SECTION IV. STATE OF THE WATERSHED REPORT
SAN JOAQUIN RIVER WATERSHED

Watershed Description

The San Joaquin River flows northward and drains the portion of the Central Valley south of the Sacramento-San Joaquin Delta and north of the Tulare Lake Basin. The San Joaquin River Basin covers 15,880 square miles and yields an average annual surface runoff of about 1.6 million acre feet. The Basin includes the entire area drained by the San Joaquin River and all watersheds tributary to the river. The principal streams in the basin are the San Joaquin River and its larger tributaries: the Consumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. Major reservoirs and lakes include Pardee, New Hogan, Millerton, McClure, Don Pedro, and New Melones.

The lower Basin (below Millerton Reservoir) has had a highly managed hydrology since implementation of the Central Valley Project (CVP) in 1951. Most of the San Joaquin River flow is diverted into the Friant-Kern Canal, leaving the river channel upstream of the Mendota Pool dry except during periods of wet weather flow and major snow melt. Poorer quality (higher salinity) water is imported from the Delta for irrigation along the west side of the river to replace water lost through diversion of the upper San Joaquin River flows. During the irrigation season, the flows in the river between the Mendota Pool and Salt Slough consist largely of groundwater accretions. Salt Slough and Mud Slough are the principal drainage arteries for the Grassland Sub-Watershed and add significantly to the flows and waste loads in the San Joaquin River upstream of its confluence with the Merced River. Discharges from three major river systems, the Merced, Tuolumne, and Stanislaus Rivers, which drain the Sierra Nevada, dominate flow and quality of discharges from the east side of the Lower San Joaquin River Basin. Flows from the west side of the river basin are dominated by agricultural return flows since westside streams receive no snowmelt to maintain their flows and most would go dry during the summer months.

The major land use in the valley floor along the Lower San Joaquin River is agriculture, with over 2.1 million irrigated acres, representing 22% of the irrigated acreage in California. Urban growth on the valley floor is converting historical agricultural lands to urban areas and is leading to increased potential for stormwater and urban impacts to local waterways.

The San Joaquin River Watershed can be broken into smaller units to address specific problems. One such area is the Grassland Watershed, a 370,000-acre area west of the San Joaquin River between the Tulare Lake Basin and the Orestimba Creek alluvial fan. The watershed contains managed wetlands, irrigated agriculture and a 97,000-acre drainage project area, which is the primary source of selenium to the San Joaquin River. Mud Slough (north) and Salt Slough are tributary to the river and serve as the only drainage outlets for the Grassland Watershed. The watershed has been the focus of the Region's subsurface agricultural drainage program since 1985, and considerable staff effort and resources have been directed to the effort of developing a comprehensive monitoring program, insuring stakeholder involvement, and adopting Basin Plan Amendments and Waste Discharge Requirements in order to develop a workable and comprehensive selenium control program.

The San Joaquin River Basin also includes all or part of nine major groundwater basins: Madera Basin, Chowchilla Basin, Merced Basin, Modesto Basin, Eastern San Joaquin County Basin, Tracy Basin, Delta-Mendota Basin, Westside Basin and Sacramento County Basin. Groundwater is also used in some upland areas and in foothill and mountain valleys.

Water Quality Assessment, Strategies and Activities, and Resource Needs

SURFACE WATER

The most significant surface water quality problems in the San Joaquin River watershed are selenium, salt, boron, pesticides, and unknown toxicity. All of these problems result primarily from agricultural activities and are exacerbated by altered flow regimes. In addition, the Regional Board is concerned with storm water runoff, discharges from inactive or abandoned mines, discharges from dairies, discharges from National Pollutant Discharge Elimination System (NPDES) facilities, and elevated temperature caused by water management practices. Most of these concerns are included in the TMDL workplan to address the Clean Water Act Section 303(d) list.

The US Geological Survey, as a part of its National Water-Quality Assessment (NAWQA) Program, recently released a series of reports on results of a five-year study on the quality of water in 20 major drainage basins throughout the Nation, including the San Joaquin and Tulare Basins. The report, *Water Quality in the San Joaquin - Tulare Basins, California, 1992-95,* describes some general conclusions regarding surface water quality in the San Joaquin River basin: (1) nitrate and ammonia generally do not limit beneficial uses in the mainstem of the San Joaquin River, (2) some nitrate and ammonia concentrations exceed U.S. EPA criteria in some of the smaller tributaries, (3) the potential exists for toxicity to aquatic organisms from water-borne pesticides because concentrations of seven pesticides have exceeded aquatic life criteria, and (4) the potential exists for adverse effects on aquatic life from pesticides in bed sediment and aquatic tissue samples. The US Geological Survey results are consistent with Clean Water Act Section 303(d) listings and water quality assessments. The study did not review selenium, boron, and salt in order to avoid duplicating monitoring and evaluation being conducted by other federal, State, and local agencies. An additional issue not reviewed by the US Geological Survey included seasonal depletions of dissolved oxygen in the lower reaches of the San Joaquin River and the impact to downstream water bodies, including the Sacramento-San Joaquin Delta.

The overall goal for this watershed is to implement Regional Board point and nonpoint source programs in a manner that compliments the activities and goals of other stakeholders in order to achieve water quality improvement and promote restoration of water resources. All the activities fall somewhere on the continuous basin planning cycle, which includes monitoring and assessment, problem evaluation, strategy development and implementation. Resources will be targeted in all of these areas, however most existing resources will be focused on (1) continuing existing point source control efforts, (2) addressing significant nonpoint source problems that have already been identified, (3) assessing water quality throughout the basin in order to update current 303(d) listings and prioritize any additional water quality concerns, and (4) involving

local stakeholders in determining priorities and addressing problems. More resources are needed in each of these areas to fully address water quality concerns.

Continuing existing point source control efforts: Current funding is being directed at eliminating an existing backlog within the watershed. With rapid urban growth occurring in the Basin, an overall increase in workload is anticipated.

Addressing significant nonpoint source problems that have already been identified: Addressing problems in water bodies included on the 303(d) list for the San Joaquin River Basin is a high priority for this region. This list and TMDL time schedule is staff's best estimate of what work will be undertaken over the next five to seven years under specified funding assumptions. An important element of the proposed strategy is to involve local stakeholders in determining priorities and addressing problems.

