Staff Report of the

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

AMENDMENTS
TO
THE WATER QUALITY CONTROL PLAN FOR THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS

FOR

THE CONTROL OF SALT AND BORON DISCHARGES INTO THE SAN JOAQUIN RIVER

APPENDIX A: TMDL METHODS AND DATA SOURCES

APPENDIX B: GEOGRAPHIC INFORMATION SYSTEM PROCESSING INFORMATION AND METADATA

September 2003

Peer Review Draft

State of California

California Environmental Protection Agency

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APPENDIX A: METHODS AND DATA SOURCES

Extensive flow and water quality data were compiled from numerous sources and evaluated to determine the historical salt and boron loads originating from the LSJR sub-areas and the DMC. The core data used to determine sub-area loads consists of monthly flow and water quality data compiled for seven key monitoring stations (Table A-1) along the LSJR and it's major tributaries (Figure A-1). The data used to determine historical loads from the LSJR sub-areas is comprised of monthly flow (acre-feet), TDS concentrations (mg/L), and boron concentrations (mg/L) for water years 1977-1997 (Core Data Set). In general, the monthly flow data is the sum of the daily flows at each station.

Table A-1. Flow Data Sources Used for TMDL Source Analysis

Period of Record	Site Code	Operator	Measurement Frequency
(1) SAN JOAQUIN RIVER AT THE AIRPORT WAY BRIDGE NEAR VERNALIS			
WY 77-97	11303500	USGS	Daily
(2) SAN JOAQUIN RIVER NEAR STEVINSON (Lander Ave.)			
WY 77--97	B07400	DWR	Daily
(3) MERCED RIVER NEAR STEVINSON			
WY 77-95	11272500	USGS	Daily
WY 96-97	B05125	DWR	Daily
(4) TUOLUMNE RIVER AT MODESTO			
WY 77-97	11290000	USGS	Daily
(5) STANISLAUS RIVER NEAR RIPON			
WY 77-97	11303000	USGS	Daily
(6) MUD SLOUGH (NORTH) NEAR GUSTINE			
WY 77-85	Estimated †		
WY 85-97	11262900	USGS	Daily
(7) SALT SLOUGH AT HWY 165 NEAR STEVINSON			
WY 77-85	B00470	DWR	Daily
WY 85-97	11261100	USGS	Daily

† Flow data used to determine historical Mud Slough loading was estimated from Salt Slough data and sporadic discharge measurements of Mud Slough. (*State Water Resources Control Board (SWRCB). 1987. SWRCB Order No. W.Q. 85-1 Technical Committee Report: Regulation of Agricultural Drainage to the San Joaquin River. Appendix C, (pp C54-C56). Sacramento, CA*.)

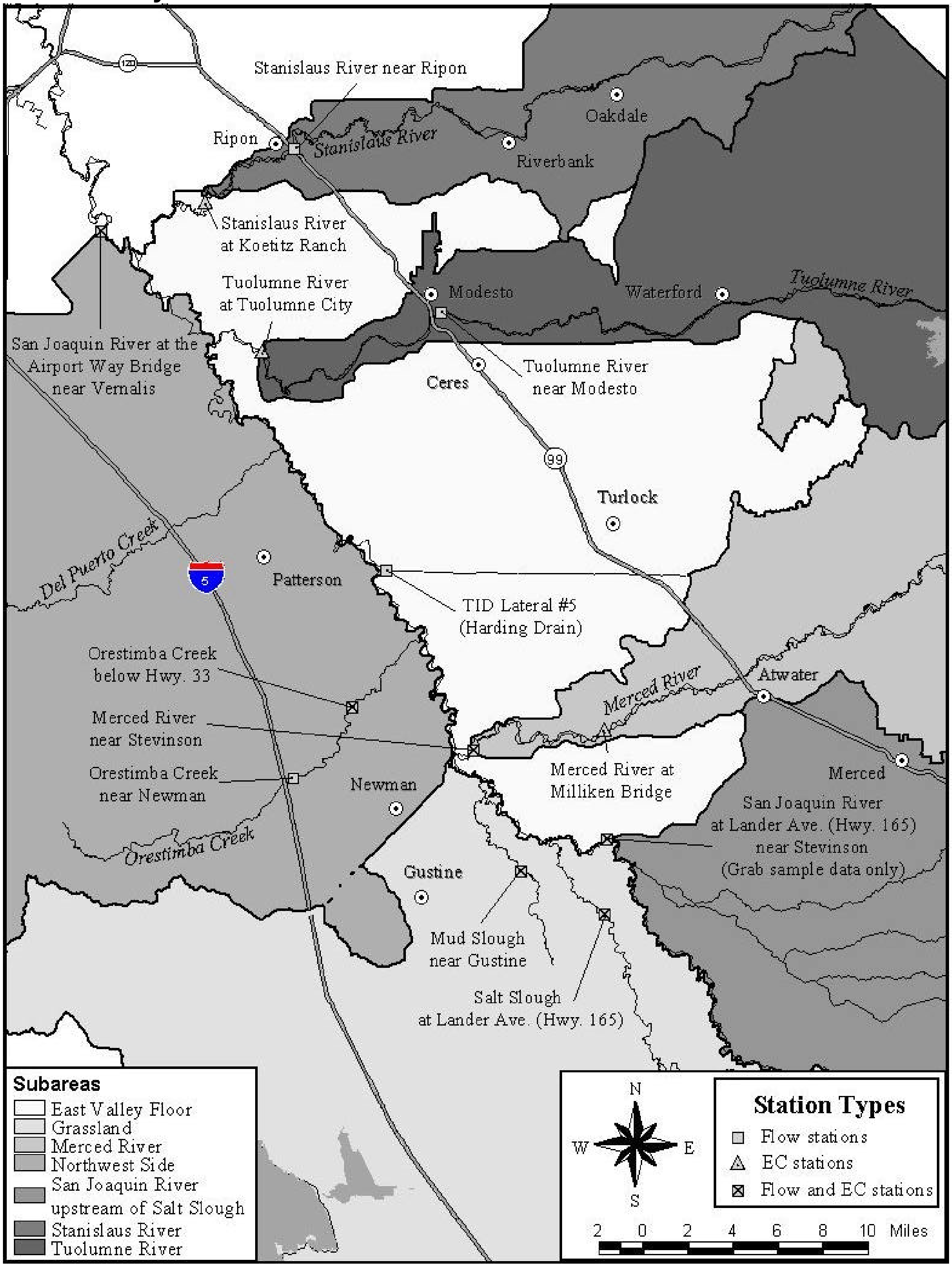
The historic salt load for the LSJR upstream of Salt Slough, Grasslands, Merced River, Tuolumne River, and Stanislaus River Sub-areas was calculated using flow and water quality data for one or two key monitoring points located upstream of the sub-area confluence with the main stem of the LSJR. Loads calculated for the LSJR at Lander Avenue were used to represent the loads generated from the LSJR upstream of Salt Slough Sub-area. Loads from the Grasslands Sub-area are equal to the sum of the loads from Mud Slough (north) and Salt Slough, which are the two primary tributaries in the Grasslands Sub-area. Loads for the Merced River, Tuolumne River, and Stanislaus River Sub-areas were calculated using flow and water quality data from gaging stations upstream of these east-side tributary confluences with the LSJR (Table A-2).

Table A-2: Locations of Major Gaging Stations Used to Determine Sub-area Loads

Sub-area	Flow Monitoring Station Used to calculate Loads	Miles upstream of LSJR confluence
LSJR upstream of Salt Sl.	SJR Near Stevinson (Lander Ave.)	0
Grasslands	Mud Slough(north) near Gustine, Salt Slough @ Highway 165	9 6
Merced River	Merced River near Stevinson	5
Tuolumne River	Tuolumne River @ Modesto	17
Stanislaus River	Stanislaus River near Ripon	18

In some instances flow data from multiple sources was used because gaging stations were discontinued over time or data was missing. Once the historic record of flow data was established, salinity (TDS) and boron data was paired to flow data at each station. All water quality data from the closest site available was used when water quality data for a given site was not available at the same location as the respective flow gage (Figure A-1).

Figure A-1: Lower San Joaquin River Sampling Locations Used in TMDL SourceAnalysis



Salinity data

Water quality data was obtained from numerous sources in order construct a complete 21-year historical record. At some locations there was no data available for a given time span, so estimates were made based on the available data. Generally, salinity data was available as daily EC measurements. Daily EC values were converted to TDS (mg/L) using site specific EC to TDS conversion ratios that were calculated using paired EC and TDS data (Table A-3). Flow-weighted average monthly TDS data used for the LSJR at the Airport Way Bridge near Vernalis station based on a daily record of EC.

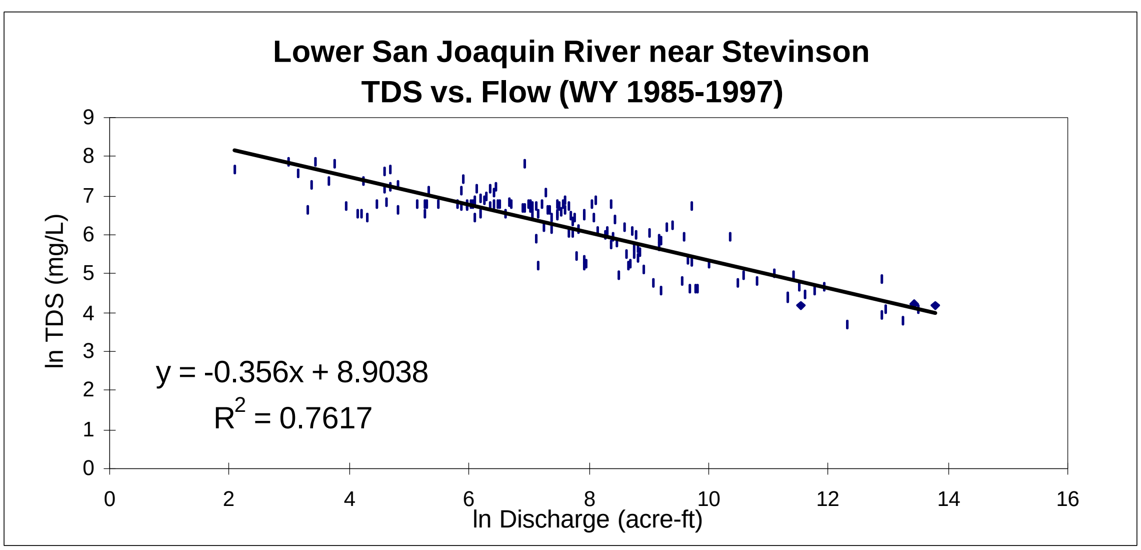
Table A-3: TDS/EC Ratios for LSJR and Tributaries

LOCATION	NUMBER OF SAMPLES	TDS/EC RATIO
SJR at Lander[1]	37	0.64
Salt Slough[2]	44	0.68
Mud Slough[2]	38	0.69
Merced River[1]	25	0.66
Tuolumne River[1]	32	0.67
Stanislaus River[1]	35	0.69
SJR near Vernalis[2]	40	0.61

Data Sources: [1]Kratzer, 1987 [2]Grober, 1998

Weekly Regional Board grab sample data for EC were used to develop a flow-weighted average monthly TDS record for the LSJR at Stevinson (Lander Ave) for water years 1985 to 1997. No grab sample data was available prior to water-year 1985, so monthly TDS for the LSJR at Stevinson was estimated for water years 1977 to 1984 using the available flow data. The natural log of the monthly discharge and TDS data were plotted and a linear regression was used to develop a correlation between discharge and TDS (Figure A-2).

Figure A-2: Lower San Joaquin River near Stevinson Flow VS. EC Regression for WY 85-97



The regression equation was then used to estimate monthly TDS from monthly flow data for water-years 1977 through 1984. Mean monthly EC data for water years 1977 through 1984, for the Merced River (at Milliken), the Tuolumne River (at Tuolumne City), and the Stanislaus River (at Koetitz) were obtained from the San Joaquin River Input Output (SJRIO) model input files which are based on continuous EC readings from DWR water quality monitoring stations (Kratzer, 1987). Monthly flow-weighted averages of daily EC data were used for the Merced River, the Tuolumne River, and the Stanisluas River for water-years 1985-1997. Site-specific linear regression analysis of flow and EC was used to fill in any data gaps. The natural log of the monthly discharge and TDS data was plotted and a linear regression was used to develop a correlation between discharge and TDS. The regression equations (Table A-4) were used to estimate monthly TDS from monthly flow data for months when no EC data was available. All TDS concentration data that was estimated using this method is indicated in italics in the Attachment (core data set).

Table A-4: Site specific linear regression equations used to estimate monthly mean TDS for missing data

Site/Location	Regression Equation	R^2
Merced River	ln mean monthly TDS = -0.385 * ln Q_M + 8.4386	0.70
Tuolumne River	ln mean monthly TDS = -0.4164 * ln Q_M + 9.0859	0.58
Stanisluas River	ln mean monthly TDS = -0.2823 * ln Q_M + 7.2897	0.53
Q_M = total monthly flow		

Flow and TDS data for Mud Slough near Gustine and Salt Slough near Stevinson for water years 1977-1984 was also obtained directly from SJRIO model input files. Flow and EC data collected between water years 1985 through 1995, for Salt Slough, Mud Slough, and the SJR at the Airport Way Bridge near Vernalis sites were obtained from a Regional Board Staff Report entitled *Loads of Salt Boron and Selenium in the Grassland Watershed and Lower San Joaquin River October 1985 to September 1995 Raw Data Supplemental Appendix* (Grober, 1998). Flow and EC data for water years 1986 and 1995, for Salt Slough near Stevinson, Mud Slough near Gustine, and the SJR at the Airport Way Bridge near Vernalis sites was obtained (as text files) from the USGS.

<u>Boron data</u>

Boron data for water years 1985 through 1997 for the SJR at Lander Avenue, Mud Slough, Salt Slough, and SJR at the Airport Way Bridge near Vernalis sites was based on data from the Regional Boards water quality data base, which is a compilation of grab sample data collected by the Regional Board. This data set represents over 650 discrete samples collected at these four sites between 1985 and 1997. Monthly averages of the grab sample data coupled with total monthly flow were used to determine monthly boron loads at each of the sites. Boron data for water years 1977-1985, were estimated using site-specific linear correlations of EC and Boron (Table A-5).

Table A-5: EC/Boron Ratios for LSJR and Tributaries			
Site	Boron/EC Ratio	Number of Samples (monthly averages)	R^2
LSJR at Lander Avenue	0.0002	173	0.90
Mud Slough (North)at San Luis Drain	0.0008	72	0.70
Salt Slough at Lander Avenue	0.001	124	0.82
LSJR near Vernalis	0.0005	186	0.86

Limited boron data is available for the Merced, Tuolumne, and Stanislaus Rivers. The data suggest that boron concentrations in the tributaries varies little over time. The boron data used to compute monthly loads for the Merced, Tuolumne and Stanislaus Rivers was based on USGS water quality monitoring conducted between March 1985 and September 1988 (USGS, 1988, 1991). Available daily flow and boron values were sorted in a spreadsheet in descending order (by flow). The Microsoft Excel percentile function was used to determine the 75^{th} percentile flow values for each river. In general, flow above the 75^{th} percentile is considered to be above normal. The flow-weighted average boron concentration corresponding to flows at or above the 75^{th} percentile (high flow conditions) was calculated for each river. Similarly the flow-weighted average boron concentration corresponding to flows less than the 75^{th} percentile (low flow conditions) was calculated for each river. The mean of these flow-weighted averages was used as the estimated base boron concentration for low flow and high flow conditions. Using this method, the Merced, Tuolumne and Stanislaus Rivers were assigned a boron concentration 0.015 mg/L for months where the flows were above the 75^{th} percentile flow value for the respective river. A boron concentration of 0.03 mg/L was used for months where the flow was less than the 75^{th} percentile flow value.

II Sub-area Loading Calculations

Salt and Boron Loads for the LSJR above Lander, Grasslands, Merced River, Tuolumne River, and Stanislaus River Sub-areas were calculated directly from the 21-year core data set (Core Data Set). Monthly salt loads were calculated by converting monthly EC (µS/cm) to TDS (mg/L) using site-specific TDS/EC ratios for each tributary or river station (Table A-3). Average monthly salt concentration was used in conjunction with total monthly flow to calculate total monthly salt load at each site. The annual salt loads at each site are equal to the sum of the monthly salt loads (Equation A-1). The same method was used to calculate boron loads for each of the sub-areas. Monthly and mean annual salt and boron loading for the entire TMDL project area was also determined using flow, EC, and boron data from the LSJR at the Airport Way Bridge near Vernalis. The calculated mean annual flow, salt loads, boron loads and mean annual flow are in Tables A-6, A-7 and A-8 respectively.

$$L_a = \sum_{n=1}^{12} C_{m_n} Q_{m_n} \text{ (Equation A-1)}$$

<u>Where</u>:
L_a = annual constituent load (TDS, boron)
Cm = monthly mean constituent concentration (TDS, boron)
Qm = total monthly flow
n = months of water year

Note: water year runs from October of prior though September (e.g. water year 1997 runs from October 1996 through September 1997)

The Northwest Side and East Valley Floor Sub-areas do not have distinct drainage basins that discharge to the LSJR at a single point. These sub-areas are situated along the east and west sides of the LSJR and they drain diffusely to a 50-mile reach of the river. Discharges from these sub-areas are difficult to characterize due to limited flow and water quality data.

Salt and boron loading from the East Valley Floor Sub-area were estimated based on flow and water quality data from the Harding Drain. The Harding Drain drains approximately 53,000 acres, which represents approximately 20 percent of the entire East Valley Floor Sub-area. This approach assumes that discharges from the Harding Drain are representative of discharges from the entire East Valley Floor Sub-area. The estimates of flow and salt loading for the East Valley Floor Sub-area based on this assumption should be used with discretion because there is likely significant spatial variability in both flows and water quality throughout the sub-area.

Flows from the Harding Drain were available from the Turlock Irrigation District (TID) for Water Years 90-95 (reported as spills to river). For water years1990-1992, TID's data collection effort appears to have been focused on the irrigation season and winter flows are not reported. Therefore, the annual flows for water years 1990-1992 are likely skewed downward. Daily USGS flow data was also available from June 1992 though November 1994, and the USGS data was used in lieu of the TID data for the period that it was available. Limited EC, TDS, and boron data (EC data n = 44, TDS data n = 41, boron data n = 18) was also available from the USGS for a 31-month period between May 1992 and November 1994 (USGS, 92, 93, 94 and 95). This data was used to calculate the flow-weighted average TDS concentration (mg/L) for the Harding Drain. Similarly, a flow- weighted average boron concentration was used to estimate the average monthly boron concentration.

Average monthly TDS and boron concentrations were used in conjunction with monthly flow to calculate monthly salt and boron loads for the Harding Drain. The 72 months of salt and boron loading data were added together then divided by 6, to estimate annual average salt and boron loading from the Harding Drain during the six-year period of record. Approximately 12 thousand tons of salt and 2 tons of boron per year were discharged from the Harding Drain each year. However, approximately 9 thousand tons of salt per year are discharged to the Harding Drain from the City of Turlock's wastewater treatment plant (Table 9). This annual average salt loading from the City of Turlock's wastewater treatment plant was subtracted from the annual average Harding Drain salt load to estimate the non-point source salt loading from the Harding Drain. This yielded an annual average of approximately 3 thousand tons of salt per year from the Harding Drain.

The Harding Drain drainage area represents approximately 20 percent of the East Valley Floor Sub-area. Loads for the Harding Drain were therefore multiplied by a factor of 5 (100/20) to estimate the total annual non-point source loading to the LSJR from the East Valley Floor Sub-area. Based on the multiplier of 5, the East Valley Floor Sub-area contributes approximately 17 thousand tons of salt per year from non-point sources to the LSJR. Additionally, approximately 23 thousand tons of salt per year are attributable to the City of Turlock and the City of Modesto waste water treatment plants, both of which discharge to surface waters in the East Valley Floor Sub-area (section 3.5-III Municipal and Industrial discharges). East Valley floor Sub-area groundwater salt contributions to the LSJR were estimated by applying the groundwater loading rate of 165 tons per mile/year for shallow east-side groundwater accretions (see section 3.3-II Groundwater Accretions) to a 50-mile reach of the LSJR that flows adjacent to the East Valley Sub-area. Approximately 8 thousand tons of salt are discharged from East Valley Floor Sub-area groundwater to the LSJR, bringing the estimated total annual salt loading from the East Valley Floor Sub-area to approximately 48 thousand tons per year (sum of non-point source salt loads, M&I salt loads, and groundwater salt loads). This salt load was used in the evaluation of the 21-year period of record (POR) generated for the sites at which a full data set was available. The mean annual boron load was determined simply by multiplying the Harding drain boron loads (2 tons/year) by a factor of 5, which results in approximately 10 tons of boron per year. No adjustments to the boron loading data were made to differentiate non-point source loading from point source loading (TableA-9).

Annual scaling factors (SF_{EVF}) were developed in order to estimate the annual variability of calculated EVF Sub-area annual flows. The scaling factors were developed by first summing the annual flows for the five sub-areas for which flow and water quality data was widely available (LSJR upstream of Salt Slough, Grassland, Merced River, Tuolumne River, and Stanislaus River). The scaling factor for any given year is equal to the annual flow for the 5 sub-areas divided by the mean flow for the five sub-areas for WYs 1977-1997. This is the ratio of the annual flow for the five sub-areas to the 21-year mean flow for the five sub-areas. Annual flow as calculated by multiplying the mean annual flow (98 taf) by the annual scaling factor for each year. The same procedure was used to estimate variability in East Valley Floor salt and boron loads.

TableA-9: East Valley Floor (EVF) Sub-area Discharge and Load Calculation

Calculation of East Valley Floor Mean Annual Discharge	
TID 5 Mean Annual discharge WY's 1990-1995	23,481
Estimated drainage area of TID 5	53,000
Estimated drainage area of entire EVF	264,000
TID 5 drainage area as a percent of EVF drainage area	20%
Multiplier =East Vally Floor area/ TID 5 Area	5
Turlock mean annual M&I discharge from Appendix C (acre-feet)	11,032
Modesto mean annual M&I discharge from Appendix C (acre-feet)	14,730
M&I discharge total (acre-feet)	**25,762**
TID 5 annual discharge - Turlock annual M&I discharge (acre-feet)	12,449
EVF Surface Water discharge calculated w/o Turlock M&I discharge (acre-feet)	**62,009**
GW flow (cfs/mi)	0.29
Reach legnth for EVF (miles)	50
EVF groundwater flow (cfs)	15
EVF groundwater flow (acre-feet/year)	**10,498**
Total Flow from EVF (includes M&I, surface, and groundwater) (acre-feet)	**98,269**
Calculation of East Valley Floor Mean Annual Salt Loading	
TID 5 Mean Annual Load WY's 1990-1995	12,003
Estimated drainage area of TID 5 (acres)	53,000
Estimated drainage area of entire EVF (acres)	264,000
TID 5 drainage area as a percent of EVF drainage area	20%
Multiplier =East Valley Floor area/ TID 5 Area	5
Turlock mean annual M&I load from Appendix C (tons)	8,650
Modesto mean annual M&I load from Appendix C (tons)	13,971
M&I load total (tons)	**22,621**
TID 5 annual load - Turlock annual M&I load (tons)	3,353
EVF surface water load calculated w/o Turlock M&I discharge (tons)	**16,701**
Estimated GW TDS concentration (mg/L)	600
EVF groundwater load (tons)	**8,560**
Total Load from EVF (includes M&I, surface, and groundwater) (tons)	**47,882**

Salt loading for the Northwest Side Sub-area was estimated by subtracting the sum of the loads for the 6 other sub-areas from the total load at the Airport Way Bridge near Vernalis. This estimate was also verified using two alternate methods. These alternate methods are described in Appendix E.

III Salt Imports to the LSJR

The total salt loads imported to the TMDL project area from the Delta via the DMC, were calculated to determine the relative impact of imported salts on the LSJR. The load of salts imported into each affected sub-area was also calculated.

Water quality and flow data was obtained from the USBR to determine the quantity of salt being transported via the DMC and delivered to public water agencies within the TMDL project area. Flow data for this analysis was obtained from the USBR Central Valley Operations Reports from 1977-1997, which report monthly water deliveries from the DMC and Mendota Pool to the 60 individual public water agencies that received supply water from the Delta during this 21-year period of record. Water quality data was obtained directly from spreadsheets provided by the USBR. Daily EC data was available from the USBR for the DMC at the Tracy pumping plant for the entire period of record, however, digital data was only available after 1991. Data prior to 1991 was based on the average of two daily EC values per month (seventh and 21st day of each month). Daily EC data was also available from 1992 through 1997 for the DMC at Check 13, and the DMC at Check 21 (Table A- 10). A linear regression of the EC data at Tracy versus the available EC data at check 13 (1992-1997) was used to develop a correlation between the two sites ($n=72$, $r^2=.83$). The linear correlation was used to estimate EC at check 13 from the EC at Tracy for October 1977 through December 1977 for which there was no data available. Monthly grab sample EC data was also available for the Mendota Pool (at the Mowry Bridge) from December 1985 through October 1992 and this monthly grab sample data was used to augment the available data for Mendota Pool deliveries. Monthly mean EC data for the available 1985-1998 water quality data set was used for water-years 1977 through 1992 for which there was no data available at check 21 (representing delivery quality from the Mendota Pool). An EC to TDS conversion factor of 0.62 was used to convert mean monthly EC in µS/cm to mean monthly TDS in mg/L (all sites).

In order to track geographic differences of Delta supply water quality, the DMC was divided into two reaches. Reach 1 is from the Tracy pumping plant to just before the O'Neill Forebay and Reach 2 is from just after the O'Neill Forebay to the Mendota Pool (Figure A-3). This division was used to reflect the changes in water quality that occur as a result of the combined operations between State and Federal Water Projects at the O'Neill Forebay. Monthly mean TDS data for the Tracy pumping plant site was applied to deliveries made from the DMC Reach 1 and TDS data from Check 13 was applied to all deliveries from Reach 2. It is assumed that there is little change in the water quality of the DMC within each of these reaches. Monthly mean TDS data from Check 21, which is a water quality monitoring station on the DMC just before it flows into the Mendota Pool, was used to represent the quality of the deliveries from the Mendota Pool.

The location of each public water agency's diversion point on the DMC was used to determine the appropriate reach specific TDS value to apply to a given public water agency's supply water. The source reach for deliveries made to wetland users (Core Data Set; SJR at Lander Avenue, SJR Near Vernalis, Merced River) was determined by best professional judgment and inspection of public water agency boundary maps. Mean monthly EC and monthly flow were used to calculate the monthly loads delivered to each public water agency.

Table A-10: Location of DMC Water Quality Monitoring Stations

Site Location	Mile Point †
Tracy Pumping Station	3.50 miles (salinity recorder) pumping plant @ 2.53
Check 13 O'Neill Forebay	70.01 miles
Check 21 Mendota Pool	116.48 miles
† miles from beginning of DMC	

Sub-area boundaries were overlaid with the public water agencies' boundaries using a GIS to determine how much land area of each water agency is contained within each sub-area. In many instances, all of a water agency was within a given sub-area. For instances where an agency straddles two or more sub-areas, the GIS was used to determine the percent of the agency's jurisdictional area that lies within each sub-area. These area percentages were applied to the agency's total salt load to determine the amount of salt delivered to each sub-area from that agency. Salt loads delivered to each sub-area were calculated by adding the loads delivered to each public water agency, or portion thereof, within the given sub-area (Core Data Set; SJR at Lander Avenue and SJR Near Vernalis).

Approximately 513 thousand tons of salt per year on average were imported annually to the TMDL project area from the Delta from 1977 to 1997. This is almost half of the total salt loading from the TMDL project area as measured at the Airport Way Bridge near Vernalis. The Grasslands, and the LSJR above Salt Slough Sub-areas received 423,297 and 89,890 tons of salt per year respectively. Nearly the same amount of salt was imported as was discharged from the Grasslands Sub-area over the 21-year period of record. This analysis demonstrates the need to consider source water supply when allocating loads to each of the sub-areas.

Figure A-3: Delta Mendota Canal Locations

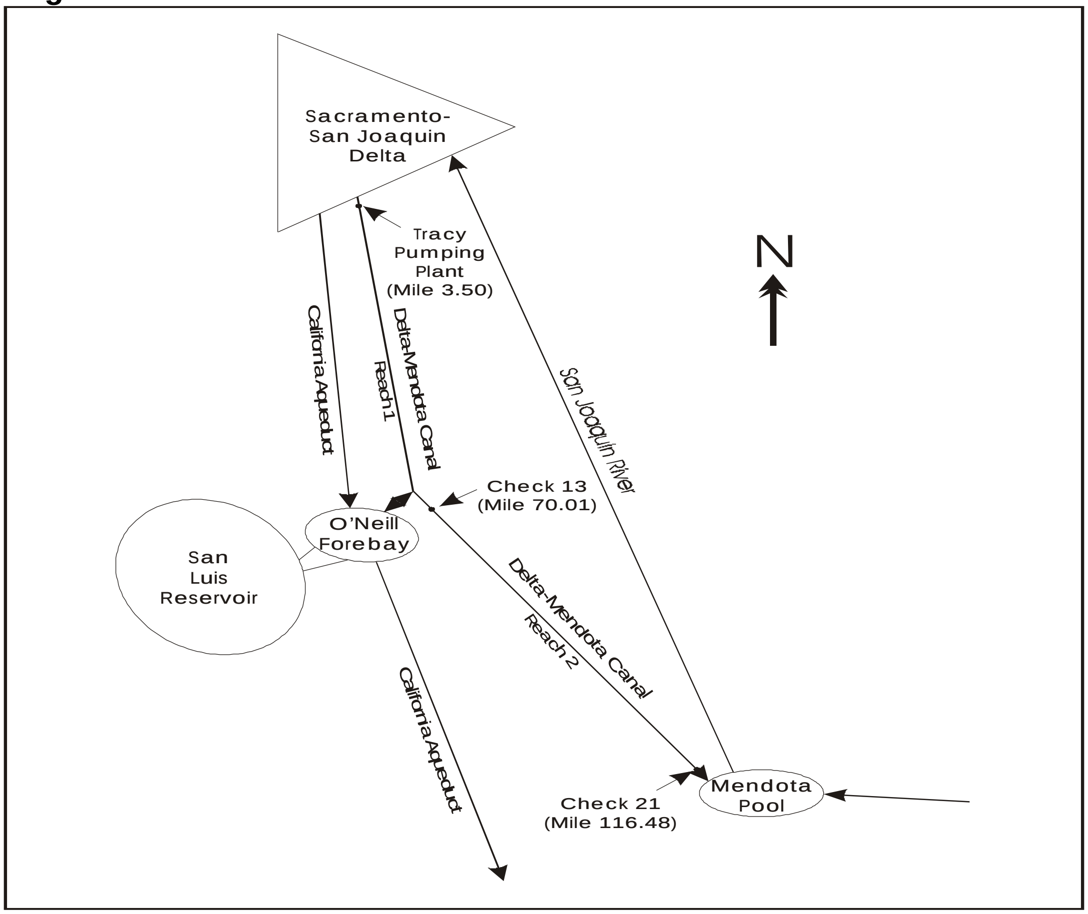


Figure A-4: LSJR Salt Imports and Exports

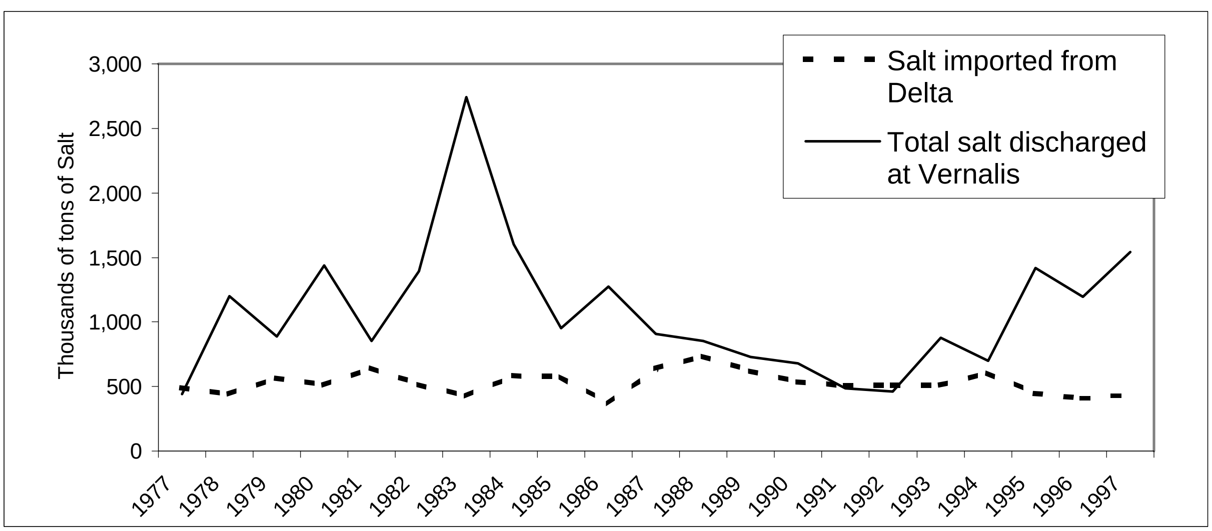


Table A-11: DMC salt loads delivered to public water agencies within the Grasslands sub-area (tons)

