ATTACHMENT C

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

SUPPORTING DOCUMENTATION
FOR
ORDER NO. R5-2009-0875
MONITORING AND REPORTING PROGRAM
FOR
SACRAMENTO VALLEY WATER QUALITY COALITION
UNDER AMENDED ORDER NO. R5-2006-0053
COALITION GROUP CONDITIONAL WAIVER OF
WASTE DISCHARGE REQUIREMENTS
FOR DISCHARGES FROM IRRIGATED LANDS

This Attachment is provided as part of the Monitoring and Reporting Program Order for the Sacramento Valley Water Quality Coalition (Coalition). The purpose of this Attachment is to provide background information and documentation in support of monitoring site selection, schedule, and identification of monitoring parameters for the Coalition's monitoring program.

The Sacramento Valley Water Quality Coalition is comprised of ten (10) subwatershed areas (Figure 1). Each subwatershed area is organized and managed by a group of local representatives who are actively engaged in agriculture and/or resource management in their region. The Coalition coordinates program activities across all of the subwatersheds to ensure consistency and provide its members the economic benefits gained from sharing costs across the region. Subwatershed Group representatives implement Coalition tasks at the local level, making use of the knowledge, expertise and connections that are vital to the Coalition. This includes education and outreach to members, maintaining membership information and processing fees, and working with growers and other stakeholders to identify and implement management practices, as needed.

Each of the Coalition's ten Subwatershed Groups is listed below, along with the name of the managing entity(s) (in parentheses):

- Butte-Yuba-Sutter Subwatershed (Sutter County RCD and Farm Bureau)
- Colusa-Glenn Subwatershed (Colusa Glenn Subwatershed Program)
- El Dorado Subwatershed (El Dorado County Agricultural Water Quality Management Corporation)
- Lake-Napa Subwatershed (Lake County Agricultural Watershed Program and Napa County Putah Creek Watershed Group)
- Pit River Subwatershed (Northeastern California Water Association)
- Placer-Nevada-South Sutter-North Sacramento Subwatershed (PNSSNS Subwatershed Group)

- Sacramento-Amador Subwatershed (Sacramento Amador Water Quality Alliance)
- Shasta-Tehama Subwatershed (Shasta Tehama Water Education Coalition)
- Solano-Yolo Subwatershed (Solano Resource Conservation District Water Quality Coalition and Yolo County Farm Bureau Education Corporation)
- Upper Feather River Subwatershed (Upper Feather River Watershed Group)

A description of important characteristics and background for each Subwatershed Group area is provided below. The six key topics include 1) physical factors; 2) agriculture and crops; 3) hydrology, water management and irrigation methods; 4) management practices; 5) monitoring site selection; and 6) past water quality monitoring. The subwatershed area descriptions are focused on information that is relevant to agriculture, water quality and the monitoring program for the Coalition.

The Sacramento Valley Coalition has been monitoring water quality and reporting monitoring results to the Central Valley Water Board in accordance with the Irrigated Lands Regulatory Program since 2004. Results have served to inform the Coalition about water quality impacts that require management plans, as well as constituents that do not pose water quality threats, in the various subwatershed areas. These results combined with knowledge of agricultural operations, watershed characteristics, and documented pesticide use records are being used to develop a more effective and cost-efficient monitoring program.

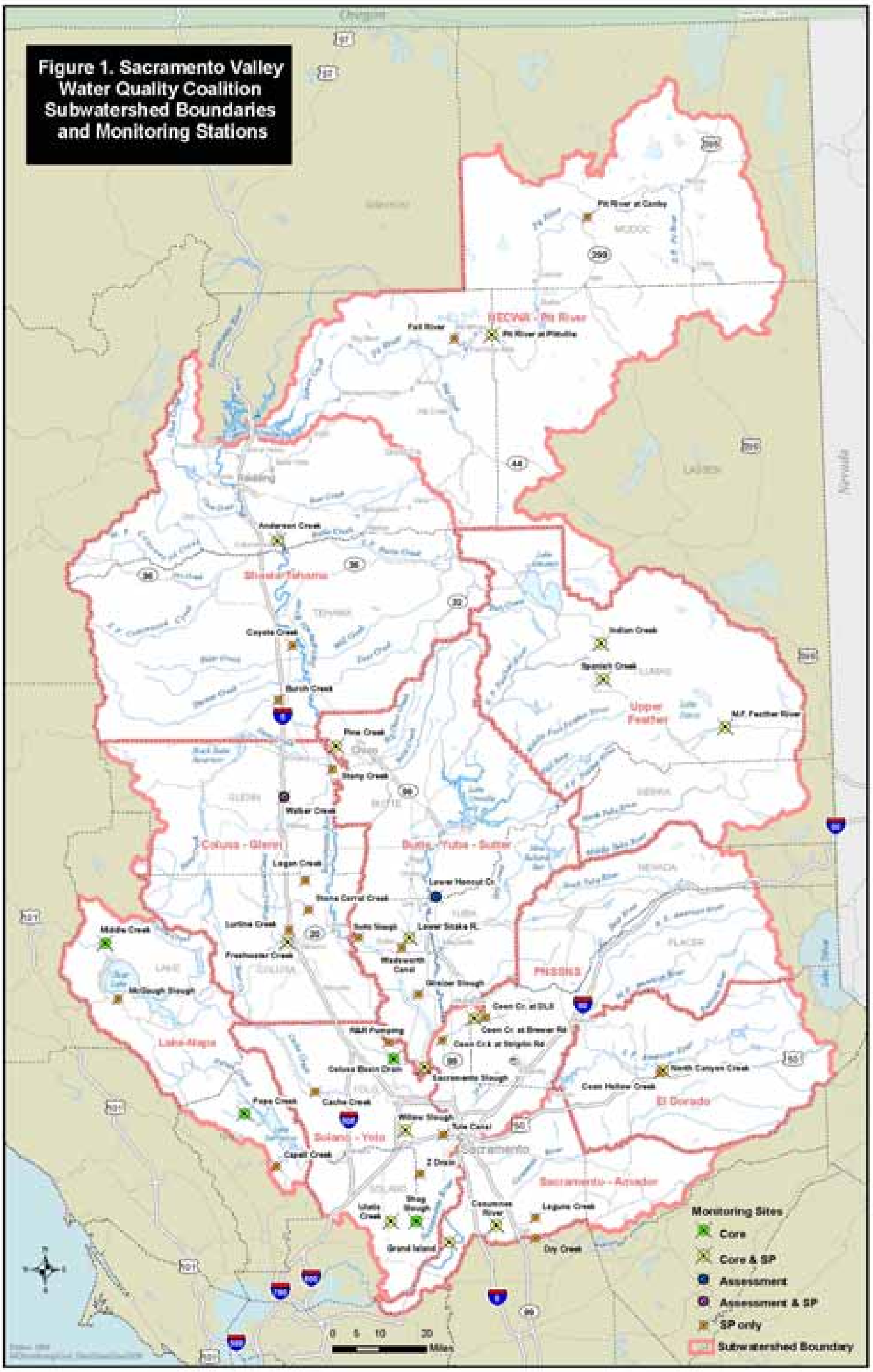
Figure 1. Sacramento Valley Water Quality Coalition Subwatershed Boundaries and Monitoring Stations
Monitoring Sites
Core
Core & SP
Assessment
Assessment & SP
SP only
Subwatershed Boundary
Miles

Butte-Yuba-Sutter Subwatershed

The Butte-Yuba-Sutter Subwatershed encompasses approximately 1,874,510 acres in the central portion of the Sacramento Valley, and includes all of Butte and Yuba Counties and roughly three-quarters of Sutter County. Approximately 251,000 acres are in the upper portions of the watershed and have no irrigated acreage. The subwatershed area is bounded on the east by the Sierra Nevada Range, on the west by the Sacramento River, on the north by the Tehama County line, and on the south by the Feather and Bear Rivers (Figure 1). Topography varies from a relatively flat valley floor, to rolling foothills and volcanic buttes, to steep forested mountains and deep river canyons. Elevation ranges from approximately 20 to 7,000 feet above sea level. Irrigated agriculture occurs in a large portion of the Butte-Yuba-Sutter Subwatershed, with approximately 570,000 acres currently being farmed, a significant portion (about 260,000 acres) of which is planted in rice. Some dryland grains are also grown, typically in rotation with other field crops. Other land use types include non-irrigated grazing rangeland, urban and rural residential development, and coniferous forests, oak woodlands, grasslands, and wetlands.

Significant Subwatershed Characteristics
The key factors relevant to agriculture and water quality in the Butte-Yuba-Sutter Subwatershed are climate, soils and hydrology. In general, the Mediterranean climate – warm, dry summers and cool to cold, wet winters – is the dominant influence on weather patterns. Throughout the subwatershed, average annual precipitation ranges from 17 to 30 inches per year (varying greatly with location). Most of the rainfall (snow in upper elevations) occurs from October through April. Average maximum temperatures vary from about 36°F in winter to 96°F in summer.

Soil characteristics play a significant role in both crops grown and water quality conditions. The Sacramento Valley portion of Butte County is comprised primarily of alluvial deposits resulting from foothill and mountain erosion. These alluvial fans are deep, nearly flat, and very fertile. Fine clay provides soil well suited for growing rice. The western third of Butte County contains soil classifications which support a variety of irrigated agriculture crops. Yuba County's alluvial soils are deep to very deep and well drained on the stream terraces. Orchard crops are grown on the Conejo-Kilaga soils. In Sutter County, soil types can be characterized as moderately to very deep, level to nearly level, well drained loam and sandy loam, and moderately deep, level to nearly level well drained clay and clay loam.

Irrigation is necessary to grow most crops in the Butte-Yuba-Sutter Subwatershed. A relatively dependable water supply allows the high level of agricultural production that exists today. To achieve this, the natural hydrology of the area was largely altered over the past 150 years, mainly to create the irrigation distribution and drainage system that serves agricultural needs. Additional information on hydrology and water management is provided below in the *Hydrology, Water Management, and Irrigation Methods* section.

Agriculture and Crops

The types of crops grown in Butte, Yuba, and Sutter Counties are generally similar, although regional differences exist in their occurrence and distribution. Typical crops common to the entire subwatershed include rice, walnuts, dried plums, almonds, peaches, and hay.

The leading crops (by acreage) in the Butte County portion of the subwatershed are rice, almonds, walnuts, and dried plums. Irrigated and non-irrigated pasture lands also encompass significant acreages. Other important crops in Butte County include olives, peaches, alfalfa, wheat and nursery stock.

The leading crops (by acreage) in the Yuba portion of the subwatershed include prunes, rice, walnuts, and peaches. Irrigated and non-irrigated pastures also encompass large acreages. Other important crops include kiwi, almonds, hay, and seeds.

The leading crops (by acreage) in the Sutter portion of the subwatershed include dried plums, rice, walnuts, peaches, almonds, alfalfa, wheat, tomatoes, and beans. Other important crops include corn, safflower, melons, and seed crops.

The Butte-Yuba-Sutter Subwatershed encompasses 32 different drainages where irrigated agriculture is present. Table 1 lists the drainages by name and the crops grown within each drainage area. Figure 2 shows the extent of the drainages.

Table 1. Butte-Yuba-Sutter Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Sacramento Slough	Lower Feather River	Rice, beans, apples, walnuts, rice, almonds, prunes, pasture, peaches, alfalfa, sunflowers, safflower
Represented by Sacramento Slough monitoring site	RD 1500 (Robbins Basin)	Rice, beans, alfalfa, hay, corn, wheat, tomatoes, pumpkins, melons, onions, walnuts, milo, safflower, sunflower, sudan
	Grasshopper Slough	Walnuts, rice, pasture, almonds, prunes, safflower, peaches, nectarines, melons and squash
	Ageden Slough	Rice, prunes, pasture, walnuts, peaches, alfalfa, sunflowers, safflower, apples
	RD 70	Rice, safflower, walnuts, tomatoes, grain, beans, melons/squash, sunflowers, alfalfa
	RD 1660	Rice, safflower, tomatoes, grain, melons/squash, beans, walnuts, sunflowers
	Chandler	Rice, prunes, walnuts, peaches, alfalfa, wheat, melons
	RD 823	Rice, wheat, walnuts, alfalfa, prunes, safflower, peaches and neactarines

Type of Monitoring	Drainages	Crops
	Sutter Bypass	Rice, beans, safflower
Monitoring site in Pine Creek	Pine Creek	Almonds, walnuts, prunes, pasture, grain, beans, safflower
Represented by Pine Creek monitoring site	Little Chico Creek	Almonds, rice, grain, wheat, corn, walnuts, prunes, beans
	Big Chico Creek	Almonds, walnuts, wheat, pasture, prunes, beans
	Dicus Slough	Walnuts, almonds, prunes, olives
Monitoring site in Lower Snake River	Lower Snake River	Rice, prunes, peaches, nursery, walnuts, pasture, almonds, necatrines
Represented by Lower Snake River monitoring site	Cherokee Canal	Rice, prunes, almonds, walnuts, peaches
	Butte Creek	Rice, almonds, walnuts, pecans, beans, sunflower, safflower
	Wadsworth	Rice, prunes, peaches, walnuts, pasture, beans, melons
	Lower Oroville	Walnuts, prunes, rice, peaches,
	Gilsizer	Prunes, peaches, walnuts, rice, tomatoes, melons/squash, sunflower, safflower
	Sutter	Grain, rice, almonds, safflower, walnuts, beans
Monitoring Site on Lower Honcut Creek	Lower Honcut Creek	Rice, walnuts, prunes, pasture, citrus, olives, grapes, pasture
Represented by Lower Honcut Creek monitoring site	Jack Slough	Rice, prunes, peaches, pasture
	Lower Yuba River	Peaches, walnuts, olives, prunes, pasture, cherries
	Feather River Direct – Sutter	Walnuts, prunes, peaches
	Feather River Direct – Yuba	Peaches, prunes, walnuts, cherries, pears
	South Honcut Creek	Pasture
	North Honcut Creek	Pasture
	Browns Valley	Pasture
	Dry Creek – Yuba	Pasture
	North Yuba River	Pasture
	Upper Jack Slough	Pasture, rice
	Oroville Dam	Pasture, grain

Hydrology, Water Management, and Irrigation Methods

The Butte-Yuba-Sutter Subwatershed area encompasses a broad range of stream types, sizes, and conditions. The Sacramento River, which ultimately drains the entire Coalition area, is adjacent to a portion of the subwatershed's western boundary (Figure 1). The Sacramento River carries the largest volume of water in California and, although it generally follows much of its historic stream course, it has undergone intense hydro-modification, including channel straightening, damming, water diversion, and levee constriction, through most of its length. Other large streams in the subwatershed include the Feather River, Bear River, Yuba River, Butte Creek, Big Chico Creek, and South Honcut Creek. Some degree of hydro-modification has occurred in all of these streams. A network of many smaller tributary creeks and sloughs (typically intermittent) discharge to the larger streams or connect with an intricate system of constructed agricultural canals and drains. In addition, the region contains several wetland and wildlife areas, such as Butte Sink, Gray Lodge NWR, Oroville Wildlife Area, and Sutter NWR.

Many large reservoirs occur in the mountainous regions of the subwatershed, including Lake Oroville, New Bullards Bar Reservoir, Collins Lake, and Camp Far West Reservoir. The timing and quantity of water discharged downstream of these reservoirs is closely managed to meet urban and rural water supply needs throughout much of California. In the intensive agricultural areas that occur in the valley below the reservoirs, numerous water supply canals and drains have been constructed throughout the subwatershed to meet the needs of agricultural production. Water delivery, re-circulation, and drainage are able to meet the varied water needs of agriculture during irrigation season and convey stormwater runoff during the rainy season. Some urban runoff is directed into the system, such as stormwater from the Yuba/Marysville area that flows into Gilsizer Slough. In the regions north and south of the Sutter Buttes, a strictly managed system of canals, pumps and ditches has been created. These are especially important for controlling water levels in the numerous rice fields of the area. Drainage is generally provided by pumping plants that elevate water over the levees of the Sacramento River. Additionally, important flood control features, such as the Sutter Bypass and Tisdale Bypass were constructed to minimize flooding problems in urban and rural areas. Flows are controlled by a system of levees, gates and weirs, such as the Fremont Weir on the Sacramento River.

The water needs in the Butte-Yuba-Sutter Subwatershed are met through a combination of surface and groundwater, with surface water more prevalent as a source for Butte County agriculture and a 70/30 (surface to groundwater) split in Sutter and Yuba Counties. Surface water is supplied from a variety of sources including the Sacramento, Feather, Bear and Yuba Rivers with groundwater used in remote agricultural portions of the Butte-Yuba-Sutter Subwatershed (e.g. Northwest Yuba County) not served by one of the 30 plus irrigation, reclamation, and water districts that convey water to agricultural. The largest of these water providers include Richvale Irrigation District and Western Canal, serving rice growers in western Butte County, and the Yuba County Water Agency.

The Lower Tuscan Formation is the primary groundwater producing aquifer in Butte County, along with a portion of the East Butte Subbasin. Sutter County overlies portions of three subbasins – East Butte, Sutter and North American – within the larger Sacramento Valley Groundwater Basin. The largest of these subbasins is Sutter, which is bounded on the north by the confluence of Butte Creek and the Sacramento River, on the west by the Sacramento River, and on the south by the confluence of the Sutter Bypass and the Sacramento River.

Water management practices in the Butte-Yuba-Sutter Subwatershed include pre-planting irrigation, crop hydration, frost prevention, salinity management, and runoff management. A variety of irrigation methods are used, including drip, furrow, flood, and sprinkler.

Management Practices Information

Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant Best Management Practices (BMPs), regulations, and preventative measures are discussed with the property operator prior to issuance of permits.

A number of BMP projects and programs have been implemented in Butte, Yuba, and Sutter counties with guidance and financial assistance from the Natural Resources Conservation Service and the Resource Conservation Districts. Some of these projects are intended to address irrigation or stormwater related impacts to water quality, while others may do so as a secondary benefit. The BMPs and projects currently implemented by growers throughout the subwatershed have not been documented or evaluated as of preparation of this Order. Examples of some typical management practices and projects in place that may help protect water quality in this watershed include:

- Vegetative filter strips and cover crops
- Drainage channel restoration and stabilization,
- Irrigation system improvements,
- Irrigation Mobile Lab Service, and
- Drip and micro-spray irrigation systems.

Monitoring Site Selection

To account for crop heterogeneity, four monitoring sites were selected to represent the diversity of crops and agricultural practices in the Butte-Yuba-Sutter Subwatershed. Additionally, these sites typically have year-round flows that permit year-round sampling.

As shown in Table 1 and Figure 2, the Sacramento Slough site represents all of the dominant crops grown in the subwatershed, has a high percentage of irrigated acreage, and is an integrator site for upstream drainage. The site specifically represents nine drainages in the southern portion of the subwatershed. Sacramento Slough has been monitored annually for the ILRP since 2005. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Pine Creek monitoring sites represents four drainages in the northern portion of the subwatershed. Orchard and grain crops are the most prevalent in this region. Pine Creek has been monitored annually for the ILRP since 2006. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Lower Snake River monitoring site represents seven drainages in the western and central portion of the subwatershed. Rice and orchard crops are prevalent in this region. The Lower Snake River site has been monitored annually for the ILRP since 2007. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Lower Honcut Creek monitoring site represents twelve drainages in the eastern portion of the subwatershed. Orchard crops, rice, and pasture are the most common crops in the region. Lower Honcut Creek monitoring was initiated in 2009. Assessment-level monitoring data was collected during this period.

Past Water Quality Monitoring

Water quality monitoring has been conducted by the Sacramento Valley Coalition and Butte-Yuba-Sutter Subwatershed since 2005. Tables 2a and 2b below summarize the required ILRP monitoring parameters and results from Butte-Yuba-Sutter Subwatershed monitoring sites. In addition, the Coalition measured or analyzed 73 additional constituents (physical parameters, microbiological organisms, metals, and pesticides) at approximately the same frequency as those listed in Table 2a. No exceedances (except fecal coliform) were observed in the additional measurements. Although the additional measurements and analyses were not required for ILRP monitoring, valuable information regarding the chemicals was documented and can easily be compiled and evaluated, as needed.

Table 2a. Butte-Yuba-Sutter Subwatershed ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season											
	Butte Slough		Gilsizer Slough		Lower Snake R		Pine Creek		Sac Slough		Wadsworth Can	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
GENERAL												
pH	12	3	10	4	13	5	11	7	17	8	12	4
Electrical Conductivity	12	3	10	4	13	5	11	7	17	8	12	4
Dissolved Oxygen	12	3	10	4	13	5	11	7	17	8	12	4
Temperature	12	3	10	4	13	5	11	7	17	8	12	4
Total Dissolved Solids	10	4	9	5	10	5	6	7	13	6	11	4
Total Suspended Solids	10	4	10	5	11	5	6	7	13	6	11	4
Total Organic Carbon	10	4	10	3	11	3	6	5	13	6	11	4
Turbidity	10	4	10	5	11	5	6	7	13	5	11	4
PATHOGENS												
E-coli	5	1	10	5	11	5	6	6	14	5	12	4
WATER COLUMN TOXICITY												
Selenastrum	4	2	5	2	11	4	3	3	6	5	6	2
Ceriodaphnia	4	2	5	2	13	4	4	4	8	6	6	2
Pimephales	4	2	5	2	6	2	3	2	8	6	6	2
PESTICIDES												
Aldicarb	9	0	5	3	11	5	4	3	13	4	10	0
Atrazine	5	2	5	3	11	5	2	2	11	5	5	2
Azinphos methyl	10	4	10	5	6	4	6	7	11	6	11	4
Carbaryl	9	0	5	3	11	5	4	3	13	4	10	0
Carbofuran	9	0	5	3	11	5	4	3	13	4	10	0
Chlorpyrifos	10	4	10	5	11	5	6	7	12	8	11	4
Cyanazine	5	2	5	3	11	5	2	1	10	5	5	2
DDD	5	2	5	4	11	5	2	2	7	4	5	2
DDE	5	2	5	4	11	5	2	2	7	4	5	2
DDT	5	2	5	4	11	5	2	2	7	4	5	2

Table 2a. Butte-Yuba-Sutter Subwatershed ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season											
	Butte Slough		Gilsizer Slough		Lower Snake R		Pine Creek		Sac Slough		Wadsworth Can	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
Demeton-s	10	4	10	5	11	5	6	7	11	9	10	5
Diazinon	10	4	10	5	11	5	6	7	12	8	11	4
Dichlorvos	10	4	10	5	11	5	6	7	12	8	11	4
Dicofol	5	0	5	3	11	5	2	0	7	3	5	0
Dieldrin	5	2	5	4	11	5	2	2	7	4	5	2
Dimethoate	10	4	10	5	11	5	6	7	12	8	11	4
Disulfoton (Disyton)	10	4	10	5	11	5	6	7	12	8	11	4
Diuron	9	0	5	3	11	5	4	3	13	4	10	0
Endrin	5	2	5	4	11	5	2	2	7	4	5	2
Glyphosate	4	0	4	2	10	4	1	1	5	2	4	0
Linuron	9	0	5	3	11	5	4	3	13	4	10	0
Malathion	10	4	10	5	11	5	6	7	12	8	11	4
Methamidophos	3	2	6	3	8	7	3	5	9	5	3	2
Methidathion	10	4	10	5	11	4	6	7	11	6	11	4
Methiocarb	9	0	5	3	11	5	4	3	13	4	10	0
Methomyl	9	0	5	3	11	5	4	3	13	4	10	0
Methoxychlor	5	2	5	4	11	5	2	2	7	4	5	2
Methyl Parathion	10	4	10	5	11	5	6	7	12	8	11	4
Oxamyl	9	0	5	3	11	5	4	3	13	4	10	0
Paraquat Dichloride	4	1	4	1	10	3	1	2	6	2	4	1
Phorate	10	4	10	5	11	5	6	7	12	8	11	4
Phosmet	10	4	10	5	11	4	6	7	11	6	11	4
Simazine	5	2	5	3	11	5	2	2	11	5	5	2
Trifluralin	1	0	6	3	5	3	0	0	0	0	1	0
METALS												
Arsenic	5	2	5	3	11	5	2	2	6	2	5	2
Boron	0	0	5	3	11	5	0	1	6	2	0	0
Cadmium	5	2	5	3	11	5	2	2	6	2	4	2
Copper	5	2	5	3	11	5	2	2	6	2	4	2

Table 2a. Butte-Yuba-Sutter Subwatershed ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season											
	Butte Slough		Gilsizer Slough		Lower Snake R		Pine Creek		Sac Slough		Wadsworth Can	
PARAMETERS	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM
Lead	5	2	5	3	11	5	2	2	6	2	4	2
Nickel	5	2	5	3	11	5	2	2	6	2	5	2
Molybdenum	0	0	0	0	0	0	0	0	0	0	0	0
Selenium	5	2	5	3	11	5	2	2	6	2	4	2
Zinc	5	2	5	3	11	5	2	2	6	2	5	2
NUTRIENTS												
Total Kjeldahl Nitrogen	5	2	5	4	11	5	3	5	14	6	5	2
Nitrate + Nitrite as N	3	2	6	4	11	5	1	5	14	6	3	2
Total Ammonia	6	3	5	6	11	5	6	6	8	2	9	3
Total Phosphorous as P	0	2	5	4	11	5	1	5	10	5	0	2
Soluble Orthophosphate	3	2	6	5	11	5	1	5	14	5	3	2
SEDIMENT TOXICITY												
Hyalella	2	0	1	1	3	1	2	1	2	0	1	0

Table 2b. Butte-Yuba-Sutter Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL					
pH	106	4	6.7	9.09	pH Units
Electrical Conductivity	106	6	76	890	uS/cm
Dissolved Oxygen	106	6	0	17.54	mg/L
Temperature	106	0	7.34	32.8	C
Total Dissolved Solids	90	1	57	530	mg/L
Total Suspended Solids	92	0	ND	290	mg/L
Total Organic Carbon	86	0	0.94	15	mg/L
Turbidity	91	0	0.56	130	NTU
PATHOGENS					
E-coli	84	25	<1	2400	MPN/100 ml
WATER COLUMN TOXICITY					
Selenastrum	53	3	47	1333	% control
Ceriodaphnia	60	3	0	146	% control
Pimephales	48	0	95	108	% control
PESTICIDES					
Aldicarb	67	0	ND	ND	ug/L
Atrazine	58	0	ND	0.008	ug/L
Azinphos methyl	84	0	ND	ND	ug/L
Carbaryl	67	0	ND	ND	ug/L
Carbofuran	67	0	ND	0.19	ug/L
Chlorpyrifos	93	5	ND	1.41	ug/L
Cyanazine	56	0	ND	ND	ug/L
DDD	54	0	ND	ND	ug/L
DDE	54	2	ND	0.0053	ug/L
DDT	54	1	ND	0.0048	ug/L

Table 2b. Butte-Yuba-Sutter Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Demeton-s	93	0	ND	ND	ug/L
Diazinon	93	4	ND	0.227	ug/L
Dichlorvos	93	2	ND	0.542	ug/L
Dicofol	46	0	ND	ND	ug/L
Dieldrin	54	0	ND	ND	ug/L
Dimethoate	93	0	ND	ND	ug/L
Disulfoton (Disyton)	93	0	ND	ND	ug/L
Diuron	67	0	ND	1.5	ug/L
Endrin	54	0	ND	ND	ug/L
Glyphosate	37	0	ND	6.1	ug/L
Linuron	67	0	ND	ND	ug/L
Malathion	93	0	ND	ND	ug/L
Methamidophos	56	0	ND	ND	ug/L
Methidathion	89	0	ND	ND	ug/L
Methiocarb	67	0	ND	ND	ug/L
Methomyl	67	0	ND	ND	ug/L
Methoxychlor	54	0	ND	ND	ug/L
Methyl Parathion	93	0	ND	0.082	ug/L
Oxamyl	67	0	ND	ND	ug/L
Paraquat Dichloride	39	0	ND	0.27	ug/L
Phorate	93	0	ND	ND	ug/L
Phosmet	89	0	ND	ND	ug/L
Simazine	58	0	ND	0.669	ug/L
Trifluralin	19	0	ND	ND	ug/L
METALS					
Arsenic	50	0	ND	7.7	ug/L
Boron	33	0	6	70	ug/L
Cadmium	49	0	ND	0.02	ug/L
Copper	49	0	0.47	12	ug/L
Lead	49	0	ND	0.61	ug/L

