9 UNDERSTANDING AND CONTROLLING POLLUTANTS

9a | The WMI's Vision of Waters Unaffected by Pollutants

In the WMI's vision, southern South San Francisco Bay and the Santa Clara Basin's streams and reservoirs are fishable and swimmable. Fish and shellfish can be eaten without concern about the health effects of pollutants. Where people access the water, the sights and smells are natural, and there are few concerns about contracting water-borne diseases. No pollutants interfere with survival and reproduction of fish or other aquatic organisms, or with the birds and mammals that feed on them.

9b | A Brief History of Water Pollution in San Francisco Bay

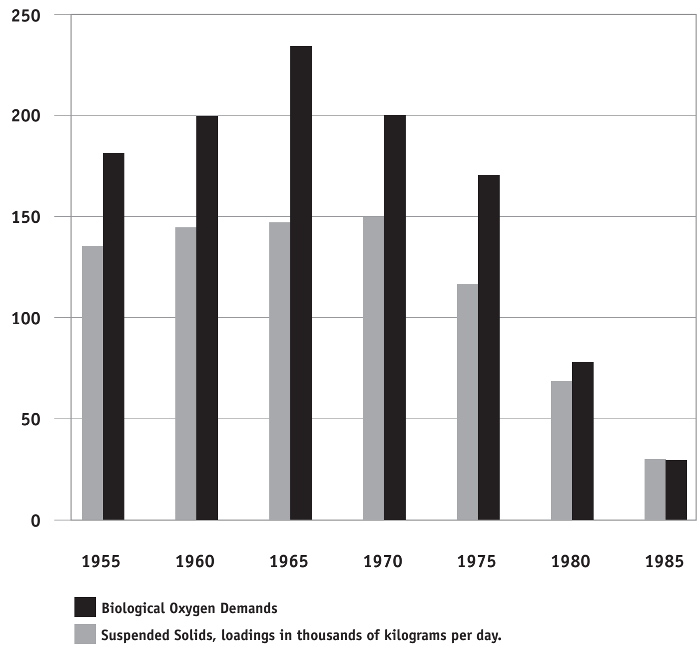
For 100 years following the Gold Rush, little was done to protect San Francisco Bay, even as 2.5 million people settled along its shores. Early sewage systems simply piped raw sewage into the Bay.

People gave up on harvesting shellfish sometime in the 1930s. By the late 1940s, the Bay produced, in summertime, an awful sulfide stench that blackened paint and tarnished household silver.

California's 1949 Dickey Act established nine Regional Water Quality Control Boards (RWQCBs) with watershed, rather than political, boundaries. The San Francisco Bay RWQCB worked with cities to begin some sewage treatment.[1] But partial treatment couldn't keep up with population growth, and the problem continued to worsen.

The 1969 Porter-Cologne Act expanded the RWQCB's powers to regulate waters "to attain the highest quality which is reasonable." But it took massive investment of public money—spurred by Federal grants—to tackle the sewage problem.

In 1972, Congress passed the Clean Water Act (CWA), establishing the National Pollutant Discharge Elimination System (NPDES) and requiring wastewater treatment facilities to implement secondary (biological) treatment. The Act also required industries to pretreat their discharges to municipal sewers. During the 1970s and 1980s, USEPA's construction grants program put more than $60 billion into public sewage treatment projects. The grants program required cities to establish fees to maintain, replace, and expand the facilities. Federal funding ended in 1990.



9.1 Loadings of Pollutants to SF Bay from Sewage Treatment Plants
BOD = Biochemical Oxygen Demand
SS = Suspended Solids, loadings in thousands of kilograms per day. Source: Bruhns, "50 years…".

With this massive public investment, Bay area cities built large plants that screen and settle sewage, then biologically treat it to remove over 90% of oxygen-depleting organics (biochemical oxygen demand, or BOD) and suspended solids. The effluent is disinfected before being discharged to the Bay. Despite increasing population and sewage flows, these plants ended the gross pollution of San Francisco Bay and restored the oxygen levels that fish need to survive (Figure 9.1).

Southern South San Francisco Bay is shallower, warmer, and has less circulation than other parts of the Bay. Occasional drops in oxygen concentrations persisted there. In 1979, the three plants discharging to southern South San Francisco Bay—in Palo Alto, Sunnyvale, and San Jose—added treatment steps to reduce ammonia, and the episodes of oxygen depletion immediately stopped.[2] These plants also filter their effluent.

