Ln.	38 28 47	122 24 56	1998
220.1	Napa River / Larkmead Ln.	38 27 20	122 24 23	1998
220.3	Napa River / Pope St.	38 25 31	122 22 25	1998
220.5	Napa River / Yountville Cross Rd.	38 22 46	122 18 37	1998
224.0	Sonoma Creek / Agua Caliente Rd.	38 17 58	122 29 01	1998
224.1	Sonoma Creek / Petaluma Rd.	38 16 49	122 28 23	1998
224.3	Sonoma Creek / Watmaugh Rd.	38 15 46	122 27 53	1998
230.0	Petaluma River / Ely Rd	38 17 06	122 40 02	1999
298.3	Concord Naval Weapons Station / Pier 4	38 03 25	122 00 01	1988
298.4	Concord Naval Weapons Station / Seal Isl	38 03 21	122 02 50	1988
299.1	Selby Slag 4	38 03 25	122 14 52	1988, 1996
299.2	Selby Slag 5	38 03 29	122 14 48	1988
299.3	Selby Slag 6	38 03 31	122 14 19	1988
299.4	Selby Slag 7	38 03 28	122 13 54	1988
300.2	Mare Island	38 04 30	122 14 45	1985-1989
301.0	Davis Point	38 03 09	122 15 36	1980, 1983, 1988
301.4	Union Oil Outfall	38 02 44	122 15 43	1988-1989
302.0	Point Pinole	38 00 60	122 21 48	1980-1993, 1995
302.4	Castro Cove Bridge	37 57 10	122 23 09	1988-1990
302.6	Paradise Cove	37 53 58	122 27 52	1996
303.0	Richmond/San Rafael Bridge	37 55 55	122 26 08	1980-1993
303.1	Santa Fe Channel / Mouth	37 54 30	122 21 40	1986, 1991
303.2	Lauritzen Canal / Mouth	37 55 15	122 21 60	1985-1988

STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE	SAMPLING HISTORY
303.3	Lauritzen Canal / End	37 55 26	122 21 58	1986-1988, 1991
303.4	Santa Fe Channel / End	37 55 26	122 22 32	1985-1987, 1991
303.6	Richmond Inner Harbor Basin	37 54 45	122 20 60	1985-1989
304.0	Staufer's	37 54 21	122 20 00	1982
304.4	Serl Intake	37 54 21	122 19 55	1991
304.6	Point Isabel	37 53 54	122 19 31	1988
305.0	San Francisco Bay / Angel Island	37 51 17	122 25 03	1980-1983
306.0	San Francisco Bay / Fort Baker	37 49 51	122 28 26	1981, 1983, 1991-1993, 1999-2000
306.1	Gashouse Cove / Laguna St	37 48 23	122 25 57	1996
306.2	Sansome St. / Pier 31	37 48 23	122 24 10	1996
306.3	Howard St. / Pier 14	37 47 35	122 23 26	1996
306.4	Central Basin / Outer	37 45 47	122 23 05	1996
306.5	Alcatraz Island	37 49 40	122 25 13	1989
307.0	San Francisco Bay / Treasure Island	37 48 42	122 21 33	1979-1993, 1997
307.1	San Leandro Bay / Damon Channel	37 45 03	122 12 49	1999
307.2	Alameda Yacht Harbor	37 46 45	122 15 15	1985-1989
307.3	Oakland Inner Harbor / West	37 47 59	122 19 53	1986-1987
307.4	Oakland Inner Harbor / Embarcadero Cove	37 46 50	122 14 40	1985-1989, 1991-1993
307.5	Lake Merritt	37 47 34	122 15 43	1992-1993
307.6	Oakland Back Harbor	37 45 30	122 13 25	1985-1988, 1999
307.7	San Leandro Bay/Elmhurst Ch	37 44 34	122 12 35	1999
307.8	San Francisco Outfall	37 44 55	122 22 30	1989
307.9	San Francisco / Islais Channel	37 44 51	122 23 05	1987-1988
308.0	San Francisco Bay / Hunter's Point	37 41 42	122 20 27	1981-1983, 1991-1993, 1995, 1997
308.2	Hunter's Point Shipyard	37 42 25	122 23 10	1988-1989
309.0	San Mateo Bridge / 8B	37 36 21	122 17 20	1980-1987, 1991-1993, 1995, 1997
310.0	San Mateo Bridge / 8A	37 35 21	122 16 08	1982
311.0	San Mateo Old Bridge	37 35 52	122 15 08	1982
311.4	North / South Bay	37 34 16	122 08 59	1996
312.0	Belmont Slough	37 32 60	122 14 47	1982
313.0	San Francisco Bay near Redwood Creek	37 33 09	122 11 45	1981-1985, 1991-1993, 1995, 1997
314.0	Redwood Creek / Channel Marker 10	37 31 49	122 11 38	1982
315.0	Redwood Creek / Towers	37 30 55	122 12 22	1982-1983
316.0	Redwood Creek / Tradewinds	37 30 09	122 12 49	1980, 1982-1983
317.0	Redwood City / STP Outfall	37 29 44	122 13 03	1983
318.0	Redwood Creek / Pete's Marina	37 30 00	122 13 24	1983
318.4	Redwood Creek / Bair Island	37 30 02	122 13 23	1987
319.0	Redwood Creek / Pulgas	37 30 30	122 14 37	1983
320.0	San Francisco Airport	37 30 55	122 14 50	1983
321.0	Dumbarton Bridge / Channel Marker 14	37 30 50	122 07 58	1980-1989, 1991-1992, 1995, 1997
323.3	Palo Alto Outfall	37 27 51	122 06 42	1989-1990
324.0	Newark Slough	37 29 36	122 05 11	1982
325.0	Channel Marker 17	37 28 41	122 04 32	1982
326.0	Palo Alto / Channel Marker 8	37 27 38	122 03 06	1982-1983, 1991-1993
327.0	Palo Alto / Yacht Club	37 27 09	122 02 10	1982

STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE	SAMPLING HISTORY
328.0	Alviso Slough	37 27 49	122 01 40	1982
329.0	Guadalupe Creek / Almaden Expressway	37 16 31	121 52 33	1997
329.1	Arroyo Calero / Harry Rd.	37 12 42	121 49 41	1998
329.2	Guadalupe Creek / Hicks Road	37 13 22	121 54 16	1997-1998
329.3	Alamitos Creek / Bubbling Well Pl.	37 13 25	121 51 10	1998
329.4	Alamitos Creek / Almanden Road	37 10 44	121 48 57	1997-1998
329.5	Guadalupe River / Capitol Expressway	37 17 53	121 49 25	1998
330.0	Duxbury Reef	37 53 38	122 42 09	1980-1981
331.0	Muir Beach	37 51 28	122 34 50	1980
332.0	Point Bonita	37 49 11	122 31 53	1980
333.0	Farallon Islands	37 41 45	123 00 00	1978-1980
334.0	Cliff House	37 46 57	122 30 46	1980
335.0	Pacifica	37 40 09	122 29 41	1980
336.0	J. Fitzgerald	37 30 45	122 30 30	1978-1981, 1991, 1998-2000
399.2	Pescadero Creek	37 14 57	122 23 40	1988-1989

Table 6-3: Toxic Substances Monitoring Network

STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE
204.30.11	Alameda Creek / Niles Canyon Road	37 34 58	121 57 47
204.30.00	Alameda Creek / Shinn Pit	37 34 17	121 59 15
205.40.17	Alamitos Creek d/s Almaden Reservoir	37 10 27	121 49 23
205.40.18	Almaden Reservoir	37 9 45	121 49 48
205.30.30	Anderson Reservoir	37 9 58	121 37 30
205.50.08	Bear Gulch Reservoir	37 26 0	122 13 40
205.50.07	Calabazas Creek d/s Tasman Drive	37 24 10	121 59 10
205.40.16	Calero Reservoir	37 10 50	121 47 10
205.30.08	Coyote Creek / Brokaw Road	37 23 0	121 54 15
205.30.18	Coyote Creek / Percolation Pond	37 13 48	121 45 12
205.30.07	Coyote Creek u/s Montague Expressway	37 23 45	121 54 50
205.30.37	Coyote Reservoir	37 7 15	121 33 5
206.50.24	Dry Creek	38 24 22	122 26 22
204.20.00	Elmhurst Creek / Mouth	37 44 35	122 12 23
205.40.13	Guadalupe Creek d/s Guadalupe Reservoir	37 12 0	121 52 50
205.40.14	Guadalupe Reservoir	37 11 53	121 52 34
205.50.09	Guadalupe River / Howard Street	37 20 20	121 54 5
205.40.08	Guadalupe River / Percolation Pond	37 14 50	121 52 19
206.50.03	Lake Chabot / Solano County	38 8 11	122 14 5
207.21.03	Lake Herman	38 5 45	122 9 20
202.10.01	Lake Merced	37 43 38	122 29 15
205.40.02	Los Gatos Creek	37 14 17	121 58 18
206.50.14	Napa River / Napa	38 22 6	122 18 8
207.10.12	New York Slough	38 2 1	121 52 7
206.30.07	Petaluma River / Lakeville	38 11 59	122 33 0
204.20.01	San Leandro Creek / Highway 880 Bridge	37 43 31	122 10 56
206.60.01	San Pablo Creek	37 58 3	122 21 46
206.40.08	Sonoma Creek	38 16 3	122 28 2
205.50.94	Stevens Creek	37 18 15	122 14 24
205.50.10	Stevens Creek Reservoir	37 17 38	122 4 41
207.10.90	Suisun Bay	38 4 5	122 2 40
205.40.01	Vasona Lake	37 14 45	121 58 0
201.12.01	Walker Creek	38 14 0	122 54 47
207.32.06	Walnut Creek	37 54 3	122 3 33