Assessing water quality throughout the basin in order to update current 303(d) listings and prioritize any additional water quality concerns: Past monitoring and assessment efforts have focused limited resources on the main stem of the San Joaquin River, the Grassland Watershed, and a few other water bodies that are located near significant pollutant sources (i.e., Penn Mine). There has never been enough resources to fully assess the conditions in even these water bodies. Many of the tributaries to the main stem river, the streams upstream from major reservoirs, and most of the lakes have received little attention. With resources made available through the Surface Water Ambient Monitoring Program (SWAMP), staff is developing and implementing strategies for completing water quality assessments throughout the watershed. A summary of the efforts is contained in the Monitoring and Assessment portion of this chapter. However, with current statewide budget shortfalls, the SWAMP funding is expected to be reduced in the coming year. In addition, more attention needs to be focused on the significant groundwater problems in the watershed.

Involving local stakeholders in determining priorities and addressing problems: An important element of the strategy for this watershed is to involve local stakeholders in determining priorities and addressing problems. Key areas for stakeholder involvement are the triennial Basin Plan review, the annual cycle of nonpoint source grants, and the biennial update of the water quality assessment and Clean Water Act 303(d) list. Agency led stakeholder groups have been formed and are working on selenium, salt and boron and pesticides. There are other local stakeholder groups that are working on problems in tributaries and upstream watersheds, including work conducted in western Stanislaus County to control offsite movement of suspended sediment and associated pesticides. With additional resources provided under various bond measures, staff anticipates expanding efforts to work with local stakeholder groups and promote development of watershed management plans, with implementation of those plans in future years.

The following information relates the water quality assessment, strategy and activities, and resource needs for major water quality concerns identified in the San Joaquin River Basin.

Selenium

In 1983, high frequencies of waterfowl deaths and deformities were observed in Kesterson National Wildlife Refuge and were attributed to elevated concentrations of selenium in subsurface agricultural drainage that was entering the site. The source of agricultural drainage to Kesterson was lands within the Westlands Water District. The discharge to Kesterson was discontinued by 1985.

A survey of lands adjacent to Westlands Water District showed that agricultural subsurface drainage from a large area in the Grassland Watershed also contained elevated selenium levels. This drainage water was being discharged directly into channels that supplied water to Grassland wetlands and also into the San Joaquin River.

In 1985, the staff of the Central Valley Regional Board began a monitoring program to assess selenium concentrations and loads in the lower San Joaquin River and the Grassland Watershed and also to track progress of a variety of management practices initiated by the agricultural community as outlined below. Results from the monitoring program indicate that although water quality objectives are now being met in the majority of wetland water supply channels and overall selenium loads to the San Joaquin River are decreasing, water quality objectives continue to be exceeded in the main stem of the river upstream of the Merced River inflow and in Mud Slough (north). The San Joaquin River and several tributaries continue to be included on the Clean Water Act 303(d) list for selenium (Table SJR-1).

Strategy and Activities

Since 1984, staff has been working with irrigation districts in the Grassland Watershed to develop and implement drainage management plans to reduce selenium discharges to the San Joaquin River and waterfowl areas. Practices that are implemented for selenium also address the boron problem. The problem has been fairly well defined through an extensive monitoring program that was initiated in 1985 and continues to date.

In 1987, a technical advisory committee was formed by the State Board to develop a program to control selenium discharges to the San Joaquin River. The committee developed a regulatory program including recommended water quality objectives and an implementation plan. Much of the program was incorporated into the Regional Board's Basin Plan through an amendment adopted in December 1988. The focus of the implementation plan was on drainage volume and pollutant load reductions through adoption of on-farm management practices -- primarily water conservation. An overall 20% reduction in water use per acre occurred. However, implementation of these measures did not fully achieved program goals. Water quality objectives were not being met in the lower reach of the San Joaquin River or in wetland water supply.

A second amendment to the Basin Plan, which became effective in January 1997, includes selenium objectives for the lower San Joaquin River, Mud Slough (north), Salt Slough and wetland water supply channels and a compliance time schedule. The compliance time scheduled emphasized the need to prioritize the water bodies impacted by selenium in the following order:

1st) wetland water supply channels and Salt Slough; 2nd) San Joaquin River downstream of the Merced River; 3rd) Mud Slough (north) and the San Joaquin River upstream of the Merced River. The amendment contains a conditional prohibition of discharge of selenium to wetland water supply channels and also contains total maximum load limits which are to be implemented through waste discharge requirements. The 1997 amendment was consistent with a consensus letter, jointly signed by the US EPA, US Fish and Wildlife Service, US Bureau of Reclamation, and the San Luis-Delta Mendota Water Authority (representing the Grassland Area Farmers under a joint-powers authority). The letter contains recommendations regarding the use of the San Luis Drain to route high selenium drainage water around the Grasslands marshes. The drainage water is now discharged to Mud Slough (north) instead of to Salt Slough and wetland water supply channels.

In July 1998, the Regional Board adopted waste discharge requirements regulating the subsurface agricultural drainage discharge to Mud Slough (north). The Basin Plan amendment and waste discharge requirements are consistent with the requirements and time schedule for TMDL development that was approved by the Regional Board in January 1998.

As part of the selenium control effort, Regional Board staff continues to work closely with all state, federal, and local agencies involved in the project. Staff serves on the multi-agency Data Collection and Reporting Team (DCRT) comprised of representatives from US EPA, US Geological Survey, US Bureau of Reclamation, US Fish and Wildlife Service, California Department of Fish and Game, and Grassland Area Farmers. The DCRT has developed a long-term monitoring plan to document environmental impacts of the project. The multi-agency monitoring effort will continue to document compliance with waste discharge requirements and impacts from the project. Staff also participates on the Technical and Policy Review Team which reviews the general direction of the project and provides recommendations to the Oversite Committee. The Oversite Committee is comprised of top management from the USBR, USEPA, USFWS, DFG, and the Central Valley Regional Board. The current agreement to utilize the San Luis Drain in this project ends in October 2001. Participating agencies are currently developing an EIR/EIS to evaluate the potential continuation of the project. The EIS/EIR was released for public review in December 2000. Options under consideration include continued use of the drain and incremental load reductions to the river. Continuation of the project may require additional staff resources to review and update current waste discharge requirements.

Although improvements have been documented, development of management options for selenium reduction must continue to insure that water quality objectives will be met. CALFED is proposing to fund a project that evaluates bacterial treatment of selenium in the Panoche Drainage area as well as selenium load impacts on the Delta. Formal Total Maximum Daily Loads (TMDLs) and other approaches (such as Real Time Monitoring and the balancing of saline and freshwater flows) will be evaluated to determine the best strategy for achieving compliance with selenium objectives established for Salt Slough, Mud Slough (north), the wetland channels, and the San Joaquin River.