Table 2b. Butte-Yuba-Sutter Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Nickel	50	0	0.7	3.9	ug/L
Molybdenum	0	0			ug/L
Selenium	49	0	ND	3	ug/L
Zinc	50	0	0.7	24	ug/L
NUTRIENTS					
Total Kjeldahl Nitrogen	67	0	ND	1.5	mg/L
Nitrate + Nitrite as N	62	0	ND	2.1	mg/L
Total Ammonia	70	0	ND	0.2	mg/L
Total Phosphorous as P	50	0	ND	0.67	mg/L
Soluble Orthophosphate	62	0	ND	0.39	mg/L
SEDIMENT TOXICITY					
Hyalella	14	2	80	110	% control

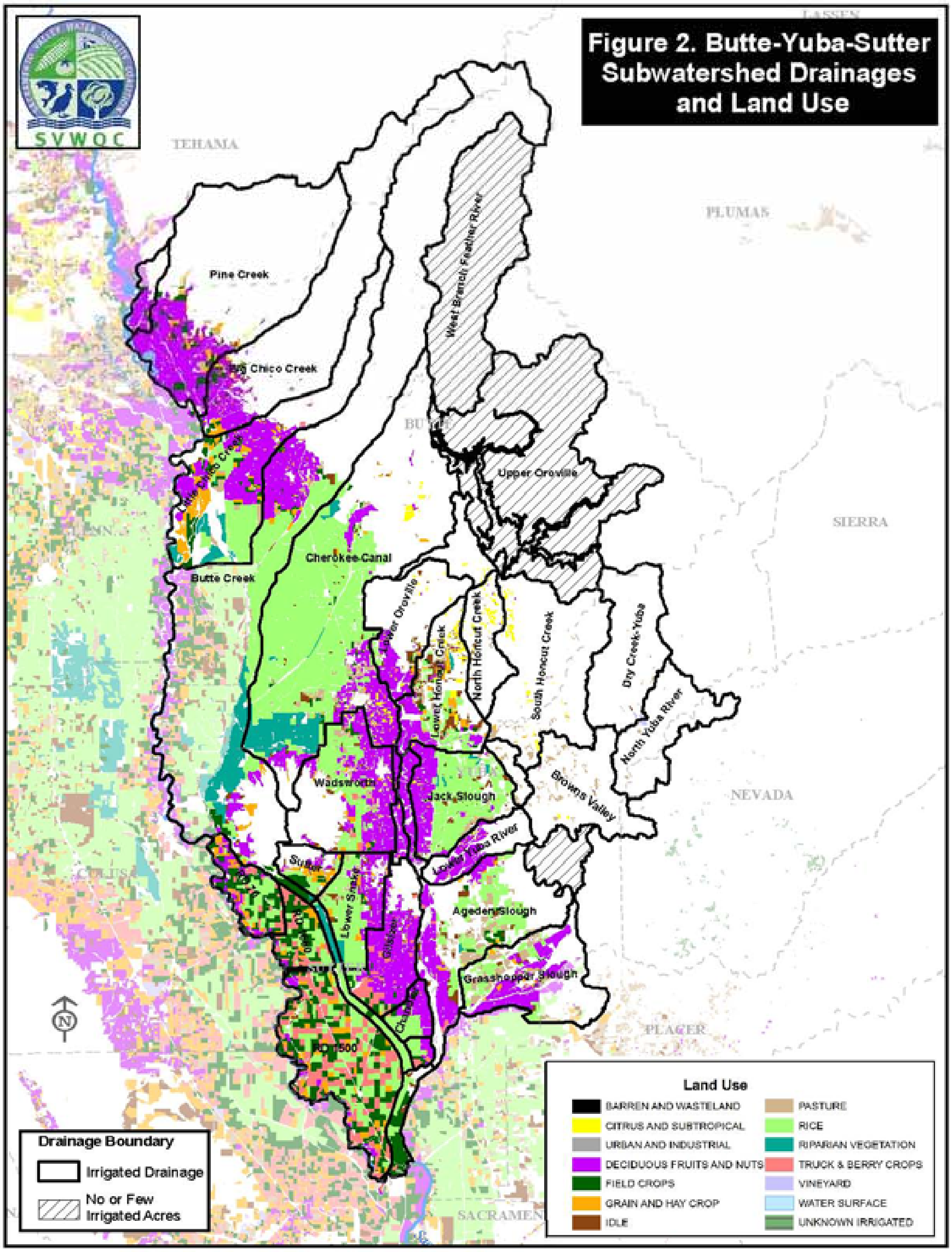

Figure 2. Butte-Yuba-Sutter Subwatershed Drainages and Land Use
SVWQC
TEHAMA
PLUMAS
SIERRA
NEVADA
PLACER
COLUSA
SACRAMENTO
Pine Creek
Big Chico Creek
West Branch Feather River
Upper Oroville
Cherokee Canal
Butte Creek
Lower Oroville
Lower Honcut Creek
North Honcut Creek
South Honcut Creek
Dry Creek-Yuba
North Yuba River
Browns Valley
Wadsworth
Jack Slough
Lower Yuba River
Sutter
Lower Snake
Gilsizer
Ageden Slough
Grasshopper Slough
RD 1500
Drainage Boundary
Irrigated Drainage
No or Few Irrigated Acres
Land Use
BARREN AND WASTELAND
CITRUS AND SUBTROPICAL
URBAN AND INDUSTRIAL
DECIDUOUS FRUITS AND NUTS
FIELD CROPS
GRAIN AND HAY CROP
IDLE
PASTURE
RICE
RIPARIAN VEGETATION
TRUCK & BERRY CROPS
VINEYARD
WATER SURFACE
UNKNOWN IRRIGATED

Colusa-Glenn Subwatershed

The Colusa-Glenn Subwatershed encompasses approximately 1.6 million acres in the west central portion of the Sacramento Valley, and includes all of Colusa and Glenn Counties and the northern portion of Yolo County. The subwatershed area is bounded on the east by the Sacramento River and Butte Creek, on the West by the Coast Ranges, on the north by the Tehama County line, and on the south by Cache Creek from the Dunnigan Hills, through the town of Yolo, to the Sacramento River at the Fremont Weir just south of Knight's Landing (Figure 1). Topography varies from a relatively flat or gently sloping valley floor, to rolling Coast Range foothills, to steep mountainous terrain. Elevation ranges from approximately 35 to 7,000 feet above sea level. Irrigated agriculture occurs in about 40% of the Colusa-Glenn Subwatershed, with approximately 600,000 acres currently being farmed, approximately 230,000 of which is rice. Over 520,000 acres in the subwatershed are in the Coast Range and have no significant irrigated acres. Some dryland grains are also grown, typically in rotation with other field crops. Other land use types include non-irrigated grazing rangeland, urban/rural residential development, and oak woodlands, grasslands, and wetlands.

Significant Subwatershed Characteristics

The key factors relevant to agriculture and water quality in the Colusa-Glenn Subwatershed are climate, soils and hydrology. In general, the Mediterranean climate – hot, dry summers and cool to cold, wet winters – is the dominant influence on weather patterns. Throughout the subwatershed, average annual precipitation ranges from 16 to 18 inches per year. Most of the rainfall occurs from October through April. Average maximum temperatures vary from about 40°F in winter to 96°F in summer.

Soil characteristics play a significant role in both crops grown and water quality conditions. Predominately well drained alluvial soils formed in alluvial fan and floodplain deposits make up the valley land soils. Some of these soils are slightly to moderately saline to alkali. Located along the Sacramento River, the oldest part of the relict Stony Creek alluvial fan lies northwest of Willows. Valley basin soils occur in the lowest elevation are nearly level and poorly drain. It is these soils on which rice is grown.

Irrigation is necessary to grow most crops in the Colusa-Glenn Subwatershed. A relatively dependable water supply allows the high level of agricultural production that exists today. To achieve this, the natural hydrology of the area was largely altered over the past 150 years, mainly to create the irrigation distribution and drainage system that serves agricultural needs. Additional information on hydrology and water management is provided below in the *Hydrology, Water Management, and Irrigation Methods* section.

Agriculture and Crops

Colusa and Glenn Counties are intensively cultivated in the eastern half of the subwatershed area (Figure 3). The leading crops (by acreage) in the Colusa County portion of the subwatershed are rice, almonds, walnuts, alfalfa, wheat, tomatoes, safflower, corn, and beans. The leading crops (by acreage) in the Glenn portion of the subwatershed include rice, almonds, walnuts, alfalfa, wheat, corn, prunes, and olives. Irrigated and non-irrigated pastures (range) encompass large acreages in both Colusa and Glenn counties.

The Colusa-Glenn Subwatershed encompasses 31 different drainages where irrigated agriculture is present. Table 3 lists the drainages by name and the crops grown within each drainage area. Figure 3 shows the extent of the drainages.

Table 3. Colusa-Glenn Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Colusa Basin Drain	Colusa Basin Drain	Tomatoes, grains, corn, safflower, rice, wheat, pasture, melons, squash
Represented by Colusa Basin Drain monitoring site	Sycamore area	Rice, tomatoes, wheat, safflower, melons/squash
	Buckeye Creek	Almonds, tomatoes, pasture, grain
	Bird Creek	Grain, rice, melons/squash, corn
	Smith Creek	Tomatoes, grain, pasture, corn, rice, melons, squash
	Breton Creek	Grain, pasture, rice, tomatoes, safflower
	Oat Creek	Grain, rice, safflower, pasture, melons/squash
	College City Area	Almonds, tomatoes, wheat, pasture
	Meridian Edge	Grain, melons/squash, cotton, tomatoes
	West Canal Landing	Rice, wheat, tomatoes, melons/squash, safflower
Monitoring site in Walker Creek	Walker Creek	Rice, grain, pasture, corn, almonds, olives, range
Represented monitoring site in Walker Creek	Lower Stony Creek	Pasture, prunes, almonds, grain, walnuts
	Orland Area	Almonds, pasture, grain, walnuts, corn, prunes
	Upper Colusa Drain	Rice, grain, almonds, corn, pasture, walnuts
	Logan Creek	Rice, grain, corn, pasture, cotton, sunflower, walnuts
	Bounde Creek	Rice, walnuts, almonds
	Provident Drain	Rice, grain, pasture, corn
	Packer Road	Rice, tomatoes, wheat, prunes
	Upper Stony Gorge	Range, pasture
	Upper Stony Creek	Range, pasture
Monitoring site in Freshwater Creek	Freshwater Creek	Rice, tomatoes, squash, grain, pasture, safflower
Represented monitoring site Freshwater Creek	Lurline Creek	Rice, pasture, grain, melons/squash
	Maxwell NE Drain	Rice, safflower
	Sand Creek	Rice, tomatoes, almonds, squash/melons

Type of Monitoring	Drainages	Crops
	Petroleum Creek	Almonds, wheat, tomatoes, melons/squash, pasture
	Elk Creek	Almonds, wheat, pasture
	East Park Reservoir	Grain
	Upper East Park	Grain, walnuts
	Stone Corral Creek	Rice, wheat, safflower, pasture
	Bear Creek	Grain, pasture
	Hopkins Slough	Rice, wheat, prunes, safflower

Hydrology, Water Management, and Irrigation Methods

The Colusa-Glenn Subwatershed contains a complex hydrologic system consisting of a variety of natural and man-made water bodies. Overall, the natural drainage pattern is from the western foothills and alluvial plains eastward towards the Sacramento River, which ultimately captures most runoff in the greater Sacramento Valley. Many large wetland systems occur in the Colusa Basin watershed, which is a low-lying area between the Sacramento River and Interstate 5. The wetlands of the Sacramento National Wildlife Refuge (NWR), Delevan NWR, Colusa NWR, Sacramento River NWR, and other preserves are critically important wildlife areas along the Pacific Flyway.

The Sacramento River and Butte Creek form the eastern perimeter of the Colusa-Glenn Subwatershed area (Figure 1). The Sacramento River carries the largest volume of water in California and, although it generally follows much of its historic stream course, it has undergone intense hydro-modification, including channel straightening, damming, water diversion, and levee constriction, through most of its length. Other perennial or intermittent streams in the subwatershed include Stony Creek, Walker Creek, Willow Creek, Logan Creek, Hunters Creek, Stone Corral Creek, Lurline Creek, Freshwater Creek, and Sycamore Slough. Some degree of hydro-modification has occurred in all of these streams. A network of many smaller tributary creeks and sloughs (typically intermittent) discharge to the larger streams or connect with an intricate system of constructed agricultural canals and drains.

Three large reservoirs – Black Butte Reservoir, Stony Gorge Reservoir, and East Park Reservoir – occur in the foothill/mountain regions in the western portion of the subwatershed. In the intensive agricultural areas located in the eastern region, large water supply canals and drains have been constructed to meet the needs of agricultural production. Water delivery, re-circulation, and drainage systems are able to meet the varied water supply needs of agriculture during irrigation season and convey stormwater runoff during the rainy season. Important water conveyance canals include the Glen-Colusa Canal, the Tehama-Colusa Canal, and the Colusa Basin Drain. For the most part, irrigation and storm water runoff are directed into the Colusa Basin Drain, which discharges to either the Yolo Bypass or the Sacramento River near Knights Landing. A carefully managed system of canals, pumps and ditches is especially important for controlling water levels in the numerous rice fields of the Colusa Basin watershed area.

The Colusa-Glenn Subwatershed includes many large canals and the infrastructure necessary to meet agricultural water needs. Surface water is the primary source of supply for agriculture in Colusa County with a majority of supply provided by the Glenn Colusa Irrigation District (GCID), Glenn County Water District, RD 108, and the Tehama-Colusa Canal Authority. Groundwater is the source of supply for agricultural water users outside these districts.

Numerous water agencies and districts provide water for Glenn County agriculture. Water from the Sacramento River is diverted into two major canals: Glenn Colusa Canal and Tehama Colusa Canal. Stony Creek is an important source of surface water in Glenn County, supported by Stony Gorge and Black Buttes Reservoirs. The current source of water for agricultural use is approximately 70% surface and 30% groundwater.

Water management practices in the Colusa-Glenn Subwatershed include pre-planting irrigation, crop hydration, frost prevention, salinity management, and runoff management. A variety of irrigation methods are used, including drip, furrow, flood, and sprinkler.

Management Practices Information

Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant BMPs, regulations, and preventative measures are discussed with the property operator prior to issuance of permits.

A number of BMP projects and programs have been implemented in Colusa and Glenn counties with guidance and financial assistance from the Natural Resources Conservation Service and the Resource Conservation Districts. Some of these projects are intended to address irrigation or stormwater related impacts to water quality, while others may do so as a secondary benefit. The BMPs and projects currently implemented by growers throughout the subwatershed have not been documented or evaluated as of preparation of this Order. Examples of some typical management practices and projects in place that may help protect water quality in this watershed include:

- Vegetative filter strips and cover crops
- Drainage channel restoration and stabilization,
- Irrigation system improvements,
- Irrigation Mobile Lab Service, and
- Drip and micro-spray irrigation systems.

Monitoring Site Selection

Three monitoring sites were selected to represent the diversity of crops and agricultural practices in the Colusa-Glenn Subwatershed: Colusa Basin Drain above Knight’s Landing, Freshwater Creek at Gibson Road, and Walker Creek near 99W and CR33. These sites typically have year-round flows that permit year-round sampling.

As shown in Table 3 and Figure 3, the Colusa Basin Drain site represents all of the dominant crops grown in the subwatershed, has a high percentage of irrigated acreage, and is an integrator site for upstream drainage. The site specifically represents ten drainages in the southern portion of the subwatershed. Colusa Basin Drain has been monitored annually for the ILRP since 2005. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Freshwater Creek monitoring site represents eleven drainages in the central portion of the subwatershed. Freshwater Creek has been monitored annually for the ILRP since 2007. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Walker Creek monitoring site represents ten drainages in the northern portion of the subwatershed. Walker Creek has been monitored annually for the ILRP since 2007. Assessment-level monitoring data have been collected and provides a significant baseline to examine water quality trends.

Past Water Quality Monitoring
Water quality monitoring has been conducted by the Sacramento Valley Coalition and Colusa-Glenn Subwatershed since 2005. Tables 4a and 4b summarize ILRP monitoring parameters and results from Colusa-Glenn monitoring sites. In addition, the Coalition measured or analyzed 73 additional constituents (physical parameters, microbiological organisms, metals, and pesticides) at approximately the same frequency as those listed in Table 4a. No exceedances (except 1 for aldrin) were observed in the additional measurements. Although the additional measurements and analyses were not required for ILRP monitoring, valuable information regarding the chemicals was documented and can easily be compiled and evaluated, as needed.

Table 4a. Colusa-Glenn Subwatershed ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season									
	Butte Creek		Colusa Basin Drain		Freshwater Creek		Logan Creek		Lurline Creek	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
GENERAL										
pH	10	1	27	9	13	4	12	4	13	4
Electrical Conductivity	10	1	27	9	13	4	12	4	13	4
Dissolved Oxygen	10	1	27	9	13	4	12	4	13	4
Temperature	10	1	27	9	13	4	12	4	13	4
Total Dissolved Solids	11	1	24	7	11	4	12	4	12	4
Total Suspended Solids	11	1	24	7	12	4	12	4	12	4
Total Organic Carbon	11	1	24	7	12	2	12	2	12	2
Turbidity	11	1	24	7	12	4	12	4	12	4
PATHOGENS										
E-coli	11	1	23	7	12	4	12	4	12	4
WATER COLUMN TOXICITY										
Selenastrum	8	1	15	7	12	3	13	3	13	3
Ceriodaphnia	8	1	17	7	13	3	12	3	13	3
Pimephales	9	1	18	7	6	2	6	2	6	2
PESTICIDES										
Aldicarb			14	5	12	4	12	4	12	4
Atrazine	5	1	17	6	12	4	12	4	11	4
Azinphos methyl	10	1	22	7	12	3	12	3	12	3
Carbaryl			14	5	12	4	12	4	12	4
Carbofuran			14	5	12	4	12	4	12	4
Chlorpyrifos	10	1	23	9	12	4	12	4	12	4
Cyanazine	5	1	16	5	12	4	12	4	11	4
DDD	10	1	18	6	12	4	12	3	12	4
DDE	10	1	18	6	12	4	12	3	12	4

Table 4a. Colusa-Glenn Subwatershed ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season									
	Butte Creek		**Colusa Basin Drain**		**Freshwater Creek**		**Logan Creek**		**Lurline Creek**	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
DDT	10	1	18	6	12	4	12	3	12	4
Demeton-s	10	1	23	9	12	4	12	4	12	4
Diazinon	10	1	23	9	12	4	12	4	12	4
Dichlorvos	10	1	23	9	12	4	12	4	12	4
Dicofol	5		13	3	12	4	12	3	12	4
Dieldrin	10	1	18	6	12	4	12	3	12	4
Dimethoate	10	1	23	9	12	4	12	4	12	4
Disulfoton (Disyton)	10	1	23	9	12	4	12	4	12	4
Diuron			14	5	12	4	12	4	12	4
Endrin	10	1	18	6	12	4	12	3	12	4
Glyphosate	4		9	3	10	4	10	4	10	4
Linuron			14	5	12	4	12	4	12	4
Malathion	10	1	23	9	12	4	12	4	12	4
Methamidophos	3		13	4	12	3	12	3	12	3
Methidathion	9	1	21	7	12	3	12	3	12	3
Methiocarb			14	5	12	4	12	4	12	4
Methomyl			14	5	12	4	12	4	12	4
Methoxychlor	10	1	18	6	12	4	12	3	12	4
Methyl Parathion	10	1	23	9	12	4	12	4	12	4
Oxamyl			14	5	12	4	12	4	12	4
Paraquat Dichloride	4	1	10	4	10	4	10	4	10	4
Phorate	10	1	23	9	12	4	12	4	12	4
Phosmet	10	1	22	7	12	3	12	3	12	3
Simazine	5	1	17	6	12	4	12	4	11	4
Trifluralin	1		1		6	2	6	2	6	2
METALS										
Arsenic	5	1	11	4	12	4	12	4	12	4

Table 4a. Colusa-Glenn Subwatershed ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season									
	Butte Creek		**Colusa Basin Drain**		**Freshwater Creek**		**Logan Creek**		**Lurline Creek**	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
Boron			6	3	12	4	12	4	12	4
Cadmium	5	1	11	4	12	4	12	4	12	4
Copper	5	1	11	4	12	4	12	4	12	4
Lead	5	1	11	4	12	4	12	4	12	4
Nickel	5	1	11	4	12	4	12	4	12	4
Molybdenum										
Selenium	5	1	11	4	12	4	12	4	12	4
Zinc	5	1	11	4	12	4	12	4	12	4
NUTRIENTS										
Total Kjeldahl Nitrogen	5	1	17	7	12	4	12	4	12	4
Nitrate + Nitrite as N	3	1	15	7	12	4	12	4	12	4
Total Ammonia	5	1	12	4	11	4	11	4	12	4
Total Phosphorous as P	5	1	17	7	12	4	12	4	12	4
Soluble Orthophosphate	5	1	21	6	12	4	12	4	12	4
SEDIMENT TOXICITY										
Hyalella	2	1	3	1	4		4		4	

Table 4a continued

PARAMETERS	Sycamore Slough IRRIG	Sycamore Slough STORM	Stone Corral Creek IRRIG	Stone Corral Creek STORM	Stony Creek IRRIG	Stony Creek STORM	Walker Creek IRRIG	Walker Creek STORM
GENERAL								
pH	12	3	10	1	12	5	18	4
Electrical Conductivity	12	3	10	1	12	5	17	4
Dissolved Oxygen	12	3	10	1	12	5	18	4
Temperature	12	3	10	1	12	5	18	4
Total Dissolved Solids	11	4	10	2	11	4	12	4
Total Suspended Solids	11	4	10	2	11	4	12	4
Total Organic Carbon	11	4	10	2	11	4	12	2
Turbidity	11	4	10	2	11	4	12	4
PATHOGENS								
E-coli	11	4	10	2	7	1	12	4
WATER COLUMN TOXICITY								
Selenastrum	6	2	8	2	6	2	13	3
Ceriodaphnia	7	2	8	2	6	3	14	3
Pimephales	6	2	9	2	6	2	6	2
PESTICIDES								
Aldicarb	10	1			10	1	12	4
Atrazine	5	2	5	2	5	4	12	4
Azinphos methyl	11	4	10	2	11	6	12	3
Carbaryl	10	1			10	1	12	4
Carbofuran	10	1			10	1	12	4
Chlorpyrifos	11	4	10	2	11	6	12	4
Cyanazine	5	1	5	1	5	3	12	4
DDD	5	2	10	2	5	2	12	4

Number of Analyses by Site and Season

Table 4a continued

PARAMETERS	Number of Analyses by Site and Season: Sycamore Slough IRRIG	Sycamore Slough STORM	Stone Corral Creek IRRIG	Stone Corral Creek STORM	Stony Creek IRRIG	Stony Creek STORM	Walker Creek IRRIG	Walker Creek STORM
DDE	5	2	10	2	5	2	12	4
DDT	5	2	10	2	5	2	12	4
Demeton-s	11	4	10	2	11	6	12	4
Diazinon	11	4	10	2	11	6	12	4
Dichlorvos	11	4	10	2	11	6	12	4
Dicofol	5		5		5		12	4
Dieldrin	5	2	10	2	5	2	12	4
Dimethoate	11	4	10	2	11	6	12	4
Disulfoton (Disyton)	11	4	10	2	11	6	12	4
Diuron	10	1			10	1	12	4
Endrin	5	2	10	2	5	2	12	4
Glyphosate	4	1	3	1	4	1	10	4
Linuron	10	1			10	1	12	4
Malathion	11	4	10	2	11	6	12	4
Methamidophos	3	2	3		3	4	12	3
Methidathion	11	4	9	2	11	6	12	3
Methiocarb	10	1			10	1	12	4
Methomyl	10	1			10	1	12	4
Methoxychlor	5	2	10	2	5	2	12	4
Methyl Parathion	11	4	10	2	11	6	12	4
Oxamyl	10	1			10	1	12	4
Paraquat Dichloride	4	2	3	2	4	2	10	4
Phorate	11	4	10	2	11	6	12	4
Phosmet	11	4	10	2	11	6	12	3
Simazine	5	2	5	2	5	4	12	5
Trifluralin	1				1		6	2

Table 4a continued

PARAMETERS	Sycamore Slough		Stone Corral Creek		Stony Creek		Walker Creek	
	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM
METALS								
Arsenic	5	2		1	5	2	12	4
Boron	2	2				1	12	4
Cadmium	5	2		1	5	2	12	4
Copper	5	2		1	5	2	12	4
Lead	5	2		1	5	2	12	4
Nickel	5	2		1	5	2	12	4
Molybdenum								
Selenium	5	2		1	5	2	12	4
Zinc	5	2		1	5	2	12	4
NUTRIENTS								
Total Kjeldahl Nitrogen	5	1	5	2	5	2	12	4
Nitrate + Nitrite as N	4	1	3	2	3	2	12	4
Total Ammonia	10	2	5	2	11	3	11	4
Total Phosphorous as P	5	1	5	2	5	2	12	4
Soluble Orthophosphate	5	2	5	2	5	2	12	4
SEDIMENT TOXICITY								
Hyalella	2		2	1	3	1	4	

Number of Analyses by Site and Season

Table 4b. Colusa-Glenn Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL					
pH	162	7	6.52	9.28	pH Units
Electrical Conductivity	161	11	92	1234	uS/cm
Dissolved Oxygen	162	19	0.16	16.24	mg/L
Temperature	162	0	6.8	31.3	C
Total Dissolved Solids	148	11	83	880	mg/L
Total Suspended Solids	149	0	ND	230	mg/L
Total Organic Carbon	141	0	ND	57	mg/L
Turbidity	149	0	0.12	390	NTU
PATHOGENS					
E-coli	141	27	<1	2400	MPN/100 ml
WATER COLUMN TOXICITY					
Selenastrum	120	4	57	778	% control
Ceriodaphnia	125	6	0	154	% control
Pimephales	94	0	80	109	% control
PESTICIDES					
Aldicarb	105	0	ND	1.5	ug/L
Atrazine	115	0	ND	ND	ug/L
Azinphos methyl	144	1	ND	0.294	ug/L
Carbaryl	105	0	ND	ND	ug/L
Carbofuran	105	0	ND	ND	ug/L
Chlorpyrifos	151	4	ND	0.05	ug/L
Cyanazine	110	0	ND	ND	ug/L
DDD	124	1	ND	0.0062	ug/L

Table 4b. Colusa-Glenn Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
DDE	124	6	ND	0.007	ug/L
Demeton-s	151	0	ND	ND	ug/L
DDT	124	2	ND	0.0037	ug/L
Diazinon	151	1	ND	0.222	ug/L
Dichlorvos	151	1	ND	0.0847	ug/L
Dicofol	151	0	ND	ND	ug/L
Dieldrin	124	1	ND	0.0043	ug/L
Dimethoate	124	0	ND	0.119	ug/L
Disulfoton (Disyton)	151	0	ND	ND	ug/L
Diuron	105	3	ND	14	ug/L
Endrin	124	0	ND	ND	ug/L
Glyphosate	86	0	ND	13	ug/L
Linuron	105	0	ND	ND	ug/L
Malathion	151	1	ND	0.013	ug/L
Methamidophos	95	0	ND	ND	ug/L
Methidathion	141	0	ND	ND	ug/L
Methiocarb	105	0	ND	ND	ug/L
Methomyl	105	0	ND	0.53	ug/L
Methoxychlor	124	0	ND	ND	ug/L
Methyl Parathion	151	0	ND	ND	ug/L
Oxamyl	105	0	ND	ND	ug/L
Paraquat Dichloride	92	0	ND	ND	ug/L
Phorate	151	0	ND	ND	ug/L
Phosmet	144	0	ND	ND	ug/L
Simazine	116	1	ND	4.71	ug/L
Trifluralin	36	0	ND	0.0154	ug/L
METALS					
Arsenic	100	0	0.3	8.5	ug/L
Boron	78	0	49	430	ug/L

Table 4b. Colusa-Glenn Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Cadmium	100	0	ND	0.1	ug/L
Copper	100	0	0.9	29	ug/L
Lead	100	1	ND	55	ug/L
Nickel	100	0	1	54	ug/L
Molybdenum	0				ug/L
Selenium	100	0	ND	2	ug/L
Zinc	100	0	2	51	ug/L
NUTRIENTS					
Total Kjeldahl Nitrogen	114	0	ND	2.2	mg/L
Nitrate + Nitrite as N	105	0	ND	6.8	mg/L
Total Ammonia	116	0	ND	0.4	mg/L
Total Phosphorous as P	114	0	ND	0.95	mg/L
Soluble Orthophosphate	118	0	ND	0.64	mg/L
SEDIMENT TOXICITY					
Hyalella	32	3	61	113	% control