As improved technology was removing BOD, solids, and ammonia from an ever-increasing flow of sewage, the Bay area's industries were booming—and they were discharging increasing amounts of heavy metals and other toxic chemicals into municipal sewers.[3] When Bay area treatment plants began permitting and inspecting industrial dischargers in the early 1980s,[4] the amount of heavy metals in Bay waters and in aquatic organisms dropped. This was demonstrated by long-term studies of native clams in the vicinity of Palo Alto's outfall.[5]

By the late 1980s, the effects of wastewater and industrial discharges to San Francisco Bay had been greatly reduced. Some shellfish harvesting resumed. But the Bay's problems hadn't been resolved.

Water diversions from the Sacramento/San Joaquin delta—mostly to serve the State Water Project and Central Valley Project—caused saline tidal waters to move far up the Sacramento River during dry years. The relocation of the freshwater/tidal interface affected the biological productivity North Bay wetlands.

An average of two new species have been introduced to the Bay every year since 1970. Introduced clams are capable of filtering the entire volume of the South Bay once a day. This has radically affected the stock of algae, altering the entire food web.[6] The Chinese mitten crab *(Eriocheir sinensis)*, which burrows in levees and banks in tidal areas, was first collected by shrimp trawlers in South San Francisco Bay in 1992 and has since spread throughout the San Francisco/ San Joaquin delta and into Sierra streams.[7]

Pollutants continue to threaten the Bay's aquatic life and the suitability of the Bay for fishing and swimming. But today's pollutant problems are different: they come from diffuse sources throughout the watershed, and most were produced and scattered over 100 years of settlement and industrial development. Some of these "non-point" legacy pollutants also affect Basin creeks, wetlands, and reservoirs.

9c | Sources, Fate, Transport, Effects

It required billions of dollars of public investment to clean up BOD, solids, and ammonia ("conventional" pollutants) from San Francisco Bay. But that task was relatively simple, compared to removing non-point and legacy pollutants.

The sources of the conventional pollutants were well defined: the sewage outfalls circling the Bay. Once the conventional pollutants were removed by treatment, the Bay naturally processed the residue left by years of pollution. Key indicators, like dissolved oxygen and the absence of fish kills, improved rapidly.

In contrast, each non-point and legacy pollutant has its own sources, fate, transport, and effects. Three examples illustrate the diverse history and characteristics of these pollutants:

1. Tetraethyl lead was added to gasoline from the 1920s through the 1970s. Lead bonds strongly to sediment, and roadside soils are laced with lead, which is also found in the sediment of streams flowing through cities. Lead is stable (won't biodegrade), but fortunately, aquatic life does not seem to be significantly affected.

2. PCBs were developed for commercial use in the late 1920's and widely used in many applications, including in electrical transformers and as a component of industrial lubricants and coatings. Manufacturing of PCBs was banned in the U.S. in 1979. Low concentrations of PCBs are ubiquitous in urban storm drain sediments, but there are also "hot spots" where concentrations may be 100 or 1,000 times higher. PCBs bioaccumulate, and higher levels of the food chain (birds, aquatic mammals, and humans that eat fish) may suffer increased cancers or reproductive harm.

3. Industrial pretreatment programs cut by 90% the quantity of copper and silver discharged from municipal sewage treatment plants. However, both metals adsorb to sediments, and Bay sediments are "enriched" with the legacy of pre-1985 concentrations. Now, nearly two decades later, the sediments are releasing copper and silver back into the overlying water. Permanent burial of these sediments, or their erosion and transport out through the Golden Gate, will take many decades. For copper, a study of its contaminant fate and transport found that copper is unlikely to impair South San Francisco Bay. A monitoring program will determine whether copper will be an issue for the Bay in the future.[8]

9d | Controlling Pollutants from Non-point Sources

9d1 The Stormwater NPDES Program

Congress amended the Clean Water Act in 1987 to bring discharges from municipal separate storm sewer systems[9] under the NPDES program. The new Section 402(p) required cities to (1) effectively prohibit non-stormwater discharges to municipal separate storm sewer systems and (2) implement controls to reduce pollutants in stormwater to the maximum extent practicable.

USEPA promulgated requirements for municipal stormwater NPDES permits in 1990. The RWQCB enforces the requirements in the Bay area. California municipalities worked with the state to define BMPs for local programs.

< < < REWIND

SCVWD's Stream Maintenance Program is discussed in Section 8e4.