Salinity and Boron

Since the 1940s, mean annual salt concentrations in the San Joaquin River, near Vernalis have doubled. The increases are primarily due to reservoir development on the east side tributaries and upper watershed for agricultural development; the use of poorer quality, higher salinity, Delta water in lieu of San Joaquin River water on west side agricultural lands; and drainage from upslope saline soils on the west side of the San Joaquin Valley. Industrial and municipal discharges also contribute to the salinity problem. In addition, current wetland management practices are contributing significant seasonal salt loads to the river. As a result of salt contributions from the various point and nonpoint sources, salinity objectives at Vernalis are periodically exceeded. The salinity objectives were established to protect the beneficial use of water for agriculture. The San Joaquin River and several tributaries are included on the Clean Water Act 303(d) list for salt (Table SJR-1).

For many of the same reasons contributing to salinity concerns, boron concentrations in the San Joaquin River frequently exceed water quality objectives adopted for the protection of irrigation water supply. The majority of the exceedances occur during dry years, with dramatic improvements in water quality during wet years.

Strategy and Activities

As part of the 1994 Triennial Basin Plan approval, the State Board directed the Regional Board to develop a program to reduce salt loads to the San Joaquin River. In June 1997, staff presented to the Regional Board a workplan that included a framework and schedule under which a Basin Plan amendment for the control of salinity (and boron) would be developed. The proposed amendment focused on the lower San Joaquin River, downstream of Mendota Dam to Airport Way Bridge near Vernalis. The workplan described a five phase effort that would culminate in the adoption of salinity objectives and an implementation program. The entire effort is, and will continue to be, closely coordinated with stakeholders and interested parties. Regional Board staff participates on the San Joaquin River Management Program and the San Joaquin Valley Drainage Implementation Program. All phases of this program include monitoring to evaluate sources and the effectiveness of control measures. Funding from CALFED has been approved for implementing a real time monitoring program that will allow for consideration of a wider range of management options. This program meets the requirements for TMDL development and is consistent with the time schedule for TMDL development that is included in the Clean Water Act Section 303(d) list that was approved by the Regional Board in January 1998.

Pesticides

Water Column Pesticide Problems: Chemical and bioassay monitoring demonstrate that pesticides in the San Joaquin River can occur at concentrations that are toxic to sensitive aquatic organisms. Two multi-year studies have been conducted. The first found that a 43 mile reach of the River between the confluence of the Merced and Stanislaus River was found to be toxic about half of the time to the invertebrate component of the US EPA three species test (US EPA, 1989; Foe and Connor, 1991). Toxicity appeared to be caused by pesticides in storm and irrigation tailwater runoff from row and orchard crops. Follow-up testing conducted a year later

found that River toxicity had decreased to about 6 percent of the time (Foe, 1995). In these two studies and subsequent follow-up studies, the insecticides diazinon and chlorpyrifos have been identified as common causes of toxicity. Additional monitoring by the US Geological Survey, Department of Pesticide Regulation, and others have confirmed the widespread occurrence of diazinon, chlorpyrifos and other pesticides in the San Joaquin River and tributaries (Domagalski, et. Al., 1997; Kratzer, 1997; MacCoy, et. Al., 1995 and Ganapathy, et. al., 1997; Deanovic, 1996 and 1998). The most significant sources of chlorpyrifos and diazinon appear to be winter storm runoff from orchard and summer irrigation return flows. Urban runoff has also been documented to be a significant source in the vicinity of Stockton and Modesto. Urban runoff has been identified as a significant source of these two pesticides in the Bay Area and in Sacramento. The San Joaquin River and several tributaries are included on the Clean Water Act 303(d) list for chlorpyrifos and diazinon (Table SJR-1).

No water quality objectives exist for diazinon and chlorpyrifos. US EPA has developed a criterion for chlorpyrifos and a draft criterion for diazinon. The Department of Fish and Game has developed draft hazard assessment criteria for both pesticides. Both pesticides are frequently detected at levels exceeding the criteria.

Other pesticides, such as malathion and diuron, have been identified at levels of concern in monitoring studies conducted in the San Joaquin River watershed. In addition, in many toxic samples, the toxicant has not been identified.

Organophosphorous (OP) pesticides are used to control pests such as weevils, army worms, alfalfa caterpillars and aphids. According to the Department of Pesticide Regulation's 1998 Annual Pesticide Use Report, over 780,000 pounds of OP pesticide active ingredient were applied to alfalfa in 1998. Primary OP pesticides used were chlorpyrifos (282,130 lbs.) and malathion (260,526 lbs.), followed by dimethoate (84,884 lbs.), phosmet (69,864 lbs.) and methamidophos (61,568 lbs.). A host of other OP pesticides were used as well, but in smaller quantities.

Alfalfa is one of the major agricultural commodities in California, with approximately 188,000 acres in the San Joaquin Valley. OP pesticides used on alfalfa have been identified as the cause of toxicity to aquatic species in watersheds throughout the state. The transport mechanism of the OP pesticides from alfalfa fields to surface water is believed to be primarily due to storm and irrigation water runoff. A bioassay study conducted in the San Joaquin Basin in 1991 and 1992 documented chlorpyrifos detections on 190 occasions between March and June of both years, 43 times at toxic concentrations to *Ceriodaphnia* (Foe, 1995). Major uses of chlorpyrifos in March in the Central Valley are on alfalfa and sugarbeets for weevil and worm control. The United States Geological Survey (USGS), as a part of its National Water-Quality Assessment (NAWQA) Program, in 1993 sampled and analyzed for pesticides, along with other parameters, in the San Joaquin Basin. Chlorpyrifos was detected in 64% of all of the samples collected. Sample concentrations ranged from non-detect to 0.26 micrograms per liter. In 1996 and 1997, sampling on Orestimba Creek was conducted as part of a Dow Agrosciences LLC sponsored a study to characterize chlorpyrifos concentration patterns in an agriculturally dominated tributary to the San Joaquin River. Key crops grown in the watershed included alfalfa, walnuts, almonds, and dry beans. Thirteen chlorpyrifos concentration peak occurrences were associated with

specific events determining the most probable transport process – nine were related to spray drift, four to irrigation tailwater. There were approximately 29 occurrences of chlorpyrifos detections where a transport process could not be identified. Concentrations as high as 2.28 micrograms per liter were found in samples.

In addition to *Ceriodaphnia* toxicity from chlorpyrifos, algal toxicity has been observed in surface waters. The herbicide diuron has been identified as one of the causes. Potential sources are alfalfa runoff, urban storm runoff and applications to rights of way. Approximately 222,000 lbs of diuron was applied to alfalfa in the state in 1998, according to DPR's Annual Pesticide Use Reports. Additional causes of algal toxicity are unknown at this time.