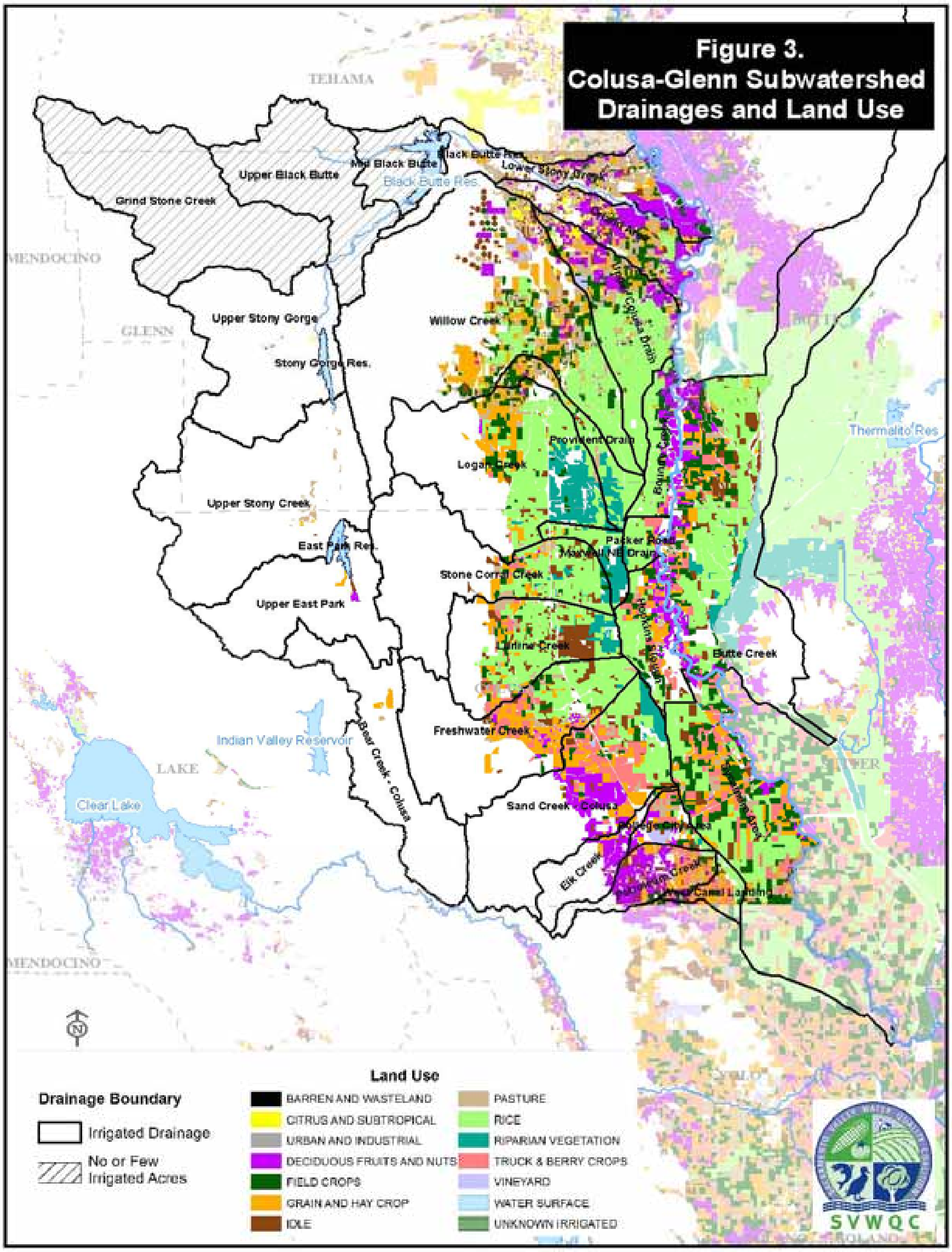
Figure 3.
Colusa-Glenn Subwatershed
Drainages and Land Use
TEHAMA
MENDOCINO
GLENN
LAKE
Upper Black Butte
Grind Stone Creek
Mid Black Butte
Black Butte Res.
Lower Stony Creek
Upper Stony Gorge
Stony Gorge Res.
Willow Creek
Provident Drain
Logan Creek
Upper Stony Creek
East Park Res.
Packer Road
Stone Corral Creek
Upper East Park
Butte Creek
Thermalito Res
Freshwater Creek
Indian Valley Reservoir
Bear Creek - Colusa
Clear Lake
Sand Creek
Elk Creek
Land Use
Drainage Boundary
Irrigated Drainage
No or Few Irrigated Acres
BARREN AND WASTELAND
CITRUS AND SUBTROPICAL
URBAN AND INDUSTRIAL
DECIDUOUS FRUITS AND NUTS
FIELD CROPS
GRAIN AND HAY CROP
IDLE
PASTURE
RICE
RIPARIAN VEGETATION
TRUCK & BERRY CROPS
VINEYARD
WATER SURFACE
UNKNOWN IRRIGATED
SVWQC

El Dorado Subwatershed

The El Dorado Subwatershed encompasses approximately 1.1 million acres in the two primary river watersheds –South Fork American River and Cosumnes River- of El Dorado County, extending from the crest of the Sierra Nevada mountains west to Folsom Lake and from the Cosumnes River north to the Rubicon River (Figure 1). The topography is characterized by mountainous terrain with elevations ranging from approximately 400 to 10,000 feet above sea level. More than 55% (636,000 acres, *El Dorado County DRAFT General Plan EIR, Section 5.12 Biological Resources, EDAW, May 2003)* of the subwatershed consists of native vegetation dominated by conifer forest and oak/grass woodlands. Agricultural use occurs on about 5,000 acres, or 0.5% of the watershed area, and is typically situated at elevations ranging from 1,200 to 3,000 feet above sea level.

Significant Subwatershed Characteristics

The key factors relevant to agriculture and water quality in the El Dorado Subwatershed are climate, topography, elevation, and soils. In general, the Mediterranean climate – warm, dry summers and cool to cold, wet winters – is the dominant influence on weather patterns. Average annual precipitation ranges from 22 to 75 inches per year (depending on location) in the form of rain and snow. Average maximum temperatures vary from the mid 90's (°F) in summer to the upper 40's (°F) in winter. Additionally, the lack of fog in El Dorado County is an important influence on growing conditions.

Elevation and complex topography combine to create important regional and local weather conditions in the El Dorado Subwatershed that determine the best locations for various crop types. The flow of warm air rising and cold air sinking on hillsides where good air circulation occurs are preferred sites for planting wine grapes, a primary crop in the area. Chilly winter conditions are beneficial to other crops such as apples, pears and Christmas trees.

Soil characteristics play a significant role in both agricultural productivity and water quality conditions. Most soils in El Dorado County are sandy to clay loams that formed in place from weathering of underlying bedrock. In general, the soils in the area are very shallow to deep and well-drained to excessively-drained. Young volcanic rocks, granitic rocks, and slate in the area have produced the soils best suited for agricultural crops. Soil depth influences where crops can be planted. Ridge tops and steep slopes may have thin soils and high erosion rates that preclude planting crops. Hillside soils are often ideal for planting, but erosion and instability are potential problems if farming practices do not address these processes.

Agriculture and Crops

The leading crops in the El Dorado Subwatershed are wine grapes, apples, walnuts, pears, Christmas trees, and irrigated pasture. Other important crops include peaches, cherries, plums, olives, and berries. Agricultural activities are concentrated within seven geographically distinct agricultural districts (Figure 4) that are generally separated by topography, geology, public forests, and urban/residential development. These districts were identified and established by El Dorado County to protect and enhance agricultural activities. The two main agricultural districts, Camino/Placerville and Somerset/Fairplay, include the major crop types found throughout the subwatershed area.

El Dorado Subwatershed encompasses nine main drainages where irrigated agriculture is present. Table 5 lists the drainages by name and the crops grown within each drainage area. Figure 5 shows the area of the nine drainages.

Table 5. El Dorado Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in North Canyon Creek	Coloma	Winegrapes, apples, pears, peaches, plums, berries, olives, irrigated pasture, Christmas trees
Represented by North Canyon Creek monitoring site	Clear & Camp Creeks	Winegrapes
	Green Valley	Winegrapes, irrigated pasture
	Lower North Fork Cosumnes River	Winegrapes, walnuts, Christmas trees
	Middle Cosumnes River	Winegrapes, walnuts, Christmas trees
	Middle Fork Cosumnes River	Winegrapes, walnuts, Christmas trees
	South Fork Cosumnes River	Winegrapes, walnuts
	Upper North Fork Cosumnes River	Winegrapes
	Weber Creek	Winegrapes, olives, irrigated pasture, Christmas trees

Hydrology, Water Management, and Irrigation Methods

The hydrology of the El Dorado Subwatershed is characterized mainly by natural water courses. The two main watersheds, the South Fork American River and the Cosumnes River, together encompass more than 800,000 acres. Large-scale water diversion canals do not exist in these systems. A few small to moderate size reservoirs exist within or near the agricultural regions, whereas larger reservoirs are located at much higher elevations, well above the agricultural areas.

Two main water purveyors supply irrigation water in El Dorado County: El Dorado Irrigation District (EID) in the Camino/Placerville district and Georgetown Divide Public Utility District in the Garden Valley/Georgetown district. EID is the largest irrigation water supplier and utilizes a gravity-fed water delivery system for all irrigation water deliveries. Commercial water deliveries are not available in the southern part of El Dorado County, including the Fairplay agricultural district. This district relies on ponds, springs, and groundwater wells for irrigation water. Consequently, low-water use crops such as grapes, walnuts and Christmas trees are grown in this area. Distinct groundwater basins do not exist in the Camino/Placerville agricultural district due to the geology and topography present in the South Fork American River watershed. Pockets of perched water and hillside springs are often present following the rainy season, but do not persist year-round.

Water management practices include irrigation and frost prevention. The El Dorado County Water Agency and water purveyors in El Dorado County require growers and other water users to implement strict water conservation measures because of limited water supplies. Consequently, nearly all growers have installed drip irrigation systems. In addition, EID provides an Irrigation Management Service to assist growers with timing and quantity of water needed for their crops.

Management Practices Information

The El Dorado County General Plan requires that all agricultural grading activities that convert one acre or more of undisturbed vegetation to agricultural cropland, and changes the contour of the land, will need to obtain an agricultural permit through the Agricultural Commissioner's office. An Erosion and Sediment Control Plan that lists the appropriate best management practices to be implemented is required with the permit application. The El Dorado County supervisors adopted a suite of best management practices relevant to agricultural grading to prevent erosion and sediment problems. These BMPs are found on the Agricultural Commissioner's website at: http://co.el-dorado.ca.us/ag/bmps.html

Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant BMPs, regulations, and preventative measures are discussed with the property operator prior to issuance of permits. The specific BMPs and measures that are implemented by growers in El Dorado County have not been documented or evaluated as of preparation of this Order.

Due to the strict water conservation requirements in El Dorado County, irrigation practices typically do not produce surface or tailwater runoff during irrigation season. Most growers use drip or micro-spray irrigation systems and utilize EID's Irrigation Management Service to determine when and how much irrigation is needed. Similar water limitations exist throughout the County. Irrigated pasture is a relatively small proportion of agricultural acreage in this subwatershed. Sprinklers are the primary irrigation method in pastures, but some flood irrigation also exists.

Stormwater runoff has the potential to cause water quality problems at sites that are vulnerable to erosion. Erosion and sediment prevention measures are implemented by many growers in the El Dorado Subwatershed, but have not been documented or evaluated as of preparation of this Order. Examples of some typical management practices that help protect water quality in this watershed include:

- Permanent vegetated buffer areas along waterways,
- Drip and micro-spray irrigation systems,
- Conservation tillage,
- Cover crops between rows of vineyards and orchards,
- Contour planting, and
- Stabilized access roads.

Monitoring Site Selection

The North Canyon Creek monitoring site was selected to represent irrigated agriculture throughout the El Dorado Subwatershed. As shown in Table 5, this drainage includes all of the major crops and agricultural activities that exist throughout the subwatershed area. The North Canyon Creek drainage has the most irrigated acres and the highest percentage of irrigated acreage in the subwatershed. Approximately 38% of all irrigated agriculture in the subwatershed occurs in this drainage. Monitoring for the ILRP has been conducted annually at this site since January 2005. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

Past Water Quality Monitoring

Water quality monitoring has been conducted by the Sacramento Valley Coalition and El Dorado Subwatershed since January 2005. Table 6 below summarizes monitoring parameters and results.

Table 6. Summary of ILRP Monitoring in El Dorado Subwatershed from 2005-2008.

	Number of Analyses by Site & Season								
	North Canyon Creek		Coon Hollow Creek						
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**TOTAL # ANALYSES**	**TOTAL # EXCEEDANCES**	**MINIMUM RESULT**	**MAXIMUM RESULT**	**UNITS**
GENERAL									
pH	16	5	11	2	34	1	6.54	8.74	pH units
Electrical Conductivity	16	5	11	2	34	0	55	251	uS/cm
Dissolved Oxygen	16	5	11	2	34	0	7.1	13.4	mg/L
Temperature	16	5	11	2	34	0	4.1	21.7	C
Total Dissolved Solids	15	6	7	2	30	0	38	160	mg/L
Total Suspended Solids	14	6	8	2	30	0	ND	42	mg/L
Total Organic Carbon	15	3	8	2	28	0	ND	8	mg/L
Turbidity	15	6	8	2	31	0	1.1	47	NTU
PATHOGENS									
E-coli	15	6	8	2	31	7	6.2	920	MPN/100
WATER COLUMN TOXICITY									
Selenastrum	10	2	8	2	22	0	75.3	779	% control
Ceriodaphnia	10	2	11	2	25	7	0	111	% control
Pimephales	10	2	2	2	16	0	62.5	102.6	% control
PESTICIDES									
Aldicarb	4				4	0	ND	ND	ug/L
Atrazine	5	2	1		8	0	ND	0.066	ug/L
Azinphos methyl	15	6	8	1	30	0	ND	ND	ug/L
Carbaryl	4				4	0	ND	ND	ug/L
Carbofuran	4				4	0	ND	ND	ug/L
Chlorpyrifos	15	6	9	2	32	0	ND	0.003	ug/L
Cyanazine	5	1	2		8	0	ND	ND	ug/L
DDD	9	4	8	2	23	0	ND	ND	ug/L

Table 6. Summary of ILRP Monitoring in El Dorado Subwatershed from 2005-2008.

	Number of Analyses by Site & Season								
	North Canyon Creek		Coon Hollow Creek						
PARAMETERS	IRRIG	STORM	IRRIG	STORM	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
DDE	9	4	8	2	23	9	ND	0.0164	ug/L
DDT	9	4	8	2	23	1	ND	0.0014	ug/L
Demeton-s	15	6	9	2	32	0	ND	ND	ug/L
Diazinon	15	6	9	2	32	1	ND	0.124	ug/L
Dichlorvos	15	6	9	2	32	0	ND	ND	ug/L
Dicofol	9	2	8	2	21	0	ND	ND	ug/L
Dieldrin	9	4	8	2	23	0	ND	ND	ug/L
Dimethoate	15	6	9	2	32	0	ND	0.0457	ug/L
Disulfoton (Disyton)	15	6	9	2	32	0	ND	ND	ug/L
Diuron	4				4	0	ND	ND	ug/L
Endrin	9	4	8	2	23	0	ND	ND	ug/L
Glyphosate	0				0				ug/L
Linuron	4				4	0	ND	ND	ug/L
Malathion	15	6	9	2	32	0	ND	ND	ug/L
Methamidophos	7	4	8	1	20	0	ND	ND	ug/L
Methidathion	15	6	8	1	30	0	ND	ND	ug/L
Methiocarb	4				4	0	ND	ND	ug/L
Methomyl	4				4	0	ND	ND	ug/L
Methoxychlor	9	4	8	2	23	0	ND	ND	ug/L
Methyl Parathion	15	6	9	2	32	0	ND	ND	ug/L
Oxamyl	4				4	0	ND	ND	ug/L
Paraquat Dichloride					0				ug/L
Phorate	15	6	9	2	32	0	ND	ND	ug/L
Phosmet	15	6	8	1	30	0	ND	ND	ug/L
Simazine	5	2	1		8	0	ND	0.152	ug/L
Trifluralin	1				1	0	ND	ND	ug/L
METALS									
Arsenic, total	8	2	8	2	20	0	ND	0.5	ug/L

Table 6. Summary of ILRP Monitoring in El Dorado Subwatershed from 2005-2008.

PARAMETERS	Number of Analyses by Site & Season: North Canyon Creek IRRIG	North Canyon Creek STORM	Coon Hollow Creek IRRIG	Coon Hollow Creek STORM	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Boron, total	6	1	8	2	17	0	ND	9	ug/L
Cadmium, dissolved	8	2	8	2	20	0	ND	ND	ug/L
Copper, dissolved	8	2	8	2	20	0	ND	0.7	ug/L
Lead, dissolved	8	2	8	2	20	0	ND	0.63	ug/L
Nickel, dissolved	8	2	8	2	20	0	ND	1.1	ug/L
Molybdenum, total					0				ug/L
Selenium, total	8	2	8	2	20	0	ND	2	ug/L
Zinc, dissolved	8	2	8	2	20	0	1	37	ug/L
NUTRIENTS									
Total Kjeldahl Nitrogen	8	2	8	2	20	0	ND	0.41	mg/L
Nitrate + Nitrite as N	8	2	8	2	20	0	0.19	2.1	mg/L
Total Ammonia	13	3	7	2	25	0	ND	0.055	mg/L
Total Phosphorous as P	3	2	8	2	15	0	0.013	0.085	mg/L
Soluble Orthophosphate	4	2	8	2	16	0	ND	0.045	mg/L
SEDIMENT TOXICITY									
Hyalella	2	1	2		5	2	88.6	98.8	% control

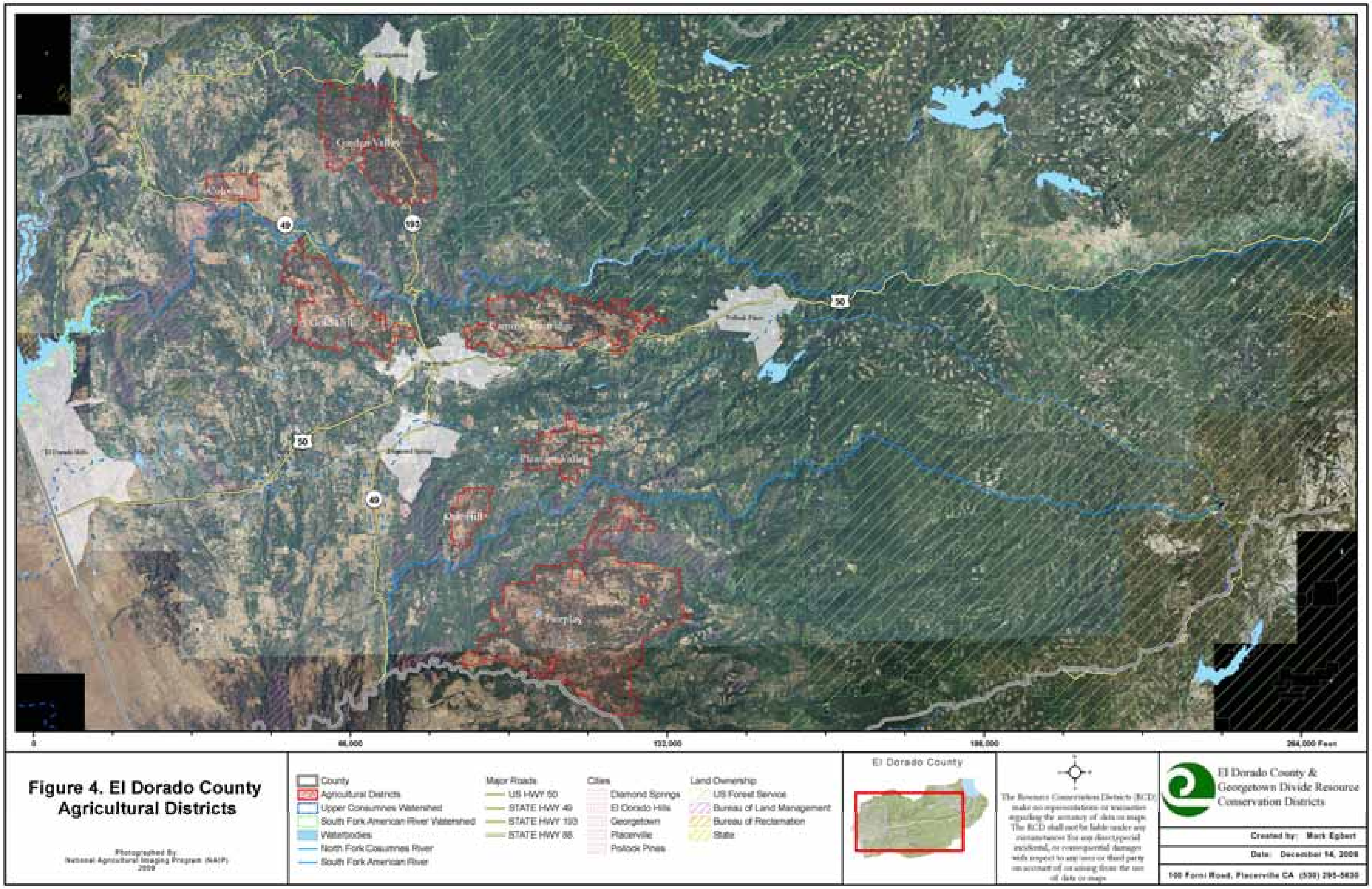

Figure 4. El Dorado County Agricultural Districts

Photographed By:
National Agricultural Imaging Program (NAIP)
2009

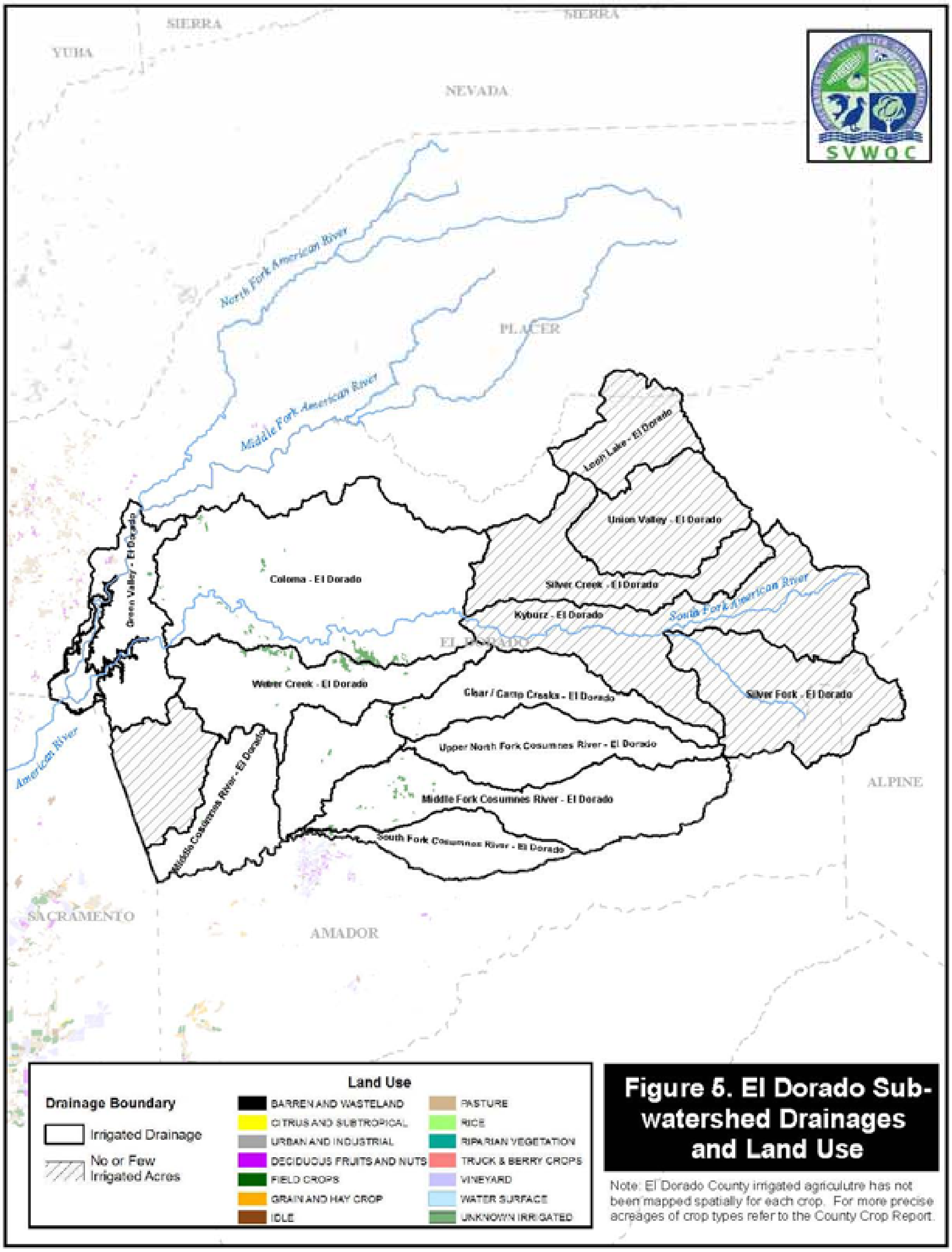

Figure 5. El Dorado Sub-watershed Drainages and Land Use

Note: El Dorado County irrigated agriculutre has not been mapped spatially for each crop. For more precise acreages of crop types refer to the County Crop Report.

Lake-Napa Subwatershed

The Lake-Napa Subwatershed encompasses approximately 850,000 acres on the southwest side of the Sacramento Valley, and includes roughly two-thirds of Lake County and one-third of Napa County (Figure 1). This subwatershed area is located in the central Coast Range, extending from the Clear Lake watershed in the north to the Lake Berryessa watershed in the south and bordered by northwest-southeast trending ridgelines. Topography is characterized by rolling hills and low mountains interspersed with valley areas adjacent to lakes and streams. Elevation ranges from approximately 440 to 4,700 feet above sea level. Irrigated agriculture occurs in a small portion of the Lake-Napa Subwatershed, with approximately 20,000 acres (<2.5%) currently being farmed. Some dryland farming also occurs in a small proportion of walnut orchards and wine grape vineyards. Other land uses include non-irrigated rangeland, urban and rural residential development, and native woodlands, chaparral, grasslands, and wetlands.

Significant Subwatershed Characteristics

The key factors relevant to agriculture and water quality in the Lake-Napa Subwatershed are climate, soils, and topography. In general, the modified Mediterranean climate – warm, dry summers and cool, wet winters – is the dominant influence on weather patterns. The subwatershed's position within the coastal mountain ranges, combined with a relatively steady flow of marine air, typically modifies the local climate and precludes the temperature extremes experienced in the Central Valley. Local conditions can differ significantly depending on location and topography. The average winter temperature in Lake County is 44°F and the average summer high temperature is 71°F. In Napa County, the average maximum winter temperatures are in the mid-50s and the average maximum summer temperatures are in the mid-90s. Throughout the subwatershed, average annual precipitation ranges from 20 to 35 inches per year (varying greatly with location). Most rainfall occurs from November through April.

Elevation and topography combine to create important regional and local weather conditions in the Lake-Napa Subwatershed that determine the best locations for various crops. The flow of warm air rising and cold air sinking on hillsides where good air circulation occurs are preferred sites for planting wine grapes, a primary crop in the area. Conditions in alluvial floodplain areas are important for walnut and pear orchards.

Soil characteristics play a significant role in both agricultural productivity and water quality conditions. The watershed includes some gently sloping valleys, terrace remnants and some limited ancient lakebeds. Over 70% of the soils in the Lake portion of the watershed are shallow (less than 20 inches deep to bedrock). The NRCS soil survey lists 25 different soil mapping units on agricultural lands in the Putah Creek drainage of Napa County. These soils are mostly upland soils and alluvial soils of ancient marine sandstones and shales and ultramafic serpentinic rocks.

Agriculture and Crops
The Napa portion of the Lake-Napa Subwatershed (Putah Creek watershed) contains less than 2% irrigated agriculture land use, which is dominated by drip-irrigated grape vineyards (98.5%). Olive production comprises the remaining 1.5% of irrigated agriculture.

The Lake portion of the Lake-Napa Subwatershed contains approximately 3% irrigated agriculture land use. Wine grapes comprise about two-thirds of the irrigated acreage and pears and walnuts comprise the remaining one-third of irrigated acreage.