The RWQCB issued the 15 SCVURPPP co-permittees a first NPDES permit in 1990 and reissued the permit in 1995 and 2001. Working individually and collectively to implement an Urban Runoff Management Plan,[10] the co-permittees eliminate illicit connections and stop illegal dumping to storm drains, educate and involve the public in preventing stormwater pollution, reduce sources of pollutants from their own municipal activities, monitor and enforce erosion and sedimentation controls at construction sites, and inspect industrial sites.

SCVURPPP also monitors implementation and effectiveness of pollution-prevention measures and, in cooperation with the WMI, monitors and assesses the status of streams and water bodies in the Basin.

9d2 Adopt-a-Creek

SCVWD established the Adopt-A-Creek program in 1994. Adopt-a-Creek assists over 100 individuals, corporations, and community groups to organize twice-yearly trash cleanups. The program issues permits for creek access, publishes a newsletter twice a year, and encourages residents to report problems such as larger debris, erosion, or pollutant discharges. These problems may be addressed through SCVWD's Stream Maintenance Program.

9e | Water-quality-based Regulation of Pollutants

The CWA has "back-up" provisions to insure that water quality standards are met. Water quality standards include designated uses, narrative or numeric water quality objectives, and measures to insure that existing water quality is not degraded. If water quality standards are not attained, point-source dischargers must further reduce their pollutant discharges. California also requires urban runoff dischargers to address attainment of water quality standards in their management plans.[11]

9e1 Water-Quality Surveys, Impaired Water Bodies and TMDLs

USEPA requires states to submit a water quality survey (Section 305(b) water quality assessment) and a list of impaired water bodies (Section 303(d) list) every two years.

If a water body is impaired, the state must calculate the maximum pollutant load that a water body can assimilate and still meet water-quality objectives. Based on this Total Maximum Daily Load (TMDL) the state allocates loads to point and non-point pollutant sources and may require pollutant-loading reductions.

9e2 The Total Maximum Daily Load Process

Congress adopted TMDL requirements in 1972. USEPA issued regulations in 1985 and 1992 but the states implemented few TMDLs until environmental advocates brought successful lawsuits in the late 1990s.

TMDLs include a problem statement, a quantitative description of the desired condition, analyses of pollutant sources and the assimilative capacity of the water body, and allocations of loads to the various sources (with a margin of safety). They also include plans and schedules to fix the impairment (i.e., meet water quality standards) and monitoring to track the implementation and effectiveness of actions.

The RWQCB created the Regional Monitoring Program for Trace Substances (RMP) in 1991 to monitor contaminant concentrations in water, sediments, and fish and shellfish tissue in San Francisco Bay and Delta. Seventy-seven NPDES permittees share the RMP's $2.5 million annual cost. The RWQCB uses RMP data when it prepares 305(b) reports, 303(d) lists, and TMDLs.[12]

In addition to supporting the RMP, Bay area POTWs and stormwater pollution prevention programs share the cost (estimated at $7 to $10 million over five years) of a Clean Estuary Partnership[13] to assist RWQCB staff with TMDLs.

9e3 Current Listings and TMDLs in the Santa Clara Basin

The RWQCB and USEPA list a number of pollutants that impair beneficial uses of San Francisco Bay. Some streams are also impaired. Table 9.1 shows TMDLs currently scheduled in Basin water bodies. The RWQCB placed additional pollutants on a "monitoring list." Following are details about some of these ongoing and potential TMDLs and WMI stakeholders' contributions:

Copper and Nickel in South San Francisco Bay. The RWQCB first listed South San Francisco Bay as impaired by copper and nickel in 1989. A 1992 study of pollutant loads to San Francisco Bay led to a "Copper Dialogue" MOU, which was intended to achieve reductions in copper loads from various sources. A 1996 Metals Control Measures Plan (MCMP) identified copper-containing brake pads as a principal source of copper in runoff; the principal source of nickel is erosion of soils containing naturally high concentrations of nickel.[14] SCVURPPP's 1997 Urban Runoff Management Plan incorporates the MCMP actions.[15] In 1998, the City of San Jose funded extensive studies of copper and nickel, and the WMI formed a "Copper and Nickel TMDL Work Group" (TWG) to guide the studies. In June 2000, the TWG found that it is unlikely that concentrations of copper and nickel in southern South San Francisco Bay are impairing aquatic life.[16]

The TWG then developed "Action Plans" for copper[17] and nickel.[18] Under the Action Plans, the WMI will study remaining uncer-

< < < REWIND

Copper/nickel actions include finding ways to reduce automobile use through changes in transportation and land use policy. See Chapter 3.

