

Appendix A Flood Management

Historic Floods

Flood Parameters

Table A-1, Record floods for selected streams, is based on US Geological Survey records. The selected stations were selected from all USGS gaging stations in the hydrologic region, according to the criteria in Box A-1.

PLACEHOLDER Table A-1 Record floods for selected streams, San Joaquin River Hydrologic Region

PLACEHOLDER Box A-1 Selection Criteria

Flood Descriptions

Early Floods—Floods have been recorded in the San Joaquin Valley for more than 175 years. Most notable in the 19th Century was the “Great Flood” of 1861-62, which inundated the West Coast states “from Canada to Mexico.” Central Valley floods of 1907 and 1909 revised flood control plans of the time and led to development of the San Joaquin River flood control system. The San Joaquin River Hydrologic Region experiences some urban and small-stream flooding in every large storm.

December 1955—Preceding the December 1955 flood, heavy rainfall and snowmelt occurred in the upper watersheds of the eastside tributaries to the San Joaquin River. This caused extensive flooding along the San Joaquin River and all its major eastside tributaries and flooding on the larger westside tributaries. This flood caused extensive damage to agriculture, homes, and public facilities. Thousands of people were evacuated from their homes during the Christmas holiday season, and several people died of heart attacks during the flood. Unusually high tides aggravated the situation by impeding the passage of floodwater through the Sacramento-San Joaquin Delta.

1962-63—Flood damage to agricultural and public facilities during the 1962-63 flood was particularly serious along the streams flowing from westside tributaries.

1968-69—Severe rain-caused floods struck the northern part of the region during the 1968-69 season, and both rain and snowmelt floods occurred in the southern part of the region. Heavy rains fell during January 1969; and substantial but lesser amounts in February. As the heavy rains continued in the valley, a snowpack of unprecedented depth and water content accumulated in the watersheds above 8,000 feet along the crest of the Sierra Nevada. The flood season was climaxed by near-record snowmelt floods during April through July.

1986 and 1995—In 1986 and 1995 three major flood events in the Central Valley caused little damage in the San Joaquin River region, though urban and small-stream flooding was widespread.

January 1997—The New Year’s Day Flood of 1997 was probably the largest in the 90-year Northern California measured record. Runoff exceeded the flood control capacity of Don Pedro Reservoir on the Tuolumne River and Millerton Lake on the San Joaquin River. Storms returned in late January before the full flood control reservation had been restored in the principal reservoirs. The San Joaquin River levee system failed in 36 places and was damaged extensively due to wavewash and sloughing.

February 1998—The El Niño year of 1998 brought heavy rains in February and a heavy snowpack. San Joaquin River system flooding was less than anticipated due to cool weather which delayed and extended the snowmelt. Although there was widespread damage, no major inundations occurred in the region.

December 2005 and April 2006—Flood events in December 2005 caused little damage in the Region, but renewed storms and high runoff in April 2006 caused local flooding adjacent to some streams. Levees sustained boils and erosion with no major breaches.

Flood Governance

Many federal, State, and local agencies have responsibilities in the overall effort to manage floods. The principal participants in the San Joaquin River Hydrologic Region and their activities are listed in Table A-2, Flood management participants. Most listed activities are self-explanatory. Descriptions of some are:

- **Flood project development**—Performing feasibility studies, planning, and design of constructed facilities.
- **Encroachment control**—Establishing, financing and operating a system of permitting and enforcing permits to encroach on constructed facilities.
- **Floodplain conservation or restoration**—Any overt activity causing part of a floodplain to remain in effect or to be reinstated as a watercourse overflow area.
- **Flood insurance administration or participation**—Contribution to the management of or acting as a sponsor and cooperator in the National Flood Insurance Program including the Community Rating System.
- **Hydrologic analysis**—Hydrologic or statistical analysis of collected hydrometeorological data.
- **Flood education**—Informing the general public about any aspect of flood management; publishing or broadcasting collected hydrometeorological data or other flood-related material.
- **Recovery Operations**—Financing or performing any activity intended to return flood-impacted facilities or persons to normal status.
- **Event Management System Administration**—Oversight of the National Incident Management System/Standardized Emergency Management System (NIMS/SEMS) as applied to California.

PLACEHOLDER Table A-2 Flood management participants, San Joaquin River Hydrologic Region

Flood Risk Management

Structural Approaches

The San Joaquin River region is the site of two large flood control developments: The Lower San Joaquin Levee Project (LSJLP) and the levees along the San Joaquin River downstream of that project. The LSJLP was developed in [date] by the Central Valley Flood Control Board (then known as The Reclamation Board) in lieu of US Army Corps of Engineers (USACE) purchase of extensive flood easements. It includes [redacted] miles of levees along the San Joaquin River, tributary streams, and three bypasses, and seven diversion structures, distributed along more than 55 miles of the San Joaquin Valley trough from due west of Fresno to due west of Merced. The downstream levees, a project of USACE, extend along the river for about 50 miles from the downstream end of the LSJLP to the Delta, tying back to high ground at some tributaries and

including lengthy levees on others. The LSJLP is shown in Figure A-1, Lower San Joaquin Levee Project, and the USACE levees are depicted in Figure A-2, USACE San Joaquin River levees.