Fish Tissue Problems: The State Board Toxic Substances Monitoring Program has found elevated levels of Group A Pesticides in fish from the Tuolumne, Merced, and Stanislaus Rivers and the mainstream San Joaquin River. Group A Pesticides include chlordane, toxaphene, endosulfan, and a few other pesticides. The chemicals are thought to result primarily from past agricultural use. Agricultural use of chlordane, DDT, and toxaphene is now banned and endosulfan use is closely regulated and much reduced. However, the materials appear to be tightly bound to sediment and move into the river systems as the sediment moves offsite. National Academy of Sciences (NAS) and US Food and Drug Administration (FDA) criteria are used to evaluate tissue levels of contaminants. The rivers mentioned above are all included on the Clean Water Act 303(d) list for Group A pesticides and/or DDT.

Strategy and Activities

The Department of Pesticide Regulation (DPR) and the State Board both have statutory responsibilities for protecting water quality from adverse effects of pesticides. A Management Agency Agreement (MAA) signed by these agencies, describes the regulatory framework for pesticides. Actions to address problems associated with any pesticide need to be consistent with section 303(d) and the MAA.

Chlorpyrifos and Diazinon: The general actions that are required to resolve water quality problems associated with these two pesticides are the same for this watershed as for the Delta and Sacramento River watersheds. Each action needs to be implemented in a manner that is appropriate to each watershed. Actions include (1) establishment of interim and long term water quality goals, (2) development of management practices that can be implemented to meet the targets, (3) development of cost estimates to implement the practices, (4) completion of studies to determine potential ecological significance of these pesticides in the Delta and tributaries, (5) establishment of mechanisms for assuring implementation of management practices, and (6) implementation of a monitoring program to measure compliance with water quality objectives. The details and general status of each action is described below since many of the actions are presently focused in the San Joaquin watershed. These actions will be implemented in a manner that satisfies the requirements for TMDL development and is consistent with the time schedule included in the 303(d) list adopted by the Regional Board in January 1998. There will need to be a significant effort to work out the details. It will require working with DPR, CALFED, and many local watershed groups and stakeholders to develop and implement this program. Some

information that is being collected by the Sacramento River Watershed Program (SRWP) can be applied to diazinon issues in the San Joaquin Watershed.

For the agricultural pesticide component, there are numerous efforts underway to develop practices that can be implemented to reduce the amount of pesticides entering surface waters. This work will be summarized as part of the SRWP over the next 12 months. DPR is investigating orchard floor management as a means to reduce discharges of dormant sprays into surface waters. Also, at California State University at Fresno, DPR is investigating the effects of microbial augmentation and post application tillage on runoff of dormant sprays. Dow-Elanco and Novartis, the registrants of chlorpyrifos and diazinon, have undertaken a multiyear study in Orestimba Creek in the San Joaquin River basin with the primary objective of identifying specific agricultural use patterns and practices which contribute the bulk of the off-site movement into surface water. The Biologically Integrated Orchard Systems (BIOS) program has received a series of grants from the State and US EPA to implement community-based efforts to implement economically viable, non-conventional, pest management practices. Colusa County Resource Conservation District is leading a runoff management project, funded through a Clean Water Act Section 319 Grant, to identify management practices that reduce runoff from almond orchards and thereby reduce pesticide loads to local creeks. The Glenn County Department of Agriculture is organizing local growers and PCAs to address the use of dormant spray insecticides in the county. The Biologically Integrated Prune Systems program is a community based project that supports implementation of reduced risk pest management strategies in prune orchards. A similar effort is underway for peach orchards. The University of California Statewide Integrated Pest Management Project has a State Board grant to identify alternative orchard management practices to prevent or reduce off-site movement of dormant sprays, provide outreach and education, and initiate monitoring to assess success of new practices. In addition, University of California was awarded a three year, one million dollar grant by CALFED to identify urban and agricultural practices to prevent and reduce off-site movement of diazinon and chlorpyrifos into surface water. The CALFED study will consider both urban and agricultural stormwater runoff and summer irrigation runoff.

For controlling urban sources of pesticides, the Regional Board is implementing the NPDES Storm Water Program. This program is further described under the section heading "Urban Storm Runoff". In addition to this regulatory effort, interested parties in the Bay Area and Central Valley formed an Urban Pesticide Committee to provide a forum for information exchange, coordination and collaboration on the development and implementation of an urban pesticide control strategy. The Committee has developed a strategy that includes a framework of roles and responsibilities that can be taken by various agencies to reduce pesticides from urban sources. CALFED has earmarked resources to develop management approaches that can be implemented to reduce discharges of pesticides from urban areas. Studies are authorized for the Sacramento urban area and in Suisun Bay.

There are studies underway and planned to try to assess the impact of diazinon, chlorpyrifos, and other pesticides on local aquatic communities. The emphasis of these studies will be on the Delta and principal tributaries to the Delta. A study is underway to conduct bioassays with local species exposed to water collected from Suisun Bay. CALFED has supported a study by UC Davis to evaluate contaminant effects on Delta smelt. CALFED has also supported

implementation of a toxicity testing program in the Delta that includes identification of responsible contaminants. In addition, CALFED has proposed to fund studies to evaluate the ecological effects of diazinon and chlorpyrifos and other pesticides on Delta aquatic species. Finally, CALFED has proposed to fund studies by the Department of Fish and Game that are needed to complete draft criteria reports for the two pesticides.

Over the next several years, staff will to work with DPR and other stakeholders to ensure that management practices are developed and implemented to reduce chlorpyrifos and diazinon concentrations in surface waters. In FY 98-99, staff began working with DPR, registrants and other stakeholders to coordinate studies and discuss results. Staff worked with DPR to develop draft cleanup plans for chlorpyrifos and diazinon. Staff continues to work closely with CALFED to evaluate and refine proposals to support efforts to develop management practices to reduce the discharge of pesticides and to study the ecological significance of measured pesticide levels on local aquatic communities. As part of this effort, staff will participate on the Interagency Ecological Program contaminant effects group. In FY00-01, staff will continue to work with DPR and stakeholders to assure that the funded work to develop management practices and to determine ecological significance proceeds. All this work will be completed in a manner that is consistent with time schedules set in the Clean Water Act Section 303(d) list. There are not enough resources to assure completion of the TMDL work on these pesticides. Resources from a federal Clean Water Act grant (Section 104/106) are being used to initiate activities.

Other pesticides: Additional work is needed in the San Joaquin Basin to ensure that all the primary chemicals causing toxicity are identified. Previous toxicity studies have identified other pesticides as causing toxicity and there are many instances where toxicity exists and the toxicant has not been identified. Staff will coordinate these efforts with DPR and stakeholders.