Water District	Total WD Acreage	% of WD within sub-area	DMC Derived Salt Load	Mendota Pool Derived Salt Load	Total Annual Salt Load	Sub-area† Load
Broadview W.D.	9,716	100.0%	5,944		5,944	5,944
Central California I.D.	124,891	82.6%	45,355	188,011	233,366	192,860
Centinella W.D.	old	100.0%	712		712	712
Clayton W.D.	3	0.1%				0
Columbia Canal Co.	16,147	100%		26,662	26,662	26,662
Davis W.D.	old	100.0%	1,321		1,321	1,321
Del Puerto W.D.	11,145	23.2%	6,500		6,500	1,508
Eagle Field W.D.	1,481	100.0%	1,239		1,239	1,239
Firebaugh Canal W.D.	23,300	100.0%	5,210	25,295	30,506	30,506
Laguna W.D.	424	100.0%				0
Lansdale W.D.	755	100.0%				0
Los Banos Gravel	?	100.0%	9		9	9
Mercy Springs W.D.	3,584	100.0%	2,640	555	3,194	3,194
Mustang W.D.	old	100.0%	3,541		3,541	3,541
Oro Loma W.D.	1,144	100.0%	1,499		1,499	1,499
Pacheco W.D.	old	100.0%	1,361		1,361	1,361
Panoche W.D.	44,651	100.0%	11,338		11,338	11,338
Quinto W.D.	old	100.0%	2,216		2,216	2,216
Romero W.D.	old	100.0%	942		942	942
Stevinson W.D.	7	0.1%				0
San Luis Canal Co.	47,095	100.0%		70,583	70,583	70,582
San Luis W.D.	64,741	100.0%	10,369		10,369	10,369
Santa Nella County W.D.	75	100.0%				0
Turner Island W.D.	23	0.3%				0
Widren W.D.	889	100.0%	541		541	541
Wetlands†† (state, federal, private)						56,940
					Total Salt Load from the Delta:	423,284 tons

†equal to water district annual load multiplied by percent of district w/in sub-area,
††includes 52,000 acre Grasslands Water District

Table A-12: DMC salt loads delivered to public water agencies within Northwest Side sub-area (tons)						
Water District	**Total WD Acreage**	**% of WD Area within sub-area**	**DMC Salt Load**	**Mendota Salt Load**	**Total Annual Salt Load**	**Sub-area† Load**
Central California I.D.	26,231	17.4%	45,355	188,011	233,366	40,506
Del Puerto W.D.	36,887	76.8%	6,500		6,500	4,991
El Solyo W.D.	4,075	100.0%				0
Foothill W.D.	old	100.0%	3,530		3,530	3,530
Hospital	old	100.0%	8,211		8,211	8,211
Kern Canon W.D.	old	100.0%	2,054		2,054	2,054
Oak Flat W.D.	4,778	100.0%				0
Orestimba W.D.	old	100.0%	4,677		4,677	4,677
Patterson W.D.	13,791	100.0%	5,137		5,137	5,137
Salado W.D.	old	100.0%	2,331		2,331	2,331
Stevinson W.D.	799	10.6%				0
Sunflower W.D.	old	100.0%	3,900		3,900	3,900
Turlock I.D.	6	<0.1%				0
West Stanislaus I.D.	22,899	100.0%	14,553		14,553	14,553
					Total Salt Load from the Delta:	89,890 tons
†equal to water district annual load multiplied by percent of district w/in sub-area						

Table A-13: DMC Turnouts and Mile Markers and corresponding Reach Numbers

Facility/Turnout/User	Mile Marker	Reach Number/Source
Banta Carbona ID	20.42	1
Broadview WD	102.95	2
Central California ID	58.27, 60.65, 76.05, 83.08	1 & 2
Centinella WD	66.2	1
China Island (76.05)	76.05	2
Del Puerto WD	19 turnouts between 35.73 – 42.51	1
Eagle Field WD	93.27, 94.57	2
Firebaugh Canal	107.85	2
Frietas Unit (76.05L)	76.05	2
Mercy Springs WD	97.70, 98.74	2
Oro Loma WD	95.50, 96.62	2
Panoche WD – Ag	93.25	2
Patterson WD	42.51	1
Plainview WD	31 turnouts between 8.52 – 20.97	1
Salt Slough Unit (76.05	76.05	2
San Luis WD – Ag	39 turnouts between 68.83 – 90.53	1 & 2
Tracy, City of	15.95	1
West Side ID	8.51	1
Widren WD	102.04	2
W. Stanislaus ID	31.31, 38.14	1
Panoche WD - M&I	93.25	2
F&G-Los Banos-W1429	76.05	2
F&G-Volta WM - W1429	69.98	1
Grassland-76.05L-W1430	76.05	2
Grassland-Volta-W1430	76.05	2
FWS-Kern -Volta-W1431	69.98	1
FWS-Kest. 76.05-W1431	76.05	2
Check 20 near Firebaugh	111.26	2
Central California I.D.	N/A	Mendota Pool
Columbia Canal Co.	N/A	Mendota Pool
Firebaugh Canal Co.	N/A	Mendota Pool
James I.D.	N/A	Mendota Pool
San Luis Canal Co.	N/A	Mendota Pool
Grasslands W.D.	N/A	Mendota Pool
Mercy Springs W.D.	N/A	Mendota Pool
San Luis Drain (USBR)	N/A	Mendota Pool
San Luis W.D.	N/A	Mendota Pool
Westlands W.D.	N/A	Mendota Pool
Patos Unlimited	N/A	Mendota Pool
Loundy, Mason A.	N/A	Mendota Pool

Table A-6. Mean annual sub-area salt loads (thousand tons)

Water Year	SJR abv. Salt Sl.	Grasslands	North West Side*	East Valley Floor**	Merced River	Tuolumne River	Stanislaus River	Total
1977	8	210	94	22	13	86	13	440
1978	210	480	250	61	55	71	80	1,200
1979	62	420	130	48	51	100	68	880
1980	170	420	460	62	73	140	110	1,400
1981	27	470	170	44	27	80	38	850
1982	150	390	480	58	86	150	68	1,400
1983	520	390	1,200	100	140	260	150	2,700
1984	160	420	570	66	69	200	120	1,600
1985	32	540	120	53	39	110	67	950
1986	130	490	370	57	49	88	78	1,300
1987	27	440	260	41	26	63	52	910
1988	18	460	240	39	23	33	43	850
1989	16	390	210	33	27	18	33	730
1990	7	380	180	32	25	25	30	680
1991	9	220	170	20	15	23	23	480
1992	29	200	140	20	23	25	20	460
1993	53	340	330	35	32	58	33	880
1994	16	380	180	33	21	30	35	700
1995	200	500	380	67	80	150	49	1,400
1996	64	480	390	51	57	100	51	1,200
1997	190	450	530	64	80	130	96	1,500
Mean	100	400	330	48	48	93	60	1,100

*Estimated by subtracting all other sub-areas from total load at Vernalis ** *Based on extrapolation from TID Lateral Number 5 mean annual load for WYs 1990-1995.* Loads rounded to two significant figures.

Table A-7. Mean annual sub-area boron loading (tons)

Water Year	SJR abv. Salt Sl.	Grasslands	North West Side*	East Valley Floor**	Merced River	Tuolumne River	Stanislaus River	Total
1977	3	190	160	3	3	6	2	360
1978	69	440	410	9	13	15	21	980
1979	21	380	260	7	15	27	16	730
1980	58	390	630	9	24	43	29	1,200
1981	9	420	220	8	9	20	13	700
1982	52	360	640	8	22	44	17	1,100
1983	170	360	1,500	11	47	81	40	2,200
1984	55	390	770	9	20	38	32	1,300
1985	10	490	210	9	10	20	21	770
1986	65	670	420	13	16	32	24	1,200
1987	10	650	170	11	6	19	20	890
1988	7	640	160	11	5	6	17	850
1989	4	580	190	10	4	5	18	810
1990	2	560	95	10	4	6	13	690
1991	5	310	91	5	3	6	8	430
1992	7	270	150	5	4	6	10	450
1993	22	560	270	10	12	15	13	890
1994	8	560	110	10	8	11	15	720
1995	590	740	65	23	25	47	16	1,500
1996	19	680	380	12	15	29	20	1,200
1997	210	740	460	17	26	45	36	1,500
Mean	66	490	350	10	14	25	19	980

** Estimated by subtracting all other sub-acres from total load at Vernalis **Based on extrapolation from TID Lateral Number 5 mean annual load for WYs 1990-1995. Loads rounded to two significant figures.*

Table A-8. Mean annual flow by sub-area (1000 acre feet)

Water Year	SJR abv. Salt Sl.	Grasslands	North West Side*	East Valley Floor**	Merced River	Tuolumne River	Stanislaus River	Total
1977	10	92	44	11	65	150	42	420
1978	1,990	200	190	120	550	470	960	4,480
1979	250	200	10	75	550	960	580	2,610
1980	1,400	240	160	170	990	1,780	1,260	5,990
1981	62	190	190	46	250	720	320	1,770
1982	1,210	200	280	150	1,000	2,010	630	5,470
1983	5,970	340	510	430	2,280	3,990	1,880	15,410
1984	1,290	240	830	160	800	1,680	1,320	6,310
1985	70	240	270	54	300	590	600	2,120
1986	1,310	280	540	140	620	1,330	1,000	5,230
1987	51	230	250	45	160	520	550	1,810
1988	20	230	180	29	110	160	450	1,170
1989	13	210	140	27	100	130	440	1,060
1990	6	190	140	23	89	160	310	920
1991	19	100	100	16	71	150	200	660
1992	24	85	81	18	100	150	240	700
1993	200	170	220	43	360	360	360	1,700
1994	33	180	130	31	220	270	360	1,220
1995	1,900	260	280	170	1,080	2,160	440	6,300
1996	370	270	600	97	660	1,180	780	3,950
1997	1,940	290	770	210	1,160	1,950	1,570	7,880
Mean	860	210	280	98	550	990	680	3,670

* Estimated by subtracting all other sub-areas from total load at Vernalis **Based on extrapolation of mean annual flow from TID Lateral #5, and estimated groundwater accretions from EVF sub-area. Discharges rounded to three significant figures.

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Core Data Set
San Joaquin River at Lander Avenue

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Oct-76	877	*659*	785	*0.22*	524
Nov-76	1,751	*515*	1,227	*0.17*	818
Dec-76	1,125	*603*	922	*0.20*	615
Jan-77	1,775	*513*	1,238	*0.17*	825
Feb-77	827	*673*	756	*0.22*	504
Mar-77	1,490	*546*	1,106	*0.18*	737
Apr-77	742	*699*	705	*0.23*	470
May-77	519	*793*	560	*0.26*	373
Jun-77	173	*1171*	275	*0.39*	184
Jul-77	58	*1725*	136	*0.58*	91
Aug-77	330	*931*	418	*0.31*	279
Sep-77	244	*1037*	344	*0.35*	229
Oct-77	105	*1398*	200	*0.47*	133
Nov-77	269	*1001*	366	*0.33*	244
Dec-77	615	*747*	625	*0.25*	416
Jan-78	41,330	*168*	9,442	*0.06*	6,294
Feb-78	221,200	*93*	27,878	*0.03*	18,585
Mar-78	409,000	*75*	41,453	*0.02*	27,635
Apr-78	726,200	*61*	60,046	*0.02*	40,031
May-78	494,800	*70*	46,875	*0.02*	31,250
Jun-78	74,100	*137*	13,763	*0.05*	9,175
Jul-78	2,977	*427*	1,728	*0.14*	1,152
Aug-78	2,692	*443*	1,620	*0.15*	1,080
Sep-78	12,240	*259*	4,305	*0.09*	2,870
Oct-78	8,499	*294*	3,402	*0.10*	2,268
Nov-78	2,953	*428*	1,719	*0.14*	1,146
Dec-78	6,337	*327*	2,815	*0.11*	1,876
Jan-79	61,830	*146*	12,245	*0.05*	8,163
Feb-79	69,380	*140*	13,190	*0.05*	8,793
Mar-79	50,050	*157*	10,683	*0.05*	7,122
Apr-79	17,510	*228*	5,424	*0.08*	3,616
May-79	10,320	*275*	3,856	*0.09*	2,571
Jun-79	2,428	*459*	1,515	*0.15*	1,010
Jul-79	3,170	*418*	1,800	*0.14*	1,200
Aug-79	2,305	*468*	1,465	*0.16*	977
Sep-79	11,160	*267*	4,056	*0.09*	2,704
Oct-79	9,527	*283*	3,662	*0.09*	2,441
Nov-79	1,741	*517*	1,223	*0.17*	815
Dec-79	3,066	*423*	1,762	*0.14*	1,174
Jan-80	188,200	*98*	25,117	*0.03*	16,745
Feb-80	344,600	*79*	37,113	*0.03*	24,742
Mar-80	592,100	*65*	52,633	*0.02*	35,089
Apr-80	73,620	*137*	13,705	*0.05*	9,137

Italicized = estimated

Core Data Set
San Joaquin River at Lander Avenue

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
May-80	114,400	*117*	18,215	*0.04*	12,144
Jun-80	18,580	*223*	5,636	*0.07*	3,757
Jul-80	32,770	*182*	8,128	*0.06*	5,419
Aug-80	5,024	*355*	2,423	*0.12*	1,615
Sep-80	13,880	*247*	4,669	*0.08*	3,112
Oct-80	10,430	*274*	3,882	*0.09*	2,588
Nov-80	2,280	*469*	1,455	*0.16*	970
Dec-80	2,230	*473*	1,434	*0.16*	956
Jan-81	5,430	*345*	2,547	*0.12*	1,698
Feb-81	6,850	*318*	2,960	*0.11*	1,973
Mar-81	20,170	*217*	5,942	*0.07*	3,962
Apr-81	4,270	*376*	2,181	*0.13*	1,454
May-81	3,710	*395*	1,992	*0.13*	1,328
Jun-81	1,250	*581*	987	*0.19*	658
Jul-81	1,130	*602*	925	*0.20*	617
Aug-81	1,460	*550*	1,091	*0.18*	727
Sep-81	2,840	*434*	1,677	*0.14*	1,118
Oct-81	4,240	*377*	2,172	*0.13*	1,448
Nov-81	4,901	*358*	2,384	*0.12*	1,590
Dec-81	6,878	*317*	2,967	*0.11*	1,978
Jan-82	44,897	*163*	9,960	*0.05*	6,640
Feb-82	52,813	*154*	11,060	*0.05*	7,374
Mar-82	64,942	*143*	12,639	*0.05*	8,426
Apr-82	600,257	*65*	53,100	*0.02*	35,400
May-82	339,913	*80*	36,787	*0.03*	24,525
Jun-82	40,000	*170*	9,244	*0.06*	6,163
Jul-82	12,714	*255*	4,412	*0.09*	2,941
Aug-82	4,129	*380*	2,135	*0.13*	1,423
Sep-82	30,111	*188*	7,696	*0.06*	5,131
Oct-82	30,260	*188*	7,721	*0.06*	5,147
Nov-82	120,330	*115*	18,819	*0.04*	12,546
Dec-82	557,450	*67*	50,624	*0.02*	33,749
Jan-83	570,800	*66*	51,403	*0.02*	34,269
Feb-83	865,470	*57*	67,246	*0.02*	44,831
Mar-83	1,179,000	*51*	82,097	*0.02*	54,731
Apr-83	790,410	*59*	63,422	*0.02*	42,281
May-83	608,750	*65*	53,584	*0.02*	35,723
Jun-83	642,760	*64*	55,498	*0.02*	36,998
Jul-83	448,410	*72*	43,989	*0.02*	29,326
Aug-83	46,770	*161*	10,226	*0.05*	6,817
Sep-83	110,140	*119*	17,775	*0.04*	11,850
Oct-83	178,160	*100*	24,244	*0.03*	16,163
Nov-83	177,740	*100*	24,207	*0.03*	16,138

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Dec-83	338,060	*80*	36,657	*0.03*	24,438
Jan-84	494,800	*70*	46,875	*0.02*	31,250
Feb-84	33,430	*181*	8,233	*0.06*	5,489
Mar-84	15,080	*240*	4,925	*0.08*	3,284
Apr-84	12,920	*254*	4,458	*0.08*	2,972
May-84	9,800	*280*	3,729	*0.09*	2,486
Jun-84	5,900	*335*	2,688	*0.11*	1,792
Jul-84	2,120	*482*	1,388	*0.16*	926
Aug-84	5,230	*350*	2,487	*0.12*	1,658
Sep-84	12,100	*260*	4,273	*0.09*	2,849
Oct-84	17,812	100	2,422	*0.03*	1,614
Nov-84	2,731	213	791	*0.07*	527
Dec-84	4,748	325	2,098	*0.11*	1,399
Jan-85	4,024	438	2,396	*0.15*	1,597
Feb-85	6,190	443	3,728	*0.15*	2,485
Mar-85	11,940	514	8,343	*0.17*	5,562
Apr-85	4,540	585	3,611	*0.20*	2,407
May-85	2,763	657	2,468	*0.22*	1,645
Jun-85	3,275	617	2,747	0.10	890
Jul-85	1,139	799	1,237	0.36	1,115
Aug-85	2,136	429	1,246	0.16	900
Sep-85	8,622	120	1,407	0.00	59
Oct-85	5,849	189	1,503	0.27	4,294
Nov-85	2,293	431	1,344	0.22	1,340
Dec-85	7,049	262	2,511	0.22	4,121
Jan-86	8,245	431	4,831	0.34	7,697
Feb-86	82,469	84	9,418	0.06	12,333
Mar-86	688,998	70	65,568	0.00	4,683
Apr-86	399,788	51	27,719	0.07	76,092
May-86	49,436	123	8,267	0.03	4,032
Jun-86	36,159	116	5,702	0.06	6,309
Jul-86	4,405	383	2,294	0.20	2,395
Aug-86	5,829	187	1,482	0.11	1,743
Sep-86	18,349	100	2,495	0.08	3,991
Oct-86	14,204	126	2,433	0.01	386
Nov-86	1,388	498	940	0.16	604
Dec-86	3,488	453	2,148	0.21	1,992
Jan-87	6,460	401	3,522	0.27	4,655
Feb-87	5,564	245	1,853	0.20	3,026
Mar-87	11,000	495	7,402	0.14	4,187
Apr-87	1,458	1180	2,339	0.21	833
May-87	1,902	726	1,877	0.35	1,810
Jun-87	1,275	690	1,196	0.13	451

Italicized = estimated

Core Data Set
San Joaquin River at Lander Avenue

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jul-87	989	803	1,080	0.28	753
Aug-87	1,176	831	1,329	0.31	991
Sep-87	2,386	237	769	0.19	1,233
Oct-87	1,240	362	610	0.04	118
Nov-87	1,374	881	1,646	0.23	859
Dec-87	2,237	579	1,761	0.26	1,581
Jan-88	4,314	315	1,847	0.29	3,402
Feb-88	2,793	694	2,635	0.33	2,506
Mar-88	1,555	768	1,624	0.28	1,175
Apr-88	3,353	964	4,394	0.23	2,051
May-88	1,238	844	1,421	0.30	1,010
Jun-88	533	1060	768	0.30	435
Jul-88	444	973	587	0.38	453
Aug-88	527	956	685	0.32	462
Sep-88	331	875	394	0.30	270
Oct-88	201	900	246	0.25	135
Nov-88	85	900	104	0.28	65
Dec-88	192	900	235	0.26	136
Jan-89	3,134	900	3,835	0.41	3,465
Feb-89	1,918	900	2,347	0.12	626
Mar-89	4,342	900	5,313	0.14	1,676
Apr-89	612	900	749	0.32	528
May-89	676	900	827	0.37	680
Jun-89	391	900	478	0.36	383
Jul-89	238	900	291	0.39	249
Aug-89	654	900	800	0.37	653
Sep-89	422	900	516	0.26	296
Oct-89	362	1709	841	0.22	217
Nov-89	74	641	64	0.19	38
Dec-89	52	845	60	0.24	34
Jan-90	574	854	666	0.23	351
Feb-90	1,599	473	1,028	0.19	826
Mar-90	1,734	866	2,041	0.30	1,433
Apr-90	565	1319	1,013	0.36	557
May-90	454	1297	801	0.34	422
Jun-90	348	833	394	0.31	293
Jul-90	39	1595	85	0.61	65
Aug-90	107	1392	202	0.56	164
Sep-90	29	1450	57	0.53	42
Oct-90	99	2080	280	0.67	180
Nov-90	109	2116	314	0.73	217
Dec-90	8	2118	23	0.70	15
Jan-91	23	1930	60	0.69	43

Italicized = estimated

Core Data Set
San Joaquin River at Lander Avenue

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Feb-91	122	1479	245	0.45	148
Mar-91	15,580	208	4,406	0.14	6,015
Apr-91	747	698	709	0.25	508
May-91	638	1356	1,176	0.38	656
Jun-91	349	1259	597	0.39	365
Jul-91	611	1173	974	0.33	548
Aug-91	203	1252	346	0.44	243
Sep-91	70	1616	154	0.55	104
Oct-91	1,014	2500	3,446	0.75	2,057
Nov-91	1,020	800	1,109	0.21	592
Dec-91	66	700	63	0.48	87
Jan-92	195	700	186	0.27	144
Feb-92	16,570	850	19,148	0.13	5,857
Mar-92	2,188	650	1,933	0.25	1,511
Apr-92	1,109	800	1,206	0.33	995
May-92	489	1050	698	0.40	537
Jun-92	1,125	900	1,376	0.64	1,942
Jul-92	123	750	125	0.76	255
Aug-92	63	700	60	0.89	152
Sep-92	27	750	28	0.94	69
Oct-92	31	2585	109	0.96	81
Nov-92	20	2617	71	1.03	56
Dec-92	43	2530	148	0.94	110
Jan-93	100,400	107	14,605	0.05	12,967
Feb-93	39,330	147	7,860	0.09	9,090
Mar-93	31,350	376	16,025	0.12	10,229
Apr-93	16,420	207	4,621	0.11	4,822
May-93	2,019	974	2,673	0.30	1,647
Jun-93	2,315	628	1,976	0.21	1,338
Jul-93	1,802	828	2,028	0.29	1,431
Aug-93	1,505	783	1,602	0.34	1,391
Sep-93	804	871	952	0.33	710
Oct-93	1,278	186	323	0.27	924
Nov-93	2,716	185	683	0.13	938
Dec-93	444	621	375	0.21	257
Jan-94	2,466	466	1,562	0.36	2,382
Feb-94	16,760	206	4,694	0.11	5,024
Mar-94	3,857	400	2,097	0.24	2,477
Apr-94	1,598	634	1,377	0.28	1,220
May-94	1,778	697	1,685	0.27	1,287
Jun-94	1,084	880	1,297	0.31	928
Jul-94	788	914	979	0.36	761
Aug-94	411	876	489	0.42	469

Italicized = estimated

Core Data Set
San Joaquin River at Lander Avenue

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Sep-94	101	944	130	0.37	100
Oct-94	99	1301	174	0.57	154
Nov-94	482	678	444	0.16	210
Dec-94	170	866	201	0.32	148
Jan-95	81,164	80	8,870	0.28	61,792
Feb-95	14,563	382	7,570	0.10	3,960
Mar-95	399,164	129	70,142	0.06	65,120
Apr-95	422,994	59	33,957	0.24	274,099
May-95	566,563	44	33,719	0.29	446,741
Jun-95	152,465	105	21,750	0.12	47,673
Jul-95	221,961	39	11,881	0.40	238,991
Aug-95	22,015	193	5,769	0.41	24,556
Sep-95	16,138	104	2,272	0.38	16,657
Oct-95	9,965	97	1,313	0.01	339
Nov-95	2,854	189	732	0.11	854
Dec-95	6,782	222	2,049	0.07	1,291
Jan-96	9,504	371	4,800	0.05	1,292
Feb-96	65,151	149	13,227	0.01	2,214
Mar-96	129,379	96	16,970	0.06	21,107
Apr-96	9,947	353	4,776	0.09	2,434
May-96	103,000	67	9,340	0.01	3,501
Jun-96	9,620	306	4,007	0.06	1,569
Jul-96	6,233	304	2,578	0.13	2,203
Aug-96	6,780	283	2,612	0.06	1,106
Sep-96	7,531	164	1,681	0.01	256
Oct-96	4,887	144	958	0.01	166
Nov-96	6,281	243	2,077	0.01	213
Dec-96	109,498	89	13,185	0.01	3,722
Jan-97	977,619	66	87,347	0.01	33,227
Feb-97	739,243	60	60,156	0.16	321,997
Mar-97	91,248	142	17,607	0.19	47,046
Apr-97	5,332	502	3,639	0.11	1,595
May-97	2,113	859	2,469	0.29	1,658
Jun-97	1,995	763	2,069	0.28	1,510
Jul-97	1,752	667	1,588	0.16	762
Aug-97	1,139	682	1,056	0.41	1,271
Sep-97	389	853	451	0.38	402

Italicized = estimated

Core Data Set
San Joaquin River near Vernalis

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Oct-76	78,310	624	66,433	*0.51*	108,906
Nov-76	67,600	630	57,898	*0.52*	94,915
Dec-76	59,330	648	52,267	*0.53*	85,684
Jan-77	67,070	973	88,720	*0.80*	145,442
Feb-77	43,790	1,042	62,033	*0.85*	101,693
Mar-77	32,200	661	28,936	*0.54*	47,436
Apr-77	12,620	981	16,831	*0.80*	27,592
May-77	24,580	849	28,371	*0.70*	46,509
Jun-77	7,020	1,014	9,677	*0.83*	15,864
Jul-77	5,710	998	7,747	*0.82*	12,700
Aug-77	7,640	958	9,950	*0.79*	16,312
Sep-77	10,630	952	13,758	*0.78*	22,554
Oct-77	15,140	958	19,718	*0.79*	32,325
Nov-77	25,570	743	25,828	*0.61*	42,342
Dec-77	31,100	620	26,214	*0.51*	42,974
Jan-78	139,900	368	69,991	*0.30*	114,740
Feb-78	406,500	231	127,659	*0.19*	209,277
Mar-78	705,600	206	197,608	*0.17*	323,948
Apr-78	1,192,000	176	285,212	*0.14*	467,561
May-78	1,176,000	132	211,038	*0.11*	345,964
Jun-78	420,700	116	66,345	*0.10*	108,763
Jul-78	117,300	332	52,944	*0.27*	86,793
Aug-78	87,190	527	62,468	*0.43*	102,406
Sep-78	162,500	240	53,021	*0.20*	86,919
Oct-78	204,600	183	50,902	*0.15*	83,446
Nov-78	208,100	214	60,543	*0.18*	99,251
Dec-78	172,900	270	63,466	*0.22*	104,042
Jan-79	321,800	170	74,373	*0.14*	121,923
Feb-79	396,400	217	116,943	*0.18*	191,709
Mar-79	532,000	171	123,676	*0.14*	202,748
Apr-79	208,600	357	101,242	*0.29*	165,971
May-79	155,200	360	75,958	*0.30*	124,521
Jun-79	134,100	310	56,516	*0.25*	92,649
Jul-79	82,000	439	48,939	*0.36*	80,228
Aug-79	89,220	463	56,159	*0.38*	92,065
Sep-79	109,500	378	56,271	*0.31*	92,248
Oct-79	171,600	234	54,590	*0.19*	89,492
Nov-79	137,500	322	60,192	*0.26*	98,675
Dec-79	152,900	297	61,737	*0.24*	101,208
Jan-80	803,600	228	249,089	*0.19*	408,342
Feb-80	1,080,000	149	218,771	*0.12*	358,641
Mar-80	1,555,000	133	281,165	*0.11*	460,926
Apr-80	609,900	165	136,811	*0.14*	224,281

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
May-80	609,500	101	83,690	*0.08*	137,197
Jun-80	315,700	150	64,379	*0.12*	105,540
Jul-80	208,000	213	60,231	*0.17*	98,740
Aug-80	121,100	449	73,921	*0.37*	121,182
Sep-80	226,200	310	95,331	*0.25*	156,280
Oct-80	250,400	167	56,850	*0.14*	93,197
Nov-80	195,000	225	59,648	*0.18*	97,784
Dec-80	181,400	304	74,970	*0.25*	122,902
Jan-81	199,900	200	54,353	*0.16*	89,103
Feb-81	159,900	681	148,039	*0.56*	242,686
Mar-81	192,000	441	115,112	*0.36*	188,708
Apr-81	150,700	423	86,663	*0.35*	142,070
May-81	120,900	418	68,704	*0.34*	112,629
Jun-81	89,180	429	52,012	*0.35*	85,266
Jul-81	77,790	423	44,735	*0.35*	73,335
Aug-81	78,050	475	50,402	*0.39*	82,626
Sep-81	70,300	446	42,625	*0.37*	69,878
Oct-81	85,250	342	39,637	*0.28*	64,979
Nov-81	93,070	416	52,636	*0.34*	86,288
Dec-81	113,900	476	73,707	*0.39*	120,831
Jan-82	239,100	396	128,722	*0.32*	211,020
Feb-82	369,100	335	168,100	*0.27*	275,574
Mar-82	618,700	171	143,832	*0.14*	235,790
Apr-82	1,366,000	128	237,706	*0.10*	389,682
May-82	1,147,000	90	140,341	*0.07*	230,068
Jun-82	451,300	201	123,322	*0.16*	202,167
Jul-82	378,900	245	126,203	*0.20*	206,890
Aug-82	247,000	261	87,643	*0.21*	143,677
Sep-82	364,700	143	70,901	*0.12*	116,231
Oct-82	502,900	91	62,216	*0.07*	101,993
Nov-82	415,000	155	87,450	*0.13*	143,360
Dec-82	1,014,000	106	146,124	*0.09*	239,548
Jan-83	1,172,000	124	197,573	*0.10*	323,891
Feb-83	1,755,000	141	336,415	*0.12*	551,500
Mar-83	2,462,000	161	538,881	*0.13*	883,412
Apr-83	2,169,000	166	489,493	*0.14*	802,448
May-83	1,954,000	111	294,867	*0.09*	483,389
Jun-83	1,552,000	84	177,235	*0.07*	290,550
Jul-83	1,182,000	113	181,583	*0.09*	297,677
Aug-83	555,500	192	144,999	*0.16*	237,703
Sep-83	673,000	93	85,090	*0.08*	139,491
Oct-83	818,800	91	101,297	*0.07*	166,061
Nov-83	635,200	227	196,027	*0.19*	321,355

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Dec-83	1,176,000	121	193,451	*0.10*	317,133
Jan-84	1,576,000	144	308,530	*0.12*	505,787
Feb-84	623,100	208	176,198	*0.17*	288,849
Mar-84	461,300	228	142,987	*0.19*	234,405
Apr-84	255,000	374	129,656	*0.31*	212,550
May-84	199,200	326	88,285	*0.27*	144,729
Jun-84	136,700	363	67,461	*0.30*	110,592
Jul-84	117,100	419	66,704	*0.34*	109,350
Aug-84	134,000	419	76,330	*0.34*	125,132
Sep-84	173,600	238	56,170	*0.20*	92,082
Oct-84	247,800	211	71,083	*0.17*	116,529
Nov-84	170,500	301	69,770	*0.25*	114,377
Dec-84	293,600	205	81,826	*0.17*	134,140
Jan-85	250,300	277	94,258	*0.23*	154,522
Feb-85	180,100	369	90,348	*0.30*	148,112
Mar-85	168,600	454	104,062	*0.37*	170,594
Apr-85	145,500	482	95,343	*0.40*	156,300
May-85	131,200	460	82,049	0.39	139,126
Jun-85	104,200	463	65,589	0.43	121,828
Jul-85	157,900	315	67,619	0.16	68,693
Aug-85	160,900	312	68,248	0.30	129,059
Sep-85	114,800	384	59,931	0.30	93,018
Oct-85	127,368	301	52,057	0.18	61,186
Nov-85	114,756	406	63,400	0.26	81,126
Dec-85	135,558	455	83,933	0.46	168,231
Jan-86	126,615	502	86,371	0.51	176,038
Feb-86	485,478	178	117,598	0.21	276,375
Mar-86	1,539,006	107	224,560	0.12	512,654
Apr-86	1,165,409	113	179,714	0.11	358,492
May-86	538,741	169	123,675	0.13	197,047
Jun-86	370,821	192	96,708	0.21	209,236
Jul-86	177,895	371	89,650	0.33	159,620
Aug-86	195,682	294	78,216	0.28	150,066
Sep-86	248,708	228	77,178	0.18	120,285
Oct-86	229,988	201	62,969	0.12	74,916
Nov-86	167,068	294	66,873	0.25	113,235
Dec-86	227,827	221	68,468	0.23	144,923
Jan-87	141,705	372	71,687	0.32	122,630
Feb-87	118,603	501	80,758	0.57	184,891
Mar-87	209,901	474	135,366	0.51	290,316
Apr-87	170,558	372	86,178	0.46	213,556
May-87	133,872	384	69,835	0.30	109,158
Jun-87	118,385	442	71,169	0.41	130,791

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jul-87	100,320	471	64,254	0.53	145,618
Aug-87	100,003	508	69,075	0.51	139,914
Sep-87	94,986	481	62,130	0.40	104,003
Oct-87	84,198	503	57,621	0.34	78,938
Nov-87	92,091	546	68,396	0.54	136,210
Dec-87	78,566	590	63,061	0.47	99,369
Jan-88	91,139	679	84,185	0.69	171,539
Feb-88	79,875	824	89,476	0.92	200,800
Mar-88	137,739	537	100,604	0.64	239,688
Apr-88	127,646	446	77,477	0.44	154,387
May-88	109,501	454	67,591	0.45	133,980
Jun-88	101,787	462	63,916	0.50	138,384
Jul-88	83,405	498	56,509	0.48	108,854
Aug-88	95,739	502	65,302	0.49	127,439
Sep-88	86,379	490	57,487	0.44	103,856
Oct-88	69,254	542	51,076	0.41	76,755
Nov-88	75,810	520	53,542	0.49	101,655
Dec-88	84,337	512	58,728	0.57	131,189
Jan-89	77,159	696	73,016	0.76	159,996
Feb-89	68,513	776	72,290	0.87	162,223
Mar-89	124,374	463	78,213	0.55	186,566
Apr-89	113,943	440	68,094	0.50	153,831
May-89	119,833	410	66,779	0.46	148,769
Jun-89	94,173	443	56,679	0.52	132,043
Jul-89	78,923	455	48,842	0.53	114,212
Aug-89	71,882	483	47,190	0.64	125,299
Sep-89	80,470	473	51,746	0.56	123,618
Oct-89	86,122	475	55,593	0.47	111,111
Nov-89	83,544	508	57,701	0.52	117,671
Dec-89	84,912	551	63,600	0.56	130,364
Jan-90	76,346	726	75,334	0.75	154,675
Feb-90	75,810	737	75,923	0.93	192,416
Mar-90	108,212	493	72,470	0.57	167,240
Apr-90	77,892	501	53,020	0.45	95,238
May-90	78,646	474	50,661	0.45	96,196
Jun-90	66,417	569	51,358	0.51	91,313
Jul-90	62,026	505	42,547	0.52	88,400
Aug-90	63,492	477	41,168	0.46	79,860
Sep-90	52,105	537	38,014	0.44	62,181
Oct-90	61,055	489	40,577	0.33	54,114
Nov-90	66,351	454	40,928	0.30	53,231
Dec-90	56,458	575	44,169	0.52	79,086
Jan-91	50,180	656	44,752	0.58	78,527