PLACEHOLDER Figure A-1 Lower San Joaquin Levee Project

PLACEHOLDER Figure A-2 USACE San Joaquin River levees

The principal reservoirs and non-storage facilities contributing to flood control are listed in Table A-3, Flood control facilities.

PLACEHOLDER Table A-3 Flood control facilities, San Joaquin River Hydrologic Region

Disaster Preparation, Response, and Recovery

Management of flood emergencies is the responsibility of many organizations and individuals. Response is required by law to conform to the Standardized Emergency Management System, under which action is taken by levels of organization. It is begun by the person or organization on the site. That entity resists personal injury and property damage to the best of its ability, only calling on the next level when its resources become insufficient, and succeeding levels follow the same procedure. Table A-4, Flood emergency responders indicates the responsible entities at successive levels of response.

PLACEHOLDER Table A-4 Flood emergency responders, San Joaquin River Hydrologic Region

Table A-5, AHPS stream forecast points, is a list of forecast points that can be used in the Advanced Hydrologic Prediction Service of NWS:

PLACEHOLDER Table A-5 AHPS stream forecast points, San Joaquin River Hydrologic Region

Integrated Regional Water Management

Of the seven IRWMPs that include part of the San Joaquin River region, six address flood control. The East Contra Costa County IRWMP emphasizes the relationship of flood control and ecosystem benefits, and identifies eight flood control projects. The Cosumnes, American, Bear, Yuba Region IRWMP recommends projects that reduce flood damages to existing water resource infrastructure and also notes the connection between flood control and ecosystem benefits. The American River Basin IRWMP identifies 17 flood or stormwater management projects and highlights five as flood control projects of the Sacramento Area Flood Control Agency. The Mokelumne/Amador/Calaveras IRWMP suggests 14 projects that have direct flood control benefits and uses diverse flood control strategies, such as reservoirs, channel modifications, and wastewater treatment facility, drainage, and culvert improvements. The Westside Regional Drainage Plan has proposed constructing a flood detention reservoir on Panoche Creek within retired farm lands. Though the Madera County IRWMP does not identify specific flood control projects to be implemented, it discusses a suite of strategies such as *Arundo donax* eradication for lessening flood risks.

Tables

Table A-1 Record floods for selected streams, San Joaquin River Hydrologic Region

Stream	Location	Mean annual runoff (taf)	Peak stage of record (ft)	Peak discharge of record (cfs)
Cosumnes R.	at Michigan Bar	362	18.5	93,000
Mokelumne R.	at Woodbridge	403 ²	29.6	27,000
San Joaquin R.	near Vernalis	3,308	34.9 ¹	79,000
Stanislaus R.	at Ripon	707	64.4 ⁴	62,500
Stanislaus R.	below Goodwin Dam, near Knights Ferry	564 ²	37.7 ⁴	62,900 ⁴
Tuolumne R.	at Modesto	985 ²	71.2 ^{1,3}	57,000
Tuolumne R.	below La Grange Dam, near La Grange	751	28.4	58,900
Del Puerto Cr.	near Patterson	6 ²	14.9	5,270
Orestimba Cr.	near Newman	13	9.5	12,000
San Joaquin R.	near Newman	1,271	69.0 ¹	36,200
Merced R.	near Stevinson	n/a	73.8	13,600
Merced R.	below Merced Falls Dam, near Snelling	1,003 ²	23.3	47,700
Merced R.	at Pohono Bridge, near Yosemite	454	23.4	24,600
San Joaquin R.	at Fremont Ford Bridge	556	71.6	23,000
San Joaquin R.	near Mendota	691	16.6 ¹	11,700
San Joaquin R.	below Friant	663 ²	23.8	77,200
Panoche Cr.	at Interstate 5, near Silver Creek	n/a	13.5	9,940
James Bypass	near San Joaquin	215 ⁶	n/a	5,570 ^{5,6}

taf = thousand acre-feet; ft = feet; cfs = cubic feet per second

1 Different date than peak discharge.

2 Most recent but less than period of record.

3 Due to backwater.

4 Outside period of record.

5 Maximum Daily Mean. No flow for all or most of each year.

6 2006 record, most recent available.