Alfalfa is suspected to be a significant source of chlorpyrifos and diuron in surface water. Presently, studies focused specifically on contributions of chlorpyrifos from alfalfa field runoff have been located in Yolo County (see the State of the Watershed Report for the Sacramento River Watershed). Initial results from the Dow Agrosciences LLC sponsored study in Orestimba Creek in the San Joaquin River Watershed were inconclusive, and did not measure concentrations in runoff directly from alfalfa fields. Additional work is being conducted in the Orestimba Creek watershed during FY00-01. More study is needed to characterize pesticide loadings to the San Joaquin River Watershed from alfalfa, and to develop and assess appropriate mitigation measures for the region.

Basin wide monitoring for organo-phosphate, carbamate, and organo-chlorine pesticides, as well as toxicity is being initiated in FY00-01. The monitoring is being coordinated with efforts by other agencies and will be conducted in the main stem of the river and in major tributaries on a monthly basis, with increased monitoring during storm events. Details of the program are discussed in the monitoring section of this chapter.

Pesticides in fish tissue: Most of the listings on the Clean Water Act Section 303(d) list for elevated fish tissue levels of pesticides are based on data collected prior to 1985. Some of the listings are based on relatively few samples. Staff, in cooperation with DPR and the Department of Fish and Game, needs to develop a study plan that could be implemented to determine

whether the listings are still appropriate. Previous studies have suggested that most of the organochlorine pesticide loads reaching the San Joaquin River result from erosion of soils from agricultural lands in the watershed. Practices that are implemented to reduce erosion from agricultural lands should reduce the levels of these pesticides reaching the San Joaquin River.

Since the mid-1970s, the Regional Board has contracted with local Resource Conservation Districts, the Natural Resources Conservation Service, and University of California, to evaluate and document BMPs to reduce sedimentation from the Westside of the valley to the San Joaquin River and costs associated with the practices. In 1987, the USGS identified Westside sediment discharges as the primary source of organo-chlorine pesticides to the San Joaquin River (USGS, 1987). In 1991, western Stanislaus County was designated as a federal Hydrologic Unit Area, and $500,000 per year was made available for the NRCS and UC Cooperative Extension to conduct public outreach, education, and promote the use of BMPs to reduce sediment loss from agricultural fields. As of 1996, 24% of the 134,000 acre HUA had been treated with structural and managerial BMPs to reduce off-site sediment movement as a direct result of the HUA program. Combined with acreage previously treated with structural BMPs from prior assistance, approximately 66% of the HUA has implemented sedimentation BMPs. However, the goal of 300 mg/L sediment in discharge has not yet been met. Funding for the project ended in 1998 with a final report to be released during FY 99/00. Staff at the Regional Board has worked with the various groups implementing the HUA and will continue to be involved with the local stakeholders.

Monitoring for total suspended solids in the main stem of the San Joaquin River was incorporated into the weekly sampling program associated with the Grassland Bypass Project in October 1998. Additional sites were added in FY00-01 and annual sediment surveys for OC-pesticides and toxicity will commence in Spring of 2001. Information from the monitoring will be released annually beginning Spring 2001.

Temperature

There are concerns about elevated temperature in the Stanislaus, Tuolumne, and Merced Rivers downstream from the major dams. The storage and diversion of water for hydroelectric and other purposes impacts downstream beneficial uses.

Strategy and Activities

The Regional Board currently has limited work underway to address temperature concerns in this watershed. The Regional Board needs to work with the Department of Fish and Game and stakeholders to develop amendments to the existing Basin Plan for temperature in the Stanislaus, Tuolumne, and Merced Rivers to protect migration and spawning of cold water species including anadromous species listed on the rare and endangered lists. It is anticipated that during FY 00/01 and FY01/02, staff will begin initial temperature assessments in the upper reaches of watersheds draining to the lower San Joaquin River. Since resources are limited, the assessments will be scheduled to one subwatershed per year. Staff will also initiate stakeholder outreach in the upper watersheds with limited resources from Proposition 13 funding.

Polychlorinated Biphenyls (PCBs)

The San Francisco Regional Monitoring Program demonstrated in 1993 and 1994 that total PCB concentrations were above US EPA recommended criteria to protect human health at all sites surveyed in San Francisco Bay, including at the confluence of the Sacramento and San Joaquin Rivers in the Delta. Furthermore, clam transplant studies demonstrated that some of the highest tissue concentrations were obtained from animals located in the Sacramento and San Joaquin Rivers. The data was interpreted to mean that the Rivers were a source of PCBs.

Strategy and Activities

Data from the San Francisco Bay Regional Monitoring program suggested that the San Joaquin River was a significant source of PCBs to the Delta. Follow-up studies are needed to confirm these study results, then source identification and control strategies need to be developed to reduce discharges. No resources have been allocated for this work.

Metals

With the finalization of the California Toxic Rule by USEPA, many water bodies in the lower San Joaquin River Basin may not meet water quality criteria for trace elements. Limited assessments have been conducted to date as part of the agricultural drainage program on the lower San Joaquin River. The focus on the assessment was on total copper, chromium, lead, nickel and zinc, which all typically fell below levels of concern given the existing hardness of the water. However, other potential trace elements of concern, such as arsenic, cadmium, and mercury, have not yet been evaluated throughout the watershed

There are localized water quality problems associated with inactive mines. The most significant site and the one staff has and will continue to spend the most resources on is Penn Mine. The Regional Board has been working on Penn Mine for more than 20 years. The Mokelumne River is on the Clean Water Act Section 303(d) list for copper, zinc, hydrogen sulfide and low dissolved oxygen. The site has been under litigation and there are detailed reports on file that describe all the activities that have taken place over the years.

Several additional inactive mines in the Sierra Nevada also drain to the San Joaquin River Basin, however, no resources have been available to evaluate potential water quality concerns at these sites.