WMI Accomplishment

The achievement of stakeholder and scientific consensus regarding copper and nickel in South San Francisco Bay, developed through an SCBWMI stakeholder process, could provide a model for other TMDLs.

tainties about impairment. Ambient concentrations will be monitored; additional actions will be triggered if concentrations rise above set levels.

In December 2000, the RWQCB revised the Basin's three treatment plants' NPDES permits and formalized the plants' ongoing commitment to improve pretreatment programs, conduct scientific studies leading to final site-specific objectives, reduce discharges through water recycling, and continue participation in the WMI. The RWQCB concluded at that time that copper and nickel did not impair southern South San Francisco Bay.[19] In early 2001, actions specific to urban runoff were included in the SCVURPPP's reissued NPDES permit.[20]

In May 2002, the RWQCB adopted site-specific water-quality objectives[21] for copper and nickel. In doing so, the RWQCB commended the WMI and its participants "for their collaborative efforts and commitment of time and resources that contributed to the success of this project. Provision for stakeholder involvement, generation of high quality and reliable studies and data, and scientific peer review of findings are hallmarks of this project that serve as a model for successful resolution of complex technical and policy issues."[22]

Mercury in All San Francisco Bay Segments. Total mercury concentrations in San Francisco Bay waters exceed the RWQCB's Basin Plan objective (0.025 µg/L). Plant and animal tissues don't readily absorb inorganic mercury, but methylated mercury, produced in a complex cycle in certain natural environments (including wetlands) is more easily absorbed and can bioaccumulate.

Some fish caught in San Francisco Bay (e.g., leopard sharks) exceed the Federal Food and Drug Administration (FDA) limit for methylmercury in fish (1 µg/g). In December 2000, USEPA recommended that states adopt site-specific standards based on local consumption. The RMP recently completed a survey of fish consumption by anglers in San Francisco Bay and a third study of concentrations in fish tissue.

RWQCB staff is working with a stakeholder group (the Mercury Council) to develop a TMDL. A 2001 staff report[23] found that Central Valley watershed sources accounted for 58% to 74% of mercury entering the Bay, and remobilization of sediments accounted for 17% to 30%. Urban stormwater (about 4%), mining waste in the Guadalupe River watershed (1% to 4%) atmospheric deposition, natural minerals in soil, and atmospheric deposition on the Bay account for the remainder. Concentrations in most of the Bay are below the methylmercury target (0.5 ng/l in water[24]), but the highest concentrations are near the Guadalupe River.

The POTWs and SCVURPPP educate the public to properly recycle and dispose of fluorescent bulbs, thermometers, and other items that contain mercury.

Mercury in the Guadalupe Watershed. From the Gold Rush era until 1975, cinnabar was mined from the New Almaden Mining District on the eastern side of this watershed. Mine tailings were deposited in drainages, or have eroded into the drainages.

Studies of fish in reservoirs and the Guadalupe River in 1987 and 1988 led to fish consumption advisories. Mercury in fish may also be harmful to fish-eating

TABLE 9.1 SCHEDULE FOR SANTA CLARA BASIN TOTAL MAXIMUM DAILY LOADS

			CURRENT PROJECTED COMPLETION DATE		
WATERBODY(S)	**POLLUTANT(S)**	**COMPLETION DATE ON 1998 303(D) LIST (► = STARTED)**	PRELIMINARY PROJECT REPORT	FINAL PROJECT REPORT	PLANNED BASIN PLAN AMENDMENT
All San Francisco Bay Segments	Mercury	2003►	June 2000	May 2003	August 2003
South SF Bay	Copper	2003►	Not Applicable	Not Applicable	Completed
South SF Bay	Nickel	2003►	Not Applicable	Not Applicable	Completed
All SF Bay Segments	PCBs	2008►	May 2003	October 2003	March 2004
SF Bay Urban Creeks (35 water bodies)	Diazinon	Listed by USEPA►	Completed	October 2003	March 2004
Guadalupe River Watershed Calero Reservoir Guadalupe Reservoir Alamitos Creek Guadalupe Creek Guadalupe River	Mercury	2003►	June 2005	February 2006	June 2006
San Francisquito Creek	Siltation	2005►	June 2004	May 2005	April 2006
All SF Bay Segments	Diazinon	2005	June 2005	June 2006	June 2007
All SF Bay Segments	Selenium	2010	June 2008	June 2009	June 2010
All SF Bay Segments	Chlordane, DDT, Dieldrin	Listed by USEPA	June 2005	December 2006	June 2007
All SF Bay Segments	Furans	Listed by USEPA	To be determined	To be determined	To be determined
All SF Bay Segments	Dioxins	Listed by USEPA	To be determined	To be determined	To be determined

Source: San Francisco Bay RWQCB TMDL Projects webpage, **www.swrcb.ca.gov/rwqcb2/tmdlprojects.htm**

birds, such as the common merganser, black-crowned night heron and belted kingfisher. Mercury concentrations in sediment exceed values that may increase mortality and teratogenesis in rainbow trout embryos. FWS recently completed a Natural Resource Damage Assessment in the Guadalupe watershed.