Table A-2 Flood management participants, San Joaquin River Hydrologic Region

	Structural approaches					Land use management					Preparedness, response and recovery																	
	Flood projects					Floodplains		Flood insurance			Regulation		Data management			Event management												
	Financing	Development	Construction	Operation	Encroachment control	Maintenance	Conservation	Restoration	Delineation	Administration	Participation	FIRM mapping	Building permits	Designated floodways	Data collection	Hydrologic analysis	Data station maintenance	Flood education	Preparedness	Response management	Response personnel	System administration	Recovery funding	Recovery operations	Mitigation			
Federal agencies																												
Federal Emergency Management Agency											•															•	•	
Natiobnal Weather Service															•	•	•	•	•	•	•							
Natural Resources Conservation Service	•	•	•														•											
US Geological Service															•	•	•											
US Army Corps of Engineers	•	•	•	•	•	•									•	•	•	•	•	•	•	•	•	•	•	•	•	•
US Bureau of Reclamation		•	•	•	•	•											•	•	•	•								
State agencies																												
California Conservation Corps																				•	•							
Central Valley Flood Protection Board					•	•								•														
Department of Corrections																						•						
Department of Forestry and Fire Protection																					•							
Department of Water Resources	•	•	•	•	•	•			•	•	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•
Office of Emergency Services																			•	•	•	•	•	•	•	•	•	•
Local agencies																												
County emergency services units																				•	•	•						
County planning departments															•													
County building departments													•															
Local flood maintenance organizations				•	•	•																						
Local conservation corps																					•	•						
Local initial responders to emergencies																			•	•	•							
Alameda County FCWCD	•	•				•	•																					
Calaveras County Department of Public Works				•																								
Contra Costa County FCWCD	•	•				•	•								•	•	•											
Madera County Engineering and General Services Department										•																		
Sacramento Area Flood Control Agency	•	•	•	•																								
San Joaquin Area Flood Control Agency	•	•	•	•																								
San Joaquin County Department of Public Works					•					•					•	•				•	•							

Table A-3 Flood control facilities, San Joaquin River Hydrologic Region

Facility	Stream	Owner (Sponsor)	Description	Protects
RESERVOIRS AND LAKES				
Camanche Res.	Mokelumne R.	EBMUD, USACE	200 taf flood control	Lodi, Woodbridge, Thornton and vicinity
New Hogan L.	Calaveras R.	USACE	165 taf flood control	Stockton and vicinity
Farmington project	Littlejohns Cr.	USACE (San Joaquin Co. DPW)	52 taf flood control, diversion dam, diversion channel, channel improvement, cutoff dikes	Farmington and vicinity
New Melones L.	Stanislaus R.	USACE, USBR	450 taf flood control	Oakdale and vicinity and areas downstream on the Stanislaus and San Joaquin Rivers
New Don Pedro Res.	Tuolumne R.	Turlock ID, Modesto ID, San Francisco, USACE	Rain 340 taf flood control Snow 1,000 taf flood control	Modesto and vicinity, Stockton, and areas downstream on the Tuolumne and San Joaquin Rivers.
Lake McClure	Merced R.	Merced ID, USACE	Rain 350 taf flood control Snow 400 taf flood control	Small communities and rural areas in MercedR. floodplain and areas downstream on the San Joaquin River
Burns Cr. FR Res. (Merced Co. Streams Group)	Burns Cr.	USACE (CVFPB)	6,800 AF flood control	Merced, Planada, Le Grand, and vicinity
Bear Cr. FR Res. (Merced Co. Streams Group)	Bear Cr.	USACE (CVFPB)	7,700 AF flood control	Merced, Planada, Le Grand, and vicinity
Owens Cr. FR Res. (Merced Co. Streams Group)	Owens Cr.	USACE (CVFPB)	3,600 AF flood control	Merced, Planada, Le Grand, and vicinity
Mariposa Cr. FR Res. (Merced Co. Streams Group)	Mariposa Cr.	USACE (CVFPB)	15 taf flood control	Merced, Planada, Le Grand, and vicinity
Canal Creek FR Res. (Merced Co. Streams Group)	Canal Cr.	USACE (CVFPB)	6,400 AF flood control	Merced, Planada, Le Grand, and vicinity
Los Banos Res.	Los Banos Cr.	USBR	14 taf flood control	Los Banos, CA Aqueduct
Eastman Lake	Chowchilla R. Ash Slough, Berenda Slough	USACE	45 taf flood control, improved channel, levees	Chowchilla and vicinity and areas downstream on the San Joaquin R.
Hensley Lake	Fresno R.	USACE	65 taf flood control	Madera and vicinity and areas downstream on the San Joaquin R.
Lake Millerton	San Joaquin R.	USBR, USACE	Rain 170 taf flood control Snow 520 taf flood control	Areas downstream on the San Joaquin R.
Marsh Cr. and Kellogg Cr. DRs	Marsh Cr., Deer Cr., Dry Cr., Sand Cr., and Kellogg Cr.	Contra Costa Co. FCWCD (NRCS)	4 maf, 230 af, and 330 af flood control	Brentwood and Oakley
Mustang Cr. Retarding	Mustang Cr.	Merced Co. DPW (NRCS)	700 AF flood control, channels	North of Ballico (Turlock Airport)