Strategy and Activities

Penn Mine: As previously mentioned, the Mokelumne River, downstream from Penn Mine, is a water quality limited segment due to elevated copper, zinc, hydrogen sulfide and low dissolved oxygen. Historically, the first rainfall event of each year resulted in annual fish kills when uncontrolled mine discharges entered the river during low stream flow conditions. Various abatement strategies have been implemented over the past twenty years to reduce the impacts of discharges from the site. Storage/holding ponds to mitigate acid rock drainage were constructed in the 1970s to contain the first few rainfall events. Beginning in the early 1990s, acid rock

drainage contained in these ponds were chemically treated to remove copper and other metals prior to release to the river. With operation of the treatment facility, 98% of all metals were removed from the discharge, increasing downstream protection of beneficial uses. However, the treatment system was not effective in removing hydrogen sulfide and treatment costs were high. The Regional Board and East Bay Municipal Utilities District jointly implemented a $10 million site restoration project which removed all associated mining wastes in the Penn Mine drainages that formulates acid rock drainage, encapsulated the 400,000 cubic yards of wastes in an on-site landfill and restored the Penn Mine site through soil amendments, topsoil additions and revegetation to simulate pre-mining conditions. Construction activities began April 1998 and were completed in November 1999. Effectiveness monitoring will be performed and additional stream restoration by the US Corps of Engineers will be implemented to enhance the site restoration. A public advisory committee has been formed and supports the proposed project.

Potential impacts from other abandoned mines draining to the San Joaquin River Basin, will not be conducted without increased internal resources or external grants.

GROUND WATER

As was previously discussed the US Geological Survey has recently released a series of reports on results of a five year study on the quality of water in 20 major drainage basins throughout the Nation, including the San Joaquin and Tulare Basins. The report, Water Quality in the San Joaquin - Tulare Basins, California, 1992-95, describes one general finding regarding ground water quality in the San Joaquin Basin: drinking water sources from ground water have been degraded by fertilizers and pesticides.

Salinity and Nitrates

More than 1000 square miles of ground water are impacted by elevated levels of salinity. Areas affected include the entire valley trough between Fresno and Modesto, the vicinity of Stockton, the southern Delta and the entire area on the west side of the valley between Mendota and Los Banos. The sources of salinity include irrigated agriculture, dairies, and other industrial and municipal discharges, as well as areas with naturally high salt concentrations, such as the grassland basin. The problems have been exacerbated by water management practices in the watershed.

There are nearly 200 square miles of ground water in the watershed with elevated nitrate levels. Shallow ground water west of the San Joaquin River in Merced and Stanislaus County has elevated nitrate levels, which affect the cities of Firebaugh, Newman, Gustine, Los Banos and Dos Palos. Also, water supplies are impacted over a wide area extending along the Highway 99 corridor between Fresno and Stockton and across the southern Delta to Brentwood. The principle sources of nitrates in the watershed are believed to be from crop production and dairies.

Strategy and Activities

There is no organized effort to address salinity and nitrates in ground water in the San Joaquin River watershed. A ground water study is underway at selected dairies to evaluate the effectiveness of current waste system design and operation to protect ground water quality Work is needed to determine the relative contribution from irrigated agriculture. A program is needed to address the problem.

Pesticides

More than 500 square miles of ground water are affected by elevated levels of pesticides, mostly Dibromochloropropane (DBCP). Most of the problems occur over a wide area extending along the Highway 99 corridor between Stockton and Fresno. The sources are past applications of DBCP, a product that is no longer in use. The sources of other pesticides in ground water are believed to be primarily from routine agricultural uses of the pesticides.

Selenium

More than 200 square miles of ground water are affected by elevated levels of selenium. The main area affected is between Mendota and Los Banos, on the west side of the valley. The source of selenium is natural. Agricultural practices cause the selenium to be discharged to surface waters.

Monitoring and Assessment

The framework for water quality monitoring in the San Joaquin River Basin was developed in 1985, to characterize and control selenium, boron and salt discharges. The program evolved into weekly monitoring of over 25 sites for EC, boron and selenium with maintenance of three automated Sigma samplers. The program was expanded monthly and quarterly to incorporate additional sites and constituents in order to provide baseline information on the lower San Joaquin River, facilitate Real Time and TMDL modeling efforts, and to evaluate ongoing agricultural drainage control efforts as well as the current WDR on the San Luis Drain. Portions of the monitoring program were incorporated into a multi-agency effort under the oversite of the USBR when the Grassland Bypass Project came on line in September 1996. Primary responsibility of the Regional Board under the multi-agency program is collection of water quality information. Coordination of the multi-agency activities occurs through monthly meetings of the Data Collection and Reporting Team (on which staff participates) and release of monthly and quarterly data reports and an annual report which provides evaluation of the overall project for the preceding water year (from 1 October through 30 September). Staff also prepares annual water quality reports specific to both the Grassland Watershed and the Lower San Joaquin River which incorporate data beyond that collected as part of the Grassland Bypass Project. A summary of the multi agency monitoring effort is described in Table SJR-2.

To maintain the integrity of the monitoring activities, specific QA/QC procedures have been developed. These procedures include precise sample preparation, collection, and processing activities, as well as, development of check samples (blanks, splits, spikes) to determine

precision and accuracy of laboratory analyses--both in-house and by contract laboratories. All activities are governed by an internal Quality Assurance Project Plan (QAPP) that is updated annually.

The established multi-agency water quality monitoring in the basin has focused on salt, boron and selenium impacts from agricultural discharges. Maintaining the existing program and expanding it to facilitate real-time monitoring activities are priorities in the basin. Other issues of concern include: aquatic toxicity from water born pesticides; aquatic life impacts from pesticides in bed sediment; habitat impacts from sedimentation; elevated nutrient and BOD levels; pathogens; elevated temperatures; impacts from abandoned mines, timber harvesting and grazing; and establishing baseline condition in coast range streams in areas slated for future development. Table SJR-3 lists the projects within the basin by priority and provides a summary of anticipated costs and projections of funded vs. unfunded activities. Specific details for each project and associated costs are described in Table 2 in Appendix 3. A general description of each project follows.

Salt/Boron/Selenium Program: This project would allow continued participation in the multi-agency monitoring effort to evaluate the effectiveness and environmental impacts of the Grassland Bypass Project on selenium, salt and boron concentrations within the Grassland Watershed and the Lower San Joaquin River.

Expansion for Real Time Monitoring: This project allows expanded monitoring of assorted inflows to the Lower San Joaquin River (including an increase in the number of sites as well as the frequency of analyses), in order to facilitate the use of a "Real Time Model" to balance discharges of fresh and saline inflows to meet salt and boron water quality objectives at the boundary of the Sacramento-San Joaquin Delta.

Main Stem of the San Joaquin River: The San Joaquin River serves as the drainage channel for the entire 16,000 square mile basin and discharges into the Sacramento-San Joaquin Delta. Eight sites, each one downstream of a major inflow to the lower river, will be monitored weekly, monthly, or quarterly (depending on the constituent) to determine overall water quality and potential source of the constituent. In addition to selenium, salt, and boron, evaluations will be conducted for general minerals, trace elements, nutrients, pesticides, total suspended solids, total organic carbon, and water column and sediment toxicity.