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Feb-91	42,079	688	39,364	0.61	69,790
Mar-91	109,355	516	76,678	0.48	141,634
Apr-91	69,494	665	62,818	0.86	162,603
May-91	64,477	389	34,123	0.31	54,362
Jun-91	33,802	544	24,986	0.46	42,223
Jul-91	36,517	517	25,671	0.41	40,838
Aug-91	33,035	550	24,700	0.44	39,537
Sep-91	34,151	553	25,685	0.44	40,535
Oct-91	48,470	466	30,732	0.38	50,178
Nov-91	64,487	375	32,879	0.29	51,349
Dec-91	55,004	529	39,527	0.43	64,931
Jan-92	58,968	582	46,629	0.60	96,456
Feb-92	120,233	433	70,759	0.42	138,317
Mar-92	90,345	654	80,381	0.78	192,566
Apr-92	84,377	455	52,217	0.50	115,403
May-92	54,806	340	25,332	0.32	47,969
Jun-92	28,589	437	16,965	0.47	36,552
Jul-92	27,461	516	19,271	0.43	32,063
Aug-92	29,684	500	20,181	0.39	31,792
Sep-92	37,752	454	23,284	0.36	36,663
Oct-92	52,171	420	29,794	0.32	44,942
Nov-92	56,853	418	32,328	0.37	56,784
Dec-92	60,337	498	40,890	0.60	97,963
Jan-93	253,269	278	95,653	0.31	216,682
Feb-93	168,535	475	108,831	0.52	237,294
Mar-93	166,116	597	134,780	0.66	296,946
Apr-93	203,495	389	107,680	0.37	206,878
May-93	221,918	276	83,394	0.26	154,258
Jun-93	139,266	357	67,533	0.36	135,447
Jul-93	92,804	494	62,363	0.50	126,104
Aug-93	122,847	340	56,799	0.37	124,954
Sep-93	164,847	247	55,333	0.20	91,486
Oct-93	186,918	207	52,551	0.17	84,742
Nov-93	104,643	468	66,540	0.43	121,021
Dec-93	100,082	491	66,799	0.50	136,057
Jan-94	108,986	488	72,270	0.49	145,014
Feb-94	110,334	476	71,412	0.59	177,256
Mar-94	135,598	472	87,000	0.70	259,838
Apr-94	110,810	399	60,080	0.33	98,884
May-94	121,260	384	63,353	0.35	114,120
Jun-94	65,955	503	45,077	0.52	93,499
Jul-94	69,796	430	40,829	0.44	83,657
Aug-94	53,303	475	34,411	0.49	71,316

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Sep-94	51,699	542	38,074	0.44	62,200
Oct-94	84,190	457	52,296	0.26	60,500
Nov-94	76,603	426	44,398	0.43	89,509
Dec-94	79,598	470	50,840	0.51	110,352
Jan-95	282,736	240	92,069	0.25	193,578
Feb-95	364,198	249	123,161	0.28	275,255
Mar-95	898,240	194	236,426	0.19	460,473
Apr-95	1,185,834	148	238,006	0.26	852,471
May-95	1,363,907	91	168,012	0.06	235,819
Jun-95	833,534	113	128,051	0.12	262,159
Jul-95	607,433	135	111,150	0.12	200,558
Aug-95	241,272	323	106,074	0.25	164,395
Sep-95	281,645	182	69,613	0.14	110,417
Oct-95	351,608	156	74,533	0.20	191,204
Nov-95	158,354	386	83,098	0.35	148,545
Dec-95	155,033	450	94,772	0.44	183,368
Jan-96	165,085	454	101,842	0.42	187,401
Feb-96	616,320	166	139,057	0.20	329,569
Mar-96	889,332	136	164,793	0.12	290,171
Apr-96	429,270	209	121,719	0.17	195,503
May-96	512,661	129	89,703	0.11	147,756
Jun-96	236,197	322	103,305	0.34	218,355
Jul-96	152,134	403	83,428	0.45	187,177
Aug-96	143,371	369	71,965	0.36	138,778
Sep-96	143,756	329	64,290	0.27	104,558
Oct-96	165,402	266	59,843	0.22	97,141
Nov-96	161,515	337	74,094	0.32	138,335
Dec-96	749,455	121	122,939	0.09	192,569
Jan-97	2,740,109	91	338,030	0.10	722,685
Feb-97	2,185,068	97	286,697	0.10	573,326
Mar-97	801,271	176	192,001	0.23	490,197
Apr-97	281,289	303	116,037	0.31	235,183
May-97	294,138	244	97,508	0.23	183,945
Jun-97	157,470	361	77,225	0.31	134,157
Jul-97	107,935	394	57,821	0.36	106,238
Aug-97	115,232	366	57,350	0.34	105,744
Sep-97	123,105	362	60,628	0.27	89,538

Italicized = estimated

Core Data Set
Merced River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Oct-76	8,720	162	1,920	*0.030*	711
Nov-76	9,430	125	1,603	*0.030*	769
Dec-76	12,030	106	1,734	*0.030*	981
Jan-77	10,590	126	1,814	*0.030*	864
Feb-77	6,730	160	1,464	*0.030*	549
Mar-77	5,800	181	1,427	*0.030*	473
Apr-77	4,110	192	1,073	*0.030*	335
May-77	4,000	186	1,011	*0.030*	326
Jun-77	1,140	246	381	*0.030*	93
Jul-77	1,000	247	336	*0.030*	82
Aug-77	548	266	198	*0.030*	45
Sep-77	670	309	281	*0.030*	55
Oct-77	699	298	283	*0.030*	57
Nov-77	7,220	120	1,178	*0.030*	589
Dec-77	11,250	84	1,285	*0.030*	918
Jan-78	21,410	106	3,085	*0.030*	1,746
Feb-78	36,910	114	5,720	*0.030*	3,011
Mar-78	70,810	86	8,279	*0.015*	2,888
Apr-78	133,000	54	9,764	*0.015*	5,424
May-78	99,790	53	7,190	*0.015*	4,070
Jun-78	76,710	44	4,589	*0.015*	3,129
Jul-78	13,730	110	2,053	*0.030*	1,120
Aug-78	17,010	115	2,659	*0.030*	1,388
Sep-78	64,840	103	9,079	*0.015*	2,644
Oct-78	90,310	30	3,683	*0.015*	3,683
Nov-78	69,330	69	6,504	*0.015*	2,828
Dec-78	28,060	131	4,997	*0.030*	2,289
Jan-79	38,360	67	3,494	*0.030*	3,129
Feb-79	74,180	67	6,757	*0.015*	3,025
Mar-79	117,400	53	8,459	*0.015*	4,788
Apr-79	26,610	103	3,726	*0.030*	2,171
May-79	29,120	111	4,394	*0.030*	2,375
Jun-79	31,200	81	3,436	*0.030*	2,545
Jul-79	14,190	105	2,026	*0.030*	1,157
Aug-79	13,650	95	1,763	*0.030*	1,113
Sep-79	21,870	76	2,260	*0.030*	1,784
Oct-79	33,570	68	3,103	*0.030*	2,738
Nov-79	26,070	59	2,091	*0.030*	2,127
Dec-79	27,130	60	2,213	*0.030*	2,213
Jan-80	178,600	76	18,453	*0.015*	7,284
Feb-80	155,800	50	10,591	*0.015*	6,354
Mar-80	252,500	41	14,074	*0.015*	10,298
Apr-80	93,220	46	5,830	*0.015*	3,802

Italicized = estimated

Core Data Set
Merced River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
May-80	90,670	41	5,054	*0.015*	3,698
Jun-80	39,440	71	3,807	*0.030*	3,217
Jul-80	18,970	98	2,527	*0.030*	1,547
Aug-80	23,680	71	2,286	*0.030*	1,932
Sep-80	53,590	37	2,696	*0.015*	2,186
Oct-80	44,270	35	2,106	*0.015*	1,806
Nov-80	33,830	43	1,978	*0.030*	2,760
Dec-80	32,690	70	3,111	*0.030*	2,667
Jan-81	24,060	95	3,107	*0.030*	1,963
Feb-81	16,710	99	2,249	*0.030*	1,363
Mar-81	22,670	107	3,298	*0.030*	1,849
Apr-81	15,380	112	2,342	*0.030*	1,255
May-81	15,400	101	2,115	*0.030*	1,256
Jun-81	10,700	111	1,615	*0.030*	873
Jul-81	9,280	135	1,703	*0.030*	757
Aug-81	10,050	110	1,503	*0.030*	820
Sep-81	10,380	110	1,552	*0.030*	847
Oct-81	10,290	127	1,777	*0.030*	839
Nov-81	14,710	99	1,980	*0.030*	1,200
Dec-81	15,310	104	2,165	*0.030*	1,249
Jan-82	21,410	119	3,464	*0.030*	1,746
Feb-82	70,240	72	6,875	*0.015*	2,865
Mar-82	120,500	49	8,027	*0.015*	4,915
Apr-82	276,500	46	17,291	*0.015*	11,277
May-82	245,800	59	19,716	*0.015*	10,025
Jun-82	84,270	73	8,363	*0.015*	3,437
Jul-82	62,980	86	7,363	*0.015*	2,569
Aug-82	31,040	118	4,979	*0.030*	2,532
Sep-82	47,490	59	3,809	*0.015*	1,937
Oct-82	107,500	34	4,969	*0.015*	4,384
Nov-82	70,430	106	10,149	*0.015*	2,872
Dec-82	148,900	61	12,348	*0.015*	6,073
Jan-83	173,800	52	12,287	*0.015*	7,088
Feb-83	260,700	43	15,240	*0.015*	10,633
Mar-83	336,900	47	21,527	*0.015*	13,740
Apr-83	294,500	45	18,017	*0.015*	12,011
May-83	224,900	49	14,982	*0.015*	9,173
Jun-83	270,500	27	9,929	*0.015*	11,032
Jul-83	220,900	36	10,811	*0.015*	9,009
Aug-83	73,270	50	4,981	*0.015*	2,988
Sep-83	102,100	44	6,107	*0.015*	4,164
Oct-83	168,400	31	7,097	*0.015*	6,868
Nov-83	44,010	111	6,641	*0.015*	1,795

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Dec-83	148,600	51	10,303	*0.015*	6,061
Jan-84	198,200	48	12,934	*0.015*	8,084
Feb-84	71,410	76	7,378	*0.015*	2,912
Mar-84	37,820	109	5,604	*0.030*	3,085
Apr-84	26,910	113	4,134	*0.030*	2,195
May-84	24,510	111	3,699	*0.030*	1,999
Jun-84	22,290	137	4,152	*0.030*	1,818
Jul-84	18,230	101	2,503	*0.030*	1,487
Aug-84	17,010	93	2,151	*0.030*	1,388
Sep-84	17,980	95	2,322	*0.030*	1,467
Oct-84	27,480	115	4,296	*0.030*	2,242
Nov-84	32,350	104	4,574	*0.030*	2,639
Dec-84	71,930	44	4,303	*0.015*	2,934
Jan-85	41,790	106	6,022	*0.015*	1,704
Feb-85	17,770	103	2,488	*0.030*	1,449
Mar-85	19,250	105	2,748	*0.030*	1,570
Apr-85	17,770	103	2,488	*0.030*	1,449
May-85	17,800	102	2,468	*0.030*	1,452
Jun-85	15,070	145	2,971	*0.030*	1,229
Jul-85	13,520	139	2,555	*0.030*	1,103
Aug-85	11,890	109	1,762	*0.030*	970
Sep-85	13,530	122	2,244	*0.030*	1,104
Oct-85	15,820	117	2,516	*0.030*	1,290
Nov-85	14,120	111	2,131	*0.030*	1,152
Dec-85	18,850	170	4,357	*0.030*	1,538
Jan-86	12,970	137	2,416	*0.030*	1,058
Feb-86	25,360	87	2,999	*0.030*	2,069
Mar-86	182,200	41	10,156	*0.015*	7,431
Apr-86	158,600	32	6,900	*0.015*	6,469
May-86	104,400	36	5,110	*0.015*	4,258
Jun-86	39,880	60	3,253	*0.015*	1,627
Jul-86	16,760	144	3,281	*0.030*	1,367
Aug-86	15,620	146	3,100	*0.030*	1,274
Sep-86	18,730	110	2,801	*0.030*	1,528
Oct-86	27,790	69	2,607	*0.030*	2,267
Nov-86	14,700	121	2,418	*0.030*	1,199
Dec-86	14,060	118	2,256	*0.030*	1,147
Jan-87	14,180	131	2,525	*0.030*	1,157
Feb-87	13,130	119	2,124	*0.030*	1,071
Mar-87	18,080	98	2,409	*0.030*	1,475
Apr-87	10,820	198	2,913	*0.030*	883
May-87	11,980	157	2,557	*0.030*	977
Jun-87	10,060	130	1,778	*0.030*	821

Italicized = estimated

Core Data Set
Merced River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jul-87	7,620	92	953	*0.030*	622
Aug-87	7,680	153	1,597	*0.030*	626
Sep-87	9,030	165	2,026	*0.030*	737
Oct-87	6,420	175	1,527	*0.030*	524
Nov-87	11,780	201	3,219	*0.030*	961
Dec-87	13,360	192	3,487	*0.030*	1,090
Jan-88	15,280	107	2,223	*0.030*	1,246
Feb-88	12,420	108	1,824	*0.030*	1,013
Mar-88	11,640	130	2,057	*0.030*	949
Apr-88	10,800	126	1,850	*0.030*	881
May-88	10,900	157	2,327	*0.030*	889
Jun-88	7,710	200	2,096	*0.030*	629
Jul-88	3,790	205	1,056	*0.030*	309
Aug-88	4,230	113	650	*0.030*	345
Sep-88	2,130	226	654	*0.030*	174
Oct-88	2,330	343	1,086	*0.030*	190
Nov-88	8,080	140	1,538	*0.030*	659
Dec-88	11,960	139	2,260	*0.030*	976
Jan-89	12,350	163	2,737	*0.030*	1,007
Feb-89	11,360	167	2,579	*0.030*	927
Mar-89	18,960	205	5,284	*0.030*	1,547
Apr-89	11,760	219	3,501	*0.030*	959
May-89	9,630	229	2,998	*0.030*	786
Jun-89	6,540	225	2,001	*0.030*	533
Jul-89	2,110	330	947	*0.030*	172
Aug-89	1,470	376	751	*0.030*	120
Sep-89	3,030	294	1,211	*0.030*	247
Oct-89	5,080	211	1,457	*0.030*	414
Nov-89	10,300	294	4,117	*0.030*	840
Dec-89	11,670	226	3,586	*0.030*	952
Jan-90	11,930	177	2,871	*0.030*	973
Feb-90	13,590	153	2,827	*0.030*	1,109
Mar-90	10,220	209	2,904	*0.030*	834
Apr-90	8,250	218	2,445	*0.030*	673
May-90	7,870	152	1,626	*0.030*	642
Jun-90	5,970	168	1,364	*0.030*	487
Jul-90	1,700	203	469	*0.030*	139
Aug-90	1,170	240	382	*0.030*	95
Sep-90	1,470	287	574	*0.030*	120
Oct-90	1,825	419	1,040	*0.030*	149
Nov-90	7,540	319	3,270	*0.030*	615
Dec-90	10,151	119	1,642	*0.030*	828
Jan-91	7,811	111	1,179	*0.030*	637

Italicized = estimated

Core Data Set
Merced River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Feb-91	3,598	160	783	*0.030*	293
Mar-91	19,676	88	2,354	*0.030*	1,605
Apr-91	7,810	100	1,062	*0.030*	637
May-91	5,774	187	1,468	*0.030*	471
Jun-91	1,447	338	665	*0.030*	118
Jul-91	371	368	186	*0.030*	30
Aug-91	1,011	219	301	*0.030*	82
Sep-91	4,242	235	1,355	*0.030*	346
Oct-91	4,266	194	1,125	*0.030*	348
Nov-91	12,222	219	3,639	*0.030*	997
Dec-91	13,644	426	7,902	*0.030*	1,113
Jan-92	13,928	67	1,269	*0.030*	1,136
Feb-92	17,795	64	1,548	*0.030*	1,452
Mar-92	16,691	121	2,746	*0.030*	1,361
Apr-92	9,354	56	712	*0.030*	763
May-92	5,609	154	1,174	*0.030*	458
Jun-92	3,552	229	1,106	*0.030*	290
Jul-92	2,063	308	864	*0.030*	168
Aug-92	2,348	246	785	*0.030*	192
Sep-92	2,471	118	396	*0.030*	202
Oct-92	10,635	33	477	*0.030*	867
Nov-92	14,888	54	1,093	*0.030*	1,214
Dec-92	12,670	69	1,189	*0.030*	1,033
Jan-93	35,689	78	3,784	*0.030*	2,911
Feb-93	21,166	101	2,906	*0.030*	1,727
Mar-93	21,386	107	3,111	*0.030*	1,744
Apr-93	60,270	63	5,162	*0.015*	2,458
May-93	56,011	59	4,493	*0.015*	2,284
Jun-93	35,316	69	3,313	*0.030*	2,881
Jul-93	22,294	70	2,122	*0.030*	1,819
Aug-93	36,817	44	2,202	*0.030*	3,003
Sep-93	35,566	45	2,176	*0.030*	2,901
Oct-93	51,914	31	2,188	*0.015*	2,117
Nov-93	14,765	99	1,987	*0.030*	1,204
Dec-93	13,922	84	1,590	*0.030*	1,136
Jan-94	14,757	80	1,605	*0.030*	1,204
Feb-94	17,947	79	1,928	*0.030*	1,464
Mar-94	15,215	82	1,696	*0.030*	1,241
Apr-94	21,561	69	2,023	*0.030*	1,759
May-94	25,726	60	2,098	*0.030*	2,098
Jun-94	10,487	130	1,853	*0.030*	855
Jul-94	19,081	63	1,634	*0.030*	1,556
Aug-94	5,683	153	1,182	*0.030*	464

Italicized = estimated

Core Data Set
Merced River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Sep-94	4,880	189	1,254	*0.030*	398
Oct-94	20,875	*100*	2,850	*0.030*	1,703
Nov-94	13,159	*120*	2,146	*0.030*	1,073
Dec-94	12,774	*121*	2,107	*0.030*	1,042
Jan-95	36,541	*81*	4,021	*0.030*	2,981
Feb-95	14,617	*115*	2,289	*0.030*	1,192
Mar-95	155,045	*46*	9,780	*0.015*	6,324
Apr-95	195,306	*42*	11,272	*0.015*	7,966
May-95	226,578	*40*	12,350	*0.015*	9,241
Jun-95	188,762	*43*	11,038	*0.015*	7,699
Jul-95	151,900	*47*	9,658	*0.015*	6,195
Aug-95	30,223	*87*	3,578	*0.030*	2,465
Sep-95	37,175	*80*	4,064	*0.030*	3,032
Oct-95	109,095	*53*	7,879	*0.015*	4,449
Nov-95	24,599	*94*	3,152	*0.030*	2,007
Dec-95	24,813	*94*	3,169	*0.030*	2,024
Jan-96	21,305	*100*	2,886	*0.030*	1,738
Feb-96	144,343	*48*	9,359	*0.015*	5,887
Mar-96	175,793	*44*	10,566	*0.015*	7,170
Apr-96	52,226	*71*	5,009	*0.015*	2,130
May-96	74,642	*61*	6,239	*0.015*	3,044
Jun-96	15,110	*114*	2,336	*0.030*	1,233
Jul-96	5,394	*169*	1,240	*0.030*	440
Aug-96	3,918	*191*	1,018	*0.030*	320
Sep-96	5,674	*166*	1,279	*0.030*	463
Oct-96	25,517	156	5,394	*0.030*	2,081
Nov-96	15,513	163	3,443	*0.030*	1,265
Dec-96	127,188	40	6,867	*0.015*	5,187
Jan-97	430,351	29	17,077	*0.015*	17,552
Feb-97	371,694	37	18,769	*0.015*	15,160
Mar-97	96,624	64	8,403	*0.015*	3,941
Apr-97	38,526	141	7,388	*0.030*	3,143
May-97	35,847	110	5,364	*0.030*	2,924
Jun-97	5,591	375	2,849	*0.030*	456
Jul-97	5,167	233	1,636	*0.030*	421
Aug-97	3,925	233	1,244	*0.030*	320
Sep-97	5,470	191	1,418	*0.030*	446

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Oct-76	5,554	245	1,850	*0.030*	453
Nov-76	4,429	248	1,493	*0.030*	361
Dec-76	5,379	278	2,033	*0.030*	439
Jan-77	5,153	239	1,674	*0.030*	420
Feb-77	3,876	234	1,233	*0.030*	316
Mar-77	4,068	200	1,106	*0.030*	332
Apr-77	3,074	185	773	*0.030*	251
May-77	3,792	182	938	*0.030*	309
Jun-77	2,947	187	749	*0.030*	240
Jul-77	1,444	181	355	*0.030*	118
Aug-77	1,348	177	324	*0.030*	110
Sep-77	834	216	245	*0.030*	68
Oct-77	801	292	318	*0.030*	65
Nov-77	1,254	264	450	*0.030*	102
Dec-77	1,636	263	585	*0.030*	133
Jan-78	25,420	180	6,221	*0.030*	2,074
Feb-78	87,390	76	9,029	*0.015*	3,564
Mar-78	186,700	68	17,260	*0.015*	7,615
Apr-78	202,300	54	14,851	*0.015*	8,251
May-78	225,700	45	13,808	*0.015*	9,205
Jun-78	158,300	41	8,824	*0.015*	6,456
Jul-78	34,560	88	4,135	*0.030*	2,819
Aug-78	15,160	107	2,205	*0.030*	1,237
Sep-78	17,280	97	2,279	*0.030*	1,410
Oct-78	17,020	111	2,568	*0.030*	1,388
Nov-78	16,020	115	2,505	*0.030*	1,307
Dec-78	26,780	74	2,694	*0.030*	2,184
Jan-79	81,830	70	7,787	*0.015*	3,337
Feb-79	99,180	82	11,056	*0.015*	4,045
Mar-79	132,000	76	13,639	*0.015*	5,384
Apr-79	35,120	115	5,491	*0.030*	2,865
May-79	70,450	101	9,673	*0.015*	2,873
Jun-79	51,920	79	5,576	*0.030*	4,235
Jul-79	15,760	113	2,421	*0.030*	1,286
Aug-79	15,820	109	2,344	*0.030*	1,290
Sep-79	14,270	110	2,134	*0.030*	1,164
Oct-79	17,670	112	2,691	*0.030*	1,441
Nov-79	14,560	128	2,534	*0.030*	1,188
Dec-79	27,060	105	3,863	*0.030*	2,207
Jan-80	203,300	68	18,794	*0.015*	8,292
Feb-80	183,200	57	14,196	*0.015*	7,472
Mar-80	153,000	83	17,264	*0.015*	6,240

Italicized = estimated

Core Data Set
Stanislaus River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Apr-80	228,400	47	14,594	*0.015*	9,315
May-80	242,400	39	12,852	*0.015*	9,886
Jun-80	65,460	85	7,564	*0.030*	5,340
Jul-80	72,060	57	5,584	*0.015*	2,939
Aug-80	21,680	101	2,977	*0.030*	1,768
Sep-80	28,720	82	3,202	*0.030*	2,343
Oct-80	28,000	92	3,502	*0.030*	2,284
Nov-80	20,770	89	2,513	*0.030*	1,694
Dec-80	13,770	141	2,640	*0.030*	1,123
Jan-81	15,710	135	2,883	*0.030*	1,281
Feb-81	12,130	153	2,523	*0.030*	989
Mar-81	21,600	112	3,289	*0.030*	1,762
Apr-81	62,370	74	6,275	*0.030*	5,088
May-81	45,590	71	4,401	*0.030*	3,719
Jun-81	32,290	64	2,809	*0.030*	2,634
Jul-81	24,080	80	2,619	*0.030*	1,964
Aug-81	26,680	64	2,321	*0.030*	2,176
Sep-81	16,800	102	2,330	*0.030*	1,370
Oct-81	16,575	119	2,682	*0.030*	1,352
Nov-81	17,393	107	2,530	*0.030*	1,419
Dec-81	14,657	134	2,670	*0.030*	1,196
Jan-82	36,245	122	6,012	*0.030*	2,957
Feb-82	61,271	94	7,830	*0.030*	4,998
Mar-82	81,480	72	7,976	*0.015*	3,323
Apr-82	46,752	110	6,992	*0.030*	3,814
May-82	27,631	107	4,019	*0.030*	2,254
Jun-82	80,330	60	6,553	*0.015*	3,276
Jul-82	80,945	56	6,163	*0.015*	3,301
Aug-82	88,561	64	7,706	*0.015*	3,612
Sep-82	81,500	60	6,648	*0.015*	3,324
Oct-82	79,300	54	5,822	*0.015*	3,234
Nov-82	79,890	56	6,082	*0.015*	3,258
Dec-82	81,140	73	8,053	*0.015*	3,309
Jan-83	84,430	101	11,593	*0.015*	3,443
Feb-83	60,270	122	9,996	*0.030*	4,916
Mar-83	210,600	75	21,473	*0.015*	8,589
Apr-83	309,900	51	21,487	*0.015*	12,639
May-83	262,950	52	18,589	*0.015*	10,724
Jun-83	196,500	49	13,090	*0.015*	8,014
Jul-83	225,700	45	13,808	*0.015*	9,205
Aug-83	172,840	49	11,514	*0.015*	7,049
Sep-83	113,790	56	8,663	*0.015*	4,641
Oct-83	111,260	65	9,832	*0.015*	4,538

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Nov-83	137,310	79	14,747	*0.015*	5,600
Dec-83	311,010	54	22,832	*0.015*	12,685
Jan-84	299,400	50	20,352	*0.015*	12,211
Feb-84	101,610	66	9,117	*0.015*	4,144
Mar-84	89,290	83	10,075	*0.015*	3,642
Apr-84	56,760	91	7,022	*0.030*	4,630
May-84	57,780	88	6,913	*0.030*	4,713
Jun-84	33,650	116	5,307	*0.030*	2,745
Jul-84	31,260	93	3,952	*0.030*	2,550
Aug-84	37,100	78	3,934	*0.030*	3,026
Sep-84	52,100	64	4,533	*0.030*	4,250
Oct-84	53,806	81	5,925	*0.030*	4,389
Nov-84	23,738	121	3,905	*0.030*	1,936
Dec-84	46,992	118	7,539	*0.030*	3,833
Jan-85	62,876	98	8,377	*0.030*	5,129
Feb-85	40,762	97	5,375	*0.030*	3,325
Mar-85	38,612	92	4,829	*0.030*	3,150
Apr-85	51,209	78	5,430	*0.030*	4,177
May-85	45,217	91	5,594	*0.030*	3,688
Jun-85	38,132	80	4,147	*0.030*	3,110
Jul-85	86,598	56	6,593	*0.015*	3,532
Aug-85	79,777	53	5,748	*0.015*	3,254
Sep-85	31,210	79	3,352	*0.030*	2,546
Oct-85	28,116	90	3,440	*0.030*	2,293
Nov-85	24,918	67	2,270	*0.030*	2,033
Dec-85	27,481	74	2,765	*0.030*	2,242
Jan-86	28,796	86	3,367	*0.030*	2,349
Feb-86	93,552	80	10,175	*0.015*	3,816
Mar-86	286,790	48	18,715	*0.015*	11,697
Apr-86	119,544	42	6,826	*0.015*	4,876
May-86	83,048	50	5,645	*0.015*	3,387
Jun-86	79,557	50	5,408	*0.015*	3,245
Jul-86	55,490	69	5,205	*0.030*	4,526
Aug-86	81,433	64	7,085	*0.015*	3,321
Sep-86	89,177	59	7,153	*0.015*	3,637
Oct-86	45,283	93	5,725	*0.030*	3,694
Nov-86	31,426	80	3,418	*0.030*	2,563
Dec-86	55,250	60	4,507	*0.030*	4,507
Jan-87	38,577	71	3,724	*0.030*	3,147
Feb-87	45,451	58	3,584	*0.030*	3,707
Mar-87	71,911	59	5,768	*0.015*	2,933
Apr-87	66,331	65	5,862	*0.015*	2,705
May-87	49,380	71	4,766	*0.030*	4,028

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jun-87	50,729	63	4,345	*0.030*	4,138
Jul-87	37,478	74	3,770	*0.030*	3,057
Aug-87	32,692	80	3,556	*0.030*	2,667
Sep-87	27,461	80	2,987	*0.030*	2,240
Oct-87	17,508	107	2,547	*0.030*	1,428
Nov-87	18,331	94	2,343	*0.030*	1,495
Dec-87	14,188	120	2,315	*0.030*	1,157
Jan-88	13,450	138	2,523	*0.030*	1,097
Feb-88	13,793	124	2,325	*0.030*	1,125
Mar-88	70,022	57	5,426	*0.015*	2,856
Apr-88	53,399	59	4,283	*0.030*	4,356
May-88	55,020	60	4,488	*0.030*	4,488
Jun-88	54,012	62	4,553	*0.030*	4,406
Jul-88	45,433	67	4,138	*0.030*	3,706
Aug-88	47,580	64	4,140	*0.030*	3,881
Sep-88	42,817	65	3,784	*0.030*	3,493
Oct-88	28,719	56	2,186	*0.030*	2,343
Nov-88	25,968	56	1,977	*0.030*	2,118
Dec-88	27,398	61	2,272	*0.030*	2,235
Jan-89	15,921	80	1,732	*0.030*	1,299
Feb-89	12,488	36	611	*0.030*	1,019
Mar-89	63,888	51	4,430	*0.030*	5,211
Apr-89	54,292	52	3,838	*0.030*	4,429
May-89	65,193	57	5,052	*0.030*	5,318
Jun-89	50,136	48	3,272	*0.030*	4,090
Jul-89	39,477	66	3,542	*0.030*	3,220
Aug-89	25,936	55	1,939	*0.030*	2,116
Sep-89	26,803	56	2,041	*0.030*	2,186
Oct-89	18,760	81	2,066	*0.030*	1,530
Nov-89	14,140	89	1,711	*0.030*	1,153
Dec-89	13,070	96	1,706	*0.030*	1,066
Jan-90	11,310	112	1,722	*0.030*	923
Feb-90	10,910	114	1,691	*0.030*	890
Mar-90	51,150	65	4,520	*0.030*	4,172
Apr-90	32,590	65	2,880	*0.030*	2,658
May-90	33,920	64	2,951	*0.030*	2,767
Jun-90	35,790	60	2,919	*0.030*	2,919
Jul-90	37,380	56	2,846	*0.030*	3,049
Aug-90	32,770	59	2,628	*0.030*	2,673
Sep-90	19,120	73	1,898	*0.030*	1,560
Oct-90	21,640	69	2,030	*0.030*	1,765
Nov-90	23,820	64	2,073	*0.030*	1,943
Dec-90	12,600	96	1,644	*0.030*	1,028

Italicized = estimated

Core Data Set
Stanislaus River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jan-91	11,640	102	1,614	*0.030*	949
Feb-91	10,560	99	1,421	*0.030*	861
Mar-91	16,010	110	2,394	*0.030*	1,306
Apr-91	13,860	110	2,073	*0.030*	1,131
May-91	24,110	81	2,655	*0.030*	1,967
Jun-91	14,980	99	2,016	*0.030*	1,222
Jul-91	19,990	61	1,658	*0.030*	1,631
Aug-91	15,090	75	1,539	*0.030*	1,231
Sep-91	15,060	79	1,617	*0.030*	1,228
Oct-91	19,980	52	1,412	*0.030*	1,630
Nov-91	22,760	58	1,795	*0.030*	1,857
Dec-91	11,610	80	1,263	*0.030*	947
Jan-92	10,990	85	1,270	*0.030*	896
Feb-92	19,550	95	2,525	*0.030*	1,595
Mar-92	17,120	70	1,629	*0.030*	1,396
Apr-92	43,100	53	3,106	*0.030*	3,516
May-92	22,480	55	1,681	*0.030*	1,834
Jun-92	15,920	54	1,169	*0.030*	1,299
Jul-92	15,560	53	1,121	*0.030*	1,269
Aug-92	16,550	52	1,170	*0.030*	1,350
Sep-92	19,580	53	1,411	*0.030*	1,597
Oct-92	21,970	56	1,673	*0.030*	1,792
Nov-92	13,280	69	1,246	*0.030*	1,083
Dec-92	13,580	72	1,329	*0.030*	1,108
Jan-93	38,770	86	4,533	*0.030*	3,162
Feb-93	17,710	111	2,673	*0.030*	1,445
Mar-93	21,770	114	3,374	*0.030*	1,776
Apr-93	30,010	84	3,427	*0.030*	2,448
May-93	86,800	53	6,254	*0.015*	3,540
Jun-93	36,500	53	2,630	*0.030*	2,977
Jul-93	25,270	49	1,683	*0.030*	2,061
Aug-93	24,170	57	1,873	*0.030*	1,972
Sep-93	27,070	51	1,877	*0.030*	2,208
Oct-93	40,580	56	3,089	*0.030*	3,310
Nov-93	19,650	69	1,843	*0.030*	1,603
Dec-93	19,420	72	1,901	*0.030*	1,584
Jan-94	19,790	86	2,314	*0.030*	1,614
Feb-94	17,830	111	2,691	*0.030*	1,454
Mar-94	56,860	114	8,812	*0.030*	4,638
Apr-94	33,680	84	3,846	*0.030*	2,747
May-94	37,160	53	2,678	*0.030*	3,031
Jun-94	31,380	53	2,261	*0.030*	2,560
Jul-94	32,720	49	2,180	*0.030*	2,669