Facility	Stream	Owner (Sponsor)	Description	Protects
Structure				
NON-STORAGE FLOOD CONTROL FACILITIES				
Lower San Joaquin River and Tributaries	San Joaquin R., Stanislaus R., Tuolumne R., Old R., Paradise Cut, Paine Slough	USACE (CVFPB)	Levees, bank protection, snag removal, flowage easements	Stockton and vicinity and areas downstream on the San Joaquin R.
Lower San Joaquin Flood Control Project	San Joaquin R., Fresno R., Bear Cr., Berenda Slough, Ash Slough, Chowchilla Canal Bypass, Eastside Bypass, Mariposa Bypass	CVFPB	Levees, bypasses, control structures, channel clearing	Areas downstream on the San Joaquin R.
Mormon Slough Bypass and related projects	Mormon Slough, Mormon Slough Diversion Channel, Calaveras R., Potter Cr., Bear Cr. (San Joaquin Co.), Duck Cr., Lone Tree Cr., Littlejohns Cr.	USACE (CVFCB, San Joaquin Co. DPW)	Improved channels, enlarged diversion channel, levees, bank protection	Stockton and vicinity
Merced County Streams Group	Burns Cr., Bear Cr. (Merced Co.), Owens Cr., Mariposa Cr., Black Rascal Cr., Canal Cr., Miles Cr.	USACE (CVFCB)	Five flood detention dams (See above under "Reservoirs and Lakes"), diversion channels, improved channels, levees	Merced and vicinity and other small communities
Mosher Creek	Mosher Cr.	San Joaquin County FCWCD (NRCS)	Channels	Stockton

Table A-4 Flood emergency responders, San Joaquin River Hydrologic Region

Responder	Level	Comment
Person(s) or organization(s) on the site	0	Any emergency
Emergency services units of the 34 cities in the region	1	Any emergency
Lower San Joaquin Levee District	1	Levees and bypasses, Mendota to Merced R.
Reclamation Districts 1602, 2099, 2100, 2101, 2102	1	Levees on the west bank of the San Joaquin River
Reclamation Districts 2031, 2063, 2091, 2092	1	Levees on the east bank of the San Joaquin River
Emergency services units of the 16 counties in the region	1 or 2	Any emergency, and by request from Level 1 responders
Department of Water Resources	2	Flood Operations Center, flood fight and Corps liaison
Office of Emergency Services, Inland Region	3	Any emergency, counties of region except Contra Costa, by request of county (operational area)
Office of Emergency Services, Coastal Region	3	Any emergency, Contra Costa County, by request of county (operational area)
U. S. Army Corps of Engineers	3	Specified water-related emergencies, by request of DWR
California Conservation Corps	3	Personnel and equipment for flood fight
Department of Forestry and Fire Protection	3	Personnel and equipment for flood fight
Office of Emergency Services Headquarters	4	All emergencies, entire hydrologic region, by request of OES Region

Table A-5 AHPS stream forecast points, San Joaquin River Hydrologic Region

River basin	Stream	Location
San Joaquin River	Cherry Creek	Cherry Lake
San Joaquin River	Cosumnes River	Michigan Bar
San Joaquin River	Eleanor Creek	Lake Eleanor
San Joaquin River	Merced River	Exchequer Reservoir
San Joaquin River	Merced River	Yosemite at Pohono Bridge
San Joaquin River	Mokelumne River	Pardee Reservoir
San Joaquin River	San Joaquin River	Millerton Reservoir
San Joaquin River	Stanislaus River	New Melones Reservoir
San Joaquin River	Tuolumne River	Hetch Hetchy Reservoir
San Joaquin River	Tuolumne River	New Don Pedro Reservoir

Box A-1 Selection Criteria

- The watercourse must be a natural stream with a watershed of at least 100 square miles.
- The station must have a reasonably continuous record of discharge from 1996 to the present.
- The station must be far enough from other stations on the same river to reasonably represent a separate condition.
- Stations in well defined watercourse locations such as deep canyons are omitted, unless particularly important to the overall flood situation.