Since 1988, Santa Clara County and SCVWD have removed or immobilized much of the mercury-laden sediments in the mining area. In 2000, the state Department of Toxic Substances Control announced that remedial actions had been completed and that the mining area (now Almaden Quicksilver County Park) was no longer a threat to public health or the environment. However, additional investigation of these area, and of mercury-laden sediments that may have moved downstream, is required.[25]

The WMI's Guadalupe River Mercury TMDL Workgroup developed a Recommended Interim Sampling and Monitoring Plan. Implementation is beginning in 2003.

PCBs in San Francisco Bay. PCBs are a group of over 200 organic chemicals. Manufactured from 1929 to 1979, PCBs were used as hydraulic fluids, lubricants, plasticizers, insulators in electrical transformers, in industrial paints and coatings, and in carbonless copy paper.

PCBs bioaccumulate, and piscivorious fish, birds, and mammals (including humans) are most vulnerable. PCBs vary in toxicity; long-term exposures have been associated with developmental abnormalities, disruption of the endocrine system, impairment of immune function, and cancer. The U.S. banned sale and production of PCBs in 1979.

A 1994 RWQCB Fish Contamination Study[26, 27] found that PCB concentrations in fish throughout the Bay exceeded screening values; this led to health advisories for the consumption of sport fish. San Francisco Bay waters exceed the California Toxics Rule criterion (170 ng/L total PCBs) at all locations. (Exceedances of this low limit can also be found in samples from Arctic waters.)

The RMP's Sources, Pathways, and Loadings Work Group (SPLWG) and Chlorinated Hydrocarbon Work Group (CHCWG) concluded that there was no declining trend in PCB concentrations in water, sediment or mussel tissues since the early 1980s. However, recent data are being analyzed to determine whether PCBs are declining.

After creating a mass budget for PCBs in the Bay and estimating losses due to outflow, burial, and volatilization, the workgroups concluded that continuing inputs from the surrounding watersheds may contribute to the persistence of high PCB concentrations. Air deposition of PCBs may also be significant. An Estuary Interface Pilot Study, funded in part by SCVURPPP and conducted by the RMP, included sampling near Standish Dam on Coyote Creek and in Alviso Slough. The authors concluded that South Bay watersheds may be ongoing sources of PCBs (as well as chlordane, dieldrin and other pollutants).

In 2000, a City of San Jose/Silicon Valley Toxics Coalition project[28] identified the accumulation of PCBs in transplanted clams in the Guadalupe River, Coyote Creek, and Sunnyvale East Channel.

SCVURPPP led a multi-stormwater-agency study to characterize the concentration of PCBs and mercury in storm drain sediments. Follow up studies include characterization of sediment concentrations at tributary mouths, pilot work to investigate areas with elevated PCBs in storm drain sediments, and initial identification and evaluation of control measures.

Chlordanes, DDTs, and Dieldrin in San Francisco Bay. Like PCBs, these chlorinated hydrocarbon pesticides (CHCs) are no longer produced or used, but they persist in sediments and are biomagnified in the food chain. The 1994 Fish Contamination Study and follow-up work by the RMP published in 1999[29] found a significant percentage of samples were above screening values for some species. In general, higher concentrations were found in more industrial areas.

1997 fish tissue DDT concentrations are as little as 3-5% of the values in 1965, when DDT was partially banned. However, most of the decrease occurred soon after the halt in widespread use. Decreases in the concentrations of CHCs will be slow, due to resuspension of sediments and continuing input of polluted sediments from contributing watersheds.

USEPA listed these pollutants, but the RWQCB has not yet scheduled development of a TMDL. However, anticipating the need for data similar to that required for PCBs, SCVURPPP and other stormwater programs incorporated CHC analyses into the second year of their stormwater sediment characterization study.

Diazinon in urban creeks. This organophosphate pesticide is widely marketed for home and garden use. It is also used in commercial agriculture. Unlike organochlorine pesticides such as DDT, it is not bioaccumulative and usually persists for only 7-40 days in surface waters.