Drainage Basin Inflows to the lower San Joaquin River: In 1993, five distinct drainage basins were identified that discharged into the lower San Joaquin River. Each drainage basin is bounded by either the Sierra Nevada or Coast Range and is comprised of like land uses and drainage patterns. All natural and constructed water bodies have been identified in each basin as well as potential water quality concerns and major representative discharges to the lower river. This project allows multi-constituent monitoring to be conducted in these representative discharges from each basin on monthly basis and twice a month during the irrigation season (February through August). The monitoring will allow an evaluation of the potential water quality concerns within the drainage basins as well as the relative impacts from the basins on the lower river.

Storm Events: The lower San Joaquin River has a highly managed hydrology with flow patterns and water quality primarily impacted by water year type (wet, normal, dry), storm events, and irrigation return flows. Frequency of standardized monitoring has been developed to emphasis predictable irrigation patterns. This project will focus on intensive monitoring of 15 key sites distributed throughout the basin during two major storm events (greater that two inches of rain in a 72-hour period). Monitoring at 10-sites will be conducted every six to twelve hours depending on accessibility, while continuous samplers will be distributed to five sites in order to determine changing concentrations over time and flow patterns.

Baseline Conditions for Future Urban Creek: Land use patters in the basin are changing as traditionally rural areas are developing into an urban corridor between Fresno and Stockton, and demand continues to increase for housing in the Bay Area. A completely new city of 55,000 is slated for development over the next three years. The development will completely surround Mountain House Creek, which currently receives drainage from agricultural and pasture lands. This project will develop a record of baseline conditions to aid evaluation of urban impacts on existing water bodies.

Algal Bloom in Hidden Reservoir: Excessive algal Blooms have been observed in Hidden Reservoir (a.k.a. Hensley Lake). The Fresno River Watershed has been identified as the contributor of nutrients. SWAMP funds will be used to begin identifying sources of nitrates and phosphorus in the Fresno River Watershed.

Intensive Rotational Basin Monitoring: The majority of monitoring efforts in the San Joaquin River Basin are focused on the valley floor and lower river reach. This project will allow a randomized approach to assess overall water quality in each subwatershed that drains into the lower river, including water bodies within the coast range and Sierra Nevada. Approximately 15-sites will be added to existing sites within a subwatershed for a one year period. Additional sites will be evaluated for EC, ph, temperature, turbidity and dissolved oxygen seasonally (at least quarterly). The subwatershed evaluated will be rotated each year.

Abandoned Mines: Mercury has been identified as a major contaminant of placer deposits in the Sierra Nevada. In addition, abandoned mercury mines exist in the coast ranges of the San Joaquin River Basin. This project will allow a preliminary review of potential mercury contamination from such sources during each round of the subwatershed evaluation discussed above.

Grazing and Timber Harvest: Impacts from grazing and timber harvest have not been evaluated within the San Joaquin River Basin. This project will allow a preliminary review of potential impacts from these activities during each round of the subwatershed evaluation discussed above.

Pathogens/Bacteria: All surface water bodies within the basin have potential municipal supply designated as a beneficial use. In addition, the San Joaquin River discharges to the Sacramento-San Joaquin Delta and can impact water supplies delivered to southern California. A major concern with drinking water supplies is contamination by pathogens and bacterial. This project will identify baseline pathogen/bacteria conditions throughout the basin and potential sources. It

is anticipated that this projected will be linked to the main stem and drainage basin projects and expanded into the rotational subwatershed project.

The costs listed in Table SJR-3 assume the use of existing laboratory contracts for the majority of water column analyses and habitat assessment, use of a Master Contract for sediment toxicity testing, and augmentation of an existing student contract for field work and data tracking. The listed costs assume that monitoring programs currently under development by the University of California, US Fish and Wildlife Service, and US Geological Survey will be in place by July 2000. In addition, the first year of cost includes the purchase of approximately $60,000 of equipment which will be utilized during future monitoring efforts.

During FY00-01, approximately $548,000 in contract dollars has been allocated to the San Joaquin River Basin for monitoring activities through a combination of funding sources including the Surface Water Ambient Monitoring Program (SWAMP) ($403,000), general office funds ($100,000) and CALFED ($70,000). The allocation has allowed staff to move forward on the first six project priorities identified for the basin (salt/boron/selenium through baseline conditions for future urban creeks) and begin preliminary site investigations for an intensive rotational baseline monitoring of subwatersheds (hydrologic units). Specific monitoring associated directly with the development of TMDLs is included in Tables T1 – T4 in the Regionwide Section.

One of the overall goals of SWAMP is to provide funding to develop a Statewide picture of the status and trends of the quality of California's water resources. It is intended that one portion of SWAMP will be implemented in each hydrologic unit of the State as least one time every five years, as funding allows, in a somewhat statistically random sampling pattern. A second portion of SWAMP will use more directed sampling to develop site-specific information on sites that are known or suspected to have water quality problems. This second portion of SWAMP is focused on collecting information on locations in water bodies the State suspects should be listed or delisted under CWA Section 303(d) as well as to show areas that may exhibit changes due to implementation of best management practices and/or changing land use practices. Although SWAMP has more than double past contract resources available for monitoring in the Basin, the deficit in past resources severely restricted detailed evaluation of known and suspected water quality impairments. Therefore, during FY00-01, all available funding is being utilized for directed sampling activities to better characterize the extent and source of known and suspected water quality impairments. Future augmentations will allow more randomized sampling during hydrologic unit rotations, which can in turn be coordinated with upper basin activities of abandoned mines, grazing, and pathogen source identification.

The contract dollar funding for these efforts is only secure for FY00-01. The SWAMP funding is reallocated annually statewide between Regions, the general office funds may be diverted to fund expanding point source enforcement activities, and the CALFED grant expires at the end of the year. Therefore, Table SJR-3 indicates that monitoring activities in the basin are unfunded after FY00-01.

The previous discussion has applied to contract dollars. A severe shortfall exists in staffing necessary to maintain the program. Staff is needed to establish and maintain analytical and

student contracts; establish and update QAPPs for each project; oversee and participate with students in sample collection, sample processing, data quality review, data entry and verification in data bases; prepare annual report; coordinate with federal, state and local agencies conducting monitoring within the Basin; and disseminate that information to area stakeholders.