Appendix B Water Quality Issues

Salinity

The salinity impairment of surface water and groundwater in the Central Valley is a subset of a more far-reaching problem shared by most of California, other arid western states, and much of the developed world. Since the 1940s, mean annual salt concentrations in the Lower San Joaquin River at the Airport Way Bridge near Vernalis have doubled and boron levels have increased significantly. Water quality monitoring data collected by the Central Valley Regional Water Quality Control Board (Regional Water Board) and other governmental agencies including the US Geological Survey, Department of Water Resources, and the US Bureau of Reclamation indicates that water quality objectives for salinity and boron at Vernalis are frequently exceeded during certain times of the year and under certain flow regimes. Consequently, the river no longer supports all of its designated beneficial uses.

High salinity is a problem in the San Joaquin River basin, because of the greatly altered flow regime of the river; most of the San Joaquin River is diverted from its natural course at Friant Dam. Moreover, irrigation water from State and federal projects annually import more than a half-million tons of salt to the Westside of the San Joaquin River basin. Water released from New Melones Reservoir on the Stanislaus River is currently used to help meet the salinity and dissolved oxygen requirements at Vernalis on the San Joaquin River. Agricultural drainage and discharges from managed wetlands are already formally managed under permit in the 370,000 acre Grasslands watershed, which contributes high levels of salts, selenium, boron, and nutrients to Mud and Salt sloughs, which in turn are the primary contributors of selenium to the San Joaquin River. The Grassland Bypass Project Use Agreement Phase II calls for a water quality monitoring program to provide information to meet waste discharge requirements issued by the Regional Water Board for water eventually entering the San Joaquin River and environmental commitments in the use agreement. Water releases from managed wetlands, part of State and federal wildlife refuge system, also discharge salts and nutrients.

The salinity and boron water quality impairment in the river has occurred, in large part, as a result of large-scale water development coupled with extensive agricultural land use and associated agricultural discharges in the watershed. Upstream river flows have been severely diminished by the construction and operation of dams and diversions. Diverted natural river flows have been replaced with poorer quality (higher salinity) imported water that is primarily used for irrigating crops. Surface and subsurface agricultural discharges are the largest sources of salt and boron loading to the river. During the irrigation season, the river is heavily influenced by irrigation return flows. Water quality generally improves downstream as higher quality tributary flows dilute salt and boron concentrations. To address this impairment, the Regional Water Board established a basin plan control program to implement salinity load and waste load allocations for dischargers to the San Joaquin River.

The Regional Water Board has gathered stakeholders to form a salinity policy group to work on solutions to the Central Valley salinity problem. The goal of the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) efforts is to maintain a healthy environment and a good quality of life for all Californians by protecting the State's water. Protecting high quality source waters should be part of the solution. These solutions go beyond the board's jurisdiction and require cooperation by a number of local, State, and federal agencies. Solutions within the board's jurisdiction will need to be incorporated into the basin plans. Basin plan amendments that the board could consider may result in more restrictive discharge limits, requirements to conduct costly studies, implementation of treatment measures or projects to manage salt, and potentially prohibition of certain discharges. Design, construction, and operation of infrastructure necessary to control salinity also will be expensive. Failure to control salinity, however, will result in continued decline of Central Valley water quality at an enormous cost to all water users,

eventually creating even greater hardship for the environment, agriculture, industry, municipal utilities, and the entire economy of the valley and the State. In the meantime, the board has been including requirements in permits and waste discharge requirements to study ways to reduce salt loads.

The US Bureau of Reclamation is conducting a feasibility study to recirculate water pumped into the Delta-Mendota Canal to the San Joaquin River thence into the south Delta. Improving the quality of water in this way would reduce the reliance of releases from New Melones Reservoir to meet water quality objectives at Vernalis. A final report on a pilot recirculation study was completed in June 2005.

The US Geological Survey and local San Joaquin County cooperators began the Joint Salinity Project in 2003. The five-year study's purpose is to investigate the elevated groundwater salinity along the western boundary of the Eastern San Joaquin (County) subbasin. Understanding the groundwater flow and saline groundwater intrusion will assist in formulating the best programs and projects for the conditions.

Pesticides

Regional Water Board staff works with growers and third party coalitions that represent growers to identify water quality problems and then to implement management plans to address those problems. Staff is developing a long-term regulatory program that will address both surface water and groundwater; processes and procedures to improve the timeliness and completeness of data evaluation; studies to determine the effectiveness of management practices to address identified water quality problems; identification of noncompliance growers to them in the program; increased outreach and enforcement to ensure that water quality protection becomes routine in all farming operations; and increased compliance and enforcement efforts.

Many of the pesticide impairments are due to chlorpyrifos and diazinon. Sale of both diazinon and chlorpyrifos for use in indoor and outdoor areas where children could be exposed was cancelled by recent US Environmental Protection Agency (EPA) regulations. The ban on residential uses of chlorpyrifos and diazinon should reduce the potential for water quality impacts from these pesticides in urban areas. Staff of the Central Valley Regional Water Board is evaluating data for pesticide impairments for urban streams in the Stockton metropolitan area for potential delisting from the Clean Water Act section 303(d) list of impaired water bodies.