Italicized = estimated

Core Data Set
Stanislaus River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Aug-94	26,700	57	2,069	*0.030*	2,178
Sep-94	20,450	51	1,418	*0.030*	1,668
Oct-94	26,265	*83*	2,958	*0.030*	2,142
Nov-94	18,376	*92*	2,289	*0.030*	1,499
Dec-94	19,061	*91*	2,350	*0.030*	1,555
Jan-95	43,305	*72*	4,235	*0.030*	3,532
Feb-95	20,984	*88*	2,518	*0.030*	1,712
Mar-95	47,243	*70*	4,508	*0.030*	3,854
Apr-95	54,485	*67*	4,994	*0.030*	4,444
May-95	90,762	*58*	7,203	*0.015*	3,702
Jun-95	41,724	*73*	4,124	*0.030*	3,403
Jul-95	28,422	*81*	3,131	*0.030*	2,318
Aug-95	25,097	*84*	2,863	*0.030*	2,047
Sep-95	26,130	*83*	2,947	*0.030*	2,131
Oct-95	34,550	60	2,818	*0.030*	2,818
Nov-95	18,769	66	1,694	*0.030*	1,531
Dec-95	20,409	71	1,964	*0.030*	1,665
Jan-96	25,674	80	2,800	*0.030*	2,094
Feb-96	83,962	69	7,917	*0.015*	3,424
Mar-96	206,351	43	12,167	*0.015*	8,416
Apr-96	109,144	36	5,401	*0.015*	4,451
May-96	97,246	41	5,383	*0.015*	3,966
Jun-96	66,585	41	3,749	*0.015*	2,716
Jul-96	46,464	43	2,707	*0.030*	3,790
Aug-96	36,535	48	2,400	*0.030*	2,980
Sep-96	31,383	57	2,430	*0.030*	2,560
Oct-96	40,304	55	2,997	*0.030*	3,288
Nov-96	46,117	52	3,283	*0.030*	3,762
Dec-96	202,147	51	14,115	*0.015*	8,245
Jan-97	407,665	45	24,954	*0.015*	16,627
Feb-97	352,994	36	17,182	*0.015*	14,397
Mar-97	175,638	44	10,543	*0.015*	7,163
Apr-97	79,213	48	5,173	*0.015*	3,231
May-97	100,657	40	5,465	*0.015*	4,105
Jun-97	69,298	43	4,053	*0.015*	2,826
Jul-97	32,208	66	2,872	*0.030*	2,627
Aug-97	30,211	68	2,799	*0.030*	2,464
Sep-97	29,731	68	2,757	*0.030*	2,425

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Oct-76	18,470	341	8,562	*0.030*	1,507
Nov-76	21,630	294	8,645	*0.030*	1,764
Dec-76	21,080	329	9,429	*0.030*	1,719
Jan-77	17,560	371	8,857	*0.030*	1,432
Feb-77	15,440	385	8,081	*0.030*	1,259
Mar-77	21,620	359	10,552	*0.030*	1,764
Apr-77	10,060	526	7,194	*0.030*	821
May-77	8,510	600	6,942	*0.030*	694
Jun-77	5,620	691	5,280	*0.030*	458
Jul-77	4,850	720	4,747	*0.030*	396
Aug-77	4,150	722	4,073	*0.030*	339
Sep-77	4,320	652	3,829	*0.030*	352
Oct-77	4,810	391	2,557	*0.030*	392
Nov-77	5,540	355	2,674	*0.030*	452
Dec-77	6,750	356	3,267	*0.030*	551
Jan-78	17,890	244	5,934	*0.030*	1,459
Feb-78	23,340	212	6,727	*0.030*	1,904
Mar-78	38,470	140	7,322	*0.030*	3,138
Apr-78	89,540	72	8,765	*0.030*	7,304
May-78	200,100	43	11,698	*0.015*	8,161
Jun-78	30,730	149	6,225	*0.030*	2,507
Jul-78	13,900	243	4,592	*0.030*	1,134
Aug-78	14,220	225	4,350	*0.030*	1,160
Sep-78	25,940	187	6,595	*0.030*	2,116
Oct-78	43,330	110	6,480	*0.030*	3,534
Nov-78	73,450	83	8,288	*0.030*	5,991
Dec-78	72,960	61	6,051	*0.030*	5,951
Jan-79	177,200	73	17,586	*0.015*	7,227
Feb-79	202,000	40	10,985	*0.015*	8,239
Mar-79	222,400	49	14,815	*0.015*	9,071
Apr-79	68,340	92	8,548	*0.030*	5,574
May-79	15,100	249	5,112	*0.030*	1,232
Jun-79	14,160	233	4,485	*0.030*	1,155
Jul-79	21,060	198	5,669	*0.030*	1,718
Aug-79	21,970	186	5,555	*0.030*	1,792
Sep-79	25,920	161	5,673	*0.030*	2,114
Oct-79	72,620	64	6,319	*0.030*	5,924
Nov-79	64,210	73	6,372	*0.030*	5,238
Dec-79	74,890	84	8,552	*0.030*	6,109
Jan-80	305,100	54	22,398	*0.015*	12,444
Feb-80	322,200	52	22,778	*0.015*	13,141
Mar-80	359,400	39	19,056	*0.015*	14,658
Apr-80	153,500	56	11,686	*0.015*	6,260

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
May-80	161,200	62	13,587	*0.015*	6,575
Jun-80	129,100	49	8,600	*0.015*	5,265
Jul-80	26,160	215	7,646	*0.030*	2,134
Aug-80	17,020	228	5,276	*0.030*	1,388
Sep-80	91,880	77	9,618	*0.030*	7,495
Oct-80	124,600	53	8,978	*0.015*	5,082
Nov-80	102,100	60	8,328	*0.015*	4,164
Dec-80	104,100	54	7,642	*0.015*	4,246
Jan-81	129,800	58	10,235	*0.015*	5,294
Feb-81	80,060	66	7,184	*0.030*	6,530
Mar-81	72,560	85	8,385	*0.030*	5,919
Apr-81	27,480	176	6,575	*0.030*	2,242
May-81	15,610	244	5,178	*0.030*	1,273
Jun-81	15,680	205	4,370	*0.030*	1,279
Jul-81	15,230	204	4,224	*0.030*	1,242
Aug-81	15,130	212	4,361	*0.030*	1,234
Sep-81	14,270	220	4,268	*0.030*	1,164
Oct-81	23,300	165	5,227	*0.030*	1,901
Nov-81	29,490	136	5,452	*0.030*	2,405
Dec-81	44,240	118	7,097	*0.030*	3,609
Jan-82	95,440	79	10,250	*0.015*	3,893
Feb-82	173,000	50	11,760	*0.015*	7,056
Mar-82	299,200	40	16,270	*0.015*	12,203
Apr-82	465,400	38	24,043	*0.015*	18,981
May-82	392,200	37	19,728	*0.015*	15,996
Jun-82	135,600	53	9,770	*0.015*	5,530
Jul-82	133,500	84	15,245	*0.015*	5,445
Aug-82	57,320	99	7,715	*0.030*	4,676
Sep-82	160,200	97	21,126	*0.015*	6,534
Oct-82	227,100	36	11,115	*0.015*	9,262
Nov-82	123,700	65	10,931	*0.015*	5,045
Dec-82	333,900	95	43,124	*0.015*	13,618
Jan-83	329,300	60	26,861	*0.015*	13,431
Feb-83	341,300	42	19,488	*0.015*	13,920
Mar-83	470,900	48	30,729	*0.015*	19,206
Apr-83	551,500	37	27,741	*0.015*	22,493
May-83	640,800	33	28,749	*0.015*	26,135
Jun-83	338,200	39	17,932	*0.015*	13,793
Jul-83	260,900	52	18,444	*0.015*	10,641
Aug-83	136,800	90	16,738	*0.015*	5,579
Sep-83	240,500	35	11,444	*0.015*	9,809
Oct-83	292,700	35	13,927	*0.015*	11,938
Nov-83	124,300	159	26,869	*0.015*	5,070

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Dec-83	263,300	131	46,892	*0.015*	10,739
Jan-84	366,600	48	23,923	*0.015*	14,952
Feb-84	267,700	49	17,833	*0.015*	10,918
Mar-84	188,300	78	19,968	*0.015*	7,680
Apr-84	56,200	214	16,350	*0.030*	4,584
May-84	38,580	182	9,546	*0.030*	3,147
Jun-84	18,550	229	5,775	*0.030*	1,513
Jul-84	18,450	210	5,267	*0.030*	1,505
Aug-84	18,980	191	4,928	*0.030*	1,548
Sep-84	23,070	172	5,395	*0.030*	1,882
Oct-84	62,430	153	12,986	*0.030*	5,092
Nov-84	69,420	134	12,646	*0.030*	5,663
Dec-84	131,200	115	20,512	*0.015*	5,351
Jan-85	96,330	100	13,096	*0.015*	3,929
Feb-85	76,290	77	7,986	*0.030*	6,223
Mar-85	46,510	121	7,651	*0.030*	3,794
Apr-85	23,200	310	9,778	*0.030*	1,892
May-85	20,640	335	9,400	*0.030*	1,684
Jun-85	19,220	222	5,801	*0.030*	1,568
Jul-85	16,750	134	3,051	*0.030*	1,366
Aug-85	15,810	86	1,848	*0.030*	1,290
Sep-85	15,250	31	643	*0.030*	1,244
Oct-85	28,520	99	3,839	*0.030*	2,326
Nov-85	33,340	99	4,487	*0.030*	2,720
Dec-85	37,780	98	5,033	*0.030*	3,082
Jan-86	37,320	95	4,820	*0.030*	3,044
Feb-86	139,800	51	9,693	*0.015*	5,702
Mar-86	380,100	27	13,952	*0.015*	15,502
Apr-86	305,300	40	16,602	*0.015*	12,452
May-86	170,200	39	9,024	*0.015*	6,942
Jun-86	102,600	46	6,416	*0.015*	4,185
Jul-86	21,870	110	3,271	*0.030*	1,784
Aug-86	21,340	130	3,772	*0.030*	1,741
Sep-86	55,810	89	6,753	*0.030*	4,552
Oct-86	77,540	102	10,752	*0.030*	6,325
Nov-86	72,140	67	6,571	*0.030*	5,884
Dec-86	127,300	45	7,788	*0.015*	5,192
Jan-87	56,400	45	3,450	*0.030*	4,601
Feb-87	26,330	130	4,653	*0.030*	2,148
Mar-87	45,650	98	6,082	*0.030*	3,724
Apr-87	44,760	70	4,260	*0.030*	3,651
May-87	26,820	171	6,235	*0.030*	2,188
Jun-87	12,060	235	3,853	*0.030*	984

Italicized = estimated

Core Data Set
Tuolumne River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jul-87	10,730	211	3,078	*0.030*	875
Aug-87	12,030	189	3,091	*0.030*	981
Sep-87	10,860	227	3,351	*0.030*	886
Oct-87	16,560	160	3,602	*0.030*	1,351
Nov-87	18,130	128	3,155	*0.030*	1,479
Dec-87	18,520	142	3,575	*0.030*	1,511
Jan-88	18,450	152	3,813	*0.030*	1,505
Feb-88	13,240	164	2,952	*0.030*	1,080
Mar-88	14,680	161	3,213	*0.030*	1,197
Apr-88	22,020	117	3,503	*0.030*	1,796
May-88	8,840	187	2,247	*0.030*	721
Jun-88	6,670	179	1,623	*0.030*	544
Jul-88	5,980	201	1,634	*0.030*	488
Aug-88	6,410	239	2,083	*0.030*	523
Sep-88	6,580	228	2,040	*0.030*	537
Oct-88	8,280	*206*	2,322	*0.030*	675
Nov-88	9,650	*194*	2,539	*0.030*	787
Dec-88	11,400	151	2,340	*0.030*	930
Jan-89	11,390	153	2,369	*0.030*	929
Feb-89	9,440	147	1,887	*0.030*	770
Mar-89	16,010	129	2,808	*0.030*	1,306
Apr-89	21,250	85	2,456	*0.030*	1,733
May-89	10,380	136	1,919	*0.030*	847
Jun-89	8,390	207	2,361	*0.030*	684
Jul-89	8,480	*204*	,2355	*0.030*	692
Aug-89	8,840	135	1,622	*0.030*	721
Sep-89	10,210	*189*	2,624	*0.030*	833
Oct-89	15,120	115	2,364	*0.030*	1,233
Nov-89	17,760	90	2,173	*0.030*	1,449
Dec-89	16,350	98	2,178	*0.030*	1,334
Jan-90	15,010	108	2,204	*0.030*	1,224
Feb-90	14,780	118	2,371	*0.030*	1,206
Mar-90	16,070	120	2,622	*0.030*	1,311
Apr-90	16,110	108	2,365	*0.030*	1,314
May-90	14,270	88	1,707	*0.030*	1,164
Jun-90	7,110	192	1,856	*0.030*	580
Jul-90	7,260	183	1,806	*0.030*	592
Aug-90	8,350	164	1,862	*0.030*	681
Sep-90	8,780	163	1,946	*0.030*	716
Oct-90	11,558	131	2,058	*0.030*	943
Nov-90	11,408	126	1,954	*0.030*	931
Dec-90	10,582	132	1,899	*0.030*	863
Jan-91	9,548	139	1,804	*0.030*	779

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Feb-91	8,619	138	1,617	*0.030*	703
Mar-91	22,629	118	3,630	*0.030*	1,846
Apr-91	22,863	50	1,554	*0.030*	1,865
May-91	26,085	77	2,731	*0.030*	2,128
Jun-91	7,741	164	1,726	*0.030*	631
Jul-91	3,001	173	706	*0.030*	245
Aug-91	6,954	169	1,598	*0.030*	567
Sep-91	6,864	201	1,876	*0.030*	560
Oct-91	9,574	161	2,096	*0.030*	781
Nov-91	11,919	115	1,863	*0.030*	972
Dec-91	11,203	125	1,904	*0.030*	914
Jan-92	11,915	117	1,895	*0.030*	972
Feb-92	25,696	55	1,921	*0.030*	2,096
Mar-92	15,780	80	1,716	*0.030*	1,287
Apr-92	18,988	114	2,943	*0.030*	1,549
May-92	21,794	140	4,148	*0.030*	1,778
Jun-92	6,585	195	1,746	*0.030*	537
Jul-92	5,972	195	1,583	*0.030*	487
Aug-92	5,950	205	1,658	*0.030*	485
Sep-92	7,016	196	1,869	*0.030*	572
Oct-92	9,890	165	2,219	*0.030*	807
Nov-92	12,426	151	2,551	*0.030*	1,014
Dec-92	12,516	237	4,033	*0.030*	1,021
Jan-93	46,282	152	9,564	*0.030*	3,775
Feb-93	24,972	108	3,667	*0.030*	2,037
Mar-93	18,101	143	3,519	*0.030*	1,476
Apr-93	49,053	52	3,468	*0.030*	4,001
May-93	45,128	88	5,399	*0.030*	3,681
Jun-93	28,536	55	2,134	*0.030*	2,328
Jul-93	19,795	208	5,598	*0.030*	1,615
Aug-93	30,424	192	7,941	*0.030*	2,482
Sep-93	59,389	100	8,074	*0.030*	4,844
Oct-93	45,672	100	6,209	*0.030*	3,725
Nov-93	23,461	77	2,456	*0.030*	1,914
Dec-93	27,035	74	2,720	*0.030*	2,205
Jan-94	38,327	72	3,752	*0.030*	3,126
Feb-94	23,124	95	2,987	*0.030*	1,886
Mar-94	19,819	89	2,398	*0.030*	1,617
Apr-94	31,000	63	2,655	*0.030*	2,529
May-94	27,099	40	1,474	*0.030*	2,210
Jun-94	8,485	55	634	*0.030*	692
Jul-94	7,081	154	1,482	*0.030*	578
Aug-94	7,692	156	1,631	*0.030*	627

Italicized = estimated

Core Data Set
Tuolumne River

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Sep-94	7,645	193	2,006	*0.030*	624
Oct-94	8,464	*206*	2,352	*0.030*	690
Nov-94	12,858	*194*	3,002	*0.030*	1,049
Dec-94	13,931	*206*	3,146	*0.030*	1,136
Jan-95	73,121	*194*	8,279	*0.030*	5,964
Feb-95	234,847	*206*	16,358	*0.015*	9,578
Mar-95	292,385	*194*	18,589	*0.015*	11,925
Apr-95	369,036	*206*	21,295	*0.015*	15,051
May-95	476,971	*194*	24,735	*0.015*	19,453
Jun-95	293,153	*206*	18,618	*0.015*	11,956
Jul-95	193,682	*194*	14,618	*0.015*	7,899
Aug-95	64,912	*206*	7,723	*0.030*	5,295
Sep-95	122,157	*194*	11,170	*0.015*	4,982
Oct-95	89,755	*206*	9,331	*0.030*	7,321
Nov-95	18,478	*194*	3,710	*0.030*	1,507
Dec-95	17,607	*206*	3,607	*0.030*	1,436
Jan-96	26,820	*194*	4,611	*0.030*	2,188
Feb-96	261,756	*206*	17,427	*0.015*	10,676
Mar-96	293,881	*194*	18,645	*0.015*	11,986
Apr-96	161,218	*206*	13,134	*0.015*	6,575
May-96	232,963	*194*	16,281	*0.015*	9,501
Jun-96	35,974	*206*	5,473	*0.030*	2,934
Jul-96	10,405	*194*	2,653	*0.030*	849
Aug-96	17,123	*206*	3,549	*0.030*	1,397
Sep-96	17,072	*194*	3,542	*0.030*	1,393
Oct-96	28,071	*206*	4,735	*0.030*	2,290
Nov-96	23,348	*194*	4,252	*0.030*	1,904
Dec-96	284,328	*206*	18,289	*0.015*	11,596
Jan-97	803,690	*194*	33,539	*0.015*	32,778
Feb-97	450,657	*206*	23,929	*0.015*	18,380
Mar-97	150,175	*194*	12,601	*0.015*	6,125
Apr-97	86,663	*206*	9,142	*0.030*	7,069
May-97	58,552	*194*	7,272	*0.030*	4,776
Jun-97	15,993	*206*	3,410	*0.030*	1,305
Jul-97	17,809	*194*	3,631	*0.030*	1,453
Aug-97	17,629	*206*	3,609	*0.030*	1,438
Sep-97	16,941	*194*	3,526	*0.030*	1,382

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Oct-76	7,715	843	8,842	*0.67*	14,147
Nov-76	9,845	1,296	17,346	*1.04*	27,754
Dec-76	3,815	1,749	9,071	*1.40*	14,514
Jan-77	8,711	2,202	26,077	*1.76*	41,724
Feb-77	7,494	2,439	24,849	*1.95*	39,758
Mar-77	1,599	3,343	7,267	*2.67*	11,627
Apr-77	468	3,431	2,183	*2.74*	3,493
May-77	144	3,347	655	*2.68*	1,048
Jun-77	92	2,515	315	*2.01*	503
Jul-77	46	2,898	181	*2.32*	290
Aug-77	116	2,656	419	*2.12*	670
Sep-77	87	2,415	286	*1.93*	457
Oct-77	100	2,174	296	*1.74*	473
Nov-77	133	1,932	349	*1.55*	559
Dec-77	501	1,976	1,346	*1.58*	2,153
Jan-78	16,390	2,020	45,010	*1.62*	72,016
Feb-78	26,719	2,064	74,974	*1.65*	119,958
Mar-78	13,520	2,107	38,728	*1.69*	61,964
Apr-78	4,388	2,151	12,832	*1.72*	20,531
May-78	1,848	2,195	5,515	*1.76*	8,823
Jun-78	535	2,239	1,628	*1.79*	2,606
Jul-78	516	2,239	1,571	*1.79*	2,513
Aug-78	623	2,327	1,971	*1.86*	3,153
Sep-78	1,393	2,371	4,490	*1.90*	7,184
Oct-78	1,534	2,414	5,034	*1.93*	8,055
Nov-78	4,414	2,458	14,750	*1.97*	23,600
Dec-78	3,470	2,502	11,803	*2.00*	18,885
Jan-79	12,329	2,546	42,674	*2.04*	68,279
Feb-79	17,261	1,967	46,158	*1.57*	73,853
Mar-79	25,411	2,381	82,255	*1.90*	131,607
Apr-79	5,654	1,518	11,668	*1.21*	18,669
May-79	1,708	2,243	5,208	*1.79*	8,333
Jun-79	240	2,684	876	*2.15*	1,401
Jul-79	702	1,967	1,877	*1.57*	3,004
Aug-79	1,055	1,573	2,256	*1.26*	3,610
Sep-79	658	1,718	1,537	*1.37*	2,459
Oct-79	1,880	2,056	5,255	*1.64*	8,408
Nov-79	5,380	1,366	9,991	*1.09*	15,986
Dec-79	3,421	1,822	8,474	*1.46*	13,558
Jan-80	19,584	2,084	55,485	*1.67*	88,777
Feb-80	30,384	994	41,059	*0.80*	65,695
Mar-80	15,753	828	17,733	*0.66*	28,372
Apr-80	6,456	1,932	16,957	*1.55*	27,131

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
May-80	1,774	2,001	4,826	*1.60*	7,721
Jun-80	425	2,208	1,276	*1.77*	2,041
Jul-80	555	2,250	1,698	*1.80*	2,716
Aug-80	541	2,293	1,686	*1.83*	2,698
Sep-80	1,456	2,335	4,622	*1.87*	7,395
Oct-80	2,700	2,378	8,729	*1.90*	13,966
Nov-80	8,184	2,420	26,925	*1.94*	43,080
Dec-80	6,287	2,463	21,052	*1.97*	33,683
Jan-81	15,863	2,505	54,022	*2.00*	86,436
Feb-81	16,971	2,548	58,788	*2.04*	94,060
Mar-81	15,556	2,590	54,774	*2.07*	87,639
Apr-81	2,536	2,452	8,454	*1.96*	13,526
May-81	1,247	2,313	3,921	*1.85*	6,274
Jun-81	283	2,175	837	*1.74*	1,339
Jul-81	404	2,299	1,263	*1.84*	2,020
Aug-81	685	2,422	2,256	*1.94*	3,609
Sep-81	581	2,546	2,011	*2.04*	3,218
Oct-81	1,571	2,670	5,703	*2.14*	9,124
Nov-81	5,652	1,450	11,142	*1.16*	17,827
Dec-81	4,429	2,010	12,103	*1.61*	19,364
Jan-82	5,546	2,180	16,437	*1.74*	26,299
Feb-82	11,347	2,710	41,805	*2.17*	66,888
Mar-82	14,958	2,850	57,956	*2.28*	92,729
Apr-82	3,555	1,547	7,477	*1.24*	11,963
May-82	1,839	243	608	*0.19*	972
Jun-82	639	1,110	964	*0.89*	1,543
Jul-82	822	1,760	1,967	*1.41*	3,147
Aug-82	829	1,570	1,769	*1.26*	2,831
Sep-82	1,476	940	1,886	*0.75*	3,018
Oct-82	3,320	754	3,403	*0.60*	5,445
Nov-82	13,609	677	12,525	*0.54*	20,041
Dec-82	17,626	599	14,354	*0.48*	22,966
Jan-83	25,725	658	23,012	*0.53*	36,820
Feb-83	29,075	718	28,381	*0.57*	45,409
Mar-83	17,640	777	18,634	*0.62*	29,814
Apr-83	6,206	836	7,053	*0.67*	11,285
May-83	2,379	306	990	*0.24*	1,583
Jun-83	682	356	330	*0.28*	528
Jul-83	1,100	1,500	2,243	*1.20*	3,589
Aug-83	1,217	862	1,426	*0.69*	2,282
Sep-83	1,869	1,396	3,547	*1.12*	5,675
Oct-83	6,150	1,203	10,058	*0.96*	16,093
Nov-83	9,214	1,010	12,652	*0.81*	20,243

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Dec-83	7,076	817	7,859	*0.65*	12,575
Jan-84	23,197	624	19,679	*0.50*	31,486
Feb-84	23,054	1,380	43,252	*1.10*	69,203
Mar-84	12,775	2,135	37,080	*1.71*	59,328
Apr-84	4,550	2,891	17,883	*2.31*	28,613
May-84	1,419	3,657	7,055	*2.93*	11,288
Jun-84	469	2,615	1,667	*2.09*	2,668
Jul-84	580	2,208	1,741	*1.77*	2,786
Aug-84	748	1,725	1,754	*1.38*	2,807
Sep-84	815	2,498	2,768	*2.00*	4,428
Oct-84	3,282	1,049	4,681	*0.84*	7,489
Nov-84	7,252	1,608	15,853	*1.29*	25,365
Dec-84	7,294	2,167	21,488	*1.73*	34,381
Jan-85	12,048	2,634	43,143	*2.11*	69,029
Feb-85	14,399	3,050	59,705	*2.44*	95,528
Mar-85	14,615	3,105	61,694	*2.48*	98,710
Apr-85	9,992	2,084	28,309	*1.67*	45,295
May-85	6,758	3,222	29,602	*2.58*	47,363
Jun-85	4,630	1,823	11,475	*1.46*	18,360
Jul-85	5,370	1,530	11,170	*1.22*	17,872
Aug-85	3,560	1,403	6,790	*1.12*	10,864
Sep-85	2,970	1,364	5,507	*1.09*	8,812
Oct-85	2,380	1,209	3,912	1.47	9,534
Nov-85	2,420	2,220	7,302	2.19	14,404
Dec-85	6,800	1,923	17,773	2.54	46,960
Jan-86	5,890	2,038	16,321	3.53	56,554
Feb-86	9,080	1,438	17,756	2.25	55,493
Mar-86	20,630	1,034	29,012	1.27	71,152
Apr-86	13,650	1,896	35,186	2.57	95,228
May-86	6,700	2,310	21,042	3.28	59,822
Jun-86	7,720	1,762	18,491	3.33	69,850
Jul-86	5,700	1,676	12,991	3.38	52,454
Aug-86	4,830	1,512	9,927	2.87	37,745
Sep-86	776	1,377	1,452	2.07	4,366
Oct-86	1,020	1,026	1,423	1.07	2,968
Nov-86	1,480	2,693	5,419	1.94	7,795
Dec-86	1,520	2,383	4,925	3.11	12,848
Jan-87	2,980	2,232	9,043	3.11	25,237
Feb-87	7,040	1,957	18,727	3.73	71,396
Mar-87	8,590	2,290	26,746	3.49	81,570
Apr-87	4,660	2,160	13,685	4.11	52,113
May-87	1,670	2,221	5,042	3.36	15,278
Jun-87	2,110	1,757	5,039	3.74	21,466

Italicized = estimated

Core Data Set
Mud Slough

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jul-87	3,680	1,460	7,305	2.99	29,962
Aug-87	6,160	1,567	13,121	3.29	55,095
Sep-87	873	1,100	1,306	2.40	5,699
Oct-87	1,990	973	2,632	0.98	5,296
Nov-87	4,080	1,270	7,044	1.25	13,880
Dec-87	1,770	2,112	5,083	2.29	11,013
Jan-88	5,110	1,925	13,373	2.38	33,050
Feb-88	4,770	1,810	11,736	2.49	32,349
Mar-88	7,920	1,875	20,184	2.57	55,244
Apr-88	3,010	1,672	6,844	2.17	17,768
May-88	3,170	1,654	7,127	2.71	23,337
Jun-88	4,090	1,660	9,231	3.16	35,187
Jul-88	1,730	1,482	3,487	2.46	11,588
Aug-88	532	1,973	1,427	3.41	4,937
Sep-88	282	4,016	1,540	3.36	2,574
Oct-88	1,380	823	1,545	0.78	2,943
Nov-88	1,130	2,018	3,100	1.73	5,326
Dec-88	3,520	1,349	6,455	1.34	12,812
Jan-89	2,870	2,088	8,148	2.32	18,126
Feb-89	2,490	1,722	5,830	2.20	14,895
Mar-89	1,730	2,402	5,649	2.80	13,149
Apr-89	3,180	2,047	8,848	3.01	26,036
May-89	1,240	1,807	3,046	2.81	9,483
Jun-89	463	2,346	1,476	2.73	3,431
Jul-89	1,110	1,352	2,040	1.83	5,532
Aug-89	1,050	2,081	2,970	2.84	8,101
Sep-89	1,090	928	1,376	1.13	3,350
Oct-89	3,510	621	2,961	0.76	7,238
Nov-89	3,570	982	4,765	0.97	9,430
Dec-89	4,430	1,241	7,474	1.21	14,522
Jan-90	3,190	1,888	8,188	1.92	16,691
Feb-90	2,200	2,232	6,677	2.96	17,706
Mar-90	1,720	2,253	5,269	3.64	17,024
Apr-90	1,420	2,782	5,370	3.59	13,861
May-90	527	3,025	2,167	4.33	6,199
Jun-90	651	2,504	2,216	4.13	7,304
Jul-90	669	2,212	2,012	4.95	9,005
Aug-90	370	1,829	920	4.25	4,271
Sep-90	159	1,742	376	3.18	1,376
Oct-90	428	2,095	1,219	0.77	890
Nov-90	448	2,179	1,327	2.38	2,893
Dec-90	361	2,544	1,249	3.85	3,779
Jan-91	379	2,175	1,120	3.32	3,421

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Feb-91	387	2,119	1,115	4.53	4,761
Mar-91	1,800	2,273	5,563	3.74	18,304
Apr-91	2,050	2,448	6,824	3.78	21,042
May-91	300	4,628	1,888	6.09	4,968
Jun-91	549	1,846	1,378	5.43	8,107
Jul-91	2,370	2,344	7,552	5.52	35,580
Aug-91	2,410	2,187	7,165	4.29	28,127
Sep-91	1,280	2,335	4,063	3.74	13,008
Oct-91	375	589	300	0.46	469
Nov-91	455	1,571	972	1.61	1,989
Dec-91	497	2,328	1,573	2.55	3,446
Jan-92	1,410	1,936	3,710	2.02	7,744
Feb-92	4,740	1,519	9,788	1.88	24,165
Mar-92	3,400	1,814	8,385	2.34	21,632
Apr-92	1,150	2,222	3,474	3.60	11,257
May-92	108	4,817	707	3.23	947
Jun-92	1,130	2,675	4,109	4.65	14,287
Jul-92	1,110	2,511	3,788	6.28	18,954
Aug-92	667	2,426	2,200	4.90	8,887
Sep-92	276	2,009	754	2.44	1,831
Oct-92	206	1,170	328	0.97	542
Nov-92	587	2,588	2,066	2.92	4,666
Dec-92	1,380	2,374	4,455	3.78	14,174
Jan-93	12,900	905	15,870	1.52	53,314
Feb-93	9,830	1,090	14,572	1.58	42,230
Mar-93	6,390	1,236	10,737	2.46	42,741
Apr-93	3,980	1,718	9,296	2.82	30,474
May-93	877	2,091	2,494	3.26	7,762
Jun-93	1,450	1,451	2,860	2.39	9,413
Jul-93	731	1,622	1,612	1.83	3,637
Aug-93	589	1,024	820	1.61	2,574
Sep-93	415	1,114	628	1.45	1,636
Oct-93	3,750	588	2,998	0.86	8,777
Nov-93	5,480	734	5,466	0.81	12,006
Dec-93	6,710	922	8,407	0.78	14,276
Jan-94	6,350	1,180	10,189	1.40	24,172
Feb-94	6,920	1,286	12,103	1.49	27,988
Mar-94	3,680	1,705	8,532	1.99	19,862
Apr-94	1,150	2,406	3,762	3.01	9,412
May-94	511	3,222	2,238	3.37	4,675
Jun-94	732	3,111	3,096	3.74	7,447
Jul-94	456	2,475	1,534	2.55	3,162
Aug-94	207	2,256	635	2.07	1,163

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Sep-94	640	823	716	1.15	2,001
Oct-94	2,260	*875*	2,689	0.85	5,208
Nov-94	2,980	*1,115*	4,515	1.11	8,978
Dec-94	4,160	*1,190*	6,728	1.14	12,895
Jan-95	15,920	*1,020*	22,086	1.03	44,693
Feb-95	7,150	*1,294*	12,576	1.80	34,994
Mar-95	22,080	*1,225*	36,768	1.81	108,764
Apr-95	6,680	*1,477*	13,413	1.89	34,250
May-95	2,690	*929*	3,396	1.56	11,410
Jun-95	1,790	*886*	2,155	1.09	5,281
Jul-95	2,210	*889*	2,670	0.89	5,363
Aug-95	1,290	*808*	1,416	1.01	3,529
Sep-95	1,050	*689*	983	1.16	3,312
Oct-95	1,338	*600*	1,091	0.62	2,259
Nov-95	4,301	*778*	4,550	0.77	8,984
Dec-95	7,474	*929*	9,436	0.91	18,586
Jan-96	6,052	*1,189*	9,782	1.29	21,266
Feb-96	18,281	*870*	21,619	1.12	55,672
Mar-96	12,041	*1,212*	19,837	1.66	54,265
Apr-96	2,766	*1,931*	7,261	2.85	21,402
May-96	2,696	*1,225*	4,491	1.49	10,949
Jun-96	1,366	*1,370*	2,546	1.40	5,196
Jul-96	614	*1,522*	1,272	1.95	3,250
Aug-96	409	*1,080*	600	1.23	1,364
Sep-96	1,012	*1,945*	2,677	3.06	8,416
Oct-96	5,975	1,199	9,742	2.98	48,361
Nov-96	10,748	1,060	15,487	1.85	53,951
Dec-96	18,745	978	24,935	1.63	83,248
Jan-97	33,503	959	43,688	1.74	158,276
Feb-97	20,588	1,437	40,214	3.08	172,597
Mar-97	10,918	2,185	32,440	4.63	137,409
Apr-97	6,550	2,772	24,686	5.93	105,519
May-97	7,085	1,995	19,216	5.20	100,177
Jun-97	4,906	2,331	15,546	5.70	76,034
Jul-97	5,471	1,945	14,466	5.84	86,875
Aug-97	4,335	1,778	10,476	5.40	63,647
Sep-97	2,477	1,154	3,885	3.63	24,412