The Lake-Napa Subwatershed encompasses eight drainages where irrigated agriculture is present. Table 7 lists the drainages by name and the crops grown within each drainage area. Figure 6 shows the extent of the drainages.

Table 7. Lake-Napa Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Middle Creek	Upper Lake (Middle Creek) (Lake County)	Walnuts, pears, wine grapes, pasture
Represented by Middle Creek monitoring site	Lakeport	Walnuts, pears, wine grapes, pasture
	Lower Lake	Walnuts, pears, wine grapes, pasture
	Upper Putah Creek	Walnut, wine grapes, pasture
	Schindler Creek	Walnuts
	North Fork Cache Creek	Walnuts, wine grapes
Monitoring site in Pope Creek	Pope Creek (Napa County)	Wine grapes
Represented by Pope Creek monitoring site	Capell Creek	Wine grapes

Hydrology, Water Management, and Irrigation Methods
The dominant hydrologic features of the Lake-Napa Subwatershed are Clear Lake and Lake Berryessa. Many perennial and ephemeral creeks flow toward or between these two large lakes. The largest include Cache Creek, Putah Creek, Middle Creek, Scotts Creek, Manning Creek, Adobe Creek, Kelsey Creek, Cole Creek, and Capell Creek.

The sources of irrigation water in the Lake-Napa Subwatershed include groundwater, retention ponds, and surface diversions. Organized water purveyors, such as irrigation districts, do not exist. Consequently, growers have developed their water sources independently and major water supply or drainage canals do not exist.

Water management practices in the Lake-Napa Subwatershed include pre-planting irrigation, crop hydration, frost prevention, and runoff management. The primary irrigation methods used are drip and sprinklers, with some flood irrigation still in use.

Management Practices Information
Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant BMPs, regulations, and preventative measures are discussed with the property operator prior to issuance of permits.

The majority of growers in the Lake County portion of this subwatershed use sprinkler and drip irrigation. Stormwater runoff has the potential to cause water quality problems at sites that are vulnerable to erosion. The Lake County Farm Bureau conducted a management practices survey of ILRP member growers in their watershed area. Results show that anywhere from 25 to 90 percent of growers that responded to the survey utilize specific practices to control erosion and runoff and monitor soil moisture for irrigation decision-making. Many Lake County wine grape growers also follow sustainable wine grape practices according to standards developed by the California Sustainable Winegrowing Alliance. Examples of some typical management practices that may help protect water quality in this watershed include:

- Drainage channel stabilization,
- Permanent vegetated buffer areas along waterways,
- Drip and micro-spray irrigation systems,
- Conservation tillage, and
- Cover crops between rows in vineyards and orchards.

In the Napa portion of the Lake-Napa Subwatershed, the vast majority of agriculture is in wine grapes (a very small proportion is in olives), which is irrigated exclusively by drip irrigation. Nearly all wine grape producers practice deficit irrigation, according to the recommendations of UC Extension researchers. Irrigation-induced soil erosion is not considered to be a concern in the drip-irrigated wine grape vineyards because application rates are well below minimum soil infiltration rates for all mapped soils in the drainage.

In 1991, the Napa County Conservation Regulations were adopted to establish agricultural requirements that address soil erosion, runoff, and riparian protection in developing and re-developing vineyard lands. The ordinance requires that applicants that are planting or replanting vineyards on lands greater than 5 percent slope submit an erosion control plan. The plans are carefully reviewed by the Napa County RCD and County planning department. In addition, all lands where vineyards are proposed for development must set back from seasonal and perennial creeks at least 35 feet to allow for water quality and riparian habitat protection. The regulations require that growers propose and adopt best management practices before a permit is issued. Examples of some typical management practices that may help protect water quality in this watershed include:

- Access road maintenance,
- Vegetation to stabilize erodible non-farmed land,
- Cover crops,
- Mulching,
- Nutrient management,

- Sediment control basins,
- Storm runoff management,
- Conservation tillage,
- Drip irrigation systems,
- Grassed waterways,
- Vegetated buffers, and
- Underground Outlet storm drains.

Monitoring Site Selection

Two monitoring sites were selected to represent the crops and agricultural practices in the Lake-Napa Subwatershed. Streams in the subwatershed do not typically have year-round flows and therefore are not monitored during the summer and early fall.

The Pope Creek upstream from Lake Berryessa monitoring site has the highest percentage of irrigated agriculture in the Napa portion of the subwatershed. Pope Creek has been monitored annually since 2005. Assessment-level monitoring (excluding those pesticides with little or no use) data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Middle Creek monitoring site represents drainages in the Lake portion of the subwatershed. Middle Creek has been monitored annually for the ILRP since 2007. Prior to Middle Creek, McGaugh Slough was monitored from 2005 to 2007. From these two sites, assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

Past Water Quality Monitoring

Water quality monitoring has been conducted by the Sacramento Valley Coalition and Lake-Napa Subwatershed since 2005. Tables 8a and 8b summarize ILRP monitoring parameters and results from Lake-Napa monitoring sites. In addition, the Coalition measured or analyzed 73 additional constituents (physical parameters, microbiological organisms, metals, and pesticides) at approximately the same frequency as those listed in Table 8a. No exceedances were observed in the additional measurements. Although the additional measurements and analyses were not required for ILRP monitoring, valuable information regarding the chemicals was documented and can easily be compiled and evaluated, as needed.

Table 8a. Lake-Napa ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season							
	Capell Creek		McGaugh Slough		Middle Creek		Pope Creek	
PARAMETERS	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM
GENERAL								
pH	4	4	3	2	4	3	4	4
Electrical Conductivity	4	4	3	2	4	3	4	4
Dissolved Oxygen	4	4	3	2	4	3	4	4
Temperature	3	3	3	2	4	3	4	4
Total Dissolved Solids	4	5	2	2	2	3	4	5
Total Suspended Solids	4	5	2	2	2	3	4	5
Total Organic Carbon	4	5	2	2	2	1	4	5
Turbidity	4	5	2	2	2	3	4	5
PATHOGENS								
E-coli	4	5	2	3	2	3	4	5
WATER COLUMN TOXICITY								
Selenastrum			2	2	2	2		
Ceriodaphnia			2	2	2	2		
Pimephales			2	2	1	1		
PESTICIDES								
Aldicarb			1		1	2		
Atrazine			1	1	2	3		
Azinphos methyl			2	2	2	2		
Carbaryl			1		1	2		
Carbofuran			1		1	2		
Chlorpyrifos			2	2	2	3		
Cyanazine			1		2	3		

Table 8a. Lake-Napa ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season							
	Capell Creek		McGaugh Slough		Middle Creek		Pope Creek	
PARAMETERS	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM
DDD			1	1	2	3		
DDE			1	1	2	3		
DDT			1	1	2	3		
Demeton-s			2	2	2	3		
Diazinon			2	2	2	3		
Dichlorvos			2	2	2	3		
Dicofol			1		2	3		
Dieldrin			1	1	2	3		
Dimethoate			2	2	2	3		
Disulfoton			2	2	2	3		
Diuron			1		1	2		
Endrin			1	1	2	3		
Glyphosate					1	3		
Linuron			1		1	2		
Malathion			2	2	2	3		
Methamidophos			1	1	2	2		
Methidathion			2	2	2	2		
Methiocarb			1		1	2		
Methomyl			1		1	2		
Methoxychlor			1	1	2	3		
Oxamyl			1		1	2		
Paraquat					1	3		
Parathion, Methyl			2	2	2	3		
Phorate			2	2	2	3		
Phosmet			2	2	2	2		
Simazine			1	1	2	3		
Trifluralin					1			

Table 8a. Lake-Napa ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season							
	Capell Creek		McGaugh Slough		Middle Creek		Pope Creek	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
METALS								
Arsenic			2	1	2	3		
Boron			1	1	2	3		
Cadmium			2	1	2	3		
Copper			2	1	2	3		
Lead			2	1	2	3		
Nickel			2	1	2	3		
Molybdenum								
Selenium			2	1	2	3		
Zinc			2	1	2	3		
NUTRIENTS								
Total Kjeldahl Nitrogen			2	1	2	3		
Nitrate + Nitrite as N			2	1	2	3		
Total Ammonia			2	1	2	3		
Total Phosphorous as P			2	1	2	3		
Soluble Orthophosphate			2	1	2	3		
SEDIMENT TOXICITY								
Hyalella				1	2			

Table 8b. Lake-Napa Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL					
pH	28	2	6	8.4	pH Units
Electrical Conductivity	28	1	102	961	uS/cm
Dissolved Oxygen	28	0	6.53	12.4	mg/L
Temperature	26	0	5.6	18.3	C
Total Dissolved Solids	27	1	92	630	mg/L
Total Suspended Solids	27	0	ND	130	mg/L
Total Organic Carbon	25	0	0.88	15	mg/L
Turbidity	27	0	0.26	110	NTU
PATHOGENS					
E-coli	28	7	11	2420	MPN/100 ml
WATER COLUMN TOXICITY					
Selenastrum	8	0	160	352	% control
Ceriodaphnia	8	1	7	106	% control
Pimephales	6	9	95	103	% control
PESTICIDES					
Aldicarb	4	0	ND	ND	ug/L
Atrazine	7	0	ND	ND	ug/L
Azinphos methyl	8	0	ND	ND	ug/L
Carbaryl	4	0	ND	ND	ug/L
Carbofuran	4	0	ND	ND	ug/L
Chlorpyrifos	9	0	ND	ND	ug/L
Cyanazine	6	0	ND	ND	ug/L
DDD	7	0	ND	ND	ug/L

Table 8b. Lake-Napa Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
DDE	7	0	ND	ND	ug/L
DDT	7	1	ND	0.0095	ug/L
Demeton-s	9	0	ND	ND	ug/L
Diazinon	9	0	ND	ND	ug/L
Dichlorvos	9	0	ND	ND	ug/L
Dicofol	6	0	ND	ND	ug/L
Dieldrin	7	0	ND	ND	ug/L
Dimethoate	9	0	ND	ND	ug/L
Disulfoton	9	0	ND	ND	ug/L
Diuron	4	0	ND	ND	ug/L
Endrin	7	0	ND	ND	ug/L
Glyphosate	4	0	ND	ND	ug/L
Linuron	4	0	ND	ND	ug/L
Malathion	9	0	ND	ND	ug/L
Methamidophos	6	0	ND	ND	ug/L
Methidathion	8	0	ND	ND	ug/L
Methiocarb	4	0	ND	ND	ug/L
Methomyl	4	0	ND	ND	ug/L
Methoxychlor	7	0	ND	ND	ug/L
Oxamyl	4	0	ND	ND	ug/L
Paraquat	4	0	ND	ND	ug/L
Parathion, Methyl	9	0	ND	ND	ug/L
Phorate	9	0	ND	ND	ug/L
Phosmet	8	0	ND	ND	ug/L
Simazine	7	0	ND	0.224	ug/L
Trifluralin	1	0	ND	ND	ug/L
METALS					
Arsenic	8	0	0.2	1.3	ug/L
Boron	7	0	24	170	ug/L

Table 8b. Lake-Napa Subwatershed ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Cadmium	8	0	ND	0.04	ug/L
Copper	8	0	0.3	2	ug/L
Lead	8	0	ND	0.06	ug/L
Nickel	8	0	0.8	15	ug/L
Molybdenum	0	0			ug/L
Selenium	8	0	ND	2	ug/L
Zinc	8	0	1	3	ug/L
NUTRIENTS					
Total Kjeldahl Nitrogen	8	0	ND	1.1	mg/L
Nitrate + Nitrite as N	8	0	0.061	0.52	mg/L
Total Ammonia	8	0	ND	ND	mg/L
Total Phosphorous as P	8	0	0.013	0.24	mg/L
Soluble Orthophosphate	8	0	ND	0.13	mg/L
SEDIMENT TOXICITY					
Hyalella	3	0	84	100	% control

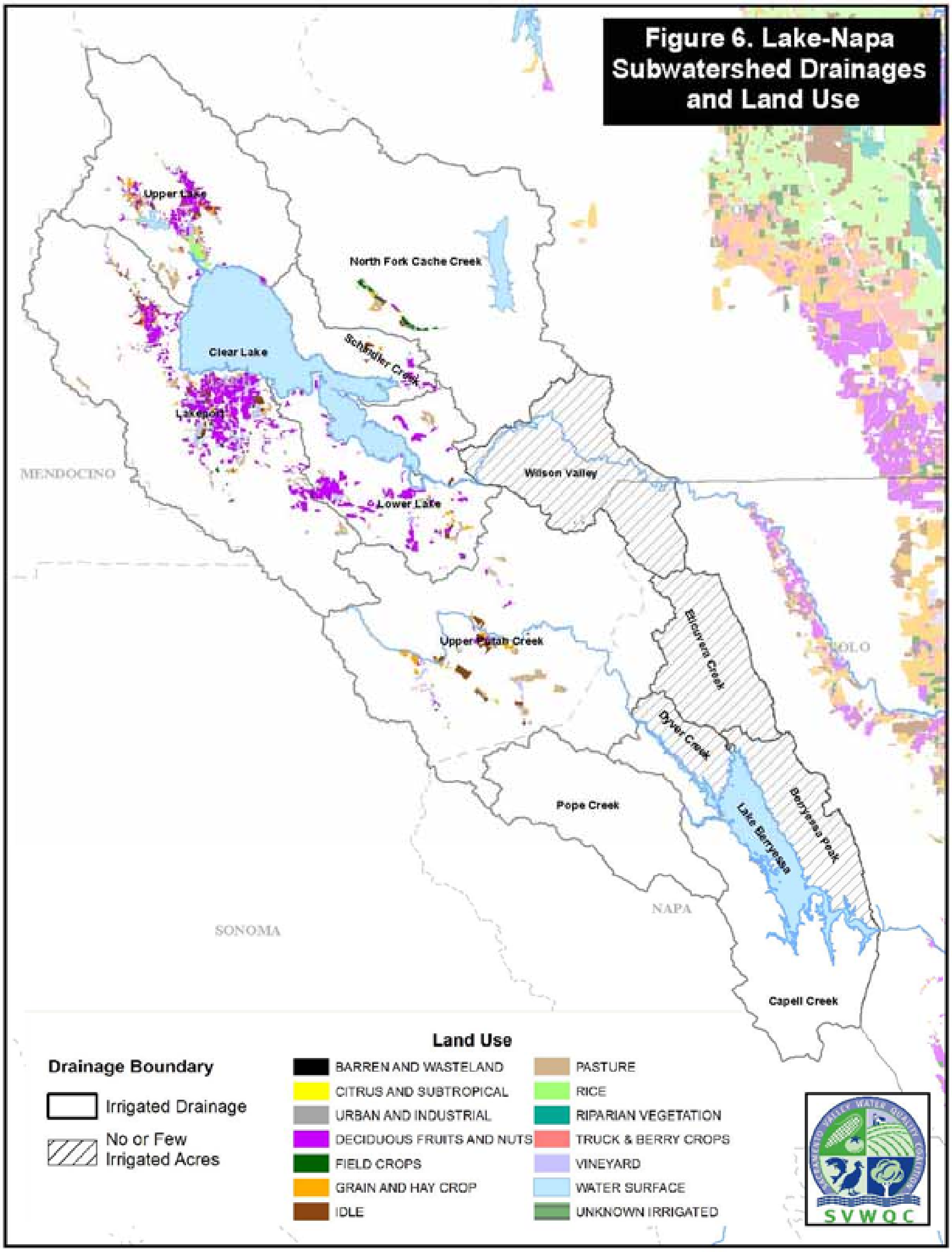
Figure 6. Lake-Napa Subwatershed Drainages and Land Use
Upper Lake
North Fork Cache Creek
Clear Lake
Schindler Creek
Lakeport
MENDOCINO
Wilson Valley
Lower Lake
Upper Putah Creek
Bucuvara Creek
YOLO
Dyver Creek
Pope Creek
Lake Berryessa
Berryessa Peak
NAPA
SONOMA
Capell Creek
Land Use
Drainage Boundary
Irrigated Drainage
No or Few Irrigated Acres
BARREN AND WASTELAND
CITRUS AND SUBTROPICAL
URBAN AND INDUSTRIAL
DECIDUOUS FRUITS AND NUTS
FIELD CROPS
GRAIN AND HAY CROP
IDLE
PASTURE
RICE
RIPARIAN VEGETATION
TRUCK & BERRY CROPS
VINEYARD
WATER SURFACE
UNKNOWN IRRIGATED
SVWQC

Upper Pit River Subwatershed

The Upper Pit River Subwatershed encompasses approximately 2,767,000 acres, extending from the Warner Mountains along the South Fork Pit River, to Shasta Lake in Shasta County (Figure 1). The subwatershed includes portions of Modoc, Lassen and Shasta counties. The topography is characterized by mountainous terrain with elevations ranging from approximately 3,200 to 9,833 feet above sea level. The low gradient of valley floors throughout the watershed is attributed to the deposition of large amounts of volcanic material. Approximately 44% of the acreage is privately owned, with predominant uses in production agriculture (ranching, hay/alfalfa, and wild rice), timber, and livestock grazing, while 56% of the subwatershed is held by federal and state agencies. It is estimated that 152,196 irrigated acres of privately owned land are currently in production.

Significant Subwatershed Characteristics

The key factors relevant to agriculture and water quality in the Upper Pit River Subwatershed are climate, topography, elevation, and soils. The overall flat topography of the Upper Pit River Valley play a significant role in the ecological and physical characteristics of the river and has allowed significant development of agriculture in the area. In general, the climate is typical of Mediterranean and high-altitude desert regions. Average annual maximum temperatures range from a low of 30°F to a high of 63°F. Most areas of the Upper Pit River Subwatershed receive approximately 13 to 16 inches of precipitation per year. Most of the precipitation falls as snow during the winter months, with 35 percent of the annual total received between December and February. The growing season, based on the freezing dates, is approximately 80 to 120 days in most valley locations and shortens considerably in the mountainous regions to approximately 40 to 80 days.

The Upper Pit River Subwatershed contains a diverse assemblage of soil types essential to farming, ranching, timber, and wildlife resources. Soils within the watershed vary from prime farmland to woodland. These soils are derived from the relatively young volcanic deposits that dominate the geology of the region and are the dominant component of the alluvial deposits where most irrigated crops are grown. Soils are generally grouped into valley, plateau-foothill, and mountain associations, with different land uses closely associated with each area.

Valley soils are found along stream terraces and basins and are used primarily for irrigated crops and pasture. They contain a surface layer of sandy loam, an upper subsoil of sandy clay loam, and a lower subsoil of sandy clay. Plateau-foothill soils occur on lava plateaus, volcanic hills, and sideslopes of volcanic cinder cones and are commonly used for livestock grazing, with some timber harvest also present. Mountain soils occur on gentle to steep mountain slopes that formed on igneous rock, volcanic ash, cinders, tephra, and basalt plateaus; they are most suitable for timber production.

Agriculture and Crops

The leading crops in the Upper Pit River Subwatershed are alfalfa hay, alfalfa/orchard grass hay, Timothy hay, assorted grass hay, oats, barley, wheat, and irrigated pasture. Other important crops include strawberry nursery plants, wild rice, peppermint, garlic, onions, and assorted vegetable seed. The Upper Pit River Subwatershed encompasses 23 main drainages where irrigated agriculture is present. Table 9 lists the drainages by name and the crops grown within each area. Figure 7 shows the location and relative extent of the drainages.

Table 9. Upper Pit River Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Pit River at Pittville	Big Lake	Pasture, rice, oats, wheat grain and hay, idle
Represented by Pit River at Pittville monitoring site	Bieber	Pasture, grain and hay, barley
	Alturas	Pasture, rice, oats, wheat, grain and hay, marsh
	Canby	Pasture, grain and hay, barley
	Lower Burney Creek	Pasture, rice, grain and hay, nursery, idle
	Upper Ash Creek	Pasture, grain and hay, barley, general field crops
	Lower Hat Creek	Pasture, nursery
	Little Valley	Pasture, idle
	Lake Britton	Pasture
	Cedar Creek	Pasture, grain and hay, barley
	Upper Burney Creek	Pasture
	Turner Creek	Pasture, grain and hay, barley, general field crops
	Montgomery Creek	Pasture
	Big Sage	Pasture, grain and hay, barley
	Hatchet Creek	Pasture
	Pondosa	Pasture
	Upper Hat Creek	Pasture
	Kosk Creek	Pasture
	Squaw Valley	Pasture
	Big Bend	Pasture
	Dunsmuir	Pasture
	Sweetbriar Creek	Pasture
	Lower McCloud River	Pasture

Hydrology, Water Management, and Irrigation Methods

There are 21 named tributaries totaling approximately 1,050 miles of perennial stream and 4,054 river miles in the Upper Pit River watershed. The North Fork and the South Fork of the Pit River drain the northern potion of the watershed. The North Fork headwaters include a number of tributaries in the Warner Mountains. The South Fork of the Pit River originates in the south Warner Mountains at Moon Lake in Lassen County.

The north and south forks of the Pit River converge in the town of Alturas in Modoc County and then flow in a southwesterly direction into Shasta Lake in Shasta County.

Sixty-three jurisdictional dams are located within the Upper Pit River Subwatershed. Total storage capacity for the reservoirs associated with the jurisdictional dams is approximately 220,000 acre-feet, and the total surface area of the reservoirs, when full, is approximately 21,000 acres.

Agriculture is the largest water using industry in the Upper Pit River Subwatershed. It has been estimated that approximately 230,000 acre-feet of surface water is diverted annually for irrigation purposes. Water management practices include crop irrigation and runoff management. Various methods of irrigation are used, including wild flood, flood, pivot, wheel-line sprinklers, and hand-line sprinklers. Wild rice uses a flood method that inundates the plant under at least six inches of water throughout the growing season.

A number of appropriative and riparian surface water rights are the source of irrigation water in the Upper Pit River watershed. Dams and diversions operated in accordance with established water rights are installed along the main stem of the Pit River as early as April. Diversions are typically flashboard structures that divert water to a weir box then outlet to a ditch for flood irrigation. A few pumps are used, but they are located in holding ponds located off-stream**.** A substantial reach of the South Fork of the Pit River was converted to canals decades ago.

The South Fork and the Hot Springs Valley Irrigation Districts are two of the larger sources of irrigation water in the Upper Pit River watershed. Irrigation supply in the Big Valley is the result of an adjudication in 1959 that provides for 167,766 acre feet of storage. The South Fork Irrigation District (SFID) includes 12,900 acres below West Valley Reservoir. The rotational schedule described in the Decree for the South Fork of the Pit River is only implemented when water volumes are low, and only within the district boundaries. Within SFID, water transportation is through gravity flow ditches from flashboard dam diversions. There are no pumps operating within SFID. The Hot Springs Valley Irrigation District water users currently irrigate approximately 7,000 acres. There are eight private dams and three district dams in operation. The dams are concrete flashboard structures of varying width approximately 10 to 12 feet in height.

Management Practices Information

The use of pesticides/herbicides in the Upper Pit River Subwatershed is limited. Growers may obtain site-specific permits from county offices within the Upper Pit River Subwatershed to purchase and use many agricultural chemicals. Pesticide use enforcement staff evaluates each permit application to determine if the pesticide can be used safely and effectively. Some pesticides require notice prior to application to assure permit conditions are met. Pesticide use reports are examined to monitor the use of restricted materials and track the agricultural and commercial use of pesticides in each individual county.

Stormwater runoff and tailwater return flow have the potential to cause water quality problems at agricultural sites in the Upper Pit River Subwatershed. Examples of some typical management practices that may help protect water quality in this watershed include:

- Improved application of irrigation water to minimize tailwater return flow.
- Tailwater retention in ponds, ditches, sloughs, and recycle systems.
- Prevention of irrigation discharge where fresh manure has been applied.
- Application of pesticides and other agricultural chemicals at agronomic rates.
- Use of off-site water facilities and water gaps to reduce the direct contact of livestock with watercourses.
- Prevention of drainage from corrals and direct discharge from concentrated feeding areas to watercourses.
- Exclusion fencing and rotational grazing to minimize streambank trampling and maintain riparian vegetation cover.
- Proper construction and maintenance of ranch roads and stream crossings to minimize erosion and sediment discharge to watercourses.
- Protection of wetlands to maintain and improve habitat value and function.

Monitoring Site Selection

The Pit River at Pittville monitoring site was selected to represent irrigated agriculture throughout the Upper Pit River Subwatershed. As shown in Table 9, this drainage includes all of the major crops and agricultural activities that exist in the subwatershed. It also serves as an integrator of agricultural runoff for the subwatershed. Monitoring for the ILRP has been conducted annually at this site since 2004.

Past Water Quality Monitoring

Water quality monitoring has been conducted by the Sacramento Valley Coalition and Upper Pit River Subwatershed since 2004. Table 10 below summarizes monitoring parameters and results. Metals samples were collected and analyzed during the 2009 monitoring season, thus are not included here. Many pesticides are not used by agriculture in the Upper Pit River Subwatershed and, therefore, were not analyzed under the ILRP.