Studies in the Santa Clara Valley in 1992 suggested that some toxicity in urban runoff might be due to organic compounds. Subsequent toxicity identification evaluation (TIE) procedures associated observed toxicity with diazinon.[30] Grab samples from creeks throughout the Bay area in 1995 showed widely ranging concentrations of diazinon, with many in the range associated with laboratory toxicity to *Ceriodaphnia dubia*.

There is no water quality objective for diazinon. However, several creeks were observed to exhibit toxicity due to diazinon. EPA chose to list all urban creeks (37 are named) as impaired based on exceedance of the toxicity narrative objective.

Diazinon's chief manufacturer, Syngenta, will phase out all home and garden applications over the next four years. The voluntary phase-out responds to USEPA concerns about potential health impacts, particularly to children. RWQCB staff recommends continued listing until in-stream data show that concentrations are below those associated with aquatic toxicity. As use of organophosphate pesticides declines, regulatory attention is shifting to possible "third generation" successors, such as pyrethrins and pyrethroids, and whether these naturally derived pesticides might cause toxicity in urban creeks.

A Bay Area/Central Valley Urban Pesticide Committee seeks ways to limit use.[31] SCVURPPP promotes integrated pest management and other alternatives to pesticides.

Dioxins and Furans in San Francisco Bay. In 1999, USEPA added dioxins and furans to the 303(d) list. The RWQCB's TMDL schedule is "to be decided." Like PCBs, dioxins can be extremely toxic in low concentrations, tend to adhere to sediments, and degrade very slowly in the natural environment. Unlike PCBs, they have a plethora of continuing sources, including nearly all types of combustion—particularly the combustion of wood in stoves and fireplaces and diesel fuel. Garbage burning and medical waste incineration have been major sources of dioxin emissions in other parts of the U.S. While these activities are no longer practiced in the Bay area, they may have contributed to dioxin in Bay and watershed sediments.

In 2002, SCVURPPP reviewed data on methods used to characterize dioxins in stormwater runoff and surface waters and concentrations typically found in the Bay Area and other areas. SCVURPPP is currently collaborating with other Bay Area stormwater management agencies to develop a "synthesis" document that will summarize the current state of knowledge regarding dioxins in stormwater runoff.

Sediment and Siltation in San Francisquito Creek. Adult steelhead migrate up San

Francisquito Creek to spawning redds on Los Trancos Creek and Bear Creek. In the early 1990s, a group of local citizens began to plan a clean up and enhancement of the watershed. The Peninsula Conservation Center Foundation adopted a formal Coordinated Resource Management and Planning (CRMP) process in 1993. A watershed plan was prepared in 1995 and 1996. A February 1998 flood brought new urgency to flood management issues. That same year, the RWQCB added San Francisquito Creek (along with San Gregorio Creek and Pescadero Creek in San Mateo County) to the 303(d) list, stating that they were impaired by sediment and siltation.

< < < REWIND

The concept of stream equilibrium is essential to understanding sediment in streams. See Section 8d.

Meanwhile, the CRMP (now the San Francisquito Watershed Council) has produced its own Long Term Monitoring and Assessment Plan (LTMAP) for the San Francisquito Creek watershed. The LTMAP includes metadata for existing studies and outlines future monitoring needs.

SCVURPPP, the San Mateo Countywide Stormwater Pollution Prevention Program (SMCSTOPPP) and other stakeholders are planning a sediment assessment to meet the different requirements of the RWQCB's TMDL work plan, SCVURPPP's NPDES permit, SMCSTOPPP's NPDES permit, additional requirements of RWQCB staff, and conditions of grant funding. They propose to use USGS and Stanford University sediment analyses that are currently underway. A draft scope suggests broad geomorphic studies, assessments of habitat, endangered species, and land use, and application of different approaches to assessing sources and impacts of sediment to the creek. The WMI's SOILS (Sediment Observations in Lotic Systems) Work Group is helping coordinate.

9e4 Potential new TMDLs in the Santa Clara Basin:

In 2001, the RWQCB created a "monitoring list" of pollutants and water bodies that need further investigation and possible listing in the next cycle. The "monitoring list" includes:

Sediment or Siltation in other creeks. SCVURPPP used the WMI's metadata database, supplemented by additional research, to prioritize investigation of possible impairment of stream reaches. The prioritization was based on beneficial use designation, type of fish community present, fish habitat survey data, and benthic macroinvertebrate community structure data. Evidence of bed and bank erosion, sediment accumulation areas, land use, and channel modifications were also considered. These factors were weighted for availability and relevance of data. SCVURPPP identified Stevens Creek and Coyote Creek as the highest priorities for conducting watershed analysis and assessing existing management practices for sediment and erosion control and prevention. SCVURPPP developed a work plan and schedule to conduct a watershed analysis and management practice assessment for these stream reaches, which will begin in July 2003.