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Oct-76	8,892	947	11,448	*0.95*	22,896
Nov-76	7,458	1,320	13,384	*1.32*	26,767
Dec-76	3,289	1,706	7,628	*1.71*	15,256
Jan-77	7,188	2,092	20,443	*2.09*	40,886
Feb-77	5,821	2,379	18,827	*2.38*	37,653
Mar-77	5,671	1,701	13,114	*1.70*	26,228
Apr-77	2,884	1,688	6,618	*1.69*	13,237
May-77	2,368	1,541	4,961	*1.54*	9,922
Jun-77	1,299	1,505	2,658	*1.51*	5,316
Jul-77	2,099	1,236	3,527	*1.24*	7,054
Aug-77	3,652	855	4,245	*0.86*	8,490
Sep-77	855	1,425	1,656	*1.43*	3,313
Oct-77	413	1,766	992	*1.77*	1,983
Nov-77	595	2,046	1,655	*2.05*	3,310
Dec-77	1,765	2,077	4,984	*2.08*	9,968
Jan-78	7,553	2,109	21,656	*2.11*	43,312
Feb-78	17,350	2,140	50,477	*2.14*	100,954
Mar-78	18,520	1,940	48,845	*1.94*	97,690
Apr-78	16,250	1,740	38,440	*1.74*	76,880
May-78	16,800	1,541	35,196	*1.54*	70,392
Jun-78	17,840	1,341	32,524	*1.34*	65,048
Jul-78	12,890	1,141	19,995	*1.14*	39,990
Aug-78	12,460	941	15,940	*0.94*	31,880
Sep-78	11,610	1,111	17,536	*1.11*	35,072
Oct-78	3,130	1,281	5,451	*1.28*	10,902
Nov-78	3,344	1,450	6,592	*1.45*	13,184
Dec-78	2,991	1,620	6,587	*1.62*	13,175
Jan-79	5,117	1,790	12,452	*1.79*	24,904
Feb-79	8,622	1,607	18,837	*1.61*	37,673
Mar-79	22,940	1,423	44,379	*1.42*	88,758
Apr-79	17,770	1,240	29,956	*1.24*	59,913
May-79	11,940	1,056	17,141	*1.06*	34,283
Jun-79	11,070	873	13,138	*0.87*	26,277
Jul-79	11,830	689	11,081	*0.69*	22,162
Aug-79	13,360	929	16,873	*0.93*	33,747
Sep-79	8,551	1,169	13,590	*1.17*	27,179
Oct-79	3,836	1,410	7,353	*1.41*	14,706
Nov-79	4,076	1,650	9,143	*1.65*	18,286
Dec-79	2,949	1,890	7,577	*1.89*	15,155
Jan-80	9,025	1,790	21,962	*1.79*	43,925
Feb-80	19,730	1,606	43,078	*1.61*	86,155
Mar-80	21,580	1,421	41,689	*1.42*	83,379
Apr-80	23,910	1,237	40,209	*1.24*	80,419

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
May-80	16,130	1,052	23,069	*1.05*	46,138
Jun-80	14,150	868	16,698	*0.87*	33,395
Jul-80	13,880	683	12,888	*0.68*	25,776
Aug-80	10,810	795	11,683	*0.80*	23,367
Sep-80	12,130	907	14,957	*0.91*	29,914
Oct-80	5,510	1,018	7,626	*1.02*	15,251
Nov-80	6,200	1,130	9,525	*1.13*	19,049
Dec-80	5,420	1,410	10,390	*1.41*	20,779
Jan-81	7,310	1,690	16,795	*1.69*	33,590
Feb-81	11,020	1,970	29,514	*1.97*	59,028
Mar-81	21,310	1,756	50,873	*1.76*	101,746
Apr-81	13,060	1,542	27,378	*1.54*	54,757
May-81	11,340	1,328	20,473	*1.33*	40,947
Jun-81	9,440	1,114	14,297	*1.11*	28,593
Jul-81	10,110	900	12,370	*0.90*	24,740
Aug-81	13,690	1,063	19,784	*1.06*	39,568
Sep-81	4,840	1,227	8,074	*1.23*	16,147
Oct-81	3,207	1,390	6,060	*1.39*	12,121
Nov-81	4,282	1,400	8,150	*1.40*	16,300
Dec-81	3,818	1,730	8,980	*1.73*	17,959
Jan-82	7,164	2,110	20,550	*2.11*	41,101
Feb-82	7,368	2,545	25,493	*2.55*	50,985
Mar-82	20,491	1,260	35,100	*1.26*	70,201
Apr-82	13,166	2,050	36,693	*2.05*	73,387
May-82	16,718	1,317	29,933	*1.32*	59,866
Jun-82	21,310	583	16,890	*0.58*	33,780
Jul-82	20,560	680	19,007	*0.68*	38,014
Aug-82	16,571	559	12,593	*0.56*	25,187
Sep-82	12,299	672	11,236	*0.67*	22,472
Oct-82	6,775	946	8,713	*0.95*	17,426
Nov-82	10,310	1,008	14,129	*1.01*	28,257
Dec-82	15,195	1,070	22,104	*1.07*	44,207
Jan-83	11,855	1,349	21,742	*1.35*	43,483
Feb-83	18,880	1,628	41,786	*1.63*	83,573
Mar-83	24,164	1,450	47,634	*1.45*	95,268
Apr-83	22,986	1,268	39,624	*1.27*	79,249
May-83	21,623	648	19,049	*0.65*	38,098
Jun-83	22,734	604	18,668	*0.60*	37,336
Jul-83	27,492	136	5,083	*0.14*	10,166
Aug-83	24,337	564	18,661	*0.56*	37,321
Sep-83	15,574	586	12,407	*0.59*	24,815
Oct-83	12,550	1,050	17,915	*1.05*	35,830
Nov-83	6,980	1,513	14,357	*1.51*	28,715

Italicized = estimated

Core Data Set
Salt Slough

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Dec-83	6,100	1,976	16,387	*1.98*	32,774
Jan-84	10,690	2,440	35,461	*2.44*	70,921
Feb-84	14,970	2,012	40,948	*2.01*	81,895
Mar-84	17,500	1,583	37,662	*1.58*	75,323
Apr-84	16,850	1,155	26,458	*1.16*	52,916
May-84	12,900	726	12,732	*0.73*	25,465
Jun-84	15,630	376	7,990	*0.38*	15,979
Jul-84	14,510	1,023	20,180	*1.02*	40,360
Aug-84	14,960	950	19,321	*0.95*	38,642
Sep-84	6,790	891	8,225	*0.89*	16,450
Oct-84	6,698	878	7,995	*0.88*	15,990
Nov-84	5,494	1,511	11,286	*1.51*	22,572
Dec-84	6,288	1,505	12,866	*1.51*	25,731
Jan-85	5,552	1,848	13,949	*1.85*	27,897
Feb-85	9,350	1,366	17,364	*1.37*	34,727
Mar-85	20,021	1,525	41,508	*1.53*	83,017
Apr-85	20,342	1,366	37,777	*1.37*	75,553
May-85	20,529	1,003	27,993	1.40	78,146
Jun-85	14,438	941	18,470	1.10	43,183
Jul-85	14,192	1,100	21,223	0.97	37,430
Aug-85	17,050	746	17,292	0.80	36,855
Sep-85	9,735	805	10,654	0.68	17,999
Oct-85	11,030	875	13,116	1.30	38,988
Nov-85	7,780	1,253	13,253	1.62	34,303
Dec-85	5,590	1,682	12,780	2.25	34,198
Jan-86	5,930	1,994	16,079	3.57	57,508
Feb-86	16,150	1,981	43,502	3.10	136,127
Mar-86	23,090	1,604	50,363	2.60	163,232
Apr-86	24,920	1,303	44,139	1.10	74,533
May-86	19,810	853	22,978	0.43	23,161
Jun-86	17,560	613	14,632	0.59	28,011
Jul-86	23,390	762	24,239	0.85	53,976
Aug-86	25,300	857	29,476	0.92	63,287
Sep-86	17,190	800	18,693	1.13	52,582
Oct-86	11,510	888	13,901	1.02	31,936
Nov-86	12,870	1,036	18,121	1.30	45,492
Dec-86	9,570	1,486	19,332	2.00	52,042
Jan-87	9,070	1,778	21,927	2.85	70,285
Feb-87	13,660	1,636	30,375	3.50	129,995
Mar-87	28,640	1,540	59,971	2.00	155,660
Apr-87	16,860	1,386	31,758	2.10	96,269
May-87	21,800	1,141	33,810	1.40	82,984
Jun-87	20,180	1,127	30,932	1.60	87,791

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Jul-87	19,190	1,087	28,346	1.58	82,441
Aug-87	15,630	918	19,517	0.90	38,248
Sep-87	13,080	1,069	19,016	1.39	49,435
Oct-87	11,490	1,087	16,977	1.13	35,303
Nov-87	13,520	1,369	25,159	1.45	53,303
Dec-87	6,860	2,007	18,720	3.10	57,822
Jan-88	9,290	2,167	27,369	3.40	85,882
Feb-88	13,770	1,869	34,984	3.00	112,322
Mar-88	24,580	1,467	49,033	2.20	147,033
Apr-88	18,680	1,476	37,484	2.10	106,661
May-88	15,810	1,268	27,244	1.73	74,153
Jun-88	18,940	1,181	30,421	1.72	88,576
Jul-88	19,530	1,338	35,537	2.00	106,204
Aug-88	23,260	1,186	37,511	1.58	99,609
Sep-88	16,270	1,161	25,688	1.48	65,472
Oct-88	15,600	958	20,320	1.00	42,310
Nov-88	10,650	1,351	19,559	1.55	44,884
Dec-88	9,690	1,525	20,092	2.15	56,646
Jan-89	8,580	2,016	23,512	3.13	73,098
Feb-89	13,230	1,735	31,204	2.53	91,130
Mar-89	18,000	1,680	41,102	2.68	131,165
Apr-89	18,690	1,498	38,054	2.18	110,529
May-89	17,040	1,264	29,280	2.22	102,857
Jun-89	19,930	1,258	34,094	2.20	119,217
Jul-89	20,540	1,104	30,831	1.85	103,319
Aug-89	22,520	961	29,415	1.58	96,440
Sep-89	15,670	999	21,277	1.56	66,466
Oct-89	15,700	985	21,020	1.30	55,495
Nov-89	16,230	1,086	23,968	1.45	63,988
Dec-89	11,900	1,516	24,528	2.07	66,869
Jan-90	10,830	1,938	28,540	2.83	83,187
Feb-90	14,900	1,897	38,428	2.67	108,035
Mar-90	18,960	1,846	47,594	2.62	135,067
Apr-90	13,850	1,742	32,798	2.45	92,262
May-90	12,780	1,608	27,934	2.48	86,177
Jun-90	10,770	1,642	24,035	3.18	92,976
Jul-90	16,000	1,165	25,341	2.25	97,884
Aug-90	18,210	969	23,986	1.54	76,002
Sep-90	12,110	844	13,896	1.39	45,769
Oct-90	8,650	834	9,811	0.67	15,758
Nov-90	8,580	1,058	12,344	1.05	24,495
Dec-90	3,900	2,197	11,647	3.15	33,403
Jan-91	3,730	2,518	12,766	3.62	36,714

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Feb-91	4,630	2,252	14,173	3.53	44,376
Mar-91	18,370	1,601	39,986	2.08	103,892
Apr-91	11,680	1,886	29,951	2.95	93,686
May-91	7,730	1,646	17,301	2.35	49,296
Jun-91	6,200	1,455	12,261	2.38	40,070
Jul-91	6,350	905	7,809	0.72	12,456
Aug-91	6,690	803	7,303	0.58	10,634
Sep-91	2,890	1,443	5,668	1.40	11,001
Oct-91	2,760	1,274	4,779	0.86	6,424
Nov-91	6,090	1,368	11,324	1.32	21,816
Dec-91	5,550	1,700	12,828	1.80	27,163
Jan-92	5,550	2,251	16,982	3.52	53,118
Feb-92	7,590	2,049	21,146	3.33	68,619
Mar-92	14,200	1,709	32,986	2.60	100,385
Apr-92	9,810	1,878	25,040	2.67	71,129
May-92	4,620	1,777	11,162	2.22	27,887
Jun-92	4,290	1,437	8,382	2.59	30,153
Jul-92	3,790	980	5,048	0.77	7,914
Aug-92	3,510	920	4,389	0.47	4,486
Sep-92	2,350	1,087	3,473	0.69	4,377
Oct-92	2,540	1,185	4,094	0.73	5,055
Nov-92	3,880	1,595	8,411	2.10	22,154
Dec-92	3,940	1,877	10,055	2.27	24,318
Jan-93	10,260	1,917	26,745	3.44	96,035
Feb-93	10,670	2,147	31,144	4.31	125,099
Mar-93	14,780	1,775	35,666	2.89	116,240
Apr-93	16,400	1,659	36,992	2.44	108,714
May-93	12,990	1,513	26,712	2.28	80,353
Jun-93	12,140	1,478	24,400	2.74	90,361
Jul-93	14,050	1,381	26,387	2.41	92,220
Aug-93	17,640	1,114	26,726	2.20	105,519
Sep-93	9,330	1,054	13,363	1.45	36,847
Oct-93	9,910	945	12,731	1.17	31,639
Nov-93	12,500	1,144	19,441	1.60	54,295
Dec-93	13,850	1,344	25,308	1.99	74,751
Jan-94	10,920	1,743	25,869	2.77	82,245
Feb-94	18,120	1,725	42,502	2.67	131,669
Mar-94	22,040	1,721	51,572	2.77	165,757
Apr-94	12,500	1,893	32,171	2.54	86,243
May-94	10,160	1,915	26,448	3.28	90,610
Jun-94	8,900	1,901	22,995	3.56	86,149
Jul-94	11,110	1,658	25,046	2.60	78,541
Aug-94	10,040	1,648	22,495	2.70	73,707

Italicized = estimated

Date	Flow (acre-feet)	TDS (mg/L)	Salt Load (tons)	Boron Concentration (mg/L)	Boron Load (tons)
Sep-94	6,910	1,390	13,054	1.85	34,758
Oct-94	5,929	1,280	10,319	1.08	17,331
Nov-94	7,555	1,670	17,149	1.98	40,572
Dec-94	8,414	1,673	19,140	2.04	46,670
Jan-95	15,957	1,627	35,287	2.40	104,130
Feb-95	15,279	2,256	46,855	3.75	155,789
Mar-95	23,887	1,881	61,096	3.07	199,178
Apr-95	21,859	1,677	49,848	2.68	158,985
May-95	22,884	1,162	36,138	1.83	113,554
Jun-95	11,466	1,284	20,011	2.12	66,092
Jul-95	21,357	1,208	35,073	1.98	114,687
Aug-95	22,352	1,118	33,980	1.88	113,955
Sep-95	16,570	1,106	24,916	1.60	72,086
Oct-95	12,483	860	14,601	0.91	30,887
Nov-95	11,593	1,135	17,893	1.54	48,656
Dec-95	14,559	1,361	26,945	1.98	78,259
Jan-96	11,569	1,751	27,542	2.48	78,155
Feb-96	28,785	1,511	59,112	2.12	165,784
Mar-96	31,458	1,496	63,995	2.07	176,992
Apr-96	17,224	1,416	33,157	2.02	94,517
May-96	14,311	1,372	26,695	2.32	90,097
Jun-96	15,999	1,646	35,798	2.52	109,477
Jul-96	18,035	1,445	35,427	2.58	126,368
Aug-96	20,665	1,204	33,835	1.82	102,262
Sep-96	12,915	993	17,438	1.44	50,509
Oct-96	7,591	808	8,337	0.66	13,657
Nov-96	12,548	835	14,247	0.89	30,497
Dec-96	13,139	1,011	18,056	1.10	39,299
Jan-97	26,158	1,027	36,538	1.23	87,560
Feb-97	19,749	1,079	28,961	1.23	66,136
Mar-97	21,714	838	24,749	0.64	37,982
Apr-97	9,449	1,124	14,436	0.87	22,288
May-97	9,140	927	11,516	0.71	17,594
Jun-97	9,124	878	10,896	0.69	17,200
Jul-97	9,939	700	9,453	0.55	14,809
Aug-97	11,686	625	9,923	0.51	16,125
Sep-97	6,716	693	6,331	0.56	10,272

Italicized = estimated

APPENDIX B: GEOGRAPHIC INFORMATION SYSTEM PROCESSING INFORMATION AND METADATA SUMMARY

Projection Information: All of the coverages used in the GIS Analysis were either originally in Teale Albers projection or re-projected from their original projection or coordinate system to Teale Albers.

POSC:	-1
UNIT:	Meter
GEOGRAPHIC CSYS:	GCS_North_American_1927
DATUM:	D_North_American_1927
PRIME MERIDIAN:	Greenwich
FALSE EASTING:	0
FALSE NORTHING:	-4000000
BASE PROJECTION :	Albers
CENTRAL MERIDIAN:	-120.0
CENTRAL PARALLEL:	0.0
STANDARD PARALLEL 1:	34.0
STANDARD PARALLEL 2:	40.5

1. Hydrography: Derivatives of the US EPA's Reach File 3-alpha version (RF3a) were the primary hydrographic coverages used in the GIS analysis. Various subsets of the data were used to eliminate lower order stream segments and "coarsen" the coverage for different presentation and geographic analysis purposes. However, the underlying geographic and attribute data remained unchanged. Apparently, this coverage was prepared under a collaborative effort by the Teale Data Center, US EPA, and the CA Dept. of Fish and Game. The shapefile used for LJSR GIS analysis was extracted directly from the GEO Waterbody System library (on CD) prepared by Teal Data Center for the SWRCB and the nine RWQCBs. The data was provided in a Teal Albers projection so no re-projection was needed. The accompanying metadata is on pages 47-74 of this appendix.

2. Roads: The roads layer was extracted directly from the GEO Waterbody System library (on CD) prepared by Teal Data Center for the SWRCB and the nine RWQCBs. The data was provided in a Teal Albers projection so no re-projection was needed. The layer was used primarily as a background for use in putting perspective to locations within the area of interest. The roads layer includes all major highways and freeways throughout the state, and was clipped to only those roads within the study area.

3. Counties: The county layer is from a statewide county coverage developed by the Teale Data Center. This coverage was clipped to contain the counties in and around the area of interest. It was used to define the boundaries of much of the study area and as a background reference

to see which jurisdictions are located within each of the sub-areas. The Teale Data Center metadata for this coverage is on pages 100-104 of this appendix.

4. Land Use: Land use Data was developed by the State of California, Department of Water Resources. The Department of Water Resources provided the Regional Board with five individual Arcview shapefiles. Each shapefile contained land use information for one county including Merced, Madera, San Joaquin, Stanislaus, and Fresno counties. Originally, all shapefiles were received in a custom Transverse Mercator projection used by the Department of Water Resources. The five shapefiles were re-projected to a Teale Albers projection using the Arcview projection utility. The five shapefiles were trimmed (clipped) down to county boundaries then merged to create one contiguous land use coverage using the Arcview GeoProcessing Wizard. The Department of Water Resource's Metadata for each of the five land use coverages is on pages 74-100 of this appendix.

5. Wetlands: The wetlands data is based entirely on the California Central Valley Wetlands and Riparian GIS project (see Metadata pgs. 104-112). The data was obtained electronically from the Fish and Game website as a raster based file. The raster file was converted to a vector (shape file) file using Arcview and Spatial Analyst. The file was then clipped to the shape of the Grasslands Ecological Area (Refuge Boundary see 7 below).

   The Grasslands Ecological area wetlands were broken down by sub-area to determine the acreage of the GEA in within each sub-area. Three wetland classification types were extracted from the GEA wetlands (Open Water, Seasonally Flooded Palustrine Emergents, and Permanently Flooded Emergents). These classifications were assumed to characterize the areas of ponded wetlands. Each of these three components were summed together by sub-area to determine the total acreage of ponded wetlands within each sub-area.

6. Refuge Boundary: The refuge boundary for the Grasslands Ecological Area (GEA) was downloaded from the U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory website (http://www.nwi.fws.gov) using the Wetlands Interactive Mapper Tool. The coverage was originally obtained as an Arcview Shapefile in UTM Zone 10n projection and was re-projected to Teal Albers for analysis with other coverages. Once re-projected, the shapefile was edited on-screen in Arcview to include state wetlands that appeared to be left out of the refuge boundary coverage. Editing of the shapefile was done using a combination of staff knowledge of the area, inspection of maps, and identification of local landmarks, using topographic maps and EPA's reach file 3 in the background. Therefore, the refuge boundary coverage should be considered very coarse. No Metadata was provided with the specific refuge boundary coverage downloaded from the USFWS's National Wetlands Inventory website, however, general metadata for the National Wetlands Inventory is on pages 112-134.

7. Public Water Agency Boundaries: The water Public Water Agency (water districts) boundary coverage was obtained from the Ken Winden (kwinden@water.ca.gov) with the

Department of Water Resources. No formal metadata accompanied the coverages, however, the following information was given.

Digitized scale: 1:24,000
Coordinate system: UTM Zone 10
Datum: 1927
Units: Meters

The coverage was obtained as an Arcview shapefile and was re-projected to Teal-Albers.

8. Calwater: The California Watershed Map (CALWATER version 2.2) is a set of standardized watershed boundaries meeting standardized delineation criteria. The hierarchy of watershed designations consists of six levels of increasing specificity: Hydrologic Region (HR), Hydrologic Unit (HU), Hydrologic Area (HA), Hydrologic Sub-Area (HSA), Super Planning Watershed (SPWS), and Planning Watershed (PWS). The primary purpose of Calwater is the assignment of a single, unique code to a specific watershed polygon.

   The individual numbers that were used to identify Calwater Watersheds are a combination of the following: Hydrologic Region + Hydrologic Basin (Regional Board) + Hydrologic Unit + Hydrologic Area + Hydrologic Sub-Area + Super Planning Watershed + Planning Watershed. Listed below in Table 1.1 are all of those Calwater watersheds that were either partially or completely contained within the area of interest (see metadata pgs. 135-144).

9. Monitoring Stations: Lat/Long coordinate data for each of the monitoring station within the LJSR was obtained from field personnel using hand held GPS receivers (WGS84). Each coordinate pair was converted to decimal degrees within an Excel spreadsheet. The spreadsheet was then converted to an event theme in Arcview. The resultant point theme was projected from decimal degrees to Teale Albers.

10. Area of interest: The area of interest is an accurate representation of the drainage area affecting salt and boron loads to the San Joaquin river downstream of the Mendota Pool and upstream of the San Joaquin River at the Airport Way Bridge near Vernalis site. The area of interest encompasses the drainage area contributing the majority of the salt and boron loads to the San Joaquin River at Vernalis. In general, the area of interest includes the lands draining the eastern slope of the coast range, the western slope of the Sierra Nevada foothills below the major reservoirs of New Melones Lake on the Stanislaus, Don Pedro Reservoir on the Tuolumne, and Lake McLure on the Merced, and the San Joaquin Valley Floor from the Mendota Pool to Vernalis. All of the land area of San Benito, Mariposa, Tuolumne, and Calaveras counties were excluded from the area of interest because it was determined that these areas do not contribute significant salt and boron loads to the Lower San Joaquin River (LSJR).

The boundary of the Area of Interest, clockwise from Vernalis, follows the Stanislaus River to the Caswell Park. It includes the entire park as well as the natural drainage around the park flowing into the Stanislaus River. From Caswell Park, the boundary follows the levee along the north side of the Stanislaus River. The levee gives way to a ridge forming the north edge of the Stanislaus River watershed through southern and eastern Ripon. The ridge forms the boundary to the fork of the Main District Canal east of Ripon. At this location, the Main District Canal becomes the boundary of the area of interest. The Main District Canal east, then the South San Joaquin Main Canal is followed east until the intersection with Woodward Reservoir. At this point, the boundary becomes the drainage divide between Woodward Reservoir and Littlejohns Creek, the South San Joaquin Main Canal, and the North Main Canal. Just past the intersection of North Main Canal and Littlejohns Creek, the boundary follows the divide between the San Joaquin Main Canal and Littlejohns Creek until it reaches the Stanislaus County line.

The east boundary of the area of is formed by the eastern edge of the Stanislaus and Merced County lines. Where the Merced County line meets the Madera County line, the boundary becomes the CalWater boundary until it reaches the San Joaquin River at Friant Dam.

The southern boundary is formed by the San Joaquin River to the Mendota Pool. Here the boundary becomes the southern edge of Calwater RBUASPW areas 654120000 (Los Banos Hydrologic Area), 654241052, 654241053, and 654241054. Where 654241054 meets San Benito County, the border becomes the county line north of that location.

The western boundary is formed by the eastern county line of San Benito County and the western edges of Merced and Stanislaus counties. Though some water in the area of interest does originate in San Benito County, it was excluded because the water from this region does not significantly impact the affected water bodies and to reduce the number of jurisdictions unnecessarily affected by the TMDL. Western Merced and Stanislaus counties were chosen as the boundaries because the county lines are coincident with the crest of the Coast Range and therefore the edge of the watersheds that drain the eastern slope of the Coast Range.

From the crest of the Coast Range north of the San Joaquin-Stanislaus county line, the border is formed by the drainage surrounding Hospital and Lone Tree Creeks. Where the drainage meets the boundary of Calwater 654110000 (Patterson Hydrologic Area), it is formed by the northern edge of Calwater 656410000 until it reaches the gas line running northeast across the Vernalis Gas Fields which it follows coincident with the angle of Airport Road to the San Joaquin River.

Table 1: Calwater Watersheds within the Area of Interest

Partially Contained within AOI		Entirely Contained Within AOI	
653510000	654241036	653530000	654220020
653540011	654241037	653560000	654210040
653410010	654241053	653550000	654210042
653520000	653590000	654210017	654220021
653620010	653800071	654210010	654220034
653410010		654210012	654220033
653620012		654210016	654220031
653620021		654210014	654220022
653620030		654210015	654220032
653620011		654210011	654220012
653620031		654210013	654220030
653620000		654210024	654220011
654110000		654210020	654220013
653710011		654210023	654220040
653710010		654210022	654220043
653710012		653580000	654220041
653800032		654210060	654220044
654120000		654210031	654220042
653800062		654210021	654220045
654241013		654210030	654510000
654241012		654210050	654520000
654241011		654210041	654530000

11. Subarea Boundaries: The area of interest is divided into seven subareas, each with a unique hydrologic drainage. Three of the subareas have been further delineated into minor subareas for purpose of facilitating the determination of load from various parts of the subarea watershed and the LSJR watershed as a whole. The subarea boundaries were derived, in part, on previous watershed delineations performed by Charlie Kratzer with the USGS (USGS, 1998) and modified by Regional Board staff with digital 1:24,000 USGS topographic quadrangles by digitizing new or additional boundaries using a GIS.

A. East Valley Floor:

This is the drainage area is primarily located between each of the major river drainages. It actually consists of three inter-basin areas. The northern most of the three areas is the region between the Stanislaus and Tuolumne River drainages, the middle region is between the Tuolumne and Merced River drainages, and the southern region is between the Merced River and Bear Creek drainage basins. This area is made up of all land east of the San Joaquin River that is not included in any of the previously mentioned watersheds, south of the Stanislaus River, west Tuolumne and Mariposa counties, and north of the Bear Creek drainage area.

The San Joaquin River forms the north region boundary upstream of the San Joaquin River near Vernalis at the Airport Way Bridge sampling site to the Stanislaus River. The boundary then becomes the Stanislaus River upstream to the discharge point of Lateral No. 6. From here, Lateral No. 6 becomes the boundary eastward until the Lateral No. 6 junction with the Modesto Main Canal. At this location, Modesto Main Canal becomes the northern boundary between the junction with Lateral No. 6 and Thompson Lateral. Thompson Lateral becomes the west boundary of an island of this reach of the East Valley Floor, north of this location. Stowell Lateral becomes the boundary east of the intersection of Thompson and Stowell Laterals. At the intersection of Stowell Lateral and Claribel Lateral, Claribel Lateral becomes the eastern boundary of the island south of that location to the intersection with Dry Creek. Dry Creek becomes the southern boundary briefly between Claribel Lateral and the intersection with Modesto Main Canal. Modesto Main Canal forms the southeastern boundary between Dry Creek and the intersection of Lateral No. 3.

From the intersection, the boundary becomes Lateral No. 3 westward toward the intersection with Lateral No. 4. The boundary becomes Lateral No. 4 at that intersection. Near the location where McHenry Avenue crosses Lateral No. 4, the boundary becomes the McHenry Stormdrain basin around McHenry Avenue as far north as Sylvan Avenue. Where western boundary of the McHenry Stormdrain basin intersects the Ninth Street Stormdrain basin, the Ninth Street Stormdrain basin becomes the boundary until that boundary intersects Lateral No. 4. Lateral No. 4 becomes the boundary from this location to its juncture with Lateral No. 5 (including Pioneer High School to the south). Here the boundary becomes Lateral No. 5 southwest to where it turns northwest near Michigan Avenue The boundary is a southwest-northeast line reaching from the turning point of the lateral to Paradise Road near Illinois Avenue. At the intersection of the line with Paradise Rd, Paradise Road becomes the boundary from Illinois Avenue to Shiloh Road At the intersection with Shiloh Road, Shiloh Road becomes the boundary south from that location to where it crosses the Tuolumne River.

The boundary of the central section of the East Valley Floor subarea is formed by Shiloh Road, from where it crosses the Tuolumne River to the bend in Shiloh Road At this location the boundary becomes the natural drainage between the Tuolumne River to the east and Laird Slough (San Joaquin River) to the west. Where the natural drainage crosses Lower Lateral No. 2, Lower Lateral No. 2 forms the boundary east of that location. Lower Lateral No. 2 is the boundary east to the intersection with Lower Lateral No. 1. Lower Lateral No.1 forms the boundary from this location along its entire length east and Ceres Main Canal continues to form the boundary after Lower Lateral No.1 merges with it. Turlock Main Canal becomes the boundary from the intersection with Ceres Main Canal to the intersection with Highline Canal. Highline Canal forms a portion of the eastern boundary south of Turlock Main Canal to the intersection of the natural drainage of Sand Creek, which is approximately one half mile north of the Highline Canal intersection with Keyes Road. The topographical watershed of Sand Creek east of Highline Canal forms this portion of the boundary as Sand Creek flows underneath Highline Canal and is therefore included in the East Valley Floor. Highline Canal forms the boundary again beginning at the intersection of the southern portion of the Sand Creek drainage, near where Hall Road crosses Highline Canal, south to the divide between Cross Ditch No. 1 and Cross Ditch No. 2. This divide becomes the boundary between Highline Canal and Lateral No. 6. At this location, Lateral No. 6 forms the boundary to the intersection with Lateral No. 7, which then becomes the boundary. Stevinson Lower Lateral becomes the boundary for its length to the Merced River. The boundary is formed by the natural drainage of the Merced River from this location west, around and to the exclusion of George Hatfield State Park, along Kelley Road to River Road where it crosses the Merced River.

The southern section of the East Valley Floor continues from the River Road crossing of the Merced River along the topographic watershed boundary of the Merced River until it meets the ridge defining the northern edge of the Bear Creek watershed. Here, it follows this ridge southwest to the San Joaquin River. The San Joaquin River makes up the whole western boundary of the East Valley Floor.

The East Valley Floor is composed of four minor subareas that have been delineated for the purpose of allowing a more refined look at drainage contributions to the San Joaquin River along specified reaches. Each of these minor subareas are defined below.

1. North Stanislaus:

   Located in the northern portion of Stanislaus County, south of the Stanislaus River, this minor subarea of the East Valley Floor contains much of northern Modesto and drains 68 square miles (43,400 acres) of land between the Stanislaus and Tuolumne River watersheds that flows into the San Joaquin River upstream of Airport Road and downstream of Maze Boulevard.

   Clockwise from the sampling station at the Maze Boulevard Bridge, the San Joaquin River between Maze Boulevard and the confluence of the Stanislaus and San Joaquin rivers form the boundary. The boundary then becomes the Stanislaus River upstream to the discharge point of Lateral No. 6. From here, Lateral No. 6 becomes the boundary eastward until the Lateral No. 6 junction with the Modesto Main Canal. At this location, Modesto Main Canal becomes the northern boundary between the junction with Lateral No. 6 and Thompson Lateral. Thompson Lateral becomes the west boundary of an island of this reach of North Stanislaus, north of this location. Stowell Lateral becomes the boundary east of the intersection of Thompson and Stowell Laterals. At the intersection of Stowell Lateral and Claribel Lateral, Claribel Lateral becomes the eastern boundary of the island south of that location to the intersection with Dry Creek. Dry Creek becomes the southern boundary briefly between Claribel Lateral and the intersection with Modesto Main Canal. Modesto Main Canal forms the southeastern boundary between Dry Creek and the intersection of Lateral No. 3.

From the intersection, the boundary becomes Lateral No. 3 westward toward the intersection with Lateral No. 4. The boundary becomes Lateral No. 4 at that intersection. Near the location where McHenry Avenue crosses Lateral No. 4, the boundary becomes the McHenry Stormdrain basin around McHenry Avenue as far north as Sylvan Avenue. Where western boundary of the McHenry Stormdrain basin intersects the Ninth Street Stormdrain basin, the Ninth Street Stormdrain basin becomes the boundary until that boundary intersects the south side of Highway 99. Here Highway 99 forms the boundary north to Needham Street/Kansas Avenue, which becomes the boundary between Highway 99 and the west side of the off ramp to Needham Street/Kansas Avenue. At this location, the west side of Highway 99 forms the boundary north to the Woodland Avenue/Coldwell Avenue Overpass. Between the overpass and the western boundaries of sections 21 and 28 of Township 03 South and Range 08 East, Woodland Avenue forms the boundary. The boundary becomes the western boundary of section 21 between Woodland Avenue and Lateral No.3 at this location. At that point, Lateral No. 3 becomes the boundary between (CROSSLATERAL 3-4?) and the boundary of section 21. The boundary becomes (CROSSLATERAL 3-4?) between Lateral No. 3 and a location approximately one-fifth of one mile south of Maze Boulevard along Paradise Road where the levee along the (CROSSLATERAL 3-4?) begins. Where the (CROSSLATERAL 3-4?) begins to be protected by the levee, the levee itself paralleling the north and west banks of the lateral becomes the boundary. The levee forms the boundary from this location to the intersection of the levee with the levee on which Maze Boulevard is constructed. At this location, Maze Boulevard becomes the boundary east to the San Joaquin River, except for a small diversion of the boundary south of Maze Boulevard near the river to include land thought to flow into the San Joaquin River downstream of Maze Boulevard. The San Joaquin River between Maze Boulevard and the Airport Road Bridge near Vernalis forms the western boundary of this minor subarea.

2. Norteast Bank:

This minor subarea of the East Valley Floor contains all of the land draining into the east side San Joaquin River upstream of Maze Boulevard and downstream of Las Palmas Avenue Road and covers 120 square miles (78,600 acres). It is located in central Stanislaus County and includes the cities of Houghson, Keyes, Ceres, parts of western Modesto and much of northern Turlock Irrigation District and southwest Modesto Irrigation District.