Table 10. Pit River Subwatershed ILRP Monitoring Data Summary (2004-2008)

PARAMETERS	Number of Analyses by Site and Season: Fall River IRRIG	Fall River STORM	Pit R @ Canby IRRIG	Pit R @ Canby STORM	Pit R @ Pittville IRRIG	Pit R @ Pittville STORM	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL											
pH	18	6	22	7	22	7	82	12	5.8	9.43	pH units
Electrical Conductivity	18	6	20	7	21	7	79	0	107	354	uS/cm
Dissolved Oxygen	12	5	13	5	12	5	52	6	5	12	mg/L
Temperature	18	7	22	7	22	7	83	0	8	27.5	C
Total Dissolved Solids							0				mg/L
Total Suspended Solids	15	3	15	3	17	4	57	0	ND	37	mg/L
Total Organic Carbon	2		5		6	1	14	0	0.9	8.7	mg/L
Turbidity	16	5	16	5	19	5	66	0	1.1	37.3	NTU
PATHOGENS											
Fecal coliform	14	3	9	3	9	3	41	0	ND	350	MPN/100
E-coli	15	3	15	3	17	4	57	3	1	980	MPN/100
WATER COLUMN TOXICITY											
Selenastrum		3	2	3	2	3	13	0	257	672	% control
Ceriodaphnia	1	2	2	4	2	3	14	0	100	100	% control
Pimephales		3	2	3	2	3	13	0	93	100	% control
PESTICIDES											
Azinphos methyl	2	1	2	1	2	1	9	0	ND	ND	ug/L
Chlorpyrifos	2	1	2	1	2	1	9	0	ND	ND	ug/L
Demeton-s	2	1	2	1	2	1	9	0	ND	ND	ug/L
Diazinon	2	1	2	1	2	1	9	0	ND	ND	ug/L
Dichlorvos	2	1	2	1	2	1	9	0	ND	ND	ug/L
Dimethoate	2	1	2	1	2	1	9	0	ND	ND	ug/L
Disulfoton (Disyton)	2	1	2	1	2	1	9	0	ND	ND	ug/L
Malathion	2	1	2	1	2	1	9	0	ND	ND	ug/L

Table 10. Pit River Subwatershed ILRP Monitoring Data Summary (2004-2008)

PARAMETERS	Number of Analyses by Site and Season: Fall River		Pit R @ Canby		Pit R @ Pittville		TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM					
Methamidophos	2	1	2	1	2	1	9	0	ND	ND	ug/L
Methidathion	2	1	2	1	2	1	9	0	ND	ND	ug/L
Methyl Parathion	2	1	2	1	2	1	9	0	ND	ND	ug/L
Phorate	2	1	2	1	2	1	9	0	ND	ND	ug/L
Phosmet	2	1	2	1	2	1	9	0	ND	ND	ug/L
METALS											
Arsenic							0				ug/L
Boron							0				ug/L
Cadmium							0				ug/L
Copper							0				ug/L
Lead							0				ug/L
Nickel							0				ug/L
Molybdenum							0				ug/L
Selenium							0				ug/L
Zinc							0				ug/L
NUTRIENTS											
Total Kjeldahl Nitrogen							0				mg/L
Nitrate as N	15	3	15	3	17	4	57	0	ND	2	mg/L
Total Ammonia							0				mg/L
Total Phosphorous,P	14	3	13	3	15	4	52	0	0.03	0.5	mg/L
Orthophosphate							0				mg/L
SEDIMENT TOXICITY											
Hyalella							0				% control

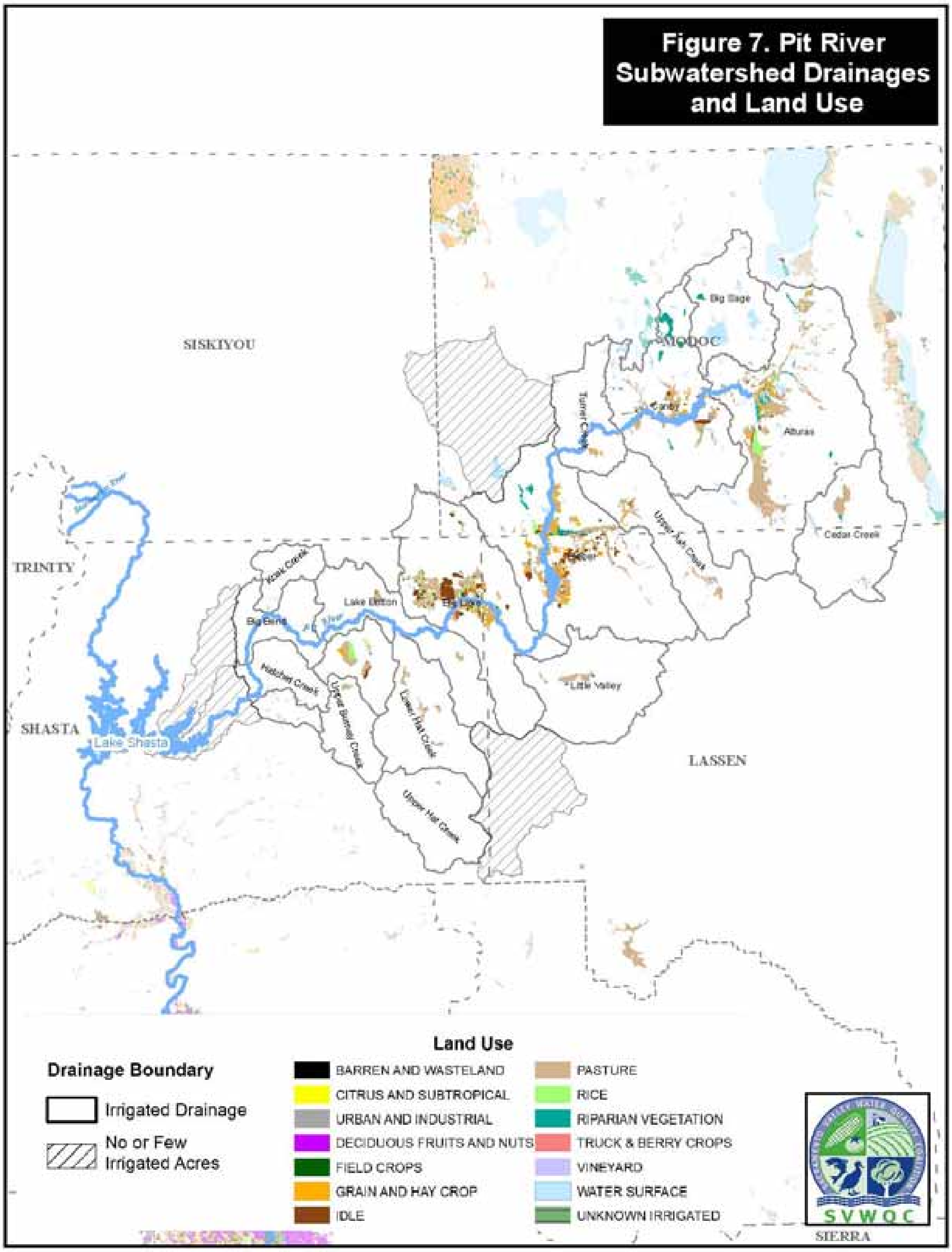

Figure 7. Pit River Subwatershed Drainages and Land Use

Placer-Nevada-South Sutter-North Sacramento Subwatershed

The Placer-Nevada-South Sutter-North Sacramento (PNSSNS) Subwatershed encompasses approximately 1.17 million acres in the southeast portion of the Sacramento Valley, and includes most of Placer and Nevada Counties, and roughly one-fifth and one-quarter of Sutter and Sacramento counties, respectively (Figure 1). About 38% (447,000 acres) of the watershed (Gold Run, Blue Canyon, Hell Hole, Snow Mountain, Rubicon River, and Duncan Canyon drainages) has no irrigated acreage. In general, the subwatershed area is bounded on the east by the Sierra Nevada Range, on the west by the Yolo Causeway and the Sacramento River, on the north by the Yuba and Bear rivers, and on the south by the Rubicon River and the American River. Topography varies from a relatively flat valley floor, to rolling foothills and volcanic buttes, to steep forested mountains and deep river canyons. Elevation ranges from approximately 30 to 7,000 feet above sea level, although irrigated cropland does not generally occur above 3,000 feet. The majority of irrigated agriculture occurs in the southwest area of the PNSSNS Subwatershed, with approximately 162,000 acres currently being farmed, of which about 72,000 acres is in rice. Some dryland grains are also grown, typically in rotation with other field crops. Other land use types include non-irrigated grazing rangeland, urban and rural residential development, and coniferous forests, oak woodlands, grasslands, and wetlands.

Significant Subwatershed Characteristics

The key factors relevant to agriculture and water quality in the PNSSNS Subwatershed are climate, soils, topography, and hydrology. In general, the Mediterranean climate – warm, dry summers and cool to cold, wet winters – is the dominant influence on weather patterns. Throughout the subwatershed, average annual precipitation ranges from about 17 to 24 inches per year (varying with location). Most of the rainfall (snow in upper elevations) occurs from October through April. Average temperatures vary from a minimum of about 36°F in winter to 96°F in summer.

Soil characteristics play a significant role in both crops grown and water quality conditions. Placer soils are predominately silt and sandy loams with some gravelly loam, clay and hardpan substratum. Northern Sacramento and south Sutter County soils are nearly level soils on low and high floodplains. These soils range from very deep and poorly to somewhat poorly drained clay, clay loam, sandy loam and clay in and around the Natomas Basin. These floodplain soils lie along the Sacramento and Feather Rivers and are characterized by a weakly expressed, darker colored surface layer; an irregular decrease in organic matter content with depth and stratified subsurface material.

Topography and elevation are important factors affecting crop types and distribution within the PNSSNS Subwatershed. Crops benefiting from more level land and warmer summer temperatures are found in the lower southern portions of the area, while others that require more winter chilling and/or are more successful in hilly areas are found in the central foothill areas.

Irrigation is necessary to grow most crops in the PNSSNS Subwatershed, particularly the rice, orchards, grains, and field crops found in the southwestern area near the Sacramento River floodplain. A relatively dependable water supply allows the high level of agricultural production that exists there today. To achieve this, the natural hydrology of the area was largely altered over the past 150 years, mainly to create the irrigation distribution and drainage system that serves agricultural needs. Additional information on hydrology and water management is provided below in the *Hydrology, Water Management, and Irrigation Methods* section.

Agriculture and Crops

The types of crops grown in Placer, Nevada, South Sutter and North Sacramento counties are fairly diverse and vary with elevation, soils, and water availability. The leading crops (by acreage) in the Placer County portion of the subwatershed are rice, walnuts, wheat, wine grapes, hay, prunes/plums, oranges, peaches, apples, and pears. The largest agricultural land use is irrigated and non-irrigated pasture lands.

The leading crops (by acreage) in the Nevada portion of the subwatershed include pasture, wine grapes, and fruit/nut orchards (walnuts, apples, pears, plums, peaches, figs, kiwi, and chestnuts). Non-irrigated pasture encompasses substantial acreages in Nevada County.

The leading crops (by acreage) in the south Sutter portion of the subwatershed include dried plums, rice, walnuts, peaches, alfalfa, and sudan. Other important crops include corn, safflower, melons, and seed crops. Significant irrigated pasture and non-irrigated rangeland acreages also occur in this region.

The leading crops (by acreage) in the north Sacramento portion of the subwatershed include rice, safflowers, walnuts, alfalfa, and corn

The PNSSNS Subwatershed encompasses 16 different drainages where irrigated agriculture is present. Table 11 lists the drainages by name and the crops grown within each drainage area. Figure 8 shows the extent of the drainages.

Table 11. PNSSNS Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Coon Creek	Middle Coon Creek	Rice, pasture, grain, sudan, walnuts, corn
Represented by Coon Creek monitoring site	Lower Coon Creek	Rice, grain pasture, walnuts, corn
	Natomas	Rice, grain, corn
	Pleasant Grove Creek	Rice, grain, pasture, corn
	Coon Creek – Auburn	Pasture
	Dry Creek – Sacramento	Rice, pasture, grain
	Secret Ravine	Pasture
	Volcanoville	Walnuts
	Lake Clementine	Pasture, corn
	Camp Far West	Pasture, wine grapes

Type of Monitoring	Drainages	Crops
	Wolf Creek	Pasture
	Dry Creek – Nevada	Pasture, wine grapes
	Lower Bear River	Pasture, grain, rice
	Rollins Reservoir	Apples
	Shady Creek	Pasture, wine grapes
	New Bullards Bar	Pasture

Hydrology, Water Management, and Irrigation Methods

The PNSSNS Subwatershed area encompasses a broad range of stream types, sizes, and conditions. Large streams in the subwatershed include the lower Feather River, Bear River, Yuba River, and American River. Other medium-size water bodies include Auburn Ravine, Coon Creek, Dry Creek, and Markham Ravine. Some degree of hydro-modification has occurred in all of these streams. A network of many smaller tributary creeks and sloughs (typically intermittent) discharge to the larger streams or connect with the intricate system of constructed agricultural canals and drains.

Several reservoirs occur in the foothill and mountain regions of the subwatershed, including Folsom Lake, Camp Far West Reservoir, Rollins Reservoir, Scotts Flat Reservoir, Sugar Pine Reservoir, Lake Combie, and Lake Wildwood. The timing and quantity of water discharged downstream of these reservoirs is closely managed to meet urban and rural water supply needs. In the intensive agricultural areas that occur in the valley below the reservoirs, water supply canals and drains have been constructed to meet the needs of agricultural production. Water delivery, re-circulation, and drainage are able to meet the varied water needs of agriculture during irrigation season and convey stormwater runoff during the rainy season.

In the region where rice is the principal crop, a strictly managed system of canals, pumps and ditches has been created to control water levels in the numerous rice fields of the area. Drainage is generally provided by pumping plants that move water over levees. Additionally, important flood control features, such as the Sutter Bypass and Yolo Bypass were constructed to minimize flooding problems in urban and rural areas. Flows are controlled by a system of levees, gates and weirs, such as the Fremont Weir on the Sacramento River.

Irrigation water sources in the PNSSNS Subwatershed are primarily from surface diversions from reservoirs, rivers and creeks. Diversions by water purveyors include the Nevada Irrigation District, Pacific Gas & Electric Company, South Sutter Water District, and Placer County Water Agency. This water is then distributed to growers through systems of canals and ditches. Several smaller water districts near the Sacramento River also provide irrigation water from the river to adjacent farmlands.

Water management practices in the PNSSNS Subwatershed include pre-planting irrigation, crop hydration, frost prevention, salinity management, and runoff management. A variety of irrigation methods are used, including drip, furrow, flood, and sprinkler.

Management Practices Information
Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant BMPs, regulations, and preventative measures are discussed with the property operator prior to issuance of permits.

BMP projects and programs have been implemented in Placer, Nevada, south Sutter, and north Sacramento counties with guidance and financial assistance from the Natural Resources Conservation Service and the Resource Conservation Districts. Some of these projects are intended to address irrigation or stormwater related impacts to water quality, while others may do so as a secondary benefit. The BMPs and projects currently implemented by growers within the subwatershed have not been documented or evaluated as of preparation of this Order. Examples of some typical management practices and projects in place that may help protect water quality in this watershed include:

- Recirculation ponds,
- Vegetative filter strips and cover crops,
- Underground water delivery pipes,
- Drainage channel stabilization,
- Irrigation system improvements,
- Irrigation Mobile Lab Service, and
- Drip and micro-spray irrigation systems.

Monitoring Site Selection
The Coon Creek at Brewer Road monitoring site was selected to represent irrigated agriculture throughout the PNSSNS Subwatershed. As shown in Table 11, this drainage includes the major crops and agricultural activities that exist throughout the subwatershed area. Monitoring for the ILRP has been conducted annually in Coon Creek since 2005. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

Past Water Quality Monitoring
Water quality monitoring has been conducted by the Sacramento Valley Coalition and PNSSNS Subwatershed since 2005. Table 12 summarizes ILRP monitoring parameters and results from PNSSNS monitoring sites.

Table 12. PNSSNS Subwatershed Monitoring Data Summary (2005-2008)

PARAMETERS	Number of Analyses by Site & Season: Coon Ck @ Striplin IRRIG	Coon Ck @ Striplin STORM	Coon Ck @ Brewer IRRIG	Coon Ck @ Brewer STORM	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL									
pH	12	4	14	4	34	1	6.55	8.87	pH Units
Electrical Conductivity	12	4	14	4	34	0	117	622	uS/cm
Dissolved Oxygen	12	4	14	4	34	6	4.95	14.5	mg/L
Temperature	12	4	14	4	34	0	6.9	29.8	C
Total Dissolved Solids	11	4	11	4	30	0	75	370	mg/L
Total Suspended Solids	11	4	12	4	31	0	ND	76	mg/L
Total Organic Carbon	11	3	12	2	28	0	0.34	16	mg/L
Turbidity	11	4	12	4	31	0	3.2	81	NTU
PATHOGENS									
E-coli	12	5	12	4	33	10	49	2400	MPN/100 ml
WATER COLUMN TOXICITY									
Selenastrum	6	2	13	3	24	1	47	492	% control
Ceriodaphnia	6	2	13	3	24	0	89	111	% control
Pimephales	6	2	6	2	16	0	73	100	% control
PESTICIDES									
Aldicarb	10	1	12	4	27	0	ND	ND	ug/L
Atrazine	5	2	12	4	23	0	ND	ND	ug/L
Azinphos methyl	11	4	12	3	30	0	ND	ND	ug/L
Carbaryl	10	1	12	4	27	0	ND	ND	ug/L
Carbofuran	10	1	12	4	27	0	ND	ND	ug/L
Chlorpyrifos	11	4	12	4	31	2	ND	0.0431	ug/L
Cyanazine	5	1	12	4	22	0	ND	ND	ug/L
DDD	5	2	12	4	23	0	ND	ND	ug/L

Table 12. PNSSNS Subwatershed Monitoring Data Summary (2005-2008)

	Number of Analyses by Site & Season								
	Coon Ck @ Striplin		Coon Ck @ Brewer						
PARAMETERS	IRRIG	STORM	IRRIG	STORM	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
DDE	5	2	12	4	23	0	ND	ND	ug/L
DDT	5	2	12	4	23	0	ND	ND	ug/L
Demeton-s	11	4	12	4	31	0	ND	ND	ug/L
Diazinon	11	4	12	4	31	0	ND	0.0386	ug/L
Dichlorvos	11	4	12	4	31	0	ND	ND	ug/L
Dicofol	5	0	12	4	21	0	ND	ND	ug/L
Dieldrin	5	2	12	4	23	0	ND	ND	ug/L
Dimethoate	11	4	12	4	31	0	ND	ND	ug/L
Disulfoton (Disyton)	11	4	12	4	31	0	ND	ND	ug/L
Diuron	10	1	12	4	27	1	ND	3.6	ug/L
Endrin	5	2	12	4	23	0	ND	ND	ug/L
Glyphosate	4	1	4	2	11	0	ND	ND	ug/L
Linuron	10	1	12	4	27	0	ND	ND	ug/L
Malathion	11	4	12	4	31	0	ND	ND	ug/L
Methamidophos	3	2	12	3	20	0	ND	ND	ug/L
Methidathion	11	4	12	3	30	0	ND	ND	ug/L
Methiocarb	10	1	12	4	27	0	ND	ND	ug/L
Methomyl	10	1	12	4	27	0	ND	ND	ug/L
Methoxychlor	5	2	12	4	23	0	ND	ND	ug/L
Methyl Parathion	11	4	12	4	31	0	ND	ND	ug/L
Oxamyl	10	1	12	4	27	0	ND	ND	ug/L
Paraquat Dichloride	4	2	4	1	11	0	ND	ND	ug/L
Phorate	11	4	12	4	31	0	ND	ND	ug/L
Phosmet	11	4	12	3	30	0	ND	ND	ug/L
Simazine	5	2	12	4	23	0	ND	0.273	ug/L
Trifluralin	1	0	6	2	9	0	ND	ND	ug/L

Table 12. PNSSNS Subwatershed Monitoring Data Summary (2005-2008)

PARAMETERS	Number of Analyses by Site & Season				TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
	Coon Ck @ Striplin		Coon Ck @ Brewer						
	IRRIG	STORM	IRRIG	STORM					
METALS									
Arsenic	5	2	12	4	23	0	0.5	4.1	ug/L
Boron	0	2	12	4	18	0	11	43	ug/L
Cadmium	5	2	12	4	23	0	ND	0.05	ug/L
Copper	5	2	12	4	23	1	1.7	39	ug/L
Lead	5	2	12	4	23	0	ND	1.1	ug/L
Nickel	5	2	12	4	23	0	1.5	6.3	ug/L
Molybdenum					0				ug/L
Selenium	5	2	12	4	23	0	ND	1	ug/L
Zinc	5	2	12	4	23	0	3	24	ug/L
NUTRIENTS									
Total Kjeldahl Nitrogen	5	2	12	4	23	0	0.15	3.9	mg/L
Nitrate + Nitrite as N	5	2	12	4	23	0	ND	0.99	mg/L
Total Ammonia	10	3	11	4	28	0	ND	1.3	mg/L
Total Phosphorous as P	7	0	6	3	16	0	0.07	0.53	mg/L
Soluble Orthophosphate	1	2	12	4	19	0	0.036	0.23	mg/L
SEDIMENT TOXICITY									
Hyalella	2	0	4	0	6	0	95	112	% control

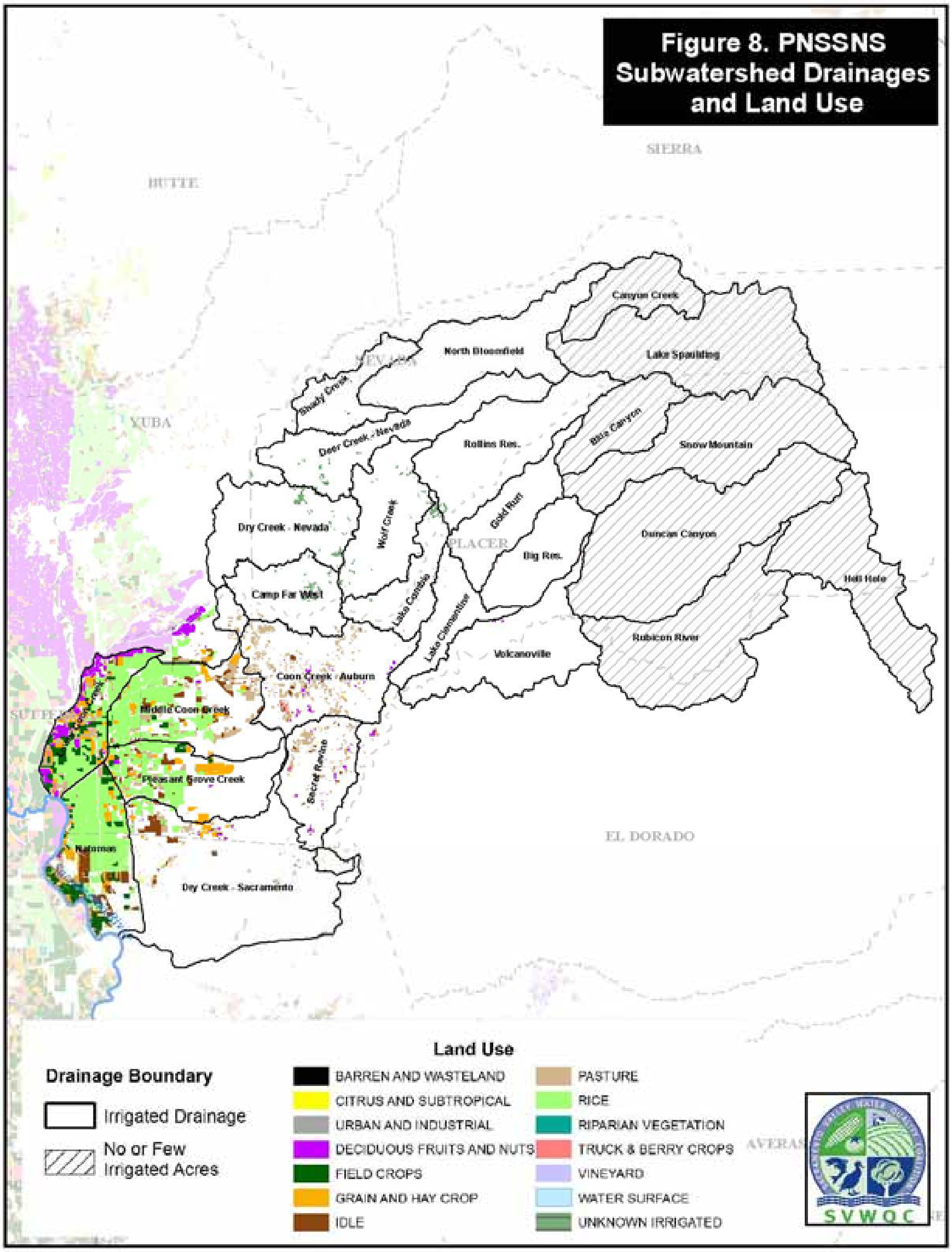
Figure 8. PNSSNS Subwatershed Drainages and Land Use
SIERRA
BUTTE
YUBA
NEVADA
PLACER
SUTTER
EL DORADO
Canyon Creek
Lake Spaulding
North Bloomfield
Shady Creek
Deer Creek - Nevada
Rollins Res.
Bitz Canyon
Snow Mountain
Dry Creek - Nevada
Wolf Creek
Gold Run
Duncan Canyon
Big Res.
Hell Hole
Camp Far West
Lake Combie
Lake Clementine
Rubicon River
Volcanoville
Coon Creek - Auburn
Middle Coon Creek
Pleasant Grove Creek
Secret Ravine
Natomas
Dry Creek - Sacramento
Land Use
Drainage Boundary
Irrigated Drainage
No or Few Irrigated Acres
BARREN AND WASTELAND
CITRUS AND SUBTROPICAL
URBAN AND INDUSTRIAL
DECIDUOUS FRUITS AND NUTS
FIELD CROPS
GRAIN AND HAY CROP
IDLE
PASTURE
RICE
RIPARIAN VEGETATION
TRUCK & BERRY CROPS
VINEYARD
WATER SURFACE
UNKNOWN IRRIGATED
SVWQC

Sacramento-Amador Subwatershed

The Sacramento-Amador Subwatershed encompasses approximately 490,000 acres at the south end of the Sacramento Valley and contains roughly three-quarters of Sacramento County and half of Amador County (Figure 1). In general, the subwatershed is bounded on the east by the Sierra Nevada foothills, on the west by the Sacramento River, on the north by the lower American River (in part) and the Cosumnes River (in part), and on the south by the Mokelumne River. Moving from west to east, the subwatershed's topography starts out relatively flat in the area of the Sacramento-San Joaquin Delta and alluvial floodplains; it then transitions to low rolling hills and dissected alluvial terraces, tabletop buttes, and escarpments; and ends up in rolling to steep foothills, mesa-like plateaus, and undulating flats and valleys. Elevations range from sea level to approximately 4,500 feet above sea level. Irrigated agriculture occurs in just over 15% of the Sacramento-Amador Subwatershed, with approximately 76,000 acres currently being farmed (Figure 9). Other land use types include non-irrigated rangeland, urban/rural residential development, and oak woodlands, grasslands, chaparral, and wetlands.

Significant Subwatershed Characteristics

The key factors relevant to agriculture and water quality in the Sacramento-Amador Subwatershed are climate, soils and hydrology. In general, the Mediterranean climate – hot, dry summers and cool to cold, wet winters – is the dominant influence on weather patterns. In the vicinity of the Delta, summertime temperatures are moderated by marine-influenced breezes, resulting in an average maximum of 91°F, while the inland average maximum is 97°F. Average minimum temperature is about 44°F. Throughout the subwatershed, average annual precipitation ranges from 15 to 24 inches per year. Most of the rainfall occurs from October through April.

Soil characteristics play a significant role in both crops grown and water quality conditions.The Arroyo Seco pediment, alluvial terraces, and floodplains of Amador County support the irrigated agriculture of this portion of the subwatershed. Two classifications (Pentz-Pardee and Honcut-Snelling-Ryer) of soils are found in the Arroyo Seco pediment. Pentz-Pardee is very shallow to moderately deep and is a gravelly alluvium, marine clay, rhyolitic tuff, sandstone and volcanic conglomerate. The Honcut-Snelling-Ryer is a deep to very deep medium-textured soil comprised of sandy, fine sandy, and silty clay loams.

The nearly level soils on low and high floodplains and in or on basin rim areas of southern and western Sacramento County support irrigated crops. Found in the Delta, along the Cosumnes River and Deer Creek, these soils range from very deep and poorly to somewhat poorly drained clay, clay loam, sandy loam and clay in and around the Delta to well drained silt and clay loams along the low terraces of the streams and rivers.

Irrigation is necessary to grow most crops in the Sacramento-Amador Subwatershed. In general, a relatively dependable water supply allows for a fairly stable level of agricultural production. However, irrigation water sources and availability vary with location within the subwatershed. Additional information on hydrology and water management is provided below in the *Hydrology, Water Management, and Irrigation Methods* section.

Agriculture and Crops

The concentration and intensity of irrigated agriculture in Sacramento-Amador is greatest in the region of the Delta islands and the Sacramento River floodplain, and becomes less dominant moving towards the northeast (Figure 9). In Amador County, most irrigated agriculture is located within one of four local areas: Shenandoah Valley, Jackson Valley, Ione Valley, and Ridge Road. The leading crops (by acreage) in the Sacramento County portion of the subwatershed include corn, hay (alfalfa, grain, clover, sudan), wine grapes, pears, tomatoes, wheat, safflower, rice, and seed crops (rice, sudan, clover). The leading crops (by acreage) in the Amador portion of the subwatershed include wine grapes, hay (alfalfa, wheat, oats), walnuts, tomatoes, and cucumbers. Irrigated and non-irrigated pastures (range) encompass large acreages in both Sacramento and Amador counties.

The Sacramento-Amador Subwatershed encompasses eight different drainages where irrigated agriculture is present. Table 13 lists the drainages by name and the crops grown within each drainage area. Figure 9 shows the extent of the drainages.

Table 13. Sacramento-Amador Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Cosumnes River	Lower Cosumnes River	Pasture, wine grapes, corn, grain, sudan, orchards (pears, cherries, apples, almonds, walnuts, peaches, nectarines, citrus, olives), strawberries
Represented by Cosumnes River monitoring site	Middle Cosumnes River	Wine grapes, pasture, corn, grain, sudan
	Elder Creek – Sacramento	Pasture, grain, hay
	Jackson Creek	Wine grapes, pasture, corn, grain
	North Fork Cosumnes River	Wine grapes, walnuts, pasture, grain
	Upper Deer Creek – Sacramento	Wine grapes, pasture
	Omo Ranch	Wine grapes, walnuts
Monitoring site in Grand Island	Grand Island (Delta)	Corn, grain, hay, wine grapes, pears, pasture

Hydrology, Water Management, and Irrigation Methods

The Sacramento-Amador Subwatershed contains a diverse natural and man-made hydrologic system. Overall, the natural drainage pattern is from the eastern mountains and foothills west and south towards the Sacramento River. The largest rivers include the American, Cosumnes, and Mokelumne rivers, which receive a large proportion of the surface runoff and ultimately discharge to the Sacramento-San Joaquin Delta. Major tributaries include Deer Creek, Laguna Creek, and Dry Creek.

The Cosumnes River, one of the few unregulated rivers in California, forms a large complex of wetlands in its lower reaches, which is managed as wildlife preserve. In contrast, the greatly modified lower American River system is controlled by Folsom Dam, a very large flood control and water storage reservoir, and flows through the urbanized greater Sacramento area. The Mokelumne River is controlled by Camanche Dam. The American, Sacramento, and Mokelumne rivers are largely constricted by flood control levees in their lower reaches. The Sacramento, Cosumnes and Mokelumne rivers become part of an intricate system of sloughs and 'islands' as they flow into the greater Sacramento-San Joaquin Delta. Flows in these waterways are highly manipulated to serve urban and agricultural water uses.