Nitrates

A 1988 State Water Resource Control Board (State Water Board) report to the State Legislature on Nitrate in Drinking Water (1988) reported that 10 percent of the samples in STORET (the EPA database) were above the primary Maximum Contaminant Level (10 milligrams per liter nitrate as nitrogen). A geographical depiction of wells with levels of nitrate above background (greater than 4.5 mg/L nitrate as nitrogen) showed the highest densities in the Central Valley are close to the Highway 99 corridor and primarily around population centers (e.g., Modesto, Yuba City, Fresno, and Bakersfield) and concentrated animal confinement areas (e.g., feedlots and dairies). As noted in California's Groundwater (DWR Bulletin 118 Update 2003), nitrate is one of the most frequently exceeded constituents in public supply wells.

The primary health concern with the consumption of water with elevated nitrate is the condition known as methemoglobinemia. Methemoglobinemia, more commonly known as the "blue baby syndrome," is the interference by nitrate byproducts in the absorption of oxygen by hemoglobin in the blood. The nitrogen byproduct combines with hemoglobin to form methemoglobin, which is much less efficient in transporting oxygen. Infants younger than a year old are most susceptible; the oxygen deficit in the blood stream produces blue coloration of the lips and skins hence the term "blue baby." More severe cases result in death.

The primary sources of nitrate in groundwater are application of nitrogen fertilizers, disposal or reuse of animal waste at confined animal production facilities, and disposal of human sewage either in community sewer systems or individual sewer systems (septic systems).

Areas of intensive crop production in highly permeable soils, especially of crops with a high nitrogen demand (e.g., vegetables, citrus, and silage corn), are known or suspected of causing elevated nitrate levels in the groundwater (e.g., Salinas Valley, the Chico non-urban area, and Hilmar Area of Merced County). Groundwater in crop production areas can become contaminated with nitrate when nitrogen fertilizers are applied at rates in excess of crop utilization and inefficient irrigation or high rainfall leach the nitrate to groundwater. Other factors that put groundwater at risk are a shallow aquifer, the absence of a restricting layer to vertical migration of nitrate, permeable soils and poor well construction. The Regional Water Board's Irrigated Lands Regulatory Program may address some of these issues by starting the process of identifying impacts and requiring development and implementation of practices to reduce and/or eliminate the impacts.

Regional Water Board's Irrigated Lands Regulatory Program

The Porter-Cologne Water Quality Control Act (found in California Water Code, Division 7) is very broad in scope. The California Water Code regulates any person discharging waste or proposing to discharge waste within any region that could affect the quality of the waters of the State. The term "waste" is very broadly defined and the term "waters of the state" includes all surface water and groundwater within the State. The California Water Code applies to point sources and non-point sources. Persons who discharge waste (dischargers) can be regulated by the Water Board in several ways, including, for example, through prohibitions of discharge, waste discharge requirements (a permit), or a waiver of waste discharge requirements (individual or general). The Central Valley Water Board has adopted the Irrigated Lands Conditional Waivers to provide one way for dischargers to comply with the California Water Code.

If you discharge waste from irrigated lands to surface waters of the State, you need to file a Report of Waste Discharge (i.e., permit application), cease discharging, or obtain coverage under either the Individual Discharger or Coalition Group Conditional Waiver. The specific requirements for compliance can be found by getting information as identified below. However, the following conditions generally apply:

- Implement management practices to protect water.
- Comply with water quality standards.
- Conduct monitoring or join a Coalition Group that is conducting monitoring.
- Prevent pollution of surface water.
- Avoid nuisance conditions, such as odor.
- Pay applicable fees.

(the above is from http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml)

Many growers/ranchers decided to form Water Quality Coalitions in lieu of pursuing Individual Discharge Permits. There are three water quality coalitions in the San Joaquin River Region. The San Joaquin County & Delta Water Quality Coalition includes San Joaquin County and the eastern portion of Contra Costa County, and a small area in the northeastern portion on Alameda County along with a small portion in Calaveras County. There are three major tributaries: the San Joaquin, Mokelumne, and Calaveras rivers (548,362 irrigated acres). The East San Joaquin Water Quality Coalition includes farmlands encompassed by the lower Stanislaus, Tuolumne and Merced River sub-watersheds (primary eastside tributaries to the San Joaquin River) and that fall into Stanislaus, Merced, Madera, Calaveras,

Mariposa and Tuolumne counties (1,187,000 irrigated acres). Finally, the Westside San Joaquin River Watershed Coalition, which includes area primarily on the west side of the San Joaquin River from the Stanislaus River on the north to 10 miles south of Mendota on the south (covering Stanislaus, Merced, Madera, and Fresno counties). This area covers approximately 550,000 acres and includes irrigated agriculture as well as private, state and federal wetlands areas. (from http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/index.shtml)