Clockwise from the Maze Boulevard Bridge, the boundary is formed by Maze Boulevard, except for the exclusion of a small area south of Maze Boulevard near the San Joaquin River thought to flow downstream of the Maze Boulevard Bridge, between the San

Joaquin River and the levee along the east bank of Finnegan Cut (San Joaquin River). Here the boundary becomes the levee south and east to the end of the levee. The levee merges into and becomes the north levee of Lateral No.4 and west levee of (CROSSLATERAL 3-4?). At this location the boundary becomes (CROSSLATERAL 3-4?) north to Lateral No. 3. Lateral No. 3 becomes the boundary between (CROSSLATERAL 3-4?) and the western boundary of section 21 of Township 03 South and Range 08 East. Between Lateral No. 3 and Woodland Avenue, the western boundary of section 21 is the boundary. Woodland Avenue forms the next length of boundary between the intersection with section 21 and the Woodland Avenue/Coldwell Avenue overpass over Highway 99. At this point the boundary becomes the west side of Highway 99 and the Needham Street/Kansas Avenue offramp between the overpass and Needham Street/Kansas Avenue. Here the boundary becomes Needham Street/Kansas Avenue and Highway 99 between the offramp and Lateral No. 4.

The eastern boundary is formed by Lateral No. 4 between Highway 99 and Lateral No. 5 (including Pioneer High School to the south). Here the boundary becomes Lateral No. 5 southwest to where it turns northwest near Michigan Avenue. The boundary is a southwest-northeast line reaching from the turning point of the lateral to Paradise Road near Illinois Avenue. At the intersection of the line with Paradise Rd, Paradise Road becomes the boundary from Illinois Avenue to Shiloh Road At the intersection with Shiloh Road, Shiloh Road becomes the boundary south from that location to where it crosses the Tuolumne River. Shiloh Road continues to form the boundary from where it crosses the Tuolumne River to the bend in Shiloh Road to the south. At this location the boundary becomes the natural drainage between the Tuolumne River to the east and Laird Slough (San Joaquin River) to the west. Where the natural drainage crosses Lower Lateral No. 2, Lower Lateral No. 2 forms the boundary east of that location. Lower Lateral No. 2 is the boundary east to the intersection with Lower Lateral No. 1. Lower Lateral No.1 forms the boundary from this location along its entire length east and Ceres Main Canal continues to form the boundary after Lower Lateral No.1 merges with it. Turlock Main Canal becomes the boundary from the intersection with Ceres Main Canal to the intersection with Highline Canal. Highline Canal forms the eastern boundary south of Turlock Main Canal to the intersection with Turlock Irrigation District Upper Lateral No. 3.

The southern boundary of the Northeast Bank minor subarea west of Turlock Main Canal is formed by Upper Lateral No. 3 and Lower Lateral No. 3, which form the boundary between Highline Canal and Central Avenue. The boundary becomes Central Avenue at this location between Lower Lateral No. 3 and Taylor Road. At this location, the boundary becomes Taylor Road east to Lower Lateral No. 3. Here, the boundary again becomes Lower Lateral No. 3 from where Taylor road begins to parallel it to where Monte Vista Avenue crosses it. The drainage divide separating Lower Lateral No. 3 and the San Joaquin River forms the boundary from Monte Vista to the levee on the San Joaquin River near Lake Ramona. The levee forms the boundary from this location to

Las Palmas Avenue, including a small area to the south of Las Palmas Avenue and west of the levee thought to drain the into the San Joaquin River downstream of the San Joaquin River. At the Las Palmas Avenue Bridge, the San Joaquin River forms the western boundary north to Maze Boulevard.

3. Stevinson:

This minor subarea of the East Valley Floor contains all of the land flowing to the San Joaquin River upstream of its confluence with the Merced River and downstream of the Lander Avenue (Highway 165) crossing and covers 44 square miles (28,000 acres). It is located in north-central Merced County.

The Stevinson minor subarea boundary is formed by, starting clockwise from the confluence of the Merced and San Joaquin Rivers, the northern topographic boundary of the Merced River from the confluence to where it crosses Hills Ferry Road. The boundary becomes Hills Ferry Road and River Road from where the topographic boundary of the Merced River crosses Hills Ferry Road east to near Hatfield Road. Approximately one half mile west of the intersection of River Road and Hatfield Road, the boundary becomes the topographic watershed boundary of the Merced River until it meets the ridge defining the northern edge of the Bear Creek watershed near the intersection of Robin and Peach Avenues southwest of the city of Livingston. Here, the boundary becomes this ridge southwest toward the San Joaquin River. Where the northern edge of the Bear Creek watershed intersects the East Side Irrigation Canal (East Side Bypass Project), the Stevinson minor subarea boundary becomes the natural watershed boundary defining that area which flows into the San Joaquin River upstream of Lander Avenue (Highway 165) from the East Side Irrigation Canal to Lander Avenue. The San Joaquin River forms the rest of the boundary between the Lander Avenue Bridge and the confluence of the San Joaquin and Merced Rivers.

4. Turlock Area:

This minor subarea of the East Valley Floor contains all of the land draining into the San Joaquin River upstream of Las Palmas Avenue and downstream of the confluence of the San Joaquin River and Merced River and covers 180 square miles (114,000 acres), including the Harding Drain (T.I.D. Lateral Number 5). It is located in south-central Stanislaus County and northern Merced County and contains much of Hillmar and the cities of Turlock and Denair, as well as most of central and southern Turlock Irrigation District (T.I.D.).

Counterclockwise from the Las Palmas Avenue Bridge, the San Joaquin River between Las Palmas Avenue and the confluence of the San Joaquin and Merced Rivers forms the boundary on the west. At this location the boundary is the northern topographic boundary of the Merced River from the confluence to where it crosses Hills Ferry Road.

The boundary becomes Hills Ferry Road and River Road from where the topographic boundary of the Merced River crosses Hills Ferry Road east to the Merced River. Here the boundary becomes the natural topographic drainage boundary of the Merced River upstream of the River Road sampling station between River Road and where the drainage boundary crosses Stevinson Lower Lateral. At this location, the boundary becomes the Stevinson Lower Lateral, Lateral No. 7, and Lateral No. 6. At Harding Road, the topographic divide between Cross Ditch No. 1 and Cross Ditch No. 2 forms the boundary. Where the topographic divide reaches Highline Canal, the boundary becomes Highline Canal north until the canal intersects Turlock Main Canal, including the whole of the natural, topographic drainage of the Sand Creek watershed to the east of Highline Canal, which flows under the canal and is therefore included in the Turlock Area minor subarea drainage.

The northern boundary of the Turlock Area minor subarea west of Turlock Main Canal is formed by Upper Lateral No. 3 and Lower Lateral No. 3, which form the boundary between Highline Canal and Central Avenue. The boundary becomes Central Avenue at this location between Lower Lateral No. 3 and Taylor Road. At this location, the boundary becomes Taylor Road east to Lower Lateral No. 3. Here, the boundary again becomes Lower Lateral No. 3 from where Taylor road begins to parallel it to where Monte Vista Avenue crosses it. The drainage divide separating Lower Lateral No. 3 and the San Joaquin River forms the boundary from Monte Vista to the levee on the San Joaquin River near Lake Ramona. The levee forms the boundary from this location to Las Palmas Avenue, excluding a small area to the south of Las Palmas Avenue and west of the levee thought to drain the into the San Joaquin River downstream of the San Joaquin River.

B. Grasslands

The Grasslands is the southwest region of the TMDL project area. It encompasses the drainage areas of Mud Slough, Salt Slough, Los Banos Creek, and a small region of direct drainage upstream of the Merced River confluence with the San Joaquin and downstream of the Mud Slough confluence.

From the confluence of the Merced River with the San Joaquin River, the boundary is formed by the San Joaquin River between this confluence and a point just to the south of Sack Dam, where the Columbia Canal Company boundary intersects the San Joaquin River. The Grassland Subarea boundary is coincident with the boundary of Columbia Canal Company's eastern boundary from this point to the location where Columbia Canal Company's boundary intersects the San Joaquin River again not far upstream of the Mendota Pool.

The San Joaquin River and Mendota Pool form the southern boundary from the intersection of the Columbia Canal Company boundary just upstream of the Mendota Pool to the Firebaugh Canal Water District Main Lift. Here the boundary becomes the southern edge of

Calwater RBUASPW areas 654120000 (Los Banos Hydrologic Area), 654241052, 654241053, and 654241054. Where 654241054 meets San Benito County, the boundary becomes the county line north from that location to the location where the San Benito County line crosses the crest of the Coast Range.

The Coast Range from the San Benito County line to the intersection of the southern edge of the Orestimba Creek drainage forms the western boundary. The northern boundary is formed by the northern edge of the Garzas Creek drainage between the crest of the Coast Range and the intersection of the drainage with Delta-Mendota Canal. Here the Delta-Mendota Canal becomes the boundary between the northern edge of the Garzas Creek drainage and Garzas Creek itself. Where the Delta-Mendota Canal crosses Garzas Creek, Garzas Creek becomes the northern boundary of the Grassland subarea to the location where Garzas Creek flows beneath Main Canal. At this location, the boundary becomes Main Canal north to the intersection of the canal with the northern boundary of Calwater RBUASPW area 6541200000 (Los Banos Hydrologic Area). The northern boundary of this Calwater RBUASPW forms the northern boundary of the Grassland subarea between Main Canal and the San Joaquin River.

C. <u>Merced River</u>

This basin includes drainage to the Merced River, Stevinson Lower Lateral, Highline Canal, Dry Creek, and Livingston Canal.

Clockwise from the sampling site, the Stevinson Lower Lateral, Lateral No. 7, and Lateral No. 6 form the boundary. At Harding Road, the topographic divide between Cross Ditch No. 1 and Cross Ditch No. 2 forms the boundary. Where the topographic divide reaches Highline Canal, the boundary becomes Highline Canal north until the canal intersects Turlock Main Canal, excluding the whole of the natural, topographic drainage of the Sand Creek watershed which flows under Highline Canal and is therefore not included in the Merced River drainage area. The exclusion of the Sand Creek watershed creates the “island” feature that drains to the Merced via Highline Canal, but is not contiguous with the rest of the watershed. This island is approximately triangular in shape and is bounded on the west by Highline Canal, on the south by the northern boundary of the topographic drainage of Sand Creek, and on the east by the natural drainage boundary of the creeks flowing west towards Highline Canal.

The boundary of larger portion of the watershed from Highline Canal is formed by the southern boundary of the drainage of Sand Creek, Turlock Lake, Peaslee Creek, Evans Creek, Goodwin Creek, and Vizard Creek. The Tuolumne County line is the boundary from where it crosses the Vizard Creek watershed, near the four corners of Stanislaus, Merced, Mariposa, and Tuolumne Counties, to where it crosses the topographic divide between the Merced River and Bear Creek, a little more than a mile northwest of La Paloma Ranch. The southern boundary of the Merced River subarea is the southern edge of the natural topographic divide of the Merced River watershed from the Merced County line to the sampling location on the Merced River at the crossing of River Road.

D. Northwest Side

This area represents the west side of the San Joaquin Valley that drains to the San Joaquin River downstream of the Merced River and upstream of the Vernalis sampling site at Airport Road. The subarea includes the entire drainage area of Orestimba, Del Puerto, Ingram and Hospital Creeks. From the sampling site, the boundary is Durham Ferry Road from the Airport Road Bridge to the southwest. At the location where Durham Ferry Road curves to the due west, the boundary is formed by a line coincident with the southwest angle of the road as if it did not curve away to the west. This is the boundary from Durham Ferry Road to the intersection with the Calwater 6541100000 (Patterson Hydrologic Area) boundary at Highway 33. At this location, the boundary becomes the northern boundary of Calwater 6541100000 (Patterson Hydrologic Area). The boundary becomes divergent from the Calwater 6541100000 (Patterson Hydrologic Area) boundary where the Calwater boundary intersects the drainage of Lone Tree Creek as drawn from 24k USGS topographic quadrangles, near the intersection of Interstate 580 and the Hetch-Hetchy Aqueduct. Here, the boundary becomes the northern edge of the Lone Tree Creek drainage boundary to the crest of the Coast Range, which becomes the boundary between this location and the southern edge of the Orestimba Creek watershed and northern edge of Garzas Creek.

The southern boundary is formed by the northern edge of the Garzas Creek drainage between the crest of the Coast Range and the intersection of the drainage with Delta-Mendota Canal. Here the Delta-Mendota Canal becomes the boundary between the northern edge of the Garzas Creek drainage and Garzas Creek itself. Where the Delta-Mendota Canal crosses Garzas Creek, Garzas Creek becomes the southern boundary of the Northwest Side subarea to the location where Garzas Creek flows beneath Main Canal. At this location, the boundary becomes Main Canal north to the intersection of the canal with the northern boundary of Calwater RBUASPW area 6541200000 (Los Banos Hydrologic Area). The northern boundary of this Calwater RBUASPW forms the southern boundary of the Northwest Side subarea between Main Canal and the San Joaquin River.

The Northwest Side has been further delineated into three minor subareas to allow for a more refined look at the areas contributing drainage to the San Joaquin River along specified reaches. Each of these minor subareas are defined below.

1. Greater Orestimba:

   Greater Orestimba comprises the 300 square miles (189,000 acres) of the Northwest Side subarea in southwest Stanislaus County and the small portion of western Merced County. It contains the drainage flowing into the San Joaquin River from the west between Las

Palmas Avenue and the confluence of the San Joaquin River and the Merced River, and is predominantly the drainage of Orestimba Creek and contains the city of Newman.

Counterclockwise from the sampling station at Las Palmas Avenue, the boundary is the natural drainage boundary of the area draining to the San Joaquin River upstream of Las Palmas Avenue. This natural boundary intersects Main Canal one-tenth of one mile southwest of where then canal flows beneath Las Palmas Avenue. At this location, the boundary becomes main canal between the intersection with the natural drainage boundary and Highway 33 south of the city of Patterson. Here Highway 33 becomes the boundary between Main Canal and Elfers Road. At the intersection of Highway 33 and Elfers Road, the boundary becomes Elfers Road between Highway 33 and Del Puerto Avenue. The boundary becomes the edge of the natural drainage boundary between Salado Creek and Little Salado Creek, beginning at the intersection of Elfers Road and Del Puerto Avenue. Near Oak Flats Ranch, the boundary becomes coincident with the natural drainage boundary of Orestimba Creek and its tributaries. The drainage area of Orestimba Creek forms the boundary of the Greater Orestimba subarea between from the intersection with the Little Salado Creek drainage west to the crest of the Coast Range, south to the northern edge of the Garzas Creek drainage area. The southern boundary is formed by the northern edge of the Garzas Creek drainage between the crest of the Coast Range and the intersection of the drainage with Delta-Mendota Canal. Here the Delta-Mendota Canal becomes the boundary between the northern edge of the Garzas Creek drainage and Garzas Creek itself. Where the Delta-Mendota Canal crosses Garzas Creek, Garzas Creek becomes the southern boundary of the Greater Orestimba minor subarea to the location where Garzas Creek flows beneath Main Canal. At this location, the boundary becomes Main Canal north to the intersection of the canal with the northern boundary of Calwater RBUASPW area 6541200000 (Los Banos Hydrologic Area). The northern boundary of this Calwater RBUASPW forms the southern boundary of the Greater Orestimba minor subarea between Main Canal and the San Joaquin River.

2. Vernalis North:

Vernalis North comprises the 9 square miles (5,770 acres) of the Northwest Side subarea located in the northern extent of the TMDL project area, just to the north of the small town of Vernalis predominantly in San Joaquin County. It contains the drainages flowing to the San Joaquin River from the west between Maze Boulevard and Airport Road.

Counterclockwise from the sampling station at Airport Road near Vernalis, the boundary is Durham Ferry Road from the Airport Road Bridge to the southwest. At the location where Durham Ferry Road curves due west, the boundary is formed by a line coincident with the southwest angle of the road as if it did not curve away to the west. This is the boundary from Durham Ferry Road to Highway 33. The boundary becomes Highway 33 at this location south to the intersection with Welty Road. Welty Road becomes the boundary for a short distance between Highway 33 and the Stanislaus-San Joaquin

County line. At this point, the county line becomes the boundary between Welty Road and the Hetch-Hetchy Aqueduct. Here, the Hetch-Hetchy Aqueduct becomes the boundary between the county line and the location where the natural drainage boundary of the land draining into the San Joaquin River upstream of Maze Boulevard intersects the Aqueduct. At this location, the boundary becomes the natural drainage boundary between the Hetch-Hetchy Aqueduct and the San Joaquin River. The San Joaquin River is the eastern boundary of the Vernalis North minor subarea between Maze Boulevard and the Airport Road sampling station.

3. Westside Creeks

Westside Creeks is comprised of the 300 square miles (191,000 acres) of the Northwest Side subarea located in western Stanislaus County. It contains the drainages of the major creeks that drain into the west side of the San Joaquin River between Maze Boulevard and Las Palmas Avenue, including the drainages of Del Puerto, Hospital, and Ingram Creeks, as well as the city of Patterson.

Clockwise from the Maze Boulevard sampling station, the boundary is the San Joaquin River south to the Las Palmas Avenue Bridge sampling station location near Patterson. From here, the boundary is the natural drainage boundary of the area draining to the San Joaquin River upstream of Las Palmas Avenue. This natural boundary intersects Main Canal one-tenth of one mile southwest of where then canal flows beneath Las Palmas Avenue. At this location, the boundary becomes main canal between the intersection with the natural drainage boundary and Highway 33 south of the city of Patterson. Here Highway 33 becomes the boundary between Main Canal and Elfers Road. At the intersection of Highway 33 and Elfers Road, the boundary becomes Elfers Road between Highway 33 and Del Puerto Avenue. The boundary becomes the edge of the natural drainage boundary between Salado Creek and Little Salado Creek, beginning at the intersection of Elfers Road and Del Puerto Avenue. Near Oak Flats Ranch, the boundary becomes coincident with the natural drainage boundary of Orestimba Creek and its tributaries. The drainage area of Orestimba Creek forms the boundary of the Westside Creeks minor subarea between from the intersection with the Little Salado Creek drainage west to the crest of the Coast Range.

The western boundary is the crest of the Coast Range from the Orestimba Creek drainage boundary to the northern boundary of the Lone Tree Creek drainage area. The northern boundary is formed by the northern border of the Lone Tree Creek drainage area between the crest of the Coast Range and the intersection of the Lone Tree Creek drainage boundary with the Hetch-Hetchy Aqueduct near the intersection of the Hetch-Hetchy Aqueduct and Interstate 580. Here, the Hetch-Hetchy Aqueduct becomes the boundary between the Lone Tree Creek drainage boundary and the location where the natural drainage boundary of the land draining into the San Joaquin River upstream of Maze Boulevard intersects the Aqueduct. At this location, the boundary becomes the natural drainage boundary between the Hetch-Hetchy Aqueduct and the San Joaquin River at the Maze Boulevard Bridge sampling station.

E. <u>San Joaquin River upstream of Salt Slough</u>

This subarea comprises the area that drains to the San Joaquin River upstream of the Lander Avenue (Highway 165) sampling site. From the site and going clockwise, the border is the watershed boundary between canals and creeks as discerned from RF3 by regional board staff until it meets the watershed boundary between Merced River and Bear Creek. It then becomes the topographic boundary of Bear Creek from this point east to the Mariposa County line. From here the Mariposa County line forms the boundary south to the Madera County line. At this point, the boundary becomes the eastern edge of the Calwater 654530000 (Berenda Creek Hydrologic Area) boundary to the San Joaquin River at Friant Dam. At this location, the boundary becomes the San Joaquin River west to where the Columbia Canal Company boundary intersects the river. At this location, the border becomes the eastern Columbia Canal Company boundary north and then west back to the San Joaquin River. Here, it becomes the San Joaquin River again north to the sampling site.

The San Joaquin River upstream of Salt Slough has been further delineated into two minor subareas to allow for a more refined look at the areas contributing drainage to the San Joaquin River along specified reaches. Each of these minor subareas are defined below.

1. Bear Creek:

Located in eastern Merced County and comprising the northern half of the LSJR upstream of Salt Slough subarea, the Bear Creek minor subarea contains the cities of Atwater, Merced, Planada, and the southern half of Livingston and drains 520 square miles (335,000 acres) of land that flows directly into Bear Creek downstream of the Merced County line and the San Joaquin River upstream of Lander Avenue (Highway 165) and downstream of the Bear Creek confluence. This minor subarea is often considered to be the effective drainage area of the LSJR upstream of Salt Slough subarea as it is the only one of the two minor subareas to have significant, year-round contributions.

Counterclockwise from the sampling station at the Lander Avenue (Highway 165) Bridge over the San Joaquin River, the boundary is the San Joaquin River between the bridge and the location where the San Joaquin River becomes coincident with the Grassland Ecological Area (GEA) boundary. Here, the boundary becomes the southern and eastern boundary of the GEA between the San Joaquin River and the intersection of the GEA boundary with the natural southern watershed boundary of Deadman Creek downstream of the intersection with El Nido Canal. At this location the boundary becomes the southern boundary of Deadman Creek between the GEA boundary and the intersection of Dutchman Creek, a tributary of Deadman Creek, with El Nido Canal. The natural watershed boundary between Dutchman Creek and Deadman Creek becomes the boundary between El Nido Canal and the Merced County line.

The eastern boundary of the Bear Creek minor subarea is the Merced County line between the northern boundary of the Dutchman Creek watershed and the southern boundary of the Merced River watershed. The northern boundary of the Bear Creek minor subarea is the southern edge of the natural topographic divide of the Merced River watershed from the Merced County line to the location where the northern Bear Creek watershed boundary diverges from the Merced River watershed, near the intersection of Robin and Peach Avenues southwest of the city of Livingston. Here, the Bear Creek drainage boundary becomes the boundary from the location where it diverges from the Merced River boundary to the East Side Irrigation Canal (East Side Bypass Project). At this location, the Bear Creek minor subarea boundary becomes the natural watershed boundary defining that area which flows into the San Joaquin River upstream of Lander Avenue (Highway 165) from the East Side Irrigation Canal to Lander Avenue.

2. Fresno-Chowchilla:

Fresno-Chowchilla is a minor subarea that comprises southern 950 square miles (609,000 acres) of the LSJR upstream of Salt Slough subarea and is located in southeast Merced County and western Madera County. It contains the drainage flowing into the San Joaquin River downstream of Sack Dam and upstream of the confluence with Bear Creek, including the drainages of the Fresno and Chowchilla Rivers. It contains the cities of Madera and Chowchilla, Chowchilla Water District, and Madera Irrigation District.

The boundaries of the Fresno-Chowchilla minor subarea are defined as, from the location where the San Joaquin River becomes coincident with the Grassland Ecological Area (GEA) boundary, the boundary becomes the southern and eastern boundary of the GEA between the San Joaquin River and the intersection of the GEA boundary with the natural southern watershed boundary of Deadman Creek downstream of the intersection with El Nido Canal. At this location the boundary becomes the southern boundary of Deadman Creek between the GEA boundary and the intersection of Dutchman Creek, a tributary of Deadman Creek, with El Nido Canal. The natural watershed boundary between Dutchman Creek and Deadman Creek becomes the boundary between El Nido Canal and the Merced County line.

The eastern boundary is the Mariposa County line south to the Madera County line. At this point, the boundary becomes the eastern edge of the Calwater 654530000 (Berenda Creek Hydrologic Area) boundary to the San Joaquin River at Friant Dam. At this location, the boundary becomes the San Joaquin River west to where the Columbia Canal Company boundary intersects the river. Here, the border becomes the eastern Columbia Canal Company boundary north and then west back to the San Joaquin River. The San

Joaquin River forms the western boundary between this location and the location where the San Joaquin River flows into the GEA.

F. Stanislaus River

This subarea contains all of the land draining into the Stanislaus River upstream of Caswell State Park and downstream of the Stanislaus County line and covers 150 square miles (97,400 acres). It is located in the northern portion of Stanislaus County and contains the cities of Oakdale and Riverbank as well as much of Salida, and part of Ripon.

The boundary of the Stanislaus River subarea, from the Caswell State Park sampling site, is formed by the levee that excludes nearly the entire park, but includes some surrounding land that is thought to drain into the Stanislaus River. From Caswell Park, the levee continues to form the boundary to the location where Robert Avenue intersects the levee south of Ripon. Here, the boundary becomes a ridge, forming the natural watershed boundary of the Stanislaus River, north of which water is known to flow downstream of Vernalis, but south of which flows into the Stanislaus River, to the fork of the Main District Canal east of Ripon. At this location, the Main District Canal becomes the boundary. The Main District Canal, then the South San Joaquin Main Canal is forms the boundary from this location east to the intersection with Woodward Reservoir. At this point, the boundary becomes the drainage divide between Woodward Reservoir and Littlejohns Creek, and then becomes South San Joaquin Main Canal where the drainage divide intersects the canal. At the intersection between South San Joaquin Main Canal and North Main Canal, the boundary becomes North Main Canal north of that location to just past the intersection of North Main Canal and Littlejohns Creek, at which point, the boundary becomes the divide between San Joaquin Main Canal and Littlejohns Creek to the Stanislaus County line.

The county line forms the boundary south to the drainage of Wildcat Creek approximately one half mile southeast of the point where the county line crosses the Stanislaus River. The boundary then becomes the northern boundary of the drainage of Wildcat Creek from the county line to the intersection with Oakdale South Main Drain. Here, the boundary becomes Oakdale South Main Drain south to the intersection with the northern boundary of the Cashman Creek drainage. At this location, the boundary becomes the northern boundary of the Cashman Creek drainage upstream of the Cashman Dam from here to the Cashman Dam. At the Cashman Dam, the boundary becomes the drainage between the Oakdale South Main Canal and Cashman Creek, but primarily the southern boundary of the drainage area contributing to the Oakdale South Main Canal. The boundary becomes the Oakdale South Main Canal at the intersection between the canal and Kearney Lateral to the intersection with Claribel Lateral, which forms the boundary from this point south to the intersection with Albers Lateral. Where Albers intersects Stowell Lateral, Stowell Lateral becomes the boundary to the intersection with Thompson Lateral, which becomes the boundary south from this point to the Modesto Main Canal, which becomes the boundary from here east to

Lateral No. 6. The boundary becomes Lateral No. 6 between Modesto Main Canal and the intersection with the Stanislaus River. At this point the boundary becomes the divide between the area draining to the Stanislaus River upstream of the Caswell State Park sampling site and the area draining the downstream portion of the Stanislaus River and to the San Joaquin River.

G. <u>Tuolumne River</u>

This basin includes drainage to the Tuolumne River at the Shiloh Road sampling station. Clockwise from the sampling site, the boundary is Shiloh Road north to Paradise Road, which then forms the boundary east to near Illinois Avenue. Near Illinois Avenue, the boundary becomes a northeast-southwest line coincident with the angle of Lateral No. 5. Lateral No. 5 forms the boundary from this location northeast to Lateral No. 4, which becomes the boundary at this location east, excluding Pioneer High School, to the juncture with the boundary of the Ninth Street Stormdrain basin. The Ninth Street Stormdrain basin and McHenry Stormdrain basin form the boundary at this point to Lateral No. 4, the boundary of the stormdrain basins stretching as far north along McHenry as Sylvan Avenue. Lateral No. 4 briefly forms the boundary to the junction with Lateral No. 3, which becomes the boundary east of that location to Modesto Main Canal. At this location, the boundary is Modesto Main Canal from Lateral No. 3 to Dry Creek. From Dry Creek the boundary becomes Claribel Lateral north to Oakdale South Main Canal. Oakdale South Main Canal forms the boundary to the intersection with Kearney and Union Laterals. From this location, the boundary becomes the drainage divide between Oakdale South Canal, Kearney Lateral and the other natural drainage south of Oakdale South Main Canal. Near where Oakdale South Main Canal intersects Cashman Creek, the boundary becomes the northern drainage boundary of Cashman Creek. The boundary again becomes Oakdale South Main Canal near Wildcat Creek. Near where Highway 108 crosses the Oakdale South Main Canal, the boundary becomes the divide between Stanislaus River (and tributaries) and Wildcat Creek to the Stanislaus-Tuolumne County line. The county line south of this location is the boundary to the drainage boundary between the Tuolumne and Merced Rivers near the four corners of Stanislaus, Merced, Mariposa, and Tuolumne Counties. Here, the boundary becomes the divide between Tuolumne River and Merced River, including in the Tuolumne River subarea the drainages of Vizard Creek, Goodwin Creek, Evans Creek, Peasley Creek, and Turlock Lake. At this location, the natural topographic drainage basin of Sand Creek as well as the streams north of Sand Creek flowing into Highline Canal becomes the boundary to the intersection of Highline Canal and Turlock Main Canal. West of this location, the boundary is formed by Turlock Main Canal, Ceres Main Canal, Lateral No. 1, and Lateral No. 2 until Lateral No. 2 intersects the watershed boundary between Laird Slough (San Joaquin River) and the Tuolumne River. The boundary becomes the border between the two drainages and then becomes Shiloh Road where the boundary crosses the road. Shiloh Road forms the boundary from that location to the sampling site where it crosses the river.

12. Subarea Technical Descriptions

The Lower San Joaquin River watershed has been divided into seven major geographic subareas. In some cases, the major subareas have been further subdivided into minor subareas to provide a greater level of detail. The following is a technical description of each of the subareas comprising the TMDL project area.

East Valley Floor Subarea

BEGINNING at the junction of the Stanislaus River and the San Joaquin River lying in Section 19, Township 3 South, Range 7 East, Mount Diablo Meridian; thence along the following courses:

A. Meander the centerline of the Stanislaus River northeasterly upstream to its intersection with boundary of Calwater RBUASPW area 6535100000 (Manteca Hydrologic Area) near Caswell Memorial State Park;

B. North on the said boundary of Calwater RBUASPW area 6535100000 (Manteca Hydrologic Area) near Caswell Memorial State Park to its intersection with the centerline of the first road it crosses;

C. East on centerline of said road to its junction with the centerline of the north levee of the Stanislaus River;

D. Southwesterly on centerline of said Stanislaus River levee to its intersection with the boundary of Caswell Memorial State Park;

E. Northeasterly on the boundary of Caswell Memorial State Park to its intersection with the centerline of the Stanislaus River;

F. South 1000 feet;

G. East to the centerline of the levee following the south bank of the Stanislaus River;

H. Meander centerline of said levee northeasterly to its intersection with the centerline of Modesto Irrigation District Lateral Number 6;

I. Meander centerline of said Lateral No. 6 easterly to its junction with the centerline of Modesto Main Canal;

J. Meander centerline of said Main Canal southeasterly to its junction with the centerline of Thompson Lateral;

K. Meander centerline of said Thompson Lateral northerly to its junction with the centerline of Stowell Lateral;

L. Meander centerline of said Stowell Lateral northeasterly to its junction with the centerline of Claribel Lateral;

M. Meander centerline of said Claribel Lateral southerly to its junction with the centerline of Dry Creek;

N. Meander centerline of Dry Creek westerly to its intersection with the centerline of Modesto Main Canal;

O. Meander centerline of said Main Canal northwesterly to its junction with Modesto Irrigation District Lateral Number 3;

P. Meander centerline of said Lateral No. 3 westerly to its junction with Modesto Irrigation District Lateral Number 4;

Q. Meander centerline of said Lateral No. 4 southwest to its intersection with the boundary of the McHenry Avenue Stormdrain Basin, as defined by the City of Modesto, in Modesto;

R. Meander the boundary of the said McHenry Avenue Stormdrain Basin to its intersection with the boundary of the Ninth Street Stormdrain Basin, as defined by the City of Modesto, in Modesto;

S. Meander boundary of the said Ninth Street Stormdrain Basin to its intersection with the centerline of Franklin Street;

T. South on the centerline of Franklin Street to the intersection with the centerline of the centerline of Locust Street;

U. West on the centerline of Locust Street to its intersection with the centerline of Modesto Irrigation District Lateral Number 5, were it extended west to intersect the centerline of said Lateral No. 5;

V. Meander centerline of said Lateral No. 5 southwesterly to its intersection with the centerline of Michigan Avenue, were it extended north to intersect the centerline of said Lateral No. 5;

W. Southwest to the intersection of the centerlines of Illinois Avenue and Paradise Road;

X. West on the centerline of Paradise Road to its junction with the centerline of Shiloh Road;

Y. South 1.5 miles on the centerline of said Shiloh Road to the location where it bends to the due west;

Z. Meander the drainage boundary of the Tuolumne River southeasterly to its intersection with the centerline of Turlock Irrigation District Lower Lateral Number 2;

AA. Meander centerline of said Lateral No. 2 westerly to its junction with the centerline of Turlock Irrigation District Lateral Number 1;

BB. Meander centerline of said Lateral No. 1 to its junction with the centerline of Ceres Main Canal;

CC. Meander centerline of said Ceres Main Canal easterly to its junction with the centerline of Turlock Main Canal;

DD. Meander centerline of said Turlock Main Canal easterly to its junction with the centerline of Highline Canal;

EE. Meander centerline of said Highline Canal southerly to its intersection with the drainage boundary of Sand Creek approximately 2000 feet upstream of the intersection with Keyes Road in Stanislaus County;

FF. Meander drainage boundary of Sand Creek east, south, and west to its intersection with the centerline of Highline Canal approximately three quarters of one mile southwest of the intersection of Hall Road and Monte Vista Avenue in Stanislaus County;

GG. Meander centerline of said Highline Canal southwest to its intersection with the drainage divide between Turlock Irrigation District Cross Ditch Number 1 and Turlock Irrigation District Cross Ditch Number 2 approximately 0.33 miles southwest of the intersection of Santa Fe Drive with the Merced County line;

HH. Meander said drainage divide southwesterly to its intersection with the centerline of Turlock Irrigation District Lateral Number 6 at the junction of the centerlines of Turlock Main Canal, Turlock Irrigation District Lateral Number 5 (Harding Drain), and said Lateral No. 6;

II. Meander centerline of said Lateral No. 6 southwesterly to its junction with the centerline of Turlock Irrigation District Lateral Number 7;

JJ. Meander centerline of said Lateral No. 7 southwesterly to its junction with the centerline of Stevinson Lower Lateral;

KK. Meander centerline of said Stevinson Lower Lateral southwesterly to its intersection with the centerline of an unnamed aqueduct approximately one quarter of one mile west of the intersection of Tegner Road and Taylor Avenue in Merced County;

LL. Southwest on the centerline of said aqueduct to its intersection with the centerline of Faith Home Road near its intersection with Turner Avenue;

MM. Meander the drainage boundary of the Merced River westerly to its intersection with the centerline of Kelley Road;

NN. South on the centerline of Kelley Road to its intersection with the centerline of River Road;

OO. East on the centerline of River Road to its intersection with the drainage boundary of the Merced River;

PP. Meander said drainage boundary northeasterly to its intersection with the drainage boundary of Bear Creek;

QQ. Meander said drainage of Bear Creek southwesterly to its intersection with the centerline of East Side Irrigation Canal;

RR. Meander the drainage boundary defined by the area draining to the San Joaquin River upstream of the Lander Avenue (Highway 165) Bridge westerly to its intersection with the centerline of the San Joaquin River at its intersection with the centerline of Lander Avenue (Highway 165);

SS. Meander centerline of said San Joaquin River northwesterly to its junction with the centerline of the Stanislaus River and the point of beginning of this description.