Irrigation water sources in the Sacramento-Amador Subwatershed are primarily from surface water diversions, with some groundwater utilized in the Amador County foothill areas. Water purveyors include the Jackson Valley Irrigation District and the Sacramento County Water Agency.

Water management practices in the Sacramento-Amador Subwatershed include pre-planting irrigation, crop hydration, frost prevention, salinity management, and runoff management. A variety of irrigation methods are used, including drip, furrow, flood, and sprinkler.

Management Practices Information

Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant BMPs, regulations, and preventative measures are discussed with the property operator prior to issuance of permits.

A number of BMP projects and programs have been implemented in Sacramento-Amador Subwatershed area with guidance and financial assistance from the Natural Resources Conservation Service and the Resource Conservation Districts. Some of these projects are intended to address irrigation or stormwater related impacts to water quality, while others may do so as a secondary benefit. The BMPs and projects currently implemented by growers throughout the subwatershed have not been documented or evaluated as of preparation of this Order. Examples of some typical management practices and projects in place that may help protect water quality in this watershed include:

- Vegetative filter strips and cover crops,
- Drainage channel stabilization,
- Irrigation system improvements,
- Irrigation Mobile Lab Service,
- Drip and micro-spray irrigation systems, and
- Fencing and stock watering systems in rangeland.

Monitoring Site Selection

Two monitoring sites were selected to represent the diversity of crops and agricultural practices in the Sacramento-Amador Subwatershed: Cosumnes River at Twin Cities

Road and Grand Island at Leary Road. These sites typically have year-round flows that permit year-round sampling.

As shown in Table 13 and Figure 9, the Cosumnes River site represents the dominant crops grown in Amador and southern Sacramento counties (excluding the Delta) and has a high percentage of irrigated acreage. The site specifically represents seven drainages in the subwatershed. The Cosumnes River site has been monitored annually for the ILRP since 2005. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Grand Island monitoring site was selected to represent Delta island drainages and includes the dominant crops grown on the Delta islands. Grand Island drain has been monitored annually for the ILRP since 2008. Assessment-level monitoring data are being evaluated and will provide a significant baseline to examine water quality trends.

Past Water Quality Monitoring

Water quality monitoring has been conducted by the Sacramento Valley Coalition and Sacramento-Amador Subwatershed since 2005. Tables 14a and 14b summarize ILRP monitoring parameters and results from Sacramento-Amador monitoring sites. In addition, the Coalition measured or analyzed 73 additional constituents (physical parameters, microbiological organisms, metals, and pesticides) at approximately the same frequency as those listed in Table 14a. No exceedances were observed in the additional measurements. Although the additional measurements and analyses were not required for ILRP monitoring, valuable information regarding the chemicals was documented and can easily be compiled and evaluated, as needed.

Table 14a. Sacramento-Amador ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season									
	Big Indian Ck		Cosumnes River		Dry Creek		Grand Island		Laguna Creek	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
GENERAL										
pH	2		10	3	10	4	5	3	11	7
Electrical Conductivity	2	1	10	3	10	4	5	3	11	7
Dissolved Oxygen	2		10	3	10	4	5	3	11	7
Temperature	2		10	3	10	4	5	3	11	7
Total Dissolved Solids	1	2	8	4	8	5	5	3	10	6
Total Suspended Solids	1	2	8	4	8	5	5	3	10	6
Total Organic Carbon	1	1	8	3	8	3	5	3	10	4
Turbidity	1	2	8	4	8	5	5	3	10	6
PATHOGENS										
E-coli	1	1	4	2	8	5	5	3	10	6
WATER COLUMN TOXICITY										
Selenastrum	1	2	4	2	5	2	5	3	11	4
Ceriodaphnia	1	2	4	2	5	3	5	3	11	6
Pimephales	1	2	4	2	5	2	5	3	5	3
PESTICIDES										
Aldicarb	1	1	5	1	3	3	5	3	10	6
Atrazine	1	1	7	2	3	3	5	3	10	7
Azinphos methyl	1	1	7	4	3	3	5	2	10	5
Carbaryl	1	1	5	1	3	3	5	3	10	6
Carbofuran	1	1	5	1	3	3	5	3	10	6
Chlorpyrifos	1	1	8	4	3	3	5	3	10	7
Cyanazine			4	1	3	3	5	3	10	7
DDD	1	1	7	2	3	3	5	3	10	6
DDE	1	1	7	2	3	3	5	3	10	6
DDT	1	1	7	2	3	3	5	3	10	6

Table 14a. Sacramento-Amador ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season									
	Big Indian Ck		Cosumnes River		Dry Creek		Grand Island		Laguna Creek	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
Demeton-s	1	1	8	4	3	3	5	3	10	7
Diazinon	1	1	8	4	3	3	5	3	10	7
Dichlorvos	1	1	8	4	3	3	5	3	10	7
Dicofol			4		3	3	5	3	10	6
Dieldrin	1	1	7	2	3	3	5	3	10	6
Dimethoate	1	1	8	4	3	3	5	3	10	7
Disulfoton	1	1	8	4	3	3	5	3	10	7
Diuron	1	1	5	1	3	3	5	3	10	6
Endrin	1	1	7	2	3	3	5	3	10	6
Glyphosate		1	5	1	2	2	5	3	4	2
Linuron	1	1	5	1	3	3	5	3	10	6
Malathion	1	1	8	4	3	3	5	3	10	7
Methamidophos	1		2	2	3	3	5	2	10	5
Methidathion	1	1	8	4	3	3	5	2	10	5
Methiocarb	1	1	5	1	3	3	5	3	10	6
Methomyl	1	1	5	1	3	3	5	3	10	6
Methoxychlor	1	1	7	2	3	3	5	3	10	6
Oxamyl	1	1	5	1	3	3	5	3	10	6
Paraquat		1	5	2	2	1	5	3	4	1
Parathion, Methyl	1	1	8	4	3	3	5	3	10	7
Phorate	1	1	8	4	3	3	5	3	10	7
Phosmet	1	1	8	4	3	3	5	2	10	5
Simazine	1	2	7	2	3	3	5	3	10	7
Trifluralin			1		1				1	
METALS										
Arsenic	1	2	7	2	3	3	5	3	9	6
Boron		2	1	1	3	3	5	3	9	6
Cadmium	1	2	7	2	3	3	5	3	9	6

Table 14a. Sacramento-Amador ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season									
	Big Indian Ck		Cosumnes River		Dry Creek		Grand Island		Laguna Creek	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
Copper	1	2	7	2	3	3	5	3	9	6
Lead	1	2	7	2	3	3	5	3	9	6
Nickel	1	2	7	2	3	3	5	3	9	6
Molybdenum										
Selenium	1	2	7	2	3	3	5	3	9	6
Zinc	1	2	7	2	3	3	5	3	9	7
NUTRIENTS										
Total Kjeldahl Nitrogen	2	2	8	2	3	3	5	3	10	6
Nitrate + Nitrite as N	1	1	2	2	3	3	5	3	10	6
Total Ammonia		2	6	3	3	4	5	3	10	6
Total Phosphorous as P	2	2	8	2	3	3	5	3	10	6
Soluble Orthophosphate		1	4	2	4	3	5	3	10	6
SEDIMENT TOXICITY										
Hyalella	1		2		1	1	1	1	2	2

Table 14b. Sacramento-Amador ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL					
pH	55	7	4.84	8.82	pH Units
Electrical Conductivity	56	2	51	13000	uS/cm
Dissolved Oxygen	55	6	0.91	15.9	mg/L
Temperature	55	0	8.13	33.5	C
Total Dissolved Solids	52	4	32	940	mg/L
Total Suspended Solids	52	0	ND	350	mg/L
Total Organic Carbon	46	0	0.72	44	mg/L
Turbidity	52	0	0.32	190	NTU
PATHOGENS					
E-coli	45	11	8	2400	MPN/100 ml
WATER COLUMN TOXICITY					
Selenastrum	39	1	91	520	% control
Ceriodaphnia	42	4	5	111	% control
Pimephales	32	0	90	103	% control
PESTICIDES					
Aldicarb	38	0	ND	ND	ug/L
Atrazine	42	1	ND	2.6594	ug/L
Azinphos methyl	41	0	ND	ND	ug/L
Carbaryl	38	0	ND	ND	ug/L
Carbofuran	38	0	ND	ND	ug/L
Chlorpyrifos	45	0	ND	0.0094	ug/L
Cyanazine	36	0	ND	ND	ug/L
DDD	41	0	ND	ND	ug/L

Table 14b. Sacramento-Amador ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
DDE	41	1	ND	0.0032	ug/L
DDT	41	1	ND	0.0105	ug/L
Demeton-s	45	0	ND	ND	ug/L
Diazinon	45	0	ND	0.0068	ug/L
Dichlorvos	45	0	ND	ND	ug/L
Dicofol	34	0	ND	ND	ug/L
Dieldrin	41	0	ND	ND	ug/L
Dimethoate	45	0	ND	0.0244	ug/L
Disulfoton	45	0	ND	ND	ug/L
Diuron	38	0	ND	1.5	ug/L
Endrin	41	0	ND	ND	ug/L
Glyphosate	25	0	ND	7.5	ug/L
Linuron	38	0	ND	ND	ug/L
Malathion	45	0	ND	ND	ug/L
Methamidophos	33	0	ND	ND	ug/L
Methidathion	42	0	ND	ND	ug/L
Methiocarb	38	0	ND	ND	ug/L
Methomyl	38	0	ND	ND	ug/L
Methoxychlor	41	0	ND	ND	ug/L
Oxamyl	38	0	ND	ND	ug/L
Paraquat	24	0	ND	ND	ug/L
Parathion, Methyl	45	0	ND	ND	ug/L
Phorate	45	0	ND	ND	ug/L
Phosmet	42	0	ND	ND	ug/L
Simazine	43	0	ND	0.83	ug/L
Trifluralin	3	0	ND	ND	ug/L
METALS					
Arsenic	41	1	ND	7.9	ug/L
Boron	33	0	ND	650	ug/L

Table 14b. Sacramento-Amador ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Cadmium	41	0	ND	0.06	ug/L
Copper	41	0	ND	6.8	ug/L
Lead	41	0	ND	1.7	ug/L
Nickel	41	0	ND	19	ug/L
Molybdenum	0				ug/L
Selenium	41	0	ND	1.4	ug/L
Zinc	42	0	ND	34	ug/L
NUTRIENTS					
Total Kjeldahl Nitrogen	44	0	ND	3.6	mg/L
Nitrate + Nitrite as N	36	1	ND	12	mg/L
Total Ammonia	42	0	ND	0.42	mg/L
Total Phosphorous as P	44	0	ND	1.8	mg/L
Soluble Orthophosphate	38	0	ND	3.1	mg/L
SEDIMENT TOXICITY					
Hyalella	11	4	30	100	% control

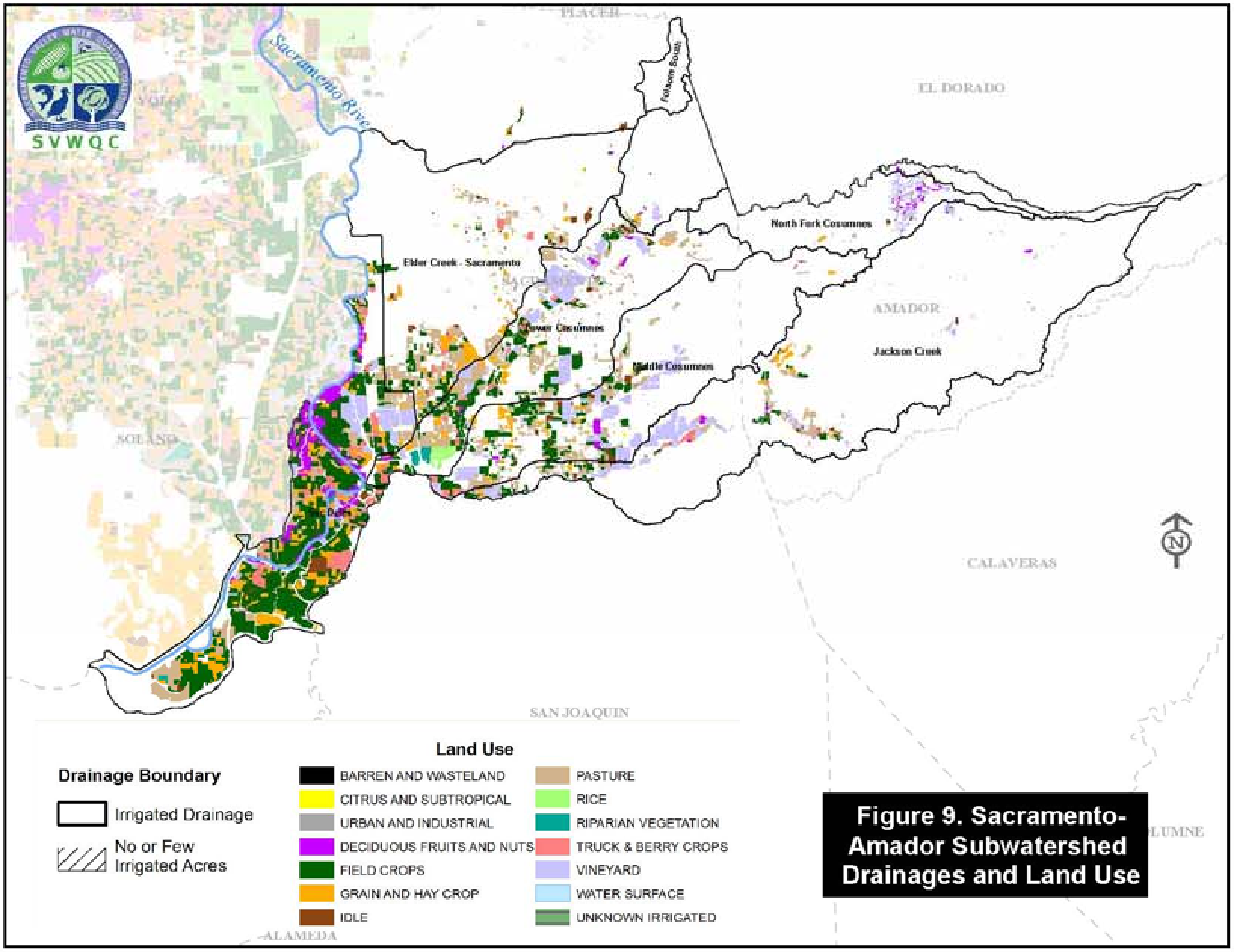

Figure 9. Sacramento-Amador Subwatershed Drainages and Land Use

Shasta-Tehama Subwatershed

The Shasta-Tehama Subwatershed is located in the north central part of California and encompasses approximately 2.7 million acres within Shasta and Tehama counties (Figure 1). These counties are contiguous from north to south and represent a hydrologic unit that is framed by Shasta Dam to the north and the political boundaries associated with Glenn and Butte counties to the south. The subwatershed area is bounded by the convergence of the Klamath and Coastal Mountain Ranges to the west and northwest and the Cascade Mountain Range to the east. The topography varies from the flat valley floor through rolling foothills up to rugged, steep mountains, with elevations ranging from approximately 300 to over 8,000 feet above sea level.

Industries that process forest and agricultural products account for a majority of the economic activity in the Shasta-Tehama subwatershed area. Over 80 percent of the total land area is dedicated in varying degrees of intensity to the production of food and fiber.

Within the scope of the Irrigated Lands Regulatory Program, the Shasta-Tehama Subwatershed is characterized as an agricultural area that supports irrigated orchards, a diversity of irrigated field crops, and irrigated pasture for livestock. These crops comprise approximately 156,700 acres or a little more than 5% of the total acres in the subwatershed, located primarily in the floodplains of the Sacramento River and its tributaries. Agriculture is primarily a family-owned and operated industry. The individual farm size averages about 900 acres, but there are significant numbers of smaller farms that are operated by people whose principal occupation is not farming.

Significant Subwatershed Characteristics

Weather patterns in the Shasta-Tehama Subwatershed are dominated by cool, wet winters and dry, hot summers. Large elevation differences influence temperatures significantly, with valley regions experiencing very hot, dry summers and temperate winters, and mountainous areas experiencing warm, dry summers and very cold winters.

Annual precipitation varies in the two county areas from less than 20 inches near Red Bluff and Corning to more than 70 inches in the surrounding mountains. During winter storms, snowpack and precipitation is concentrated at the upper end of the valley around the convergence of the mountain ranges. Major winter storms often result in intense precipitation over a short duration, with 90% of the precipitation occurring between October-April. The pattern is one of large cyclic storms in the winter and spring with only infrequent thunderstorms in the summer.

There is a 230 to 260 day growing season in the valley floor. The first frost can be expected in the middle of November and the last frost around the first of March. In the higher elevations, the frost-free growing season can be as short as 70 days. Dominant winds are north-northwest and south-southwest and they can blow from two to forty miles per hour. Dry north winds are common in late spring, summer and fall. Soils and vegetation are rapidly dried out by these winds. Depending on the spring rainfall, temperature, and wind conditions on the valley floor, the irrigation season typically begins sometime in April or May but can begin as late as June. Peak periods of irrigation occur in July and August and begin to curtail in September and end in October.

Soils vary depending on their relative proximity to the Sacramento River. Deep alluvial soils exist along the east and west sides of the Sacramento River corridor and adjacent to many of its tributaries in Shasta and Tehama Counties. Typically, these soils are located within one (1) mile of the Sacramento River or its tribuataries. These soils have traditionally been the first to be developed into irrigated crops and in particular orchard crops. In the past decade some areas within this corridor have been removed from agriculture as part of river and stream restoration efforts. Terrace soils exist further west and east of the river corridor (distances typically greater than one (1) mile from the river and its tributaries). The soils are not as deep as the alluvial soils along the Sacramento River and its tributaries and have more limitations on their suitability for irrigated agricultural production. However, in the past decade, due to greater competition for land within the river corridor and more widespread use of drip and microsprinkler irrigation, many of these terrace soils have been and continue to be developed into irrigated agriculture (principally orchard crops such as almond, olive, prune, and walnut).

Agriculture and Crops

Total irrigated acreage in Shasta and Tehama counties is approximately 39,964 acres and 116,762 irrigated acres, respectively. In Shasta County, irrigated pasture is the predominant crop accounting for 27,656 acres, or 69 percent, of the total irrigated cropland. Orchard crops, field and forage crops, and eucalyptus make up the remainder of the irrigated acreage in Shasta County. Alfalfa/grass and small grains (grown for hay, green manure crops, or grain) and English walnuts are the second and third most widely grown irrigated crops in Shasta County, but these crops do not exceed 2,800 acres or more than about 7 percent of the total irrigated cropland. Idle cropland with a history of irrigation accounts for 4,422 acres or 11 percent of the total irrigated cropland in Shasta County.

Tehama County has substantially more irrigated acreage and greater crop diversity than Shasta County. Orchard crops account for 40,689 acres or 35 percent of the total irrigated cropland. English walnuts, prunes, almonds, and olives are the four major orchard crops in the county. Smaller acreages of permanent crops such as pecan, pistachio, peach, figs, wine grapes, and berries are grown in the county. Irrigated pasture accounts for 27,117 acres or 23 percent of the irrigated acres, the second largest fraction of cropland in Tehama County. Alfalfa, oats, barley, and wheat grown for hay, forage, or as green manure crops total 15,269 acres or 13 percent of the total irrigated acreage in Tehama County, the third largest fraction of irrigated cropland. Field and row crops such as wheat, corn, dry beans, rice, and vegetables account for 12,899 irrigated acres or 11 percent of the total irrigated cropland in Tehama County.

None of these individual field or row crops account for more than 3.6 percent of the irrigated acreage in Tehama County.

The Shasta-Tehama Subwatershed encompasses 35 drainages where irrigated agriculture is present. Table 15 lists the drainages by name and the crops grown within each drainage area. Figure 10 shows the location and relative extent of the drainages.

Table 15. Shasta-Tehama Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring Site	Anderson Creek	Pasture, Walnuts, Prunes, Olives, Almonds, Eucalyptus
Represented by Anderson Creek monitoring site	Rice/Burch Creek	Pasture, Walnuts, Prunes, Almond, Olives, Rice
	Elder Creek	Pasture, Walnuts, Prunes, Almond, Olives
	Kopta Slough	Pasture, Walnuts, Prunes, Almond, Olives
	Cottonwood Creek	Pasture, Walnuts, Prunes, Almond, Olives
	Salt Creek	Pasture, Walnuts, Prunes, Almond, Olives
	Thomes Creek	Pasture, Walnuts, Prunes, Almond, Olives
	Coyote Creek	Pasture, Walnuts, Prunes, Almond, Olives
	Red Bank Creek	Pasture, Walnuts, Prunes, Almond, Olives
	Antelope Creek	Pasture, Walnuts, Prunes, Olives, Eucalyptus
	Jewett Creek	Pasture, Walnuts, Prunes, Almond, Olives
	Vina-Hoag N/Dicus Slough	Pasture, Walnuts, Prunes, Almond, Olives, Grains, Safflower
	Capay (SE Birch Creek)	Pasture, Prunes, Almond, Olives, Eucalyptus
	McClure Creek	Pasture, Walnuts, Prunes, Olives, Eucalyptus
	Dry Creek – Tehama	Pasture, Walnuts, Prunes, Olives, Grains
	Cow Creek	Pasture, Walnuts, Grains
	Battle Creek	Pasture, Walnuts, Prunes, Eucalyptus, Grains
	Deer Creek – Tehama	Pasture, Walnuts, Prunes, Almond, Eucalyptus
	Stillwater Creek	Pasture, Walnuts, Almonds, Olives, Euralyptus
	Foster Island (NE Birch Ck)	Pasture, Walnuts, Prunes, Olives, Eucalyptus
	Dye Creek	Pasture, Walnuts, Prunes
	Mill Creek	Pasture, Walnuts, Prunes, Eucalyptus, General Field Crops
	Paynes Creek	Pasture, Walnuts, Prunes, Eucalyptus, Grain
	Paynes Slough	Pasture, Walnuts, Prunes, Almond, Grain, Wheat
	Reeds	Pasture, Olives, Grain, Kiwis, Plums
	Jelly School	Pasture, Walnuts, Prunes, Almonds, Eucalyptus
	Bear Creek	Pasture, Grain
	Lower Clear Creek	Pasture, Grain
	Dibble Creek	Pasture, Olives, Wheat
	Rancheria Creek	Pasture, Safflower, Strawberries
	Blue Tent Creek	Pasture, Grain
	Middle Clear Creek	Pasture
	Inks Creek	Pasture, Wheat
	Upper Clear Creek	Pasture
	North and adjacent Paynes Slough	Walnuts

Hydrology, Water Management, and Irrigation Methods
The Shasta-Tehama Subwatershed area drains naturally toward the Sacramento River (Figure 1). Twenty-seven year-round or seasonal tributaries to the Sacramento River occur in the Shasta-Tehama area. The major tributaries include Clear Creek, Cow Creek, Cottonwood Creek, Dry Creek, Elder Creek, Thomes Creek, Bear Creek, Battle Creek, Mill Creek, and Deer Creek. Landowners and operators of irrigated lands within many of these drainages either retain water rights and divert surface water, or use groundwater for irrigation. These tributaries receive irrigation and stormwater return flow and provide essential drainage to agricultural landowners and operators in their respective watersheds.

There are two diversions on the Sacramento River between Shasta Dam (Shasta County) and the southern county line of Tehama County that are part of the Central Valley Water Project: 1) the Anderson Cottonwood Irrigation District Diversion located in Northern Redding (near River Mile 299) and the Red Bluff Diversion located just south of Red Bluff at River Mile 243. The Red Bluff diversion provides water for the Tehama Colusa Canal Authority and the Corning Canal Water District. In combination, the two entities deliver water to about 17 water districts representing about 150,000 acres of irrigated land along the Westside of the Sacramento River located in Tehama, Glenn, Colusa, and Yolo Counties.

In Tehama County, about 80 percent of the total annual water use is for irrigation purposes. Approximately 10 percent of the annual water use contributes to groundwater recharge due to conveyance losses from streams, canals, and ditches. The balance of the water use (about 10 percent) is for domestic, industrial, and environmental uses. In Tehama County, groundwater (~63%) and small stream diversions (~27%) are the primary sources of water used to meet irrigation needs. While the Red Bluff Diversion (part of the Central Valley Project) is in Tehama County, a relatively small proportion (<10%) of the county’s water demand is supplied by project water. A number of water purveyors (e.g. Corning Water District, Proberta Water District, El Camino Irrigation District, and Kirkwood Water District) provide water through pipeline distribution systems to reduce seepage and evaporation losses.

Water conservation is emphasized and evident in Tehama County. Drip and microsprinkler irrigation have been used widely in orchard crops for more than a decade throughout the county and are being adopted almost exclusively in new orchard plantings. Efficient on-farm irrigation management has been promoted for more than a decade by public and private sectors. Examples include the Mobile Irrigation Lab provided by the Tehama County Resource Conservation District, irrigation education and research by the University of California Cooperative Extension in Tehama County, and private consulting firms that specialize in monitoring and aiding in on-farm water management decisions. The Natural Resources Conservation Service supports several irrigation system conversions from flood and hand line sprinkler systems to drip and microsprinkler irrigation each year through the Environmental Quality Incentive Program (EQIP) and other programs.

Shasta County is more reliant on Central Valley Project water than Tehama County, which reflects unique differences in water resources and infrastructure, as well as the types of irrigated crops grown in the respective counties. In Shasta County, about 67 percent of the total annual water demand is supplied by Central Valley Project water. Nine of 12 water purveyors rely in whole or part on surface water deliveries from the Central Valley Project. About 19 percent of the water use is supplied by groundwater, and the balance (about 11 percent) is supplied by stream diversion. Flood irrigation of pastures for livestock grazing is common in Shasta County, since the beef cattle industry is predominant in the county.

Water management practices in Shasta-Tehama Subwatershed include pre-planting irrigation, crop hydration, frost prevention, and runoff management. A variety of irrigation methods are used including drip, furrow, flood, and sprinkler.

Management Practices Information

Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant BMPs, regulations, and preventative measures are discussed with the property operator prior to issuance of permits.

A number of water quality protection projects have been implemented in Shasta and Tehama Counties with guidance and assistance from the University of California Cooperative Extension (UCCE), Natural Resources Conservation Service, and Resource Conservation Districts. These projects may address irrigation or stormwater related impacts to water quality. The BMPs and projects currently implemented by growers have been partially documented by the Shasta-Tehama Subwatershed coordinators. A comprehensive list and evaluation of projects and BMPs has not been performed as of preparation of this Order. Examples of implemented management practices and BMPs that may help protect water quality in this watershed include:

- Resident vegetation or cover crops between rows and adjacent to field edges,
- Filter strips and grassed waterways,
- Integrated Pest Management Practices to determine the need for pesticides,
- Integrated Pest Management Practices that limit environmental exposure to pesticides,
- Soil and plant tissue testing to determine the need for fertilizers,
- Fertilizer practices that limit the environmental exposure of nutrients,
- Irrigation Mobile Lab Service,
- Use of knowledge and techniques to aid irrigation management decisions,
- Underground pipeline for irrigation water conveyance,
- Micro-irrigation and sprinkler systems
- Tailwater recovery and recirculation systems,
- Water control structures,
- Fencing to manage grazing rotation,
- Off-stream livestock watering, and
- Streambank stabilization.

UCCE staff conducts problem solving research and demonstration projects and regular outreach activities in the Shasta-Tehama Subwatershed. Permanent UCCE staff serving the area include two Natural Resource and Livestock Farm Advisors, a Tree Fruit and Nut Crops Farm Advisor, and an Irrigation and Water Resources Farm Advisor.

Monitoring Site Selection

The Anderson Creek at Ash Creek Road was selected to represent irrigated agriculture throughout the Shasta-Tehama Subwatershed. As shown in Table 15, this drainage includes the major crops and agricultural activities that exist within the subwatershed area. The Anderson Creek drainage has a relatively high percent of irrigated agriculture, and is one of the few streams in the region with year-round flows, allowing for sampling during irrigation season. Monitoring for the ILRP has been conducted annually at this site since 2006. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

Past Water Quality Monitoring

Water Quality monitoring has been conducted by the Sacramento Valley Coalition and Shasta-Tehama Subwatershed since 2006. Tables 16a and 16b summarize monitoring parameters and results from the Shasta-Tehama Subwatershed monitoring results. In addition, the Coalition measured or analyzed 73 additional constituents (physical parameters, microbiological organisms, metals, and pesticides) at approximately the same frequency as those listed in Table 16a. No exceedances (except fecal coliform) were observed in the additional measurements. Although the additional measurements and analyses were not required for ILRP monitoring, valuable information regarding the chemicals was documented and can easily be compiled and evaluated, as needed.