Trash in urban creeks. Bay area cities commented at length on the RWQCB's consideration of a 303(d) listing and TMDL for all urban creeks. The RWQCB rejected the view that ongoing active municipal clean-up efforts are sufficient to avoid a listing, as programmatic measures of effort alone do not provide evidence of whether or not the water body is impaired.

The Los Angeles Basin RWQCB adopted a Trash TMDL for the Los Angeles River in September 2001. The target quantity is zero. The Los Angeles TMDL foresees installation of devices to catch trash in storm drains and requires that these be cleaned out within 72 hours after each rain event and every 3 months during dry weather.

Recent SCVURPPP efforts have addressed trash. One project expands on an earlier preliminary evaluation of storm drain inlet designs to prevent trash from entering drains. Another seeks to identify and map trash "hot spots;" this could lead to prioritizing cleanup and enforcement. SCVURPPP developed a work plan and schedule to address trash problems in urban creeks. Work will begin July 1, 2003 and continue for the next two years. Work plan tasks include documenting and evaluating existing trash management practices, identifying and prioritizing trash problem areas, conducting trash assessments, and implementing additional BMPs at high priority trash areas.

Polybrominated Diphenyl Ethers (PBDEs). In 1998, the RMP CHCWG found that "The RMP is underestimating contamination in the Bay by focusing on chemicals that are no longer in use.… CHCs have been replaced by other pesticides, insulators, and flame retardants that are required to be highly toxic and/or persistent in order to serve their purpose. Few of the chemicals that are currently in heavy use and are of potential concern in the Bay are currently monitored by the RMP."[32] Jay Davis at the San Francisco Estuary Institute (SFEI) subsequently noted that gas chromatograph (GCMS) traces from cormorant egg samples suggested concentrations of unknown contaminants, later identified as PBDEs. Later studies have found PBDEs in harbor seal blubber and human adipose tissue. PBDEs are similar in chemical structure to PCBs and are obviously bioaccumulative, but little is known of their effects.

RWQCB staff did not recommend a 303(d) listing for PBDEs because no applicable water quality criteria have been established; however, PBDEs are included on the monitoring list. The RMP 2002 Monitoring Plan includes special studies to sample Bay waters for pollutants on the 1977 USEPA priority list that have not been previously monitored and to review the toxic substances registry for possible substances that may persist in the environment or bioaccumulate.

Endocrine Disrupting Chemicals (EDCs). High concentrations of organochlorine pesticides, PCBs, dioxins, and some synthetic and plant-derived estrogens can disrupt animal endocrine systems. It is unknown if humans or wildlife are affected by lower concentrations of the same chemicals. Improved laboratory techniques allow scientists to measure concentrations in the part-per-trillion range in runoff and treated wastewater.

The endocrine system plays a critical role in normal growth, development, and reproduction. Even small disturbances in endocrine function may have profound and lasting effects, and multiple EDCs may have synergistic effects. A coordinated federal research effort has been underway since the late 1990s.

The WMI's Emerging Contaminants Workgroup includes scientists, engineers, regulatory personnel, environmental advocates, water retailers, health practi-

< < < REWIND

SCVWD's "Adopt-a-Creek" program is discussed in Section 9d2.

tioners, and community members. The workgroup discusses and researches issues related to pollutants that has become recognized as new environmental concerns, such as EDCs and PBDEs.

Pathogens in Creeks. In 2001, the RWQCB listed ocean beaches and creeks in San Francisco and San Mateo County and added Redwood Creek in the South Bay to the "monitoring list." Discerning whether a water body may be impaired by disease-causing microbes is complicated because:

- The relationship between the presence of indicator organisms (typically coliform bacteria) and the presence of pathogens is variable and complex.
- The presence of coliform or fecal coliform may be due to wildlife or domestic animals rather than pollution with human feces.
- Indicator-based water-quality criteria are complex and require calculation of a mean of samples taken within a specified period.
- Actual public health risk depends on opportunities for exposure. Evaluation of actual use for swimming and other contact recreation is required.
- Both use and water quality vary with season.
- Actual public health risk depends on the size and immune status of the population exposed.