North Stanislaus Minor Subarea

BEGINNING at the junction of the Stanislaus River and the San Joaquin River lying in Section 19, Township 3 South, Range 7 East, Mount Diablo Meridian; thence along the following courses:

A. Meander the centerline of the Stanislaus River northeasterly upstream to its intersection with boundary of Calwater RBUASPW area 6535100000 (Manteca Hydrologic Area) near Caswell Memorial State Park;

B. North on the said boundary of Calwater RBUASPW area 6535100000 (Manteca Hydrologic Area) near Caswell Memorial State Park to its intersection with the centerline of the first road it crosses;

C. East on centerline of said road to its junction with the centerline of the north levee of the Stanislaus River;

D. Southwesterly on centerline of said Stanislaus River levee to its intersection boundary of Caswell Memorial State Park;

E. Northeasterly on the boundary of Caswell Memorial State Park to its intersection with the centerline of the Stanislaus River;

F. South 1000 feet;

G. East to the centerline of the levee following the south bank of the Stanislaus River;

H. Meander centerline of said levee northeasterly to its intersection with the centerline of Modesto Irrigation District Lateral Number 6;

I. Meander centerline of said Lateral No. 6 easterly to its junction with the centerline of Modesto Main Canal;

J. Meander centerline of said Main Canal southeasterly to its junction with the centerline of Thompson Lateral;

K. Meander centerline of said Thompson Lateral northerly to its junction with the centerline of Stowell Lateral;

L. Meander centerline of said Stowell Lateral northeasterly to its junction with the centerline of Claribel Lateral;

M. Meander centerline of said Claribel Lateral southerly to its junction with the centerline of Dry Creek;

N. Meander centerline of Dry Creek westerly to its intersection with the centerline of Modesto Main Canal;

O. Meander centerline of said Main Canal northwesterly to its junction with Modesto Irrigation District Lateral Number 3;

P. Meander centerline of said Lateral No. 3 westerly to its junction with Modesto Irrigation District Lateral Number 4;

Q. Meander centerline of said Lateral No. 4 southwest to its intersection with the boundary of the McHenry Avenue Stormdrain Basin, as defined by the City of Modesto, in Modesto;

R. North, west, and south on the boundary of the said McHenry Avenue Stormdrain Basin to its intersection with the boundary of the Ninth Street Stormdrain Basin, as defined by the City of Modesto, in Modesto;

S. West and south on the boundary of the said Ninth Street Stormdrain Basin to its intersection with the centerline Franklin Street;

T. South on centerline of said Franklin Street to its intersection with the centerline of Highway 99;

U. Northwest on centerline of said Highway 99 to its intersection with the centerline of Woodland Avenue/Coldwell Avenue;

V. West on centerline on said centerline of Woodland Avenue to its intersection with the western boundary intersection of Sections 21 and 28, Township 3 South, Range 8 East, Mount Diablo Meridian;

W. North on boundary of Section 21, Township 3 South, Range 8 East, Mount Diablo Meridian to its intersection with the centerline of Modesto Irrigation District Lateral Number 3;

X. West on centerline of said Lateral No. 3 to its junction with the centerline of (Crosslateral 3-4?);

Y. Meander centerline of said (Crosslateral 3-4?) southwesterly to its junction with the centerline of the north levee of Modesto Irrigation District Lateral Number 4 if it were extended to cross (Crosslateral 3-4?);

Z. Meander centerline of said levee of Lateral No. 4 westerly to its junction with the centerline of the eastern levee of Finnegan Cut on San Joaquin River;

AA. Meander centerline of said levee of Finnegan Cut on the San Joaquin River to its intersection with the centerline of Maze Boulevard in Stanislaus County;

BB. Westerly on centerline of said Maze Boulevard to its intersection with the centerline of the east bank levee San Joaquin River;

CC. Westerly on the drainage boundary of the San Joaquin River upstream of Maze Boulevard to its intersection with the centerline of the San Joaquin River at the Maze Boulevard Bridge;

DD. Meander centerline of said San Joaquin River northerly to its intersection with the centerline of the Stanislaus River and the point of beginning of this description.

<u>Northeast Bank Minor Subarea</u>

BEGINNING at the centerline of the San Joaquin River at the Maze Boulevard Bridge lying in Section 29, Township 3 South, Range 7 East, Mount Diablo Meridian; thence along the following courses:

A. Easterly on the drainage boundary of the San Joaquin River upstream of Maze Boulevard to its intersection with the centerline of Maze Boulevard;

B. Easterly on centerline of said Maze Boulevard to its intersection with the centerline of the east bank levee of the San Joaquin River;

C. Meander centerline of said levee of the San Joaquin River southeasterly to its intersection with the north bank levee of Modesto Irrigation District Lateral Number 4;

D. Meander centerline of said levee of Lateral No. 4 easterly to its intersection with the centerline of an unnamed lateral connecting Lateral No. 3 and Lateral No. 4, were it extended east to said centerline;

E. Meander centerline of said unnamed lateral to its junction with the centerline of Modesto Irrigation District Lateral Number 3;

F. East on centerline of said Lateral No. 3 to its intersection with the western boundary of Section 21, Township 3 South, Range 8 East, Mount Diablo Meridian;

G. South on boundary of said Section 21 to its intersection with the centerline of Woodland Avenue;

H. East on the centerline of said Woodland Avenue to its intersection with the centerline of Highway 99;

I. Southeast on the centerline of said Highway 99 to its intersection with the centerline of Franklin Street;

J. South on the centerline of Franklin Street to the intersection with the centerline of the centerline of Locust Street;

K. West on the centerline of Locust Street to its intersection with the centerline of Modesto Irrigation District Lateral Number 5, were it extended west to intersect said Lateral No. 5;

L. Meander centerline of said Lateral No. 5 southwesterly to its intersection with the centerline of Michigan Avenue, were it extended north to said Lateral No. 5;

M. Southwest to the intersection of the centerlines of Illinois Avenue and Paradise Road;

N. West on the centerline of Paradise Road to its junction with the centerline of Shiloh Road;

O. South 1.5 miles on the centerline of said Shiloh Road to the location where it bends to the due west;

P. Meander the drainage boundary of the Tuolumne River southeasterly to its intersection with the centerline of Turlock Irrigation District Lower Lateral Number 2;

Q. Meander centerline of said Lateral No. 2 westerly to its junction with the centerline of Turlock Irrigation District Lateral Number 1;

R. Meander centerline of said Lateral No. 1 to its junction with the centerline of Ceres Main Canal;

S. Meander centerline of said Ceres Main Canal easterly to its junction with the centerline of Turlock Main Canal;

T. Meander centerline of said Turlock Main Canal southerly to its junction with the centerline of Turlock Irrigation District Upper Lateral Number 3;

U. Meander centerline of said Lateral No. 3 westerly to its junction with the centerline of Turlock Irrigation District Lower Lateral Number 3;

V. West on centerline of said Lateral No. 3 to its intersection with the centerline of Central Avenue in Stanislaus County;

W. South on centerline of said Central Avenue to its intersection with the centerline of Taylor Road;

X. West on centerline of said Taylor Road to its intersection with the centerline of Turlock Irrigation District Lower Lateral Number 3, were it extended west to intersect said Lateral No. 3;

Y. West on centerline of said Lateral No. 3 to its intersection with the centerline of an unnamed drain located approximately 0.58 miles downstream of the Lateral No. 3 intersection with the centerline of Carpenter Road in Stanislaus County;

Z. South on centerline of said unnamed drain to its intersection with the centerline of Monte Vista Avenue in Stanislaus County;

AA. Southwesterly on the drainage boundary separating the San Joaquin River from the unnamed drain and associated natural channel to its junction with the centerline of the east bank levee of the San Joaquin River;

BB. Northwesterly on centerline of said levee of the San Joaquin River to its intersection with the drainage of the San Joaquin River upstream of Maze Boulevard approximately 0.14 miles southeast of the intersection of the centerline of the east bank levee of the San Joaquin River and the centerline of Maze Boulevard;

CC. Northwesterly on drainage boundary of the San Joaquin River upstream of Las Palmas Avenue in Stanislaus County to its intersection with the centerline of the San Joaquin River at its intersection with the centerline of Las Palmas Avenue;

DD. Northwesterly on the centerline of said San Joaquin River to its intersection with the centerline of Maze Boulevard and the point of beginning of this description.

<u>Stevinson Minor Subarea</u>

BEGINNING at the centerline of the San Joaquin River at its junction with the centerline of the Merced River lying in Section 03, Township 07 South, Range 09 East, Mount Diablo Meridian; thence along the following courses:

A. Northeast on the drainage boundary of the Merced River to its intersection with the centerline of Hills Ferry Road in Merced County;

B. East on centerline of said Hills Ferry Road to its intersection with the centerline of River Road in Merced County;

C. Southeast on centerline of said River Road to its intersection with the drainage boundary of Merced River approximately 0.36 miles west of its intersection with the centerline of Hatfield Road in Merced County;

D. Northeast on said drainage boundary of Merced River to its intersection with the drainage boundary of Bear Creek, near the intersection of Robin and Peach Avenues in Merced County;

E. South on said drainage boundary of Bear Creek to its intersection with the centerline of the East Side Irrigation Canal, also known as the East Side Bypass Project;

F. Southwesterly on the drainage boundary of the San Joaquin River upstream of its intersection with Lander Avenue (Highway 165) to its intersection with the centerline of the San Joaquin River at its intersection with the centerline of Lander Avenue (Highway 165);

G. Northwesterly on centerline of said San Joaquin River to its junction with the centerline of the Merced River and the point of beginning of this description.

<u>Turlock Area Minor Subarea</u>

BEGINNING at the centerline of the San Joaquin River at the intersection with the centerline of the Las Palmas Avenue Bridge lying in Section 15, Township 05 South, Range 08 East, Mount Diablo Meridian; thence along the following courses:

A. Southeasterly on the drainage boundary of the San Joaquin River upstream of Las Palmas Avenue in Stanislaus County to its intersection with the centerline of the east bank levee of the San Joaquin River approximately 0.14 miles southeast of the intersection of the centerline of said levee and the centerline of Las Palmas Avenue;

B. Southeasterly on centerline of said levee of the San Joaquin River to its intersection with the drainage boundary approximately 0.66 miles south of the intersection of the centerline of Jennings Road and the centerline of Las Palmas Avenue in Stanislaus County separating the San Joaquin River from an unnamed drain and associated natural channel downstream of its intersection with the centerline with Monte Vista Avenue in Stanislaus County;

C. Northwesterly on said drainage boundary to its intersection with the centerline of Monte Vista Avenue at its intersection with the centerline of the unnamed drain;

D. North on centerline of said unnamed drain to its junction with the centerline of Turlock Irrigation District Lower Lateral Number 3 approximately 0.58 miles downstream of said Lateral No. 3 intersection with the centerline of Carpenter Road in Stanislaus County;

E. East on centerline of said Lateral No. 3 to its intersection with the centerline of Taylor Road in Stanislaus County, were it extended east to intersect Taylor Road;

F. East on centerline of said Taylor Road to its intersection with the centerline of Central Avenue;

G. North on centerline of said Central Avenue to its intersection with the centerline Turlock Irrigation District Lower Lateral Number 3;

H. Meander centerline of said Lateral No.3 east to its junction with the centerline of Turlock Irrigation District Upper Lateral Number 3;

I. Meander centerline of said Lateral No. 3 east to its junction with the centerline of Turlock Main Canal;

J. Meander centerline of said Turlock Main Canal north to its junction with the centerline of Highline Canal;

K. Meander centerline of said Highline Canal southwest to its intersection with the drainage divide between Turlock Irrigation District Cross Ditch Number 1 and Turlock Irrigation District Cross Ditch Number 2 approximately 0.33 miles southwest of the intersection of Santa Fe Drive with the Merced County line;

L. Meander said drainage divide southwesterly to its intersection with the centerline of Turlock Irrigation District Lateral Number 6 at the junction of the centerlines of Turlock Main Canal, Turlock Irrigation District Lateral Number 5 (Harding Drain), and said Lateral No. 6;

M. Meander centerline of said Lateral No. 6 southwesterly to its junction with the centerline of Turlock Irrigation District Lateral Number 7;

N. Meander centerline of said Lateral No. 7 southwesterly to its junction with the centerline of Stevinson Lower Lateral;

O. Meander centerline of said Stevinson Lower Lateral southwesterly to its intersection with the centerline of an unnamed aqueduct approximately one quarter of one mile west of the intersection of Tegner Road and Taylor Avenue in Merced County;

P. Southwest on the centerline of said aqueduct to its intersection with the centerline of Faith Home Road near its intersection with Turner Avenue;

Q. Meander the drainage boundary of the Merced River westerly to its intersection with the centerline of Kelley Road;

R. South on the centerline of Kelley Road to its intersection with the centerline of Hills Ferry/River Road;

S. West on centerline of said Hills Ferry Road to its intersection with the drainage of the Merced River;

T. Meander said drainage of the Merced River southerly to its intersection with the centerline of the Merced River at its junction with the centerline of the San Joaquin River;

U. Meander centerline of said San Joaquin River northwesterly to its intersection with the centerline of Las Palmas Avenue and the point of beginning of this description.

<u>Grassland Subarea</u>

BEGINNING at the junction of the Merced River and the San Joaquin River lying in Section 3, Township 7 South, Range 9 East, Mount Diablo Meridian; thence along the following courses:

A. Meander the centerline of the San Joaquin River southeasterly upstream to its junction with the jurisdictional boundary of Columbia Canal Company;

B. West and south on the jurisdictional boundary of Columbia Canal Company to its intersection with the San Joaquin River;

C. Meander said centerline of the San Joaquin River easterly to its intersection with the center point of the Mendota Pool;

D. Meander the centerline of the Fresno Slough channel southerly to its intersection with the centerline of the Firebaugh Canal Water District Main Lift;

E. West southwest on the centerline of said Main Lift to its intersection with the centerline of the Firebaugh Canal Water District Third Lift Canal;

F. Northwesterly and westerly on the boundary of Calwater RBUASPW area 7551120000 (Westlands Hydrologic Area) to its intersection with the southern drainage boundary of Capita Canyon;

G. Meander on said drainage boundary of Capita Canyon southwesterly to its intersection with the southern drainage boundary of Moreno Gulch;

H. Meander on said drainage boundary of Moreno Gulch westerly to its intersection with southern drainage boundary of Little Panoche Creek;

I. Meander on said drainage boundary of Little Panoche Creek northwesterly to its intersection with the county line between Fresno and San Benito counties where the county line crosses the southern boundary of Section 31, Township 14 South, Range 11 East, Mount Diablo Meridian;

J. Northwesterly on the San Benito County line to its intersection with the crest of the Coast Range;

K. Meander on the crest of the Coast Range north-northwesterly to its intersection with the peak of Mustang Peak, where the drainage divide between Orestimba Creek and Garzas Creek diverges from crest of the Coast Range;

L. Meander on said drainage boundary of Garzas Creek northwesterly to its intersection with the centerline of the Delta-Mendota Canal;

M. South on said centerline of the Delta-Mendota Canal to its intersection with the centerline of Garzas Creek;

N. Meander on said centerline of Garzas Creek southeasterly to its intersection with the centerline of Main Canal;

O. North-northwesterly on said centerline of Main Canal to its intersection boundary of Calwater RBUASPW area 6541200000 (Los Banos Hydrologic Area);

P. Northeast on the boundary of said Calwater RBUASPW area 6541200000 (Los Banos Hydrologic Area) to its junction with the San Joaquin River at the junction of the San Joaquin and Merced rivers and the point of beginning of this description.

<u>Merced River Subarea</u>

BEGINNING at the intersection of the centerline of the Merced River and the centerline of River Road lying in Section 3, Township 7 South, Range 9 East, Mount Diablo Meridian; thence along the following courses:

A. West on centerline of said River Road to its intersection with the centerline of Kelley Road;

B. North on centerline of said Kelley Road to its intersection with the drainage boundary of the Merced River;

C. Meander said drainage of the Merced River easterly to its intersection with an unnamed aqueduct at the intersection of Faith Home Road and Turner Avenue in Merced County;

D. East on centerline of said aqueduct to its intersection with the centerline of Stevinson Lower Lateral;

E. Meander centerline of said Stevinson Lower Lateral northwesterly to its junction with the centerline of Turlock Irrigation District Lateral Number 7;

F. Meander centerline of said Lateral No. 7 northeasterly to its junction with the centerline of Turlock Irrigation District Lateral Number 6;

G. Meander centerline of said Lateral No. 6 northeasterly to its intersection with the drainage divide between Turlock Irrigation District Cross Ditch Number 1 and Turlock Irrigation District Cross Ditch Number 2 at the junction of the centerlines of Turlock Main Canal, Turlock Irrigation District Lateral Number 5 (Harding Drain), and said Lateral No. 6;

H. Meander said drainage northeasterly to its intersection with the centerline of Highline Canal approximately 0.33 miles southwest of the intersection of Santa Fe Drive with the Merced County line;

I. Meander centerline of said Highline Canal north to its junction with the centerline of Turlock Main Canal;

J. Meander drainage boundary of unnamed creeks draining easterly toward Highline Canal and to the Merced River via said canal southeasterly to its intersection with the drainage boundary of Sand Creek;

K. Meander said drainage of Sand Creek southwesterly to its intersection with the centerline of Highline Canal approximately 2000 feet upstream of the intersection with Keyes Road;

L. Meander centerline of said Highline Canal southerly to its intersection with the northern drainage boundary of the Merced River, approximately three quarters of one mile southwest of the intersection of Hall Road and Monte Vista Avenue in Stanislaus County;

M. Meander said drainage boundary of the Merced River to its intersection with the Stanislaus County line, near the four-corner intersection of Stanislaus, Tuolumne, Merced, and Mariposa counties;

N. Southeast on said Stanislaus County line to its intersection with the Merced County line;

O. Southeasterly on the Merced County line to its intersection with the drainage boundary between Merced River and Bear Creek;

P. Meander said drainage boundary of the Merced River southwesterly to its intersection with the centerline of River Road approximately 0.36 miles west of its intersection with the centerline of Hatfield Road in Merced County;

Q. West on centerline of said River Road to its intersection with the centerline of the Merced River and the point of beginning of this description.

<u>Northwest Side Subarea</u>

BEGINNING at the intersection of the centerline of the San Joaquin River and the centerline of the Airport Way Bridge lying in Section 13, Township 3 South, Range 6 East, Mount Diablo Meridian; thence along the following courses:

A. Southeasterly on centerline of said San Joaquin River to its junction with the centerline of Merced River;

B. Southwest on the boundary of Calwater RBUASPW area 6541200000 (Los Banos Hydrologic Area) to its intersection with the centerline of Central California Irrigation District Main Canal;

C. Meander centerline of said Main Canal southeasterly to its intersection with the centerline of Garzas Creek;

D. Meander centerline of said Garzas Creek northwesterly to its intersection with the centerline of the Delta-Mendota Canal;

E. North on centerline of said Delta-Mendota Canal to its intersection with the drainage boundary of Garzas Creek;

F. Meander said drainage boundary of Garzas Creek to its intersection with Mustang Peak, at which point the drainage boundary and Garzas Creek becomes the crest of the Coast Range;

G. Meander said crest of the Coast Range northwesterly to its intersection with the drainage boundary of Hospital Creek;

H. Meander said drainage boundary of Hospital Creek northerly to its intersection with the drainage boundary of Lone Tree Creek;

I. Meander drainage boundary of Lone Tree Creek northwesterly to its intersection with the centerline of the Hetch-Hetchy Aqueduct near the intersection of the Hetch-Hetchy Aqueduct and Interstate 580;

J. East on centerline of said Hetch-Hetchy Aqueduct to its intersection with the San Joaquin County line;

K. Northeast on said San Joaquin County line to its intersection with the centerline of Welty Road;

L. North on centerline of said Welty Road to its intersection with the centerline of Highway 33;

M. Northwest on centerline of said Highway 33 to its intersection with the centerline of Durham Ferry Road, were the centerline extended southwest to intersect Highway 33 from said Durham Ferry Road at the angle which it extends southwest from its intersection with Kasson Road coincident with an unnamed gas pipeline crossing the Vernalis Gas Fields;

N. Northeast on said centerline of Durham Ferry Road, were it extended to intersect Highway 33 in said manner, to its intersection with the centerline of Durham Ferry Road;

O. Northeast on said centerline of Durham Ferry Road to its intersection with the centerline of the San Joaquin River at the Airport Way Bridge and the point of beginning of this description.

<u>Greater Orestimba Minor Subarea</u>

BEGINNING at the centerline of the San Joaquin River at the intersection with the centerline of the Las Palmas Avenue Bridge lying in Section 15, Township 05 South, Range 08 East, Mount Diablo Meridian; thence along the following courses:

A. Southeasterly on centerline of said San Joaquin River to its junction with the centerline of Merced River;

B. Southwest on the boundary of said Calwater RBUASPW area 6541200000 (Los Banos Hydrologic Area) to its intersection with the centerline of Main Canal;

C. Meander centerline of said Main Canal southeasterly to its intersection with the centerline of Garzas Creek;

D. Meander centerline of said Garzas Creek northwesterly to its intersection with the centerline of the Delta-Mendota Canal;

E. North on centerline of said Delta-Mendota Canal to its intersection with the drainage boundary of Garzas Creek;

F. Meander said drainage boundary of Garzas Creek to its intersection with Mustang Peak, the point at which said drainage of Garzas Creek intersects the crest of the Coast Range;

G. Meander said crest of the Coast Range northwesterly to its intersection with the drainage boundary of Orestimba Creek;

H. Meander said drainage boundary of Orestimba Creek easterly to its intersection with the drainage boundary of Little Salado Creek near Oaks Flat Ranch;

I. Meander said drainage boundary of Little Salado Creek northeasterly to its intersection with the centerline of Elfers Road at its intersection with the centerline of Del Puerto Avenue in Stanislaus County near Patterson;

J. East on centerline of said Elfers Road to its intersection with the centerline of Highway 33;

K. Northwest on centerline of said Highway 33 to its intersection with the centerline of Patterson Main Canal;

L. Northeast on centerline of said Patterson Main Canal to its intersection with the drainage boundary of the area draining to the San Joaquin River upstream of Las Palmas Avenue approximately 0.12 miles upstream of the intersection of the centerlines of said Patterson Main Canal and Las Palmas Avenue;

M. Meander said drainage boundary of the San Joaquin River upstream of Las Palmas Avenue northeasterly to its intersection with the centerline of the San Joaquin River at its intersection with the centerline of Las Palmas Avenue and the point of beginning of this description.

<u>Vernalis North Minor Subarea</u>

BEGINNING at the intersection of the centerline of the San Joaquin River and the centerline of the Airport Way Bridge lying in Section 13, Township 3 South, Range 6 East, Mount Diablo Meridian; thence along the following courses:

A. Southeasterly on centerline of said San Joaquin River to its intersection with the centerline of Maze Boulevard in Stanislaus County;

B. Meander drainage boundary of the area draining the San Joaquin River upstream of Maze Boulevard southwesterly to its intersection with the centerline of the Hetch-Hetchy Aqueduct, approximately 0.11 miles downstream of its intersection with the centerline of McCracken Road;

C. West on centerline of said Hetch-Hetchy Aqueduct to its intersection with the San Joaquin County line;

D. Northeast on said San Joaquin County line to its intersection with the centerline of Welty Road;

E. North on centerline of said Welty Road to its intersection with the centerline of Highway 33;

F. Northwest on centerline of said Highway 33 to its intersection with the centerline of Durham Ferry Road, were the centerline extended southwest to intersect Highway 33 from said Durham Ferry Road at the angle which it extends southwest from its intersection with Kasson Road coincident with an unnamed gas pipeline crossing the Vernalis Gas Fields;

G. Northeast on said centerline of Durham Ferry Road, were it extended to intersect Highway 33 in said manner, to its intersection with the centerline of Durham Ferry Road;

H. Northeast on said centerline of Durham Ferry Road to its intersection with the centerline of the San Joaquin River at the Airport Way Bridge and the point of beginning of this description.

Westside Creeks Minor Subarea

BEGINNING at the centerline of the San Joaquin River at the Maze Boulevard Bridge lying in Section 29, Township 3 South, Range 7 East, Mount Diablo Meridian; thence along the following courses:

A. Meander centerline of said San Joaquin River southeasterly to its intersection with the centerline of Las Palmas Avenue;

B. Meander the drainage of the area draining to the San Joaquin River upstream of Las Palmas Avenue southwesterly to its intersection with the centerline of the Patterson Main Canal;

C. Southwesterly on centerline of said Patterson Main Canal to its intersection with the centerline of Highway 33 in Stanislaus County;

D. Southeast on centerline of said Highway 33 to its intersection with the centerline of Elfers Road;

E. West on centerline of said Elfers Road to its intersection with the centerline of Del Puerto Avenue;

F. Meander the drainage boundary of Little Salado Creek southwesterly to its intersection with drainage boundary of Orestimba Creek;

G. Meander said drainage boundary of Orestimba Creek southwesterly to its intersection with intersects the hydrologic divide of the San Joaquin River basin in the Coast Range, heretofore referred to as the crest of the Coast Range;

H. Meander said crest of the Coast Range northwesterly to its intersection with the drainage boundary of Hospital Creek;

I. Meander said drainage boundary of Hospital Creek northerly to its intersection with the drainage boundary of Lone Tree Creek;

J. Meander drainage boundary of Lone Tree Creek northwesterly to its intersection with the centerline of the Hetch-Hetchy Aqueduct near the intersection of the Hetch-Hetchy Aqueduct and Interstate 580;

K. East on centerline of said Hetch-Hetchy Aqueduct to its intersection with the drainage boundary of the area draining to the San Joaquin River upstream of its intersection with the centerline of Maze Boulevard, approximately 0.11 miles downstream the intersection of the centerlines of said Hetch-Hetchy Aqueduct and McCracken Road;

L. Meander said drainage boundary of the San Joaquin River upstream of Maze Boulevard northeasterly to its intersection with the centerline of the San Joaquin River at its intersection with the centerline of Maze Boulevard and the point of beginning of this description.

<u>San Joaquin River Upstream of Salt Slough Subarea</u>

BEGINNING at the centerline of the San Joaquin River at its intersection with the centerline of Lander Avenue (Highway 165) in Merced County lying in Section 27, Township 07 South, Range 10 East, Mount Diablo Meridian; thence along the following courses:

A. Northeasterly on the drainage boundary of the San Joaquin River upstream of its intersection with Lander Avenue (Highway 165) to its intersection with the centerline of the East Side Irrigation Canal;

B. Meander the drainage boundary of Bear Creek northeasterly to its intersection with the Merced County line;

C. Meander Merced County line southeasterly to its intersection with the Madera County line;

D. Southeasterly on the boundary of Calwater 654530000 (Berenda Creek Hydrologic Area) to its intersection with the centerline of the San Joaquin River at Friant Dam;

E. Southwesterly on centerline of said San Joaquin River to its intersection with the jurisdictional boundary of Columbia Canal Company;

F. Northwesterly on said boundary of Columbia Canal Company to its intersection with the centerline of the San Joaquin River;

G. Northwesterly on said San Joaquin River to its intersection with the centerline of Lander Avenue (Highway 165) and the point of beginning of this description.

<u>Bear Creek Minor Subarea</u>

BEGINNING at the centerline of the San Joaquin River at its intersection with the centerline of Lander Avenue (Highway 165) in Merced County lying in Section 27, Township 07 South, Range 10 East, Mount Diablo Meridian; thence along the following courses:

A. Northeasterly on the drainage boundary of the San Joaquin River upstream of its intersection with Lander Avenue (Highway 165) to its intersection with the centerline of the East Side Irrigation Canal;

B. Meander the drainage boundary of Bear Creek northeasterly to its intersection with the Merced County line;

C. Meander Merced County line southeasterly to its intersection with the drainage boundary of Dutchman Creek;

D. Westerly on said drainage boundary of Dutchman Creek to the junction of Dutchman Creek and Deadman Creek;

E. Westerly on the drainage boundary of Deadman Creek downstream of Dutchman Creek to its intersection with the centerline of Sandy Mush Road in Merced County;

F. West on centerline of said Sandy Mush Road to its intersection with the centerline of Lone Tree Road;

G. South on centerline of said Lone Tree Road to its intersection with the centerline of Chamberlain Road;

H. West on centerline of said Chamberlain Road to its intersection with the centerline of the south levee of the East Side Bypass;

I. Meander centerline of said levee of the East Side Bypass northwesterly to its intersection with the centerline of Sandy Mush Road in Merced County;

J. West on centerline of said Sandy Mush Road to its intersection with the centerline of the East Side Canal;

K. Northwest on centerline of said East Side Canal to its intersection with the centerline of the south levee of the Mariposa Bypass;

L. West on centerline of said levee of the Mariposa Bypass to its junction with the centerline of the north levee of Mariposa Slough;

M. South to the intersection with the northern boundary of land ownership devoted to agricultural production;

N. West on said land boundary to its intersection with the centerline of the San Joaquin River, were it extended west to said centerline;

O. Northwesterly on centerline of said San Joaquin River to its intersection with the centerline of Lander Avenue (Highway 165) and the point of beginning of this description.

<u>Fresno-Chowchilla Minor Subarea</u>

BEGINNING at the centerline of the San Joaquin River at its intersection with the land boundary south of the confluence with Mariposa Slough in Merced County that denotes the beginning of agricultural production south of said confluence with Mariposa Slough, were the land boundary extended to said centerline of the San Joaquin River, and lying in Section 34, Township 08 South, Range 7 East, Mount Diablo Meridian; thence along the following courses:

A. East on said land boundary to its intersection with a line due south from the intersection of the centerlines of the north levee of Mariposa Slough and the south levee of the Mariposa Bypass, were such a line projected;

B. North on said line to its intersection with the centerlines of the north levee of Mariposa Slough and the south levee of the Mariposa Bypass;

C. East on centerline of said levee of the Mariposa Bypass to its intersection with the centerline of the East Side Canal;

D. Southeast on centerline of said East Side Canal to its intersection with the centerline of Sandy Mush Road in Merced County;

E. East on centerline of said Sandy Mush Road to its intersection with the centerline of the south levee of the East Side Bypass;

F. Meander centerline said levee of the East Side Bypass southeasterly to its intersection with the centerline of Chamberlain Road in Merced County;

G. East on centerline of said Chamberlain Road to its intersection with the centerline of Lone Tree Road;

H. North on centerline of said Lone Tree Road to its intersection with the centerline of Sandy Mush Road;

I. East on centerline of said Sandy Mush Road to its intersection with the drainage boundary of Deadman Creek;

J. Meander said drainage boundary of Deadman Creek downstream of Dutchman Creek easterly to its intersection with the confluence of Deadman and Dutchman Creeks;

K. Meander northern drainage boundary of Dutchman Creek easterly to its intersection with the Merced County line;

L. Meander Merced County line southeasterly to its intersection with the Madera County line;

M. Southeasterly on the boundary of Calwater 654530000 (Berenda Creek Hydrologic Area) to its intersection with the centerline of the San Joaquin River at Friant Dam;

N. Southwesterly on centerline of said San Joaquin River to its intersection with the jurisdictional boundary of Columbia Canal Company;

O. Northwesterly on said boundary of Columbia Canal Company to its intersection with the centerline of the San Joaquin River;

P. Northwesterly on said San Joaquin River to its intersection with the land boundary south of the confluence with Mariposa Slough in Merced County that denotes the beginning of agricultural production south of said confluence with Mariposa Slough, were the land boundary extended to said centerline of the San Joaquin River, and the point of beginning of this description.

<u>Stanislaus River Subarea</u>

BEGINNING at the centerline of the Stanislaus River at its upstream intersection with the boundary of Caswell Memorial State Park lying in Section 02, Township 03 South, Range 07 East, Mount Diablo Meridian; thence along the following courses:

A. Southwesterly on said boundary of Caswell Memorial State Park to its intersection with the centerline of north levee of the Stanislaus River;

B. Meander centerline of said Stanislaus River levee northeasterly to the location at which it diverges to form a riverbank levee and a secondary levee away from the river;

C. Meander centerline of said secondary levee to its intersection with the Ripon City Limit;

D. Meander drainage boundary of the Stanislaus River northeasterly to its intersection with the centerline of an unnamed canal tributary to the South San Joaquin Main District Canal;

E. Meander centerline of said unnamed canal northeasterly to its junction with the centerline of South San Joaquin Main District Canal;

F. Meander centerline of said Main District Canal northeasterly to its junction with Woodward Reservoir;

G. Meander drainage boundary between Woodward Reservoir and Littlejohn's Creek easterly to its intersection with the centerline of North Main Canal;

H. Meander drainage boundary of South San Joaquin Main District Canal easterly to its intersection with the Stanislaus County line;

I. Southeast on said Stanislaus County line to its intersection with the drainage boundary of Wildcat Creek;

J. Meander said drainage boundary of Wildcat Creek southwesterly to its intersection with the centerline of Oakdale South Main Drain;

K. Meander centerline of said Oakdale South Main Drain to its southwesterly intersection with the drainage boundary of Cashman Creek upstream of Cashman Dam;

L. Meander said drainage boundary of Cashman Creek upstream of Cashman Dam westerly to its intersection with Cashman Dam;

M. Meander drainage boundary between Cashman Creek southwesterly to its intersection with the drainage boundary of Kearney Lateral;

N. Meander said drainage boundary of Kearney Lateral to its intersection with the centerline of Oakdale South Main Canal;

O. Meander centerline of said Oakdale South Main Canal westerly to its junction with the centerline of Claribel Lateral;

P. South on centerline of said Claribel Lateral to its junction with the centerline of Albers Lateral;

Q. Meander centerline of said Albers Lateral southwesterly to its junction with the centerline of Stowell Lateral;

R. Meander centerline of said Stowell Lateral southwesterly to its junction with the centerline of Thompson Lateral;

S. Meander centerline of said Thompson Lateral southerly to its junction with the centerline of Modesto Main Canal;

T. Meander centerline of said Modesto Main Canal northwesterly to its junction with the centerline of Modesto Irrigation District Lateral Number 6;

U. Meander centerline of said Lateral No. 6 westerly to its intersection with the centerline of the south bank levee of the Stanislaus River;

V. Meander centerline of said levee of the Stanislaus River southwesterly 1.04 miles,

W. Due west 0.22 miles,

X. North to the location where the boundary of Caswell Memorial State Park and the centerline of the Stanislaus River intersect and the point of beginning of this description.