Table 16a. Shasta-Tehama ILRP Monitoring Data Summary: Parameter Analyses by Site (2006-2008)

	Number of Analyses by Site and Season							
	Anderson Ck		Burch Ck Woodson		Burch Ck Rawson		Coyote Ck	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
GENERAL								
pH	10	4	3	4	1	1	10	5
Electrical Conductivity	10	4	3	4	1	1	10	5
Dissolved Oxygen	10	4	3	4	1	1	10	5
Temperature	10	4	3	4	1	1	10	5
Total Dissolved Solids	10	5	1	4	1		6	5
Total Suspended Solids	10	5	1	4	1		7	5
Total Organic Carbon	10	3	1	4	1		6	4
Turbidity	10	5	1	4	1		6	5
PATHOGENS								
E-coli	10	4	1	3	1		7	5
WATER COLUMN TOXICITY								
Selenastrum	5	2	1	4	1		7	4
Ceriodaphnia	5	2	1	5	1	1	7	4
Pimephales	5	2	1	4	1	1	5	3
PESTICIDES								
Aldicarb							7	5
Atrazine		1		1				
Azinphos methyl	5	2	1	3	1	1	7	4
Carbaryl							7	5
Carbofuran							7	5
Chlorpyrifos	5	2	1	3	1	1	7	5
Cyanazine		1		1				
DDD		1		1				

Table 16a. Shasta-Tehama ILRP Monitoring Data Summary: Parameter Analyses by Site (2006-2008)

	Number of Analyses by Site and Season							
	Anderson Ck		Burch Ck Woodson		Burch Ck Rawson		Coyote Ck	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
DDE		1		1				
DDT		1		1				
Diazinon	5	2	1	3	1	1	7	5
Dichlorvos	5	2	1	3	1	1	7	5
Dicofol								
Dieldrin		1		1				
Dimethoate	5	2	1	3	1	1	7	5
Dimeton-s	5	2	1	3	1	1	7	5
Disulfoton (Disyton)	5	2	1	3	1	1	7	5
Diuron							7	5
Endrin		1		1				
Glyphosate							1	1
Linuron							7	5
Malathion	5	2	1	3	1	1	7	5
Methamidophos	1		1	2			7	4
Methidathion	5	2	1	3	1	1	7	4
Methiocarb							7	5
Methomyl							7	5
Methoxychlor		1		1				
Methyl Parathion	5	2	1	3	1	1	7	5
Oxamyl							7	5
Paraquat Dichloride							1	1
Phorate	5	2	1	3	1	1	7	5
Phosmet	5	2	1	3	1	1	7	4
Simazine		1		1				
Trifluralin	1						2	2
METALS								
Arsenic	5	4		2	1		7	5

Table 16a. Shasta-Tehama ILRP Monitoring Data Summary: Parameter Analyses by Site (2006-2008)

	Number of Analyses by Site and Season							
	Anderson Ck		Burch Ck Woodson		Burch Ck Rawson		Coyote Ck	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
Boron	5	3					7	5
Cadmium	5	4		2	1		7	5
Copper	5	4		2	1		7	5
Lead	5	4		2	1		7	5
Nickel	5	4		2	1		7	5
Molybdenum								
Selenium	5	4		2	1		7	5
Zinc	5	4		2	1		7	5
NUTRIENTS								
Total Kjeldahl Nitrogen	5	2		2	1		6	5
Nitrate + Nitrite as N	3	2		2			6	5
Total Ammonia	5	2	1	3	1	1	6	5
Total Phosphorous as P	5	2		2	1		6	5
Soluble Orthophosphate	4	2		2			6	5
SEDIMENT TOXICITY								
Hyalella	1	1		1			2	2

Table 16b. Shasta-Tehama ILRP Monitoring Data Summary: Total Analyses and Exceedances (2006-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL					
pH	38	2	6.02	9.05	pH Units
Electrical Conductivity	38	0	54	423	uS/cm
Dissolved Oxygen	38	24	0.56	15.42	mg/L
Temperature	38	0	5.68	26.93	C
Total Dissolved Solids	32	0	63	310	mg/L
Total Suspended Solids	33	0	ND	22	mg/L
Total Organic Carbon	29	0	1.9	15	mg/L
Turbidity	32	0	0.25	55	NTU
PATHOGENS					
E-coli	31	14	ND	2400	MPN/100 ml
WATER COLUMN TOXICITY					
Selenastrum	24	1	70	715	% control
Ceriodaphnia	26	4	0	111	% control
Pimephales	22	0	85	105	% control
PESTICIDES					
Aldicarb	12	0	ND	ND	ug/L
Atrazine	2	0	ND	ND	ug/L
Azinphos methyl	24	0	ND	ND	ug/L
Carbaryl	12	0	ND	ND	ug/L
Carbofuran	12	0	ND	ND	ug/L
Chlorpyrifos	25	0	ND	ND	ug/L
Cyanazine	2	0	ND	ND	ug/L
DDD	2	0	ND	ND	ug/L

Table 16b. Shasta-Tehama ILRP Monitoring Data Summary: Total Analyses and Exceedances (2006-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
DDE	2	0	ND	ND	ug/L
DDT	2	0	ND	ND	ug/L
Diazinon	25	1	ND	0.316	ug/L
Dichlorvos	25	0	ND	ND	ug/L
Dicofol	0	0	ND	ND	ug/L
Dieldrin	2	0	ND	ND	ug/L
Dimethoate	25	0	ND	ND	ug/L
Dimeton-s	25	0	ND	ND	ug/L
Disulfoton (Disyton)	25	0	ND	ND	ug/L
Diuron	12	0	ND	ND	ug/L
Endrin	2	0	ND	ND	ug/L
Glyphosate	2	0	ND	ND	ug/L
Linuron	12	0	ND	ND	ug/L
Malathion	25	1	ND	0.0124	ug/L
Methamidophos	15	0	ND	ND	ug/L
Methidathion	24	0	ND	ND	ug/L
Methiocarb	12	0	ND	ND	ug/L
Methomyl	12	0	ND	ND	ug/L
Methoxychlor	2	0	ND	ND	ug/L
Methyl Parathion	25	0	ND	ND	ug/L
Oxamyl	12	0	ND	ND	ug/L
Paraquat Dichloride	2	0	ND	ND	ug/L
Phorate	25	0	ND	ND	ug/L
Phosmet	24	0	ND	ND	ug/L
Simazine	2	0	ND	0.0132	ug/L
Trifluralin	5	0	ND	ND	ug/L
METALS					
Arsenic	24	0	ND	3.2	ug/L
Boron	20	0	13	68	ug/L

Table 16b. Shasta-Tehama ILRP Monitoring Data Summary: Total Analyses and Exceedances (2006-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Cadmium	24	0	ND	0.3	ug/L
Copper	24	0	0.2	3.1	ug/L
Lead	24	0	ND	0.17	ug/L
Nickel	24	0	1	6.9	ug/L
Molybdenum	0				ug/L
Selenium	24	0	ND	1	ug/L
Zinc	24	0	1	24	ug/L
NUTRIENTS					
Total Kjeldahl Nitrogen	21	0	ND	2.1	mg/L
Nitrate + Nitrite as N	18	0	ND	3.5	mg/L
Total Ammonia	24	0	ND	0.16	mg/L
Total Phosphorous as P	21	0	0.042	0.61	mg/L
Soluble Orthophosphate	19	0	ND	0.46	mg/L
SEDIMENT TOXICITY					
Hyalella	7	1	95	108	% control

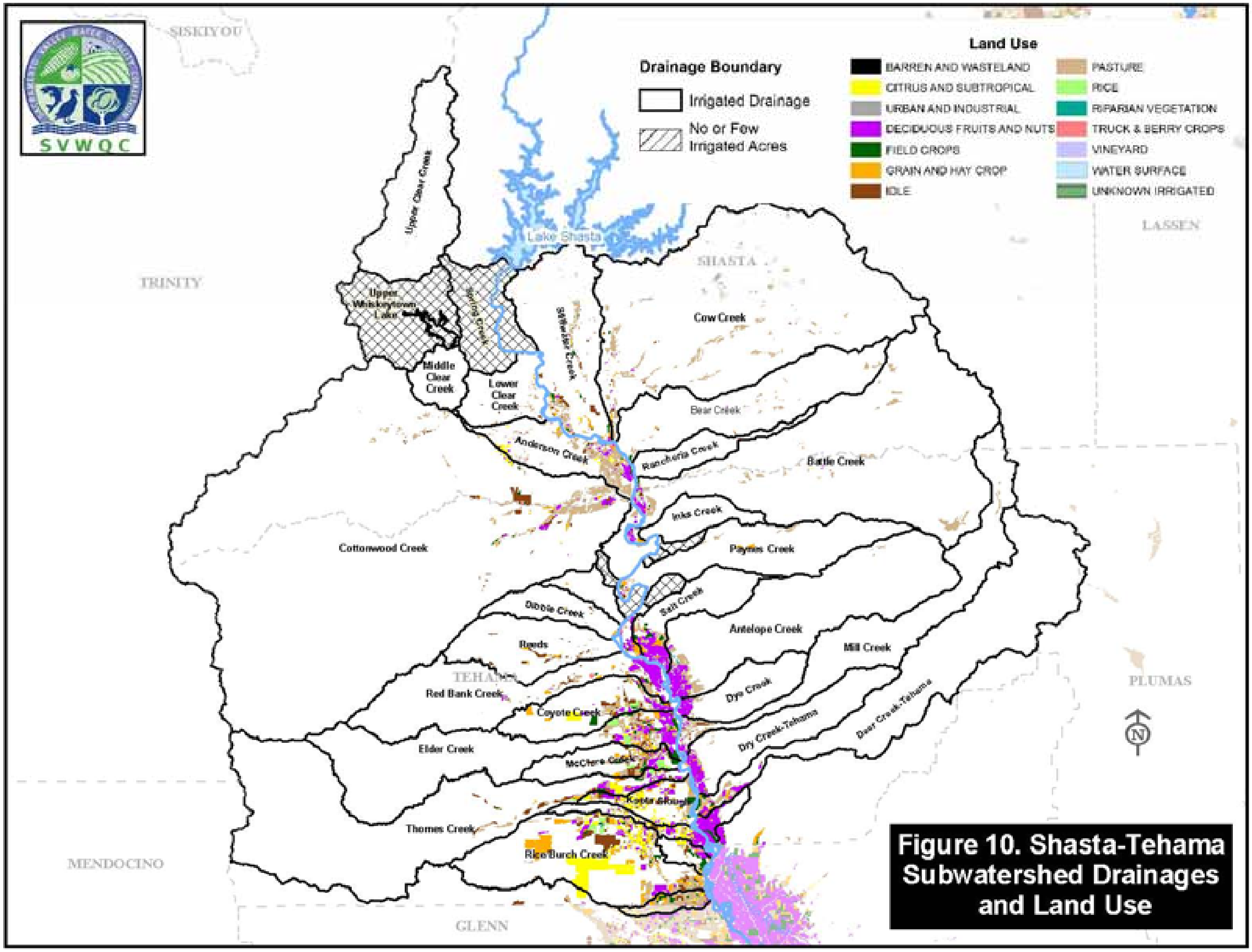

Figure 10. Shasta-Tehama Subwatershed Drainages and Land Use

Solano-Yolo Subwatershed

The Solano-Yolo Subwatershed encompasses approximately 872,000 acres on the lower portion and west side of the Sacramento Valley, and includes all of Yolo County south of Cache Creek and roughly half of Solano County. This subwatershed area is bounded on the east by the Sacramento River, on the west by the California Coast Ranges, on the north by the Yolo County line, and on the south and southwest by sloughs and wetlands of the Grizzly Island area near the Delta (Figure 1). Topography varies from a nearly level or gently sloping landscape in the eastern region, to rolling hills in the southeast and steep mountainous terrain in the west. Elevation ranges from approximately 10 to 2,800 feet above sea level. The southern portion of Solano County contains a large area of tidal flats and marshland adjacent to Suisun Bay that has been cut into islands by a maze of natural drainage channels. Intensive irrigated agriculture occurs in a large portion of the Solano-Yolo Subwatershed, with approximately 518,000 acres currently being farmed, with about 14,000 acres in rice. Some dryland grains are also grown, typically in rotation with other field crops. Other land uses include non-irrigated rangeland, urban and rural residential development, and native woodlands, grasslands, and wetlands.

Significant Subwatershed Characteristics

The key factors relevant to agriculture and water quality in the Solano-Yolo Subwatershed are climate, soils and hydrology. In general, the Mediterranean climate – warm, dry summers and cool to cold, wet winters – is the dominant influence on weather patterns. However, local conditions can differ significantly depending on location and topography. The eastern and northern portion of the subwatershed is characterized by very hot, dry summers and cool to cold winter conditions. In the area to the south and west, near northern San Francisco Bay, the moderating influence of marine air creates relatively cool, humid summers and moderate winter conditions. Throughout the subwatershed, average annual precipitation ranges from 16 to 30 inches per year (varying greatly with location). About 95% of rainfall occurs from October through April. Average maximum temperatures vary from 53°F in winter to 80-96°F in summer. The growing season ranges from 230 to 300 days, depending on elevation.

Soil characteristics play a significant role in both agricultural productivity and water quality conditions. In Solano County, seventeen soil classifications fall into four major groups based on slope, drainage, class and physiographic position of the soils in the landscape. These loams (silty clay, gravelly, and stony) and clays are mostly level to gently sloping. Irrigated crops are grown in both well drained to somewhat poorly drained soils in both Solano and Yolo Counties.

Irrigation is necessary to grow most crops in the Solano-Yolo Subwatershed. A relatively dependable water supply allows the high level of agricultural production that exists today. To achieve this, the natural hydrology of the area was largely altered over the past 150 years, mainly to create the irrigation distribution and drainage system that serves agricultural needs.   Additional information on hydrology and water management is provided below in the *Hydrology, Water Management, and Irrigation Methods* section.

Agriculture and Crops

Solano and Yolo Counties are both intensively cultivated with the majority of land used for irrigated row crops, field crops, and orchards. The leading crops (by acreage) in the Solano County portion of the subwatershed include wine grapes, walnuts, almonds, prunes, pears, tomatoes, corn, alfalfa, wheat, ryegrass, safflower, sudangrass, seed crops, and irrigated pasture. The rolling hills in the southeastern portion of the county are used for dryland grain and pasture of annual grasses. The mountainous uplands are used for rangeland, consisting primarily of oak woodlands and grasslands.

The leading crops (by acreage) in the Yolo County portion of the subwatershed include alfalfa, tomatoes, wheat, rice, barley, beans, sunflowers, almonds, irrigated pasture, wine grapes, corn, walnuts, hay, safflower, seed crops, prunes, and melons. Dryland grain is grown in some areas that are irrigable but do not have an adequate supply of irrigation water. The rolling terraces are used for dryland grain and for pasture of annual grasses. The mountainous uplands consist primarily of oak woodlands and grasslands, and scrub-brush grows on large areas of very shallow soils.

The Solano-Yolo Subwatershed encompasses eight main drainages where irrigated agriculture is present. Table 17 lists the drainages by name and the crops grown within each drainage area. Figure 11 shows the extent of the drainages.

Table 17. Solano-Yolo Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Shag Slough	South Yolo Bypass	Corn, alfalfa, rice, safflower, sunflower, tomatoes, pasture, grain
Represented by Shag Slough monitoring site and partly Ulatis Creek monitoring site (walnuts, almonds, wine grapes, melons)	Southwest Yolo Bypass	Almonds, walnuts, corn, alfalfa, safflower, sunflower, wheat, tomatoes, pasture, grain
	Putah Creek South	Almonds, walnuts, tree fruits, wine grapes, corn, alfalfa, safflower, sunflower, wheat, melons, tomatoes, pasture, grain
Monitoring site in Ulatis Creek	Cache Slough	Almonds, walnuts, tree fruits, wine grapes, corn, alfalfa, safflower, sunflower, wheat, melons, tomatoes, pasture, grain
Represented by Ulatis Creek monitoring site	Sacramento River-Solano	Grain, safflower, pasture
Monitoring site in Willow Slough	Willow Slough	Grain, alfalfa, pasture, corn, tomatoes, rice, walnuts, almonds, wheat, sunflower, prunes,
Represented by Willow Slough monitoring site	Cache Creek	Almonds, walnuts, prunes, corn, alfalfa, rice, safflower, sunflower, wheat, melons, tomatoes, pasture, grain
	North Yolo Bypass	Grain, tomatoes, corn, rice, pasture, safflower

Hydrology, Water Management, and Irrigation Methods
The hydrology of the Solano-Yolo Subwatershed is generally characterized by streams that originate in the Coast Ranges and flow eastward toward the Sacramento River. The largest include Cache Creek, Putah Creek, Cottonwood Slough, Willow Slough, and the Alamo Creek/Ulatis Creek system. There are numerous smaller (mostly intermittent) creeks that also flow eastward from the Coast Ranges and either connect to irrigation delivery systems or merge with other creeks. The southern portion of Solano County contains a large area of tidal flats and marshland that are cut into islands by a maze of natural channels. Several intermittent streams drain the southern portion of the county southward into Suisun Bay. The northern part of Yolo County contains intermittent streams such as Oat Creek and Bird Creek, which drain into the Colusa Basin Drainage Canal. The southeastern portion of Yolo County is mostly drained by pumping.

Where streams originate in the hilly western portion of the subwatershed they generally follow their original pathways. However, as they enter the valley, significant hydrologic alterations have occurred, including straightened channels, dams, water diversions, flood control features, water conveyance canals, and modified stream flow (timing and quantity).

In Solano County, the Ulatis Flood Control Project and many smaller drainage projects serve the agricultural lands by conveying re-circulated irrigation water during the growing season and stormwater runoff during the rainy season. In addition, urban runoff from the City of Vacaville is directed into the Ulatis Flood Control Project through Ulatis Creek and Alamo Creek, which join below Vacaville after flowing through the city. An intricate system of canals, lift pumps, and dams makes it possible to re-use irrigation water many times during the irrigation season. Eventually, irrigation runoff and storm runoff flow through Cache Slough and out to the Sacramento River.

Yolo County maintains a similar, but completely separate, system of canals, ditches and pumps as Solano County to manage both irrigation water deliveries and storm water runoff. As water flows through croplands, tailwater can be collected and distributed for re-use in down-slope fields. Water in many canals, smaller sloughs and ditches is eventually directed to the Willow Slough Bypass, which drains into the Yolo Bypass.

Irrigation water sources in the Solano-Yolo Subwatershed include Lake Berryessa (via Putah Creek), Clear Lake (via Cache Creek), groundwater, and sloughs. In Solano County, irrigation water is obtained from Lake Berryessa for the northwest region, from groundwater in the middle region, and from the Sacramento River (via Haas Slough) for the southeast region. The primary water purveyors are Solano Irrigation District, Main Prairie Irrigation District, and the Bureau of Reclamation. The Solano Irrigation District diverts water at the Lake Solano diversion dam on Putah Creek into the Putah South Canal. This water is then distributed to growers through the system of canals and ditches. The Bureau of Reclamation delivers irrigation water in the southeast region that is pumped from Haas Slough.

In Yolo County, irrigation water is primarily obtained from Clear Lake and groundwater sources. The Yolo County Flood Control and Water Conservation District diverts water at the Capay Diversion Dam on Cache Creek into the Winters Canal and the West Adams Canal. The irrigation water is then distributed to growers through a carefully managed system of canals. These canals are intentionally unlined to allow water to percolate through the substrate and recharge groundwater. Up to 25% of water in the canals goes to groundwater, which can then be accessed via groundwater wells during periods when less water is available from surface water. Several smaller water districts near the Sacramento River also provide irrigation water from the river to adjacent farmlands.

Water management practices in the Yolo-Solano Subwatershed include pre-planting irrigation, crop hydration, frost prevention, salinity management, and runoff management. A variety of irrigation methods are used, including drip, furrow, flood, and sprinkler.

Management Practices Information

Registered agricultural chemicals require permits from the Agricultural Commissioner prior to use. Relevant BMPs, regulations, and preventative measures are discussed with the property operator prior to issuance of permits.

A number of water quality protection projects have been implemented in Yolo and Solano counties with guidance and financial assistance from the Natural Resources Conservation Service and the Resource Conservation Districts. These projects may address irrigation or stormwater related impacts to water quality. The BMPs and projects currently implemented by growers in the subwatershed have not been documented or evaluated as of preparation of this Order. Examples of some typical management practices that may help protect water quality in this watershed include:

- Tailwater recirculation systems,
- Drainage channel stabilization,
- Sediment retention ponds,
- Irrigation Mobile Lab Service,
- Permanent vegetated buffer areas along waterways,
- Drip and micro-spray irrigation systems,
- Conservation tillage, and
- Cover crops between rows in vineyards and orchards.

Monitoring Site Selection

Three monitoring sites were selected to represent the diversity of crops and agricultural practices in the Solano-Yolo Subwatershed. Additionally, these sites typically have year-round flows that permit year-round sampling.

As shown in Table 17 and Figure 11, the Shag Slough site represents a portion of the crops and drainages in the northern and eastern portions of Solano County and southeastern Yolo County. Additionally, the Ulatis Creek site represents crops that are not grown in the Shag Slough drainage, including almonds, walnuts, tree fruits, wine grapes, and melons. Shag Slough has been monitored annually for the ILRP since 2005. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Ulatis Creek monitoring site represents drainages in a large portion of Solano County that is within the Coalition area. Most of the area drains to Ulatis Creek. A wide variety of crops and practices are represented in this area. Ulatis Creek has been monitored annually for the ILRP since 2006. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

The Willow Slough monitoring site represents the drainage areas in Yolo County that are within the Coalition area. Most of the region is drained through the Willow Slough Bypass. Willow Slough has been monitored annually for the ILRP since 2007. Assessment-level monitoring data have been collected and evaluated and provides a significant baseline to examine water quality trends.

Past Water Quality Monitoring

Water quality monitoring has been conducted by the Sacramento Valley Coalition and Solano-Yolo since 2004. Tables 18a and 18b below summarize ILRP monitoring parameters and results from Solano-Yolo monitoring sites. In addition, the Coalition measured or analyzed 73 additional constituents (physical parameters, microbiological organisms, metals, and pesticides) at approximately the same frequency as those listed in Table 18a. No exceedances were observed in the additional measurements. Although the additional measurements and analyses were not required for ILRP monitoring, valuable information regarding the chemicals was documented and can easily be compiled and evaluated, as needed.

Table 18a. Solano-Yolo ILRP Monitoring Data Summary: Parameter Analyses by Site (2004-2008)

	Number of Analyses by Site and Season											
	Shag Slough		Ulatis Creek		Willow Slough		Cache Creek		Tule Canal		Z-Drain	
PARAMETERS	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM	IRRIG	STORM
GENERAL												
pH	20	6	18	5	16	6	15	4	14	6	16	7
Electrical Conductivity	20	6	18	5	16	6	15	4	14	6	15	6
Dissolved Oxygen	20	6	18	5	15	6	15	4	13	6	16	7
Temperature	20	6	18	5	16	6	15	4	14	6	16	7
Total Dissolved Solids	19	7	17	6	13	4	13	4	13	6	13	5
Total Suspended Solids	19	7	13	6	13	4	13	4	13	6	13	5
Total Organic Carbon	19	5	17	4	13	2	14	2	12	6	13	4
Turbidity	19	7	16	6	15	5	12	4	13	6	13	5
PATHOGENS												
E-coli	19	7	17	6	15	5	15	5	14	7	13	5
WATER COLUMN TOXICITY												
Selenastrum	16	6	12	5	12	3	10	3	8	4	13	6
Ceriodaphnia	20	5	11	5	15	3	17	3	8	4	13	6
Pimephales	13	5	11	4	7	2	7	2	7	4	14	6
PESTICIDES												
Aldicarb	6	3	6	3	6	3	6	3				
Atrazine	7	3	7	3	6	3	6	3				
Azinphos methyl	6	2	6	2	6	2	6	2				
Carbaryl	6	3	6	3	6	3	6	3				
Carbofuran	6	3	6	3	7	3	6	3				
Chlorpyrifos	6	3	6	3	10	3	6	3				
Cyanazine	6	3	6	3	6	3	6	3				
DDD	6	3	6	3	6	3	6	3				

Table 18a. Solano-Yolo ILRP Monitoring Data Summary: Parameter Analyses by Site (2004-2008)

	Number of Analyses by Site and Season											
	Shag Slough		Ulatis Creek		Willow Slough		Cache Creek		Tule Canal		Z-Drain	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
DDE	6	3	6	3	6	3	6	3				
DDT	6	3	6	3	6	3	6	3				
Demeton-s	6	3	6	3	6	3	6	3				
Diazinon	6	3	7	6	6	3	6	3		2		
Dichlorvos	6	3	6	3	6	3	6	3	1			
Dicofol	6	3	6	3	6	3	6	3				
Dieldrin	6	3	6	3	6	3	6	3				
Dimethoate	6	3	6	3	7	3	6	3		1		
Disulfoton (Disyton)	6	3	6	3	6	3	6	3				
Diuron	6	4	9	4	9	4	6	3		1	4	
Endrin	6	3	6	3	6	3	7	3				
Glyphosate	6	3	6	3	6	3	6	3				
Linuron	6	3	6	3	6	3	6	3				
Malathion	6	3	8	3	7	3	6	3				
Methamidophos	6	2	7	2	6	2	6	2				
Methidathion	6	2	6	2	6	2	6	2				
Methiocarb	6	3	6	3	6	3	6	3				
Methomyl	6	3	6	3	6	3	6	3				
Methoxychlor	6	3	6	3	6	3	6	3				
Methyl Parathion	6	3	6	3	6	3	6	3				
Oxamyl	6	3	6	3	6	3	6	3				
Paraquat Dichloride	6	3	6	3	6	3	6	3				
Phorate	6	3	6	3	6	3	6	3				
Phosmet	6	2	6	2	6	2	6	2				
Simazine	10	6	11	4	8	4	9	3	1	2	1	
Trifluralin			2	2	4	2	1	1				
METALS												
Arsenic	19	7	13	5	12	4	12	4	8	3	8	2

Table 18a. Solano-Yolo ILRP Monitoring Data Summary: Parameter Analyses by Site (2004-2008)

	Number of Analyses by Site and Season											
	Shag Slough		Ulatis Creek		Willow Slough		Cache Creek		Tule Canal		Z-Drain	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
Boron	17	6	16	6	12	4	14	4	4	2	4	1
Cadmium	10	4	7	5	7	3	6	3	6	1	3	
Copper	19	7	13	5	13	4	14	4	10	3	8	2
Lead	19	7	13	5	14	4	14	4	10	3	7	2
Nickel	19	7	13	5	12	4	12	4	8	3	8	2
Molybdenum												
Selenium	13	6	10	5	12	4	10	4	8	3	6	2
Zinc	19	7	13	5	12	4	11	4	8	3	8	2
NUTRIENTS												
Total Kjeldahl Nitrogen	19	7	12	4	12	4	12	4	7	2	8	2
Nitrate + Nitrite as N	15	5	12	4	13	4	11	4	5	1	3	1
Total Ammonia	6	5	7	4	9	3	6	3	1	1	5	1
Total Phosphorous as P	16	7	13	4	12	4	13	4	5	3	5	2
Soluble Orthophosphate	13	6	12	4	13	3	8	3	1	2	1	1
SEDIMENT TOXICITY												
Hyalella	6	1	3	1	4		4		2		2	2

Table 18b. Solano-Yolo ILRP Monitoring Data Summary: Total Analyses and Exceedances (2004-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL					
pH	133	9	6.79	9.38	pH Units
Electrical Conductivity	131	43	50	1406	uS/cm
Dissolved Oxygen	131	9	3.5	19.9	mg/L
Temperature	133	0	6.7	30.2	C
Total Dissolved Solids	120	29	92	1000	mg/L
Total Suspended Solids	116	0	ND	680	mg/L
Total Organic Carbon	111	0	ND	18	mg/L
Turbidity	121	0	1.5	230	NTU
PATHOGENS					
E-coli	128	29	5.1	2400	MPN/100 ml
WATER COLUMN TOXICITY					
Selenastrum	98	10	11	1152	% control
Ceriodaphnia	110	5	0	111	% control
Pimephales	82	0	89	105	% control
PESTICIDES					
Aldicarb	36	0	ND	ND	ug/L
Atrazine	38	0	ND	0.1225	ug/L
Azinphos methyl	32	0	ND	ND	ug/L
Carbaryl	36	0	ND	ND	ug/L
Carbofuran	37	1	ND	0.72	ug/L
Chlorpyrifos	40	4	ND	0.083	ug/L
Cyanazine	36	0	ND	ND	ug/L
DDD	36	0	ND	ND	ug/L
DDE	36	8	ND	0.0115	ug/L