In 1993 the Regional Water Board conducted a survey of groundwater beneath five typical well operated dairies in the vicinity of Hilmar. The average nitrate-nitrogen concentration beneath these dairies was 49 mg/L with a maximum value of 250 mg/L. This far exceeds the drinking water standard of 10 mg/L. Conditions were conducive to migration of nitrates to groundwater as soils are highly permeable (sandy) and the water table is shallow (4 to 25 below ground surface). The Regional Water Board adopted general waste discharge requirements in May 2007 to control the discharges from the 1,550 milk cow dairies in the Central Valley. The board found that many dairies in the region have impacted groundwater quality with salt and nitrates. The general waste discharge requirements provide for a phased approach with several milestones that culminate in five years with discharger certifications of facility retrofit and implementation of the Nutrient Management Plan with the goal of reducing salt and nitrate contamination. This program is implemented with the cooperation of the industry. The California Dairy Quality Assurance Program with assistance from Regional Water Board staff has developed and held workshops to provide education and outreach to help dairy producers comply with the general waste discharge requirements.

The Central Valley has approximately 600,000 individual onsite systems within its boundaries (equivalent dwelling units). Collectively, these systems discharge approximately 120-million gallons per day to the subsurface. Pollutants of concern in these discharges consist primarily of nutrients and pathogens, but metals, salts, and personal care products (e.g. pharmaceuticals) are also a concern.

The Regional Water Board developed “Guidelines for Waste Disposal from Land Developments” in 1976 to protect drinking water beneficial uses and human health concerns from contact. Regulatory agencies have not had adequate opportunity to evaluate the many developments in the onsite disposal industry, especially in foothill areas that have shallow soil cover and sloping surfaces.

In 2000 the legislature passed Assembly Bill 885, which required the State Water Board to develop regulations for onsite wastewater systems that ought to include criteria to evaluate new engineered onsite disposal systems. However, these regulations have not yet been adopted.

In the past, the Regional Water Board has prohibited discharge in problematic service areas. In the San Joaquin River Hydrologic Region, the board has adopted 13 prohibitions of discharge from individual sewage disposal systems. Currently, all of these areas are served by community sewage systems.

Water quality impacts can occur if septic tanks are not properly sited. Other areas in the region are likely to have groundwater contamination problems due to onsite wastewater treatment systems, but this potential problem has not been investigated.

Sedimentation and Erosion

Excessive soil erosion and sediment delivery can impact the beneficial uses of water by (1) silting over fish spawning habitats; (2) clogging drinking water intakes; (3) filling in pools creating shallower, wider, and warmer streams, and increasing downstream flooding; (4) creating unstable stream channels; and (5) losing riparian habitat. Timber harvesting in the riparian zone can adversely affect stream temperatures by removing stream shading which is especially a concern for spawning and rearing habitat

for salmonids. Thousands of miles of streams are potentially impacted, and the lack of resources has prevented a systematic evaluation of these impacts.

During the past five years, in the San Joaquin River Hydrologic Region, timberland owners have submitted 332 timber harvest plans that allow harvesting on almost 100,000 acres.

Another major source of erosion is construction activities that expose or loosen soils. In the past 5 years, the board has documented 9 incidents of water quality impacts that resulted in formal enforcement action and 97 incidents that could result in water quality impacts if not corrected.

Legacy Mine Impacts

Historical mercury mining on the Coast Range side of the Central Valley and use of the mercury to amalgamate gold on the Sierra side has resulted in substantial mercury loads discharged to the Central Valley waterways. Methylmercury is the most toxic form of mercury and accumulates in successive levels of the food chain. It is a neurotoxicant that adversely affects reproductive and immune systems in humans and wildlife that consume contaminated fish and shellfish. In the San Joaquin River Hydrologic Region, the Office of Health and Human Assessment has issued fish advisories for the mercury levels in fish in Cosumnes, Mokelumne, and San Joaquin rivers.

Mercury mines have impacted the Marsh Creek watershed in the northwest part of this hydrologic region. Mercury impacts from gold mining activities have been identified in reservoirs all along the Sierra. In addition, copper and zinc from copper mining is an identified water quality impact of the Lower Mokelumne River and Camanche Reservoir. These metals are naturally occurring elements that are toxic to aquatic life at elevated concentrations; although, these concentrations may not be high enough to cause human health impacts. Drainage from abandoned copper mines contributes metals and other water quality problems downstream. The 1999 remediation of Penn Mine, a copper mine in the Mokelumne River watershed, is an example of how acid mine drainage can be corrected.