Citizen monitoring of Saratoga Creek in the early 1990s found some samples with apparently high coliform levels; however, the data were insufficient for comparison with RWQCB Basin Plan objectives. (Further investigation eventually identified sewer leaks draining to the creek.)

SCVURPPP has created a computer-based tool that can evaluate coliform data and identify the boundaries of potential health risks based on that data. The screening tool uses a previously tested model of microbial risk.

In January 2001, USEPA published a Protocol for Developing Pathogen TMDLs. The protocol suggests an expanded set of microbial indicators; however, the approach is based on the broad application of criteria, rather than assessment of the actual risk in a specific location.

9f | Strategies for Understanding and Controlling Pollutants

9f1 Assessing Potential Impairments

Non-point source pollution is diffuse and variable. Sources, fate, transport, and effects vary from location to location within the Basin. Assessments need to be targeted and site specific.

Future watershed assessments will need to rapidly review (screen) stream reaches or wetland areas, identify which may be affected by pollutants, and prioritize these locations for further investigation. Prioritization criteria might include nearby land uses, proximity of known pollutant sources, or physical and visual evidence (disturbance, turbidity, oil sheen, trash) commonly associated with pollutants. The prioritization should also consider specific uses, habitat functions, and seasonality and how these may affect how long organisms are exposed and at what stage in their life cycle. The prioritization should lead to focused, well-designed studies to determine whether specific pollutants impair specific reaches or areas.

9f2 Impaired Water Bodies and TMDLs

The TMDL process provides a venue for stakeholders to participate in creating comprehensive, long-term plans to reduce specific pollutants. These pollutant-specific plans should build on previously planned and ongoing programs to reduce erosion, control urban runoff pollutants, restore habitat functions, and protect and enhance Basin watersheds. Regulatory actions should be pragmatic (results-oriented) and linked to achievable environmental benefits.[33]

When the RWQCB has placed a pollutant on the 303(d) list or "monitoring list," a structured, stakeholder-based process should be used to coordinate all further efforts to investigate or control that pollutant.

9g | Summary of Actions to Understand and Control Pollutants

The WMI has identified the following actions that agencies, organizations, and individuals can implement to understand and control pollutants:

- Improve implementation of TMDLs.
- Assess sources, fate, transport, and potential effects of pesticides, mercury, PCBs, dioxins, PBDEs, and endocrine-disrupting compounds.
- Review, prioritize, and implement actions to reduce potential effects of pollutants. Identify and remediate "hot spots" of PCBs.
- Identify and remediate "hot spots" of mercury. Assess actions that could reduce the methylation of mercury in wetlands.
- Assess the potential effects of pathogens on swimmers and other recreational users of streams, reservoirs, and southern South San Francisco Bay.
- Remove trash and larger debris from streams and wetlands and find ways to limit what gets dumped there.

9h | Next Steps for the WMI

9h1 WMI Actions Needed to Implement the Strategic Objective

- Continue to build on the WMI's successful collaborative processes that led to the 1998 adoption of uncontested discharge permits for the three POTWs and to the 2002 adoption of site-specific objectives for copper and nickel.
- Continue to develop assessment methodologies based on "lessons learned" from the assessments of the San Francisquito, Guadalupe, and Upper Penitencia watersheds and the SCVURPPP assessment of the Coyote watershed.
- Coordinate assessment results and data from TMDLs and other mandated studies with other WMI objectives, including watershed stewardship planning, expansion of the DESFBNWR, and habitat conservation.

- Prepare annual reports updating key indicators of watershed health and describing recent progress in preserving and enhancing Basin watersheds, new findings and study results, and WMI achievements and successes. (Consider the annual "Pulse of the Estuary" report as a model.)

9h1 Other WMI Actions that Support the Strategic Objective

- Reconvene the WMI Guadalupe Mercury TMDL Working Group.
- Continue the WMI's SOILS Working Group's efforts to coordinate the requirements of the RWQCB's San Franciscquito Sediment TMDL work plan, SCVURPPP's NPDES permit, SMCSTOPPP's NPDES permit, additional requirements of RWQCB staff, and conditions of grant funding.
- Convene additional work groups as needed to develop and implement TMDLs and pollutant-specific action plans.
- Conduct public outreach and education on the "virtual elimination" of mercury.
- Conduct public outreach programs encouraging integrated pest management and proper and limited use of pesticides.
- Research gaps and conflicts in regulations controlling air pollution and water pollution; initiate or influence legislation.
- Explore and encourage legislative actions and regulations that control the availability of products, including pesticides, that cause water pollution.
- Publish information, directed at policy-makers, that links pollutants and land use/transportation decisions.