Table 18b. Solano-Yolo ILRP Monitoring Data Summary: Total Analyses and Exceedances (2004-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
DDT	36	1	ND	0.0033	ug/L
Demeton-s	36	0	ND	ND	ug/L
Diazinon	42	1	ND	0.154	ug/L
Dichlorvos	37	0	ND	0.0146	ug/L
Dicofol	36	0	ND	ND	ug/L
Dieldrin	36	0	ND	ND	ug/L
Dimethoate	38	0	ND	0.7161	ug/L
Disulfoton (Disyton)	36	0	ND	ND	ug/L
Diuron	50	5	ND	23	ug/L
Endrin	37	0	ND	0.0075	ug/L
Glyphosate	36	0	ND	5	ug/L
Linuron	36	0	ND	ND	ug/L
Malathion	39	5	ND	0.455	ug/L
Methamidophos	33	0	ND	0.065	ug/L
Methidathion	32	0	ND	ND	ug/L
Methiocarb	36	0	ND	ND	ug/L
Methomyl	36	0	ND	0.2	ug/L
Methoxychlor	36	0	ND	ND	ug/L
Methyl Parathion	36	0	ND	ND	ug/L
Oxamyl	36	0	ND	ND	ug/L
Paraquat Dichloride	36	0	ND	ND	ug/L
Phorate	36	0	ND	ND	ug/L
Phosmet	32	0	ND	ND	ug/L
Simazine	59	2	ND	11.922	ug/L
Trifluralin	12	0	ND	0.1274	ug/L
METALS					
Arsenic	97	1	1	8	ug/L
Boron	90	33	64	3100	ug/L
Cadmium	55	0	ND	0.1	ug/L

Table 18b. Solano-Yolo ILRP Monitoring Data Summary: Total Analyses and Exceedances (2004-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Copper	102	0	0.7	7.9	ug/L
Lead	102	0	ND	0.94	ug/L
Nickel	97	0	1.3	11	ug/L
Molybdenum	0				ug/L
Selenium	83	0	ND	11	ug/L
Zinc	96	0	ND	33	ug/L
NUTRIENTS					
Total Kjeldahl Nitrogen	93	0	ND	3	mg/L
Nitrate + Nitrite as N	78	0	ND	1.3	mg/L
Total Ammonia	51	0	ND	0.96	mg/L
Total Phosphorous as P	88	0	0.014	1.5	mg/L
Soluble Orthophosphate	67	0	ND	1.4	mg/L
SEDIMENT TOXICITY					
Hyalella	25	4	10	103	% control

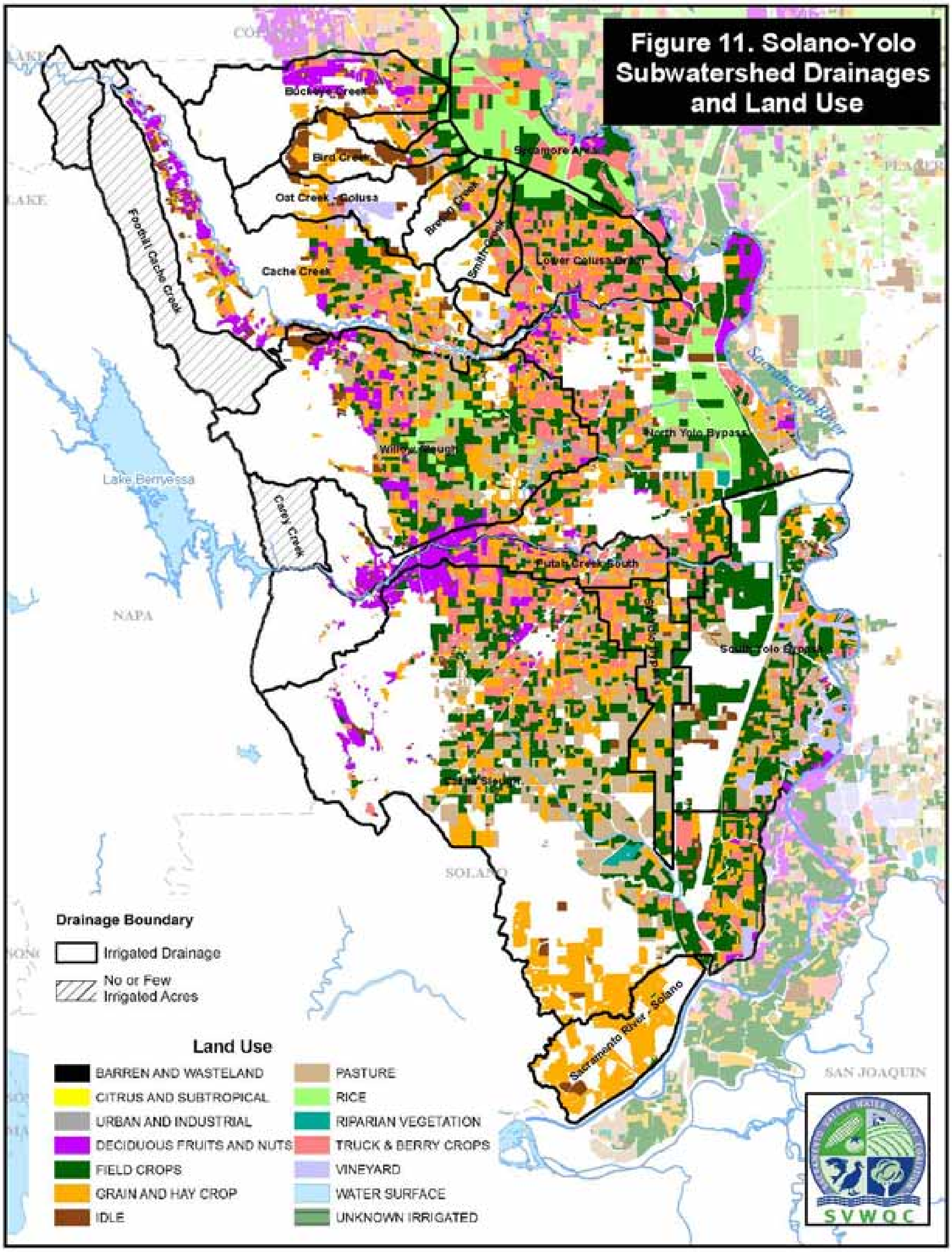
Figure 11. Solano-Yolo Subwatershed Drainages and Land Use
Buckeye Creek
Bird Creek
Sycamore Area
Ost Creek - Colusa
Foothill Cache Creek
Cache Creek
Smith Creek
Lower Colusa Drain
North Yolo Bypass
Willow Slough
Lake Berryessa
Putah Creek South
South Yolo Bypass
NAPA
SOLANO
SAN JOAQUIN
Sacramento River
Sacramento River - Solano
Drainage Boundary
Irrigated Drainage
No or Few Irrigated Acres
Land Use
BARREN AND WASTELAND
CITRUS AND SUBTROPICAL
URBAN AND INDUSTRIAL
DECIDUOUS FRUITS AND NUTS
FIELD CROPS
GRAIN AND HAY CROP
IDLE
PASTURE
RICE
RIPARIAN VEGETATION
TRUCK & BERRY CROPS
VINEYARD
WATER SURFACE
UNKNOWN IRRIGATED
SVWQC

Upper Feather River Subwatershed

The Upper Feather River Subwatershed encompasses an area of approximately 3,222 square miles that drains west from the northern Sierra Nevada through Lake Oroville and the Feather River to the Sacramento River (Figure 1). The topography is characterized by mountainous terrain with elevations that range from 2,250 to over 10,000 feet above sea level, and annual precipitation that varies broadly from 70 inches on the western slopes to less than 12 inches on the arid east side. The Plumas National Forest manages approximately 50% of the watershed, while alluvial valleys are predominantly privately owned with the dominant land use being livestock grazing. Agriculture accounts for 3.5% of land use in Plumas County and 6.7% of land use in Sierra County within the Upper Feather River Subwatershed region.

The Upper Feather River Subwatershed is uniquely divided into three distinct agricultural valleys located in Plumas and Sierra Counties: the Sierra Valley, the Indian Valley and the American Valley. Parallel lying valleys separated by low elevation ridges are common throughout the subwatershed. These valleys once contained ancient lakes that are now alluvial meadow systems.

Significant Subwatershed Characteristics
The key factors relevant to agriculture and water quality in the Upper Feather River Subwatershed are climate, topography, elevation, and soils. In general, the Mediterranean climate – warm, dry summers and cool to cold, wet winters – is the dominant influence on weather patterns. Average annual maximum temperatures range from a low of 30°F to a high of 63°F.

The first fall freeze generally occurs in September in Sierra Valley with May the last month of freezing temperatures. On average, most of the Upper Feather River Subwatershed receives approximately 15 to 60 inches of precipitation per year (15-60 inches in Sierra Valley, 40 inches in American Valley, and 40-45 inches in Indian Valley). Most of the precipitation falls as snow during the winter months with 77 percent of the annual total received between November and March. Rainfall during the summer months is limited to thundershowers 5 to 10 days per year. The growing season, based on the freezing dates, is approximately 60 to 100 days in most valley locations and shortens considerably at upper elevations to approximately 40 to 80 days.

Soil characteristics play an important role in both agricultural productivity and water quality characteristics. The soils in Sierra, Indian and American Valleys are mostly Pachic and Aquic Argixerolls, Aridic Haploxerolls, Typic Haplaquolls, and Aquic Natrargids, plus Abruptic Xerollic Durargids on alluvial fans on the east side of the Sierra Valley. The soils are well to poorly drained. Soil temperature regimes are mesic. Soil moisture regimes are xeric on the west side, commonly aquic on the basin floor, and aridic on the east side of the Sierra valley.

Agriculture and Crops
A generally homogenous set of crops is grown in the Upper Feather River Subwatershed, consisting primarily of hay (alfalfa, meadow, and grain), irrigated pasture, and non-irrigated pasture. Minor crops include nursery, seeds, fruits and potatoes). Plumas County contains 29,472 irrigated acres, including 18,223 acres of pastureland. Sierra County contains 10,012 irrigated acres, including 8,648 acres of pastureland. The predominant agricultural use is cattle production. Timber lands account for the largest land use area and the greatest gross monetary value reported for agricultural commodities in Plumas and Sierra counties.

The Upper Feather River Subwatershed encompasses four main drainage areas. Table 19 lists the drainages by name and the crops grown within each area. Figure 12 shows the extent of the drainages.

Table 19. Upper Feather River Subwatershed Drainages and Crops

Type of Monitoring	Drainages	Crops
Monitoring site in Middle Fork Feather River	Middle Fork Feather River Sierra Valley	Pasture, alfalfa, grass hay, grain hay, nursery, Xmas trees
Monitoring site in Spanish Creek	North Fork Feather River American Valley	Pasture, alfalfa, grass hay, oats, wheat
Monitoring site in Indian Creek	North Fork Feather River Indian Valley	Pasture, alfalfa, grass hay, oats, wheat

Hydrology, Water Management, and Irrigation Methods
The Upper Feather River Watershed is divided into four main branches: the West Branch, the North Fork, the Middle Fork and the South Fork of the Feather River. The West and South branches are relatively small, comprising 106,985 and 81,071 acres, respectively. The North Fork of the Feather River is the largest branch at 1,380,108 acres and its upper reaches are divided into two main branches: the Upper North Fork and the East Branch of the North Fork. The Middle Fork drains the remaining 738,887 acres.

The Upper Feather River Watershed contains many moderate to large size reservoirs, including Lake Almanor, Antelope Lake, Lake Davis, Frenchman Lake, Butt Valley Reservoir, Round Valley Reservoir, and Bucks Lake. These reservoirs are operated for various purposes, including flood control, State Water Project water deliveries, and recreation.

Water management in Upper Feather River Watershed is overseen by numerous local groups organized within the watershed; working both independently to serve drainages, and in a variety of partnerships to support a wide range of watershed programs and projects.

Water users in the Upper Feather River Subwatershed include agricultural, urban, industrial and commercial entities. The amount of irrigated crop area in Plumas and Sierra Counties is approximately 32,700 and 13,000 acres, respectively. Pasture and alfalfa account for most of the irrigated crops acreage in both counties. Irrigation water is typically acquired from rivers and creeks. Water diversion structures and canals are used to obtain and distribute the irrigation water.

A variety of irrigation methods are used, including wild flood, flood, pivot, wheel-line sprinklers, and hand-line sprinklers. Alfalfa fields and pastures are irrigated by flood irrigation and sprinklers. The water comes from either man-made ditches or wells. Flood irrigation is used primarily for pastures. Sprinklers are used by the alfalfa growers.

Management Practices Information

The use of pesticide/herbicides in the Upper Feather River Subwatershed is limited. Data and regulation of pesticide/herbicide use is performed by the Plumas-Sierra County Agricultural Commissioner for the control of noxious weeds and other pests. Growers may obtain site-specific permits from county offices within the Upper Feather River Subwatershed to purchase and use many agricultural chemicals. Pesticide use enforcement staff evaluates each permit application to determine if the pesticide can be used safely and effectively. Some pesticides require advance notice prior to use to assure permit conditions are met. Pesticide use reports are examined to monitor the use of restricted materials and track the agricultural and commercial use of pesticides in each individual county.

Many of the eastside watershed areas are sensitive to a variety of land-use activities, including historic mining, logging, grazing, levee construction, urbanization, public roads, forest fires, and agriculture, and therefore have the potential to exhibit degraded conditions. The alluvial valleys and meadows have been dewatered by creek channel downcutting, and sediment production is frequently high. Streambank and streambed degradation has lowered the water table in the valleys, causing changes in riparian habitat as well as in adjacent grazing lands. Land management practices that suppress the growth of riparian and upland vegetation can exacerbate head-cutting in the tributary streams initiated by rapid runoff and flooding in high water years.

Stormwater runoff and tailwater return flow has the potential to cause water quality problems at agricultural sites in the Upper Feather River Subwatershed. Examples of some typical management practices that have been implemented to help protect water quality in this watershed include:

- Improved application of irrigation water to minimize tailwater return flow.
- Tailwater retention in ponds, ditches, sloughs, and recycle systems.
- Prevention of irrigation discharge where fresh manure has been applied.
- Application of pesticides and other agricultural chemicals at agronomic rates.
- Use of off-site water facilities and water gaps to reduce the direct contact of livestock with watercourses.

- Prevention of drainage from corrals and concentrated feeding areas from direct discharge to watercourses.
- Exclusion fencing and rotational grazing to minimize streambank trampling and maintain riparian vegetation cover.
- Proper construction and maintenance of ranch roads and stream crossings to minimize erosion and sediment discharge to watercourses.
- Protection of wetlands to maintain and improve habitat value and function.

The University of California Cooperative Extension (UCCE) works closely with agriculture landowners to provide education and outreach, and conducted a three year Prop 50 funded UFRW Irrigation Discharge Management Program working with Upper Feather River Watershed Group, the local irrigated lands coalition. NRCS works with agriculture landowners to provide resource and water conservation/quality project funding opportunities.

Numerous local watershed organizations advocate and coordinate resource conservation and restoration projects on public and private lands including Feather River Conservation Resource Management (FRCRM), Feather River Resource Conservation District (FR-RCD) and Sierra Valley Resource Conservation District (SV-RCD. Sierra Valley Groundwater Management District (SVGMD), Sierra Valley Mutual Water Company (SVMWC), Little Last Chance Irrigation District, and Indian Valley Millrace Group also serve agricultural interests in the watershed.

Examples of agriculture management practice implementation projects in the Upper Feather River Subwatershed include:

- Projects that address irrigated lands discharges and mitigate data-supported agricultural contributions to water quality concerns in the UFRW.
- Projects that facilitate sound grazing management to enhance riparian areas, help protect streambanks and improve water quality of irrigation discharges.
- Projects that increase irrigation use efficiency to enhance productivity, ensure viability of the limited agricultural lands in the watershed, and preserve the open space habitats provided by those lands.
- Projects to develop tailwater buffer zones and sediment traps to mitigate potential impacts of tailwater discharges.
- Substantial wet season storage of water in fields is generally degrading to permanent and fall planted crops and not beneficial to alfalfa fields; potentially encourages growth of poorer quality grasses in pasture operations.
- Projects that improve streambank stabilization, reduce erosion, and buffer flood events.
- Projects that improve natural stream and floodplain function resulting in improved water retention during the wet season and slower release of wet meadow storage during the dry season.

Monitoring Site Selection

Three monitoring sites were selected to represent the crops and agricultural practices in the three distinct valleys of the Upper Feather River Subwatershed. As shown in Table 19, the Middle Fork Feather River site represents the Sierra Valley, the Indian Creek site represents Indian Valley, and the Spanish Creek site represents the American Valley. Monitoring for the ILRP has been conducted annually since 2005.

Past Water Quality Monitoring

Water quality monitoring has been conducted by the Sacramento Valley Coalition and Upper Feather River Subwatershed since 2005. Tables 20a and 20b summarize ILRP monitoring parameters and results from Upper Feather River monitoring sites. Many pesticides are not used by agriculture in the Upper Feather River Subwatershed and, therefore, were not analyzed under the ILRP.

Table 20a. Upper Feather River ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season											
	Indian Ck @ Arlington Bridge		Indian Ck DS of Indian Valley		Middle Fk Feather US Grizzly Ck		Middle Fk Feather CR-A23		Spanish Ck US Greenhorn Ck		Spanish Ck DS Greenhorn Ck	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
GENERAL												
pH	9	3	5	4	4	1	9	6	5	4	9	3
Electrical Conductivity	4	2	5	4	4	1	5	6	5	4	4	2
Dissolved Oxygen	9	4	12	5	4	1	16	8	11	5	9	4
Temperature	5	3	12	5			16	8	11	5	5	3
Total Dissolved Solids			5	4			5	3	5	4		
Total Suspended Solids	4	2	5	4	4	1	5	5	5	4	4	2
Total Organic Carbon			5	4			5	3	5	4		
Turbidity	4	2	5	4	4	1	5	5	5	4	4	2
PATHOGENS												
E-coli	4	2	5	3	4	1	5	5	5	3	4	2
WATER COLUMN TOXICITY												
Selenastrum	4	2					4	1			4	2
Ceriodaphnia	4	2					4	1			4	2
Pimephales	4	2					4	1			4	2
PESTICIDES												
Aldicarb												
Atrazine												
Azinphos methyl												
Carbaryl												
Carbofuran												
Chlorpyrifos												
Cyanazine												
DDD												

Table 20a. Upper Feather River ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season											
	Indian Ck @ Arlington Bridge		**Indian Ck DS of Indian Valley**		**Middle Fk Feather US Grizzly Ck**		**Middle Fk Feather CR-A23**		**Spanish Ck US Greenhorn Ck**		**Spanish Ck DS Greenhorn Ck**	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
DDE												
DDT												
Demeton-s												
Diazinon												
Dichlorvos												
Dicofol												
Dieldrin												
Dimethoate												
Disulfoton (Disyton)												
Diuron												
Endrin												
Glyphosate												
Linuron												
Malathion												
Methamidophos												
Methidathion												
Methiocarb												
Methomyl												
Methoxychlor												
Methyl Parathion												
Oxamyl												
Paraquat Dichloride												
Phorate												
Phosmet												
Simazine												
Trifluralin												

Table 20a. Upper Feather River ILRP Monitoring Data Summary: Parameter Analyses by Site (2005-2008)

	Number of Analyses by Site and Season											
	Indian Ck @ Arlington Bridge		Indian Ck DS of Indian Valley		Middle Fk Feather US Grizzly Ck		Middle Fk Feather CR-A23		Spanish Ck US Greenhorn Ck		Spanish Ck DS Greenhorn Ck	
PARAMETERS	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**	**IRRIG**	**STORM**
METALS												
Arsenic			1	1			1	1	1	1		
Boron			1	1			1	1	1	1		
Cadmium			1	1			1	1	1	1		
Copper			1	1			1	1	1	1		
Lead			1	1			1	1	1	1		
Nickel			1	1			1	1	1	1		
Molybdenum												
Selenium			1	1			1	1	1	1		
Zinc			1	1			1	1	1	1		
NUTRIENTS												
Total Kjeldahl Nitrogen			1	1			1	1	1	1		
Nitrate + Nitrite as N	4	2			6	1		2			5	2
Total Ammonia	4	2	1	1	7	1	1	3	1	1	4	2
Total Phosphorous as P	4	2			6	1					5	1
Soluble Orthophosphate	4	2			7	1		4			4	3
SEDIMENT TOXICITY												
Hyalella		1						1				1

Table 20b. Upper Feather River ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
GENERAL					
pH	62	12	6.37	9.8	pH Units
Electrical Conductivity	46	0	57	242	uS/cm
Dissolved Oxygen	88	14	4.86	18.8	mg/L
Temperature	73	0	4.2	22.63	C
Total Dissolved Solids	26	0	27	150	mg/L
Total Suspended Solids	45	0	ND	260	mg/L
Total Organic Carbon	26	0	0.76	19	mg/L
Turbidity	45	0	0.46	120	NTU
PATHOGENS					
E-coli	43	8	ND	2400	MPN/100
WATER COLUMN TOXICITY					
Selenastrum	17	0	294	1114	% control
Ceriodaphnia	17	1	50	111	% control
Pimephales	17	0	98	100	% control
PESTICIDES					
Aldicarb	0				ug/L
Atrazine	0				ug/L
Azinphos methyl	0				ug/L
Carbaryl	0				ug/L
Carbofuran	0				ug/L
Chlorpyrifos	0				ug/L
Cyanazine	0				ug/L
DDD	0				ug/L
DDE	0				ug/L
DDT	0				ug/L

Table 20b. Upper Feather River ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Demeton-s	0				ug/L
Diazinon	0				ug/L
Dichlorvos	0				ug/L
Dicofol	0				ug/L
Dieldrin	0				ug/L
Dimethoate	0				ug/L
Disulfoton (Disyton)	0				ug/L
Diuron	0				ug/L
Endrin	0				ug/L
Glyphosate	0				ug/L
Linuron	0				ug/L
Malathion	0				ug/L
Methamidophos	0				ug/L
Methidathion	0				ug/L
Methiocarb	0				ug/L
Methomyl	0				ug/L
Methoxychlor	0				ug/L
Methyl Parathion	0				ug/L
Oxamyl	0				ug/L
Paraquat Dichloride	0				ug/L
Phorate	0				ug/L
Phosmet	0				ug/L
Simazine	0				ug/L
Trifluralin	0				ug/L
METALS					
Arsenic	6	0	ND	2.39	ug/L
Boron	6	0	32	46	ug/L
Cadmium	6	0	ND	n	ug/L
Copper	6	0	0.3	4.4	ug/L

Table 20b. Upper Feather River ILRP Monitoring Data Summary: Total Analyses and Exceedances (2005-2008)

PARAMETERS	TOTAL # ANALYSES	TOTAL # EXCEEDANCES	MINIMUM RESULT	MAXIMUM RESULT	UNITS
Lead	6	0	ND	0.95	ug/L
Nickel	6	0	0.11	7.5	ug/L
Molybdenum					ug/L
Selenium	6	0	ND	0.8	ug/L
Zinc	6	0	2	23	ug/L
NUTRIENTS					
Total Kjeldahl Nitrogen	6	0	ND	0.83	mg/L
Nitrate + Nitrite as N	22	0	0.41		mg/L
Total Ammonia	28	0	ND	0.084	mg/L
Total Phosphorous as P	19	0	ND	0.45	mg/L
Soluble Orthophosphate	25	0	ND	0.12	mg/L
SEDIMENT TOXICITY					
Hyalella	3	1	94	101	% control

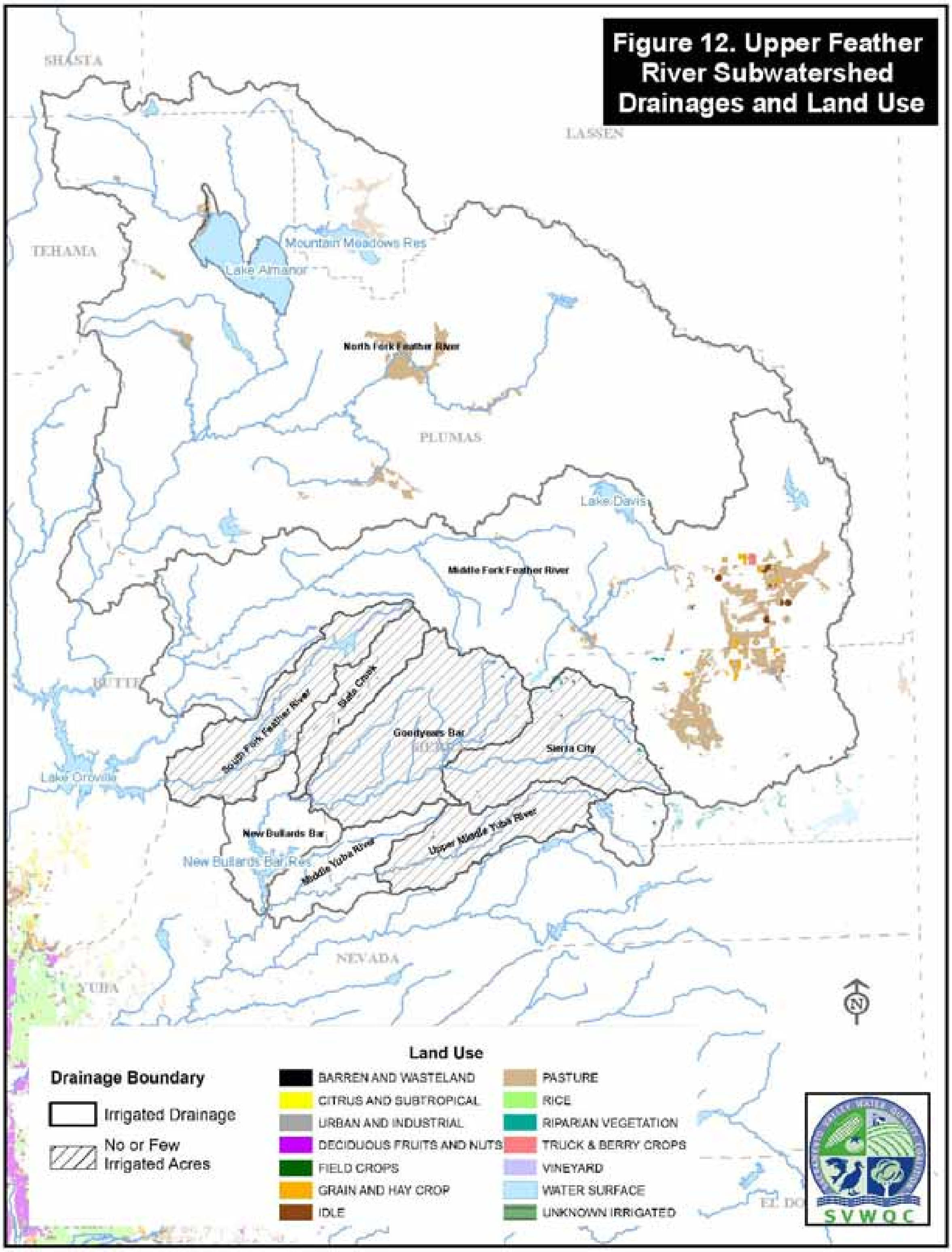

Figure 12. Upper Feather River Subwatershed Drainages and Land Use
SHASTA
LASSEN
TEHAMA
Mountain Meadows Res
Lake Almanor
North Fork Feather River
PLUMAS
Lake Davis
Middle Fork Feather River
BUTTE
South Fork Feather River
Slate Creek
Goodyears Bar
Sierra City
Lake Oroville
New Bullards Bar
New Bullards Bar Res
Middle Yuba River
Upper Middle Yuba River
NEVADA
YUBA
N
Land Use
Drainage Boundary
Irrigated Drainage
No or Few Irrigated Acres
BARREN AND WASTELAND
CITRUS AND SUBTROPICAL
URBAN AND INDUSTRIAL
DECIDUOUS FRUITS AND NUTS
FIELD CROPS
GRAIN AND HAY CROP
IDLE
PASTURE
RICE
RIPARIAN VEGETATION
TRUCK & BERRY CROPS
VINEYARD
WATER SURFACE
UNKNOWN IRRIGATED
SVWQC