Dairies, Stockyards, and Poultry Ranches

In May 2007, the Central Valley Regional Water Quality Control Board adopted a General Order for milk cow dairies. The General Order includes numerous regulatory requirements including the filing of a Report of Waste Discharge by dairy owners/operators. The order requires the development of a nutrient management plan, monitoring of wastes, identification of chemicals used, and monitoring of groundwater and surface water.

The Central Valley is the home of about 77 percent of California's 1,950 dairy farms. Approximately 840 dairies are in the San Joaquin River Hydrologic Region (California Dairy Statistics 2007). Sixteen of these dairies (11,943 cows) are also in the Sacramento-San Joaquin River Delta Region. Over two-thirds of the dairies (and two-thirds of the cows) are in Merced and Stanislaus counties. Dairies and other confined animal operations generate waste byproducts that include pathogens, nutrients, salts, and contaminants. These have the potential to enter surface water and infiltrate to the underlying groundwater. Dairy waste byproducts are typically stored in dry piles or in retention ponds as liquids. These wastes may be applied to cropland as a nutrient source.

Groundwater Quality

The purpose of the Groundwater Quality Monitoring Act of 2001 (Assembly Bill 599) is to improve the system through which groundwater quality information is gathered and to make available public information about the groundwater. The act requires the State Water Board to integrate monitoring programs and to design a new model that would meet the requirements of the act. Initial action was to

convene a task force of State departments and compose an advisory committee whose members represent a variety of backgrounds. This task force produced a report to the Governor and Legislature titled A Comprehensive Groundwater Quality Monitoring Program for California (March 2003).

Groundwater quality throughout the region is generally suitable for most urban and agricultural uses. However, some 1000 square miles of groundwater are contaminated with salinity, mostly along the western edge of the valley floor, where saline marine sediments of the Coast Range exist. Crop and wetland evapotranspiration leaves behind the majority of the salts contained in imported water, and salts remain from chemical applications to crops. The salinity of groundwater in the region increases when these salts make their way to groundwater. In addition, high water table conditions underlying marginal lands along the west side of the San Joaquin River Basin contribute to subsurface drainage problems.

Nitrates from the disposal of human and animal waste products or the inefficient application of fertilizer or irrigation water have contaminated 200 square miles of groundwater, presenting a threat to domestic water supplies. Pesticides have contaminated 500 square miles of groundwater, primarily in agricultural areas on the east side of the San Joaquin Valley, where soil permeability is higher and depth to groundwater is shallower.

The US Geological Survey and San Joaquin County cooperators began the Joint Salinity Project in 2003. The five-year study is to investigate the elevated groundwater salinity along the western boundary of the Eastern San Joaquin (County) subbasin. Understanding the groundwater flow and saline groundwater intrusion will assist in formulating the best programs and projects for the conditions.

The State Water Board and US Geological Survey established a priority of basins and a sampling/monitoring plan. This effort was named the GAMA Program (Groundwater Ambient Monitoring and Assessment). The sampling was primarily designed to test public supply and domestic groundwater use (prior to any treatment). The study period was roughly designed to rotate through a 10-year period with trend monitoring every three years. Those study units, counties, and data summary in San Joaquin River Hydrologic Region are shown in Table B-1 GAMA Program: Priority basin assessment study units, counties, and data summary.

PLACEHOLDER: Table B-1 GAMA Program: Priority basin assessment study units, San Joaquin River Hydrologic Region

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**Table B-1 GAMA Program: Priority basin assessment study units,
San Joaquin River Hydrologic Region**

Study Unit (chronologically listed)	Counties Included	Groundwater Basins	Sampling Status	Number of Wells Sampled	Data Summary	Assessment Report
North San Joaquin Valley	San Joaquin; Stanislaus	Eastern San Joaquin; Modesto; Tracy	Completed	70	Website Release 11/13/2006	In progress
Central Eastside (Modesto/Turlock/Merced)	Stanislaus; Merced	Modesto; Turlock; Merced	Completed	78	Website Release 4/18/2008	
Central Sierra	Tulare; Fresno; Madera	Outside Groundwater Basins	Completed, with time series sampling of 2 wells that continued monthly through May 2007	30	Website Release 5/22/2008	
Madera/Chowchilla	Madera	Chowchilla; Madera	Completed	35		
Sierra Regional	Kern; Tulare; Inyo; Fresno; Madera; Mono; Mariposa; Tuolumne; Calaveras; Alpine; Amador; Sacramento; El Dorado; Placer; Nevada; Yuba; Sierra; Butte; Plumas; Lassen	Areas outside priority groundwater basins	Completed	41 as of 7/30/08		
Western San Joaquin Valley	Stanislaus; Merced; Fresno	Delta-Mendota; Tracy; Westside	Will begin 2009			

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