Activities specifically slated for FY00-01 include:

- Re-establish 3-year laboratory contract for selenium and molybdenum analyses in saline water
- Augment existing laboratory contracts for:
    - Student interns
    - Nutrients, minerals, trace elements
    - Pesticides in water and sediment
    - Sediment chemistry
    - Bioassays
    - Bioassessment and habitat evaluation
- Develop scope of work for sediment toxicity analyses under Department of Fish and Game Master Contract
- Update QAPP for salt/boron/selenium program
- Create QAPPs for following new monitoring programs
    - Main stem of the San Joaquin River
    - Drainage Basin Inflows to the San Joaquin River
    - Storm Events
    - Baseline conditions for future urban creeks
    - Intensive Rotational Basin Monitoring
- Participate in updating multi-agency monitoring program for the Grassland Bypass Project (GBP)
- Coordinate field work internally and with outside agencies to meet sampling schedule outlined in Table 2, Appendix 3. ___
- Complete reports on the following topics
    - Water Quality chapter for the GBP Annual Report (Water Year 1999)
    - Water Quality within the Grassland Watershed (Water Year 1999)
    - Water Quality in the Lower San Joaquin River (Water Year 1999)
    - Selenium Concentrations in Internal Wetland Water Supply Channels within the Grassland Watershed (Water Year 1999)
    - Total Suspended Sediment Concentrations in the Lower San Joaquin River (Water Year 1999)
- Coordinate with stakeholders and disseminate information
    - Encourage Citizen Monitoring Groups
- Identify potential agency to conduct pathogen/bacteria work (possible development of a Request for Qualifications)

Table SJR-4 indicates available staffing resources and additional resources necessary to adequately address monitoring issues.

Table SJR-2. Multi-Agency Monitoring for the Grassland Bypass Project.

Site	Agency	Flow	Temp	pH	EC	TSS	Se	B	3 Spec	Biota	Sed
SLD at inflow	CVRWQCB				WC, W	W	WC	WC			
	SL&DMWA	C			C						
	USBR										S
SLD at terminus	CVRWQCB		W	W	DC, W	W	DC, W	DC, W			
	SL&DMWA								M		
	USBR										S
	USGS	C	C								
Mud Slough upstrm. of SLD	CVRWQCB		W	W	W		W	W			
	SL&DMWA								M		
	USBR										S
	USFWS/DFG									S	
	USGS	Calc.									
Mud Slough dwnstrm. of SLD	CVRWQCB		W	W	W		W	W			
	SL&DMWA								M		
	USBR										S
	USFWS/DFG									S	
	USGS	C	C		C						
Mud Slough at Hwy 140	USBR										S
	USFWS/DFG									S	
Salt Slough at Hwy 165	CVRWQCB		W	W	W		W	W			
	SL&DMWA								M		
	USBR										S
	USFWS/DFG									S	
	USGS	C	C		C						
SJR at Fremont Ford	CVRWQCB		W	W	W		W	W			
	USFWS/DFG									S	
SJR at Hill's Ferry	USFWS/DFG									S	
Mud Slough at backwater	USBR										A
	USFWS/DFG									S	
Camp 13 Ditch	CVRWQCB				W		W	W			
	SL&DMWA	C									
Agatha Canal	CVRWQCB				W		W	W			
	SL&DMWA	C									
San Luis Canal at splits	CVRWQCB				W		W	W			
	SL&DMWA	C									
Santa Fe Canal at weir	CVRWQCB				W		W	W			
	SL&DMWA	C									
SJR at Crow's Landing	CVRWQCB		W	W	DC, W		DC, W	W			
	USGS	C	C								
Delta Mendota Canal	SL&DMWA								M		

A= Annually, C = Continuously, Calc. = Calculated, DC = Daily composite, M = Monthly, S = Seasonally, W = Weekly, WC = Weekly composite

3 Spec = Three species toxicity monitoring conducted by SL&DMWA. Field measurements (Temp, pH, DO, and EC), selenium, and sulfate analyses are performed on the water used for this test.

Biota = Biological monitoring. This includes selenium concentrations of fish, tadpoles, invertebrates, bird eggs, and vegetation.

Table SJR-3. Priority Monitoring Projects in the San Joaquin River Basin and Anticipated Costs and Funding.

Project by Priority	Anticipated Program Cost	Running Total	FY00-01		FY01-02		FY02-03	
			Funded	Non-funded	Funded	Non-funded	Funded	Non-funded
Salt/Boron/Selenium Program	$145,000	$145,000	$145,000	--	--	$145,000	--	$145,000
Expansion for Real Time Monitoring	$100,000	$245,000	$100,000	--	--	$100,000	--	$100,000
Main Stem of the San Joaquin River	$60,973	$305,973	$60,973	--	--	$60,973	--	$60,973
Drainage Basin Inflows to the SJR	$140,616	$446,589	$140,616	--	--	$140,616	--	$140,616
Storm Events	$46,080	$492,669	$46,080	--	--	$46,080	--	$46,080
Baseline Conditions for Furture Urban Creeks	$16,009	$508,678	$16,009	--	--	$16,009	--	$16,009
Algal Blooms in Hidden Reservoir	$25,000	$533,678	$25,000	--	--	$25,000		
Intensive Rotational Basin Monitoring	$243,820	$777,498	$39,322	$204,498	--	$243,820	--	$204,498
Abandoned Mines	$11,292	$788,790	--	$11,292	--	$11,292	--	$11,292
Grazing	$11,024	$799,814	--	$11,024	--	$11,024	--	$11,024
Pathogens/Bacteria								
--Baseline	$50,000	$849,814	--	$50,000	--	$50,000	--	$50,000
--Source Identification	$75,000	$924,814	--	$75,000	--	$75,000	--	$75,000
		Totals:	$573,000	$351,814	$0	$924,814	$0	$924,814

Table SJR-4. Staff Resources Needed for Priority Monitoring Projects in the San Joaquin River Basin.

Project by Priority	Anticipated Staff Needed	Running Total	FY00-01		FY01-02		FY02-03	
			Funded	Non-funded	Funded	Non-funded	Funded	Non-funded
Salt/Boron/Selenium Program	2.50	2.50						
Expansion for Real Time Monitoring	1.00	3.50						
Main Stem of the San Joaquin River	0.25	3.75						
Drainage Basin Inflows to the SJR	0.25	4.00						
Storm Events	0.10	4.10						
Baseline Conditions for Furture Urban Creeks	0.10	4.20						
Algal Blooms in Hidden Reservoir	0.10	4.30						
Intensive Rotational Basin Monitoring	1.00	5.30						
Abandoned Mines	0.25	5.55						
Grazing	0.25	5.80						
Pathogens/Bacteria		5.80						
--Baseline	0.25	6.05						
--Source Identification	0.25	6.30						
		Totals:						

Note: Missing Development of Citizen Monitoring Groups