Tuolumne River Subarea

BEGINNING at the intersection of the centerline of the Tuolumne River and the centerline of Shiloh Road in Stanislaus County lying in Section 7, Township 04 South, Range 08 East, Mount Diablo Meridian; thence along the following courses:

A. North on centerline of said Shiloh Road to its intersection with the centerline of Paradise Road;

B. East on centerline of said Paradise Road to its intersection with the centerline of Illinois Avenue;

C. Northeast on a line extending from the intersection of the centerlines of Paradise Road and Illinois Avenue to the centerline of Modesto Irrigation District Lateral Number 5 at the point where the centerline of Michigan Avenue would intersect it, were it extended north to intersect the centerline of said Lateral No. 5;

D. Meander centerline of said Lateral No. 5 northeasterly to its intersection with the centerline of Locust Avenue in Stanislaus County, were it extended west to intersect the centerline of said Lateral No. 5;

E. East on centerline of said Locust Avenue to its intersection with the centerline of Franklin Street;

F. North on centerline of said Franklin Street to its intersection with the boundary of the Ninth Street Stormdrain Basin, as defined by the City of Modesto in Modesto;

G. Meander boundary of said Ninth Street Stormdrain Basin to its intersection with the boundary of the McHenry Avenue Stormdrain Basin, as defined by the City of Modesto, in Modesto;

H. Meander boundary of said McHenry Avenue Stormdrain Basin to its intersection with the centerline of Modesto Irrigation District Lateral Number 4;

I. Meander centerline of said Lateral No. 4 northeast to its junction with the centerline of Modesto Irrigation District Lateral Number 3;

J. Meander centerline of said Lateral No. 3 to its junction with the centerline of Modesto Irrigation District Main Canal;

K. Meander centerline of said Main Canal southeasterly to its intersection with the centerline of Dry Creek;

L. Meander centerline of Dry Creek easterly to its junction with the centerline of Claribel Latereal;

M. Meander centerline of said Claribel Lateral northerly to its junction with the centerline of Oakdale South Main Canal;

N. Meander centerline of said Oakdale South Main Canal easterly to its intersection with the centerline of Kearney Lateral;

O. Meander drainage boundary of Kearney Lateral southeasterly to its intersection with the drainage boundary of Cashman Creek downstream of Cashman Dam;

P. Meander said drainage boundary of Cashman Creek downstream of Cashman Dam to its intersection with Cashman Dam;

Q. Meander drainage boundary of Cashman Creek upstream of Cashman Dam northeasterly to its intersection with the centerline of Oakdale South Main Canal;

R. Meander centerline of said Oakdale South Main Canal northeasterly to its intersection with the drainage boundary of Wildcat Creek;

S. Meander said drainage boundary of Wildcat Creek northeasterly to its intersection with the Stanislaus County line;

T. Southeast on said Stanislaus County line to its intersection with the drainage boundary of Vizard Creek;

U. Meander said drainage boundary of Vizard Creek southwesterly to its intersection with the drainage boundary of Goodwin Creek;

V. Meander said drainage boundary of Goodwin Creek southwesterly to its intersection with the drainage boundary of Evans Creek;

W. Meander said drainage boundary of Evans Creek southwesterly to its intersection with the drainage boundary of Peaslee Creek;

X. Meander said drainage boundary of Peaslee Creek southwesterly to its intersection with the drainage boundary of Turlock Lake;

Y. Meander said drainage of Turlock Lake southwesterly to its intersection with the drainage boundary of an unnamed interior drainage area west of the Turlock Lake drainage basin;

Z. Meander said unnamed drainage boundary southwesterly to its intersection with the drainage boundary of Sand Creek;

AA. Meander said drainage boundary of Sand Creek northwesterly to its intersection with the drainage boundary of unnamed creeks draining easterly toward Highline Canal and to the Merced River via said canal;

BB. Meander said drainage boundary of unnamed creeks to its intersection with the centerline of Turlock Irrigation District Main Canal;

CC. Meander centerline of said Turlock Main Canal westerly to its junction with the centerline of Ceres Main Canal;

DD. Meander centerline of said Ceres Main Canal westerly to its junction with the centerline of Turlock Irrigation District Lateral Number 1;

EE. Meander centerline of said Lateral No. 1 southwesterly to its junction with the centerline of Turlock Irrigation District Lower Lateral Number 2;

FF. Meander centerline of said Lateral No. 2 to its intersection with the drainage boundary of the Tuolumne River;

GG. Meander said drainage boundary of the Tuolumne River to its intersection with the centerline of Shiloh Road in Stanislaus County at the location where Shiloh Road makes a ninety degree turn to the west 1.5 miles south of its intersection with Paradise Road;

HH. North on centerline of said Shiloh Road to its intersection with the centerline of the Tuolumne River and the point of beginning of this description.

Metadata

Reach File 3-alpha

Identification_Information:
  Citation:
    Citation_Information:
      Originator: U.S. Environmental Protection Agency/Office of Water/OST Basins
      Publication_Date: 19980309
      Title:
        USEPA/OW River Reach File 3 (RF3) Alpha for CONUS, Hawaii, Puerto Rico, and the U.S. Virgin Islands
      Edition: 3alpha
      Publication_Information:
        Publication_Place: Washington DC
        Publisher: US EPA/Office of Water
      Online_Linkage:
        For BASINS model and hydrographic data http://www.epa.gov/OST/BASINS
        For documentation and reference to EPA's River Reach data files http://www.epa.gov/owowwtr1/monitoring/rf/rfindex.html

  Description:

    Abstract:
      The U.S. Environmental Protection Agency's (EPA) Reach Files are a series of hydrographic databases of the surface waters of the continental United States and Hawaii. A key characteristic of the Reach files are their attributes that define the connected stream network. These attributes provide connectivity regardless of the presence or absence of topologic continuity in the digital linework. Flow direction is inherent in the connectivity attributes. This attribute-level connectivity enables the Reach Files to provide hydrologic ordering of stream locations using reach codes (what is upstream and downstream of a given point in the stream network) as well as network navigation proceeding in either the upstream or downstream direction.

RF3-Alpha data is un-validated and given the nature of the shortcomings that have been identified in the RF3-Alpha data and the re-design work that is being incorporated into RF3 validation to support GIS applications, it is recommended that a conservative approach be taken when processing and applying these data. The final, validated RF3 ("The National Hydrography Dataset") will provide a much improved data product. In the mean time, access to the provisional Alpha data, accompanying documentation, and technical support is provided through the Office of Water's (OW) STORET User Assistance Group. STORET, EPA's national water quality data system, is currently undergoing a major re-design to address evolving user requirements and technology advancements including GIS. Both STORET and RF3 will play integral roles in EPA's future water quality data collection, analysis, and reporting activities.

For further assistance on RF3 Alpha, please contact STORET User Assistance at 800-424-9067.

Purpose:

The structure and content of the Reach File databases were created expressly to establish hydrologic ordering, to perform hydrologic navigation for modeling applications, and to provide a unique identifier for each surface water feature, i.e., reach codes.

Supplemental_Information:

Procedures_Used

RF3a files were initially produced as ArcInfo export files (.e00 file) on a U.S. EPA mainframe computer in the STORET environment. RF3a vector files were requested by hydrological unit code (HUC) within an entire state. Upon completion of mainframe processing, the RF3a files were downloaded using file transfer protocol (FTP). (See Data Quality Information). The initial processing step involved importing the .e00 file into ArcInfo and projecting it to Albers meters. The projected coverage then had a Length_m (meters) item added with its value calculated to hold the length of the arc in meters after projecting to decimal degrees. The coverage was then projected from Albers-meters to decimal degrees-NAD83. A route feature was then built on the rf3rchid item.

The processed ArcInfo export files were compressed and copied to a PC hard disk for storage in one nationwide directory. Upon completion of processing all of the HUCs, a list was generated of all of the processed files. This list was then compared to a list of HUCs created from the United States Geological Survey's (USGS) 1:250,000 Hydrologic units maps of the Conterminous United States to verify the presence of RF3a files for each HUC.

RF3a files were distributed on for inclusion with the BASINS application on CD-ROM as a series of ArcInfo coverages that included the spatial extent of each of the nine U.S. EPA Regions (including the HUCs that crossed Region boundaries). The nine regional coverages therefore overlapped at Regional boundaries. The coverages were distributed in ArcIno coverage format.

Revisions

With the release of Basins version 2, the RF3 Arcinfo coverages were convertted into Arcview shapefiles.

Reviews_Applied_to_Data

Each HUC coverage was reviewed for quality through an ArcInfo AML. The QA/QC AML performed a variety of checks to validate the processing of the RF3a files. Included in these checks were the following steps:

- Does the rf3a.ds3 info table exist?
- Does the rf3a.ds3 info table contain records?
- Is the projection set to GEOGRAPHIC?
- Are units in decimal degrees?
- Is the datum NAD83?
- Does the RF3a route feature exist?
- Does the RF3a.AAT exist?

Once the QA/QC AML was run on each RF3a coverage, each EPA Region was examined in ArcView. The examination consisted of adding each RF3a line coverage as a theme, looking for spikes in the data, and looking for holes in the data.

Related_Spatial_and_Tabular_Data_Sets

References_Cited

McKay, Lucinda, Sue Hanson, Robert Horn, Richard Dulaney, Alan Cahoon, Mark Olsen, and Thomas Dewald, 1994. The U.S. EPA Reach File Version 3.0 Alpha Release (RF3-Alpha) Technical Reference. U.S. Environmental Protection Agency, Washington, DC

Steeves, Peter and Douglas Nebert, 1994. Hydrologic units maps of the Conterminous United States. U.S. Geological Survey, Reston, Virginia

Notes

Time_Period_of_Content:
Time_Period_Information:
Single_Date/Time:
Calendar_Date: 1994

Currentness_Reference: publication date

Status:
Progress: Complete
Maintenance_and_Update_Frequency: None planned

Spatial_Domain:
Bounding_Coordinates:
West_Bounding_Coordinate: -159.0000
East_Bounding_Coordinate: -65.0000
North_Bounding_Coordinate: 50.0000
South_Bounding_Coordinate: 17.0000

Keywords:
Theme:
Theme_Keyword_Thesaurus: None
Theme_Keyword: RF3 alpha Hydrography
Theme_Keyword: River Reach
Place:
Place_Keyword_Thesaurus: Geographic Names Information System
Place_Keyword: Conterminous United States of America
Place_Keyword: Puerto Rico PR
Place_Keyword: U.S. Virgin Islands VI
Place_Keyword: Alabama AL
Place_Keyword: Arizona AZ
Place_Keyword: Arkansas AR
Place_Keyword: California CA
Place_Keyword: Colorado CO
Place_Keyword: Connecticut CT
Place_Keyword: Delaware DE
Place_Keyword: District of Columbia DC
Place_Keyword: Florida FL
Place_Keyword: Georgia GA
Place_Keyword: Hawaii HI
Place_Keyword: Idaho ID
Place_Keyword: Illinois IL
Place_Keyword: Indiana IN
Place_Keyword: Iowa IA
Place_Keyword: Kansas KS
Place_Keyword: Kentucky KY

Place_Keyword: Louisiana LA
Place_Keyword: Maine ME
Place_Keyword: Maryland MD
Place_Keyword: Massachusetts MA
Place_Keyword: Michigan MI
Place_Keyword: Minnesota MN
Place_Keyword: Mississippi MS
Place_Keyword: Missouri MO
Place_Keyword: Montana MT
Place_Keyword: Nebraska NE
Place_Keyword: Nevada NV
Place_Keyword: New Hampshire NH
Place_Keyword: New Jersey NJ
Place_Keyword: New Mexico NM
Place_Keyword: New York NY
Place_Keyword: North Carolina NC
Place_Keyword: North Dakota ND
Place_Keyword: Ohio OH
Place_Keyword: Oklahoma OK
Place_Keyword: Oregon OR
Place_Keyword: Pennsylvania PA
Place_Keyword: Rhode Island RI
Place_Keyword: South Carolina SC
Place_Keyword: South Dakota SD
Place_Keyword: Tennessee TN
Place_Keyword: Texas TX
Place_Keyword: Utah UT
Place_Keyword: Vermont VT
Place_Keyword: Virginia VA
Place_Keyword: Washington WA
Place_Keyword: West Virginia WV
Place_Keyword: Wisconsin WI
Place_Keyword: Wyoming WY

Access_Constraints: none

Use_Constraints: none

Data_Set_Credit:

McKay, Lucinda; Sue Hanson; Robert Horn; Richard Dulaney; Alan Cahoon; Mark Olsen; and Thomas Dewald, 1994. The U.S. EPA Reach File Version 3.0 Alpha Release (RF3-Alpha) Technical Reference. U.S. Environmental Protection Agency, Washington, DC

Security_Information:
  Security_Classification_System: None
  Security_Classification: UNCLASSIFIED
  Security_Handling_Description: None

Native_Data_Set_Environment: ArcView 3.0 shapefiles on Window 95 PC

Data_Quality_Information:

Attribute_Accuracy:
  Attribute_Accuracy_Report: See Entity_Attribute_Information

Logical_Consistency_Report: Chain-node topology present.

Completeness_Report: See Supplemental Information

Lineage:

Process_Step:
  Process_Description:
    Example of the GIS process for an RF3A coverage.

```
IMPORT COVER ../RF3A RF3A
PROJECTDEFINE COVER RF3A
BUILD RF3A ARC
PROJECT COVER RF3A RF3ADD
BUILD RF3ADD ARC
BUILD RF3ADD NODE
ARCROUTE RF3ADD RF3RCH RF3RCHID
```

  Process_Date: 19971218

Spatial_Reference_Information:
  Horizontal_Coordinate_System_Definition:
    Geographic:
      Latitude_Resolution: 0.0001
      Longitude_Resolution: 0.0001
      Geographic_Coordinate_Units: Decimal Degrees
    Geodetic_Model:
      Horizontal_Datum_Name: North American Datum of 1983
      Ellipsoid_Name: Geodetic Reference System 80
      Semi-major_Axis: 6,378,137
      Denominator_of_Flattening_Ratio: 298.257

Entity_and_Attribute_Information:

  Detailed_Description:
    Entity_Type:
      Entity_Type_Label: RF3A.SHP
      Entity_Type_Definition: RF3a shapefiles
      Entity_Type_Definition_Source: USEPA/OW
    Attribute:
      Attribute_Label: -
      Attribute_Definition: RF3a arc attribute table
      Attribute_Definition_Source: U.S. EPA RF3a files
      Attribute_Domain_Values:
        Enumerated_Domain:
          Enumerated_Domain_Value: -
          Enumerated_Domain_Value_Definition:
          Enumerated_Domain_Value_Definition_Source:
    Attribute:
      Attribute_Label: SHAPE
      Attribute_Definition: Internal number
      Attribute_Definition_Source: Computed
      Attribute_Domain_Values:
        Enumerated_Domain:
          Enumerated_Domain_Value: Sequential unique positive integer
          Enumerated_Domain_Value_Definition:
          Enumerated_Domain_Value_Definition_Source:

Attribute:
  Attribute_Label: FNODE
  Attribute_Definition: From node
  Attribute_Definition_Source: Computed
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Real positive numbers
      Enumerated_Domain_Value_Definition: 8 11 F 0
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: TNODE
  Attribute_Definition: To node
  Attribute_Definition_Source: Computed
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Real positive numbers
      Enumerated_Domain_Value_Definition: 8 11 F 0
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: LPOLY
  Attribute_Definition: Internal number of the polygon on the left
  Attribute_Definition_Source: Computed
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Sequential unique positive integer
      Enumerated_Domain_Value_Definition: 8 11 F 0
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: RPOLY
  Attribute_Definition: Internal number of the polygon on the right
  Attribute_Definition_Source: Computed
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Sequential unique positive integer
      Enumerated_Domain_Value_Definition: 8 11 F 0
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: LENGTH
  Attribute_Definition: Length of arc in coverage units
  Attribute_Definition_Source: Computed
  Attribute_Domain_Values:
    Enumerated_Domain:

Enumerated_Domain_Value: Positive real numbers
Enumerated_Domain_Value_Definition: 4 5 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: Annnnnnn
Attribute_Definition: Internal feature number
Attribute_Definition_Source: Computed
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Unique positive number
Enumerated_Domain_Value_Definition: 8 11 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: Annnnnnn_I
Attribute_Definition: User assigned feature ID number
Attribute_Definition_Source: User-defined
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Unique positive integer
Enumerated_Domain_Value_Definition: 8 11 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: CU
Attribute_Definition: Hydrologic Catalog Unit
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: 8 digit positive integers
Enumerated_Domain_Value_Definition: 8 8 F 0
Enumerated_Domain_Value_Definition_Source: USGS
Attribute:
Attribute_Label: SEG
Attribute_Definition: Segment
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Positive real numbers
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: MI
Attribute_Definition: Marker Index - refer to RF3a Technical Documentation
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Integers
Enumerated_Domain_Value_Definition: 5 5 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: UP
Attribute_Definition:
Value for the IMPEDANCE command in ARC network commands such as PATH, ALLOCATE, and TOUR. To restrict the network traversal to upstream only, use IMPEDANCE DOWN UP. To restrict to downstream traversal, use IMPEDANCE UP DOWN.
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Positive real numbers
Enumerated_Domain_Value_Definition: 8 11 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: DOWN
Attribute_Definition:
Value for the IMPEDANCE command in ARC network commands such as PATH, ALLOCATE, and TOUR. To restrict the network traversal to upstream only, use IMPEDANCE DOWN UP. To restrict to downstream traversal, use IMPEDANCE UP DOWN.
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: positive real numbers
Enumerated_Domain_Value_Definition: 8 11 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: LENGTH_M
Attribute_Definition: Reach length in meters
Attribute_Definition_Source: Calculated from LENGTH in meters
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Positive real numbers
Enumerated_Domain_Value_Definition: 8 12 F 2
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: RF3RCHID
Attribute_Definition:

Unique river reach identifier concatenated from
CU, SEG, and MI
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 17 17 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: CUA
Attribute_Definition: Cataloging Unit
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: numeric
Enumerated_Domain_Value_Definition: 8 8 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: SEGA
Attribute_Definition: Segment number
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: MIA
Attribute_Definition: Marker Index
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 5 5 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: UPMI
Attribute_Definition: Upstream marker index
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 5 5 C

Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: RFLAG
Attribute_Definition: Reach flag
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (0,1)
Enumerated_Domain_Value_Definition: 1 1 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: OWFLAG
Attribute_Definition: Open water flag
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (0,1)
Enumerated_Domain_Value_Definition: 1 1 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: TFLAG
Attribute_Definition: Terminal flag
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (0,1)
Enumerated_Domain_Value_Definition: 1 1 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: SFLAG
Attribute_Definition: Start flag
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (0,1)
Enumerated_Domain_Value_Definition: 1 1 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: REACHTYPE
Attribute_Definition: Reach type code
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:

Enumerated_Domain_Value: Alphabetical character
Enumerated_Domain_Value_Definition: 1 1 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: LEVEL
Attribute_Definition: Stream level
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 2 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: JUNC
Attribute_Definition: Level of downstream reach
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 2 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: DIVERGENCE
Attribute_Definition: Divergence code
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 1 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: USDIR
Attribute_Definition: Upstream direction of main path
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 1 1 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: TERMID
Attribute_Definition: Terminal stream ID (future use)
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 5 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: TRMBLV
Attribute_Definition: Terminal base level (future use)
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 1 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: PNAME
Attribute_Definition: Primary name
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 30 30 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: PNMCD
Attribute_Definition: Primary name code
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: numeric
Enumerated_Domain_Value_Definition: 11 11 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: CNAME
Attribute_Definition: Common name
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 30 30 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: CNMCD

Attribute_Definition: Common name code
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 11 11 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: OWNAME
Attribute_Definition: Open water name
Attribute_Definition_Source: U.S. EPA RF3a files (form STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 30 30 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: OWNMCD
Attribute_Definition: Open water name code
Attribute_Definition_Source: U.S. EPA RF3a files (From STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 11 11 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: DSCU
Attribute_Definition: Downstream CU
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 8 8 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: DSSEG
Attribute_Definition: Downstream SEG
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
  Attribute_Label: DSMI
  Attribute_Definition: Downstream MI
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Numeric
      Enumerated_Domain_Value_Definition: 5 5 C
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: CCU
  Attribute_Definition: Complement CU
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Numeric
      Enumerated_Domain_Value_Definition: 8 8 F
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: CSEG
  Attribute_Definition: Complement SEG
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Numeric
      Enumerated_Domain_Value_Definition: 4 4 B
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: CMI
  Attribute_Definition: Complement MI
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Numeric
      Enumerated_Domain_Value_Definition: 5 5 C
      Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
  Attribute_Label: CDIR
  Attribute_Definition: Complement direction
  Attribute_Definition_Source: U.S. EPA RF3a files (form STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Character

Enumerated_Domain_Value_Definition: 1 1 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: ULCU
Attribute_Definition: Upstream left CU
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 8 8 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: ULSEG
Attribute_Definition: Upstream left SEG
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: ULMI
Attribute_Definition: Upstream left MI
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 5 5 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: URCU
Attribute_Definition: Upstream right CU
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 8 8 F
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: URSEG
Attribute_Definition: Upstream right SEG
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:

Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: URMI
Attribute_Definition: Upstream right MI
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 5 5 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: SEGL
Attribute_Definition: Reach length (Miles)
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (6.2)
Enumerated_Domain_Value_Definition: 4 6 F 2
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: RFORGFLAG
Attribute_Definition: RF origin flag
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (1,2,3)
Enumerated_Domain_Value_Definition: 4 1 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: ALTPNMCD
Attribute_Definition: Alternate primary name code (future use)
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 8 8 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: ALTOWNMC
Attribute_Definition: Alternate OW name code (future use)

Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 8 8 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: DLAT
Attribute_Definition: Downstream latitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: DLONG
Attribute_Definition: Downstream longitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: ULAT
Attribute_Definition: Upstream latitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: ULONG
Attribute_Definition: Upstream longitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:

Attribute_Label: MINLAT
Attribute_Definition: Minimum latitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: MINLONG
Attribute_Definition: Minimum longitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: MAXLAT
Attribute_Definition: Maximum latitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: MAXLONG
Attribute_Definition: Maximum longitude
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric (8.4)
Enumerated_Domain_Value_Definition: 8 8 F 4
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: NDLGREC
Attribute_Definition: Number of DLG records
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B

Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: LN1AT2
Attribute_Definition: DLG line attribute 1
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: LN2AT2
Attribute_Definition: DLG line attribute 2
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: AR1AT2
Attribute_Definition: DLG area attribute
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: AR1AT4
Attribute_Definition: DLG area attribute
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: AR2AT2
Attribute_Definition: DLG area attribute
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:

Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: AR2AT4
Attribute_Definition: DLG area attribute
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: UPDATE1
Attribute_Definition: Update date #1
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (mmddyy)
Enumerated_Domain_Value_Definition: 6 6 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: UPDTCD1
Attribute_Definition: Update type Code #1
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 8 8 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: UPDTSRC1
Attribute_Definition: Update Source #1
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 8 8 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW
Attribute:
Attribute_Label: UPDATE2
Attribute_Definition: Update date #2 [future use]
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)

Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (mmddyy)
Enumerated_Domain_Value_Definition: 6 6 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: UPDTCD2
Attribute_Definition: Update type code #2 [future use]
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 8 8 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: UPDTSRC2
Attribute_Definition: Update Source #2 [future use]
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 8 8 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: UPDATE3
Attribute_Definition: Update Date #3 [future use]
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character (mmddyy)
Enumerated_Domain_Value_Definition: 6 6 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: UPDTCD3
Attribute_Definition: Update Type Code #3 [future use]
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character

Enumerated_Domain_Value_Definition: 8 8 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: UPDTSRC3
Attribute_Definition: Update Source #3 [future use]
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 8 8 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: DIVCU
Attribute_Definition: Divergent CU
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 8 8 F 0
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: DIVSEG
Attribute_Definition: Divergent SEG
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 4 4 B
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: DIVMI
Attribute_Definition: Divergent MI
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Numeric
Enumerated_Domain_Value_Definition: 5 5 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
  Attribute_Label: DLGID
  Attribute_Definition: DLG number (special use)
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Numeric
      Enumerated_Domain_Value_Definition: 4 6 B
      Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
  Attribute_Label: FILLER
  Attribute_Definition: Filler [future use]
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Character
      Enumerated_Domain_Value_Definition: 7 7 C
      Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
  Attribute_Label: RF3RCHID
  Attribute_Definition:
    Unique river reach identifier concatenated from
    CU, SEG, and MI
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Character
      Enumerated_Domain_Value_Definition: 17 17 C
      Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
  Attribute_Label: DSRF3RCHID
  Attribute_Definition: Unique downstream reach identifier
  Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
  Attribute_Domain_Values:
    Enumerated_Domain:
      Enumerated_Domain_Value: Character
      Enumerated_Domain_Value_Definition: 17 17 C
      Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:

Attribute_Label: CURF3RCHID
Attribute_Definition: Unique complement reach identifier
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 17 17 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: ULRF3RCHID
Attribute_Definition: Unique upstream left reach identifier
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 17 17 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: URRF3RCHID
Attribute_Definition: Unique upstream right reach identifier
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 17 17 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Attribute:
Attribute_Label: DIVRF3RCHID
Attribute_Definition: Unique divergent reach identifier
Attribute_Definition_Source: U.S. EPA RF3a files (from STORET)
Attribute_Domain_Values:
Enumerated_Domain:
Enumerated_Domain_Value: Character
Enumerated_Domain_Value_Definition: 17 17 C
Enumerated_Domain_Value_Definition_Source: USEPA/OW

Distribution_Information:

Distributor:
Contact_Information:

Contact_Organization_Primary:
Contact_Organization: USEPA Office of Water/OST/SASD Basins
Contact_Address:
Address_Type: mailing address
Address: 401 M Street, SW Mail Stop 4305
City: Washington
State_or_Province: District of Columbia
Postal_Code: 20460
Contact_Voice_Telephone: (202) 260-7301
Contact_Facsimile_Telephone: (202) 260-9830
Hours_of_Service: 9-3 EST
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Network_Address:
Network_Resource_Name: (URL): http://www.epa.gov/OST/BASINS/
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Offline_Option:
Offline_Media: CD-ROM
Recording_Format: ISO 9660
Fees: None
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When requesting data by phone or mail, please inquire about spatial data sets that work with Better Assessment Science Integrating Point and Nonpoint Sources (BASINS). The BASINS web page has instructions for downloading datasets.   It also has a link to The National Center for Environmental Publications and Information (NCEPI), from which BASINS CD-ROMs may be ordered. Each CD-ROM contains the BASINS v2.0 application and these data sets along with others covering the spatial extent of an EPA Region.

Metadata_Reference_Information:

Metadata_Date: 19980722

Metadata_Contact:
  Contact_Information:
    Contact_Organization_Primary:
      Contact_Organization: USEPA Office of Water/OST/SASD Basins
    Contact_Address:
      Address_Type: mailing address
      Address: 401 M Street, SW Mail Stop 4305
      City: Washington
      State_or_Province: District of Columbia
      Postal_Code: 20460
    Contact_Voice_Telephone: (202) 260-7301
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: 19940608

METADATA FOR THE 1995 MERCED COUNTY LAND USE SURVEY DATA

Originator:

California Department of Water Resources

Abstract:

The 1995 Merced County land use survey data set was developed by DWR through it's Division of Planning and Local Assistance. The data was gathered using aerial photography and extensive field visits, the land use boundaries and attributes were digitized, and the resultant data went through standard quality control procedures before finalizing. The land uses that were gathered were detailed agricultural land uses, and lesser detailed urban and native vegetation land uses. The data was gathered and digitized by staff of DWR's San Joaquin District and the quality control procedures were performed jointly by staff at DWR's DPLA headquarters from San Joaquin District.

The finalized data include DWG files (land use vector data) and shape files (land use vector data).

Purpose:

This data was developed to aid in DWR's efforts to continually monitor land use for the main purpose of determining the amount of and changes in the use of water.

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Data Development:

1. The aerial photography used for this survey was taken in late June of 1995. The photographs (natural color slides taken from an altitude of about 5,500 feet above ground), were visually interpreted and land use boundaries were drawn on USGS paper 1:24,000 quadrangles.

2. The quad maps were taken to the field as field sheets, and virtually all the areas were visited to positively identify the land use. The site visits occurred in July through September 1995. Land use codes were printed within each area on the field sheets.

3. Using AUTOCAD, the land use boundaries and attributes were digitized (using a standardized digitizing process) from the field sheets on a digitizing tablet.

4. After quality control/assurance procedures were completed on each file (DWG), the data was finalized.

5. The linework and attributes from each DWG quad file were brought into ARCINFO and both quad and surveywide coverages were created, and underwent quality checks. These coverages were converted to shape files using ARCVIEW.

Data Accuracy:

The land use boundaries were hand drawn onto USGS 1:24,000 quads, and digitized on a digitizing tablet using AUTOCAD. For those areas where the lines were drawn onto USGS quads and digitized, the accuracy is less than that of the quads (about 50 foot accuracy).

The land use attribute accuracy is very high, because almost every delineated field was visited in the field. The accuracy is less than 100 percent because some errors must have occurred. There are three possible sources of attribute errors which are:

1) Misidentification of land use in the field (and entering that incorrect attribute on the field sheet);
2) Correct identification of land use, but entering an incorrect attribute on the field sheet, or;
3) Accidentally affixing an incorrect attribute during the digitizing process.

Projection Information:

The data (DWG and shape files) is in a transverse mercator projection, with identical parameters to UTM projections, except the central meridian is -120 degrees (120 degrees west). For comparison, UTM 10 has a central meridian of 123 degrees west, and UTM 11 has a central meridian of 117 degrees west. This projection allows virtually all of the geographic area of California to be in one 6 degree zone (as opposed to two zones, UTM 10 and 11).

Projection:	Transverse Mercator
Datum:	NAD27
Units:	Meter
Scale Reduction:	0.9996
Central Meridian:	120 degrees west
Origin Latitude:	0.00 N
False Easting:	500,000
False Northing:	0.00

Land Use Attributes:

All land use attributes were coded using the Department's Standard Land Use Legend dated July 1993 (93legend.pdf). The legend explains in detail how each delineated area is attributed in the field, and what the coding system is.

The actual land use code that is printed onto the field maps is different in arrangement than the codes that result from the digitizing process. The file attributes.pdf is a detailed explanation of the coding system used for both coding the field sheets, and the codes that end up in digitized form in the database files associated with the shape files.

Information on the AUTOCAD (DWG) Files:

The land use data is available in AUTOCAD 12 format by quad, with one file per quad. The file naming convention is 95MEXXXX.DWG, where XXXX is the DWR quadrangle number. For example, file 95ME3832.DWG is the AUTOCAD drawing file for the 1995 Merced County land use survey for quadrangle 3832 (the Atwater quad).

Every quadrangle file has identical layers, nomenclature, and line colors. They are as follows:

Layer	Description	Color

0	AutoCAD's default layer	White
CQN	California DWR quad number	Cyan
GSN	USGS quad number	Cyan
LUB	Land use boundary lines	Yellow
LUC	Land use codes for GRASS	White
LUT	Visible land use text	Green
QB	The quad's boundary	White
QN	Quad name	Cyan

Following is an explanation of the attributes (for each delineated area) in the LUC layer of each quad file:

ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1:	Irrigated or non-irrigated, and irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2:	Irrigated or non-irrigated, and irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3:	Irrigated or non-irrigated, and irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use

Information on the Shape Files:

Shape files were created for each quad, and one for the whole survey area. The naming conventions used for the quad DWG files is used for the quad shape files (for example, 95ME3832.shp, 95ME3832.shx, and 95ME3832.dbf for quad number 3832, the Atwater quad). The name of the shape file for the whole survey area is 95ME.shp (and .dbf and .shx). Following is an explanation of the land use attributes in the DBF files:

BL_X:	This is the X coordinate of the interior point in the delineated area
BL_Y:	This is the Y coordinate of the interior point in the delineated area
ACRES:	Number of acres in the delineated area (may or may not be present)

WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1A:	Irrigated or non-irrigated for the first land use
IRR_TYP1B:	Irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2A:	Irrigated or non-irrigated for the second land use
IRR_TYP2B:	Irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3A:	Irrigated or non-irrigated for the third land use
IRR_TYP3B:	Irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use
UCF_ATT:	Concatenated attributes from MULTIUSE to PCNT3

Important Points about Using this Data Set:

1. The land use boundaries were hand drawn directly on USGS quad maps and then digitized. They were drawn to depict observable areas of the same land use. They were not drawn to represent legal parcel (ownership) boundaries, or meant to be used as parcel boundaries.

2. This survey was a "snapshot" in time. The indicated land use attributes of each delineated area (polygon) were based upon what the surveyor saw in the field at that time, and, to an extent possible, whatever additional information the aerial photography might provide. For example, the surveyor might have seen a cropped field in the photograph, and the field visit showed a field of corn, so the field was given a corn attribute. In another field, the photograph might have shown a crop that was golden in color (indicating grain prior to harvest), and the field visit showed newly planted corn. This field would be given an attribute showing a double crop, grain followed by corn. The DWR land use attribute structure allows for up to three attributes per delineated area (polygon).

   In the cases where there were crops grown before the survey took place, the surveyor may or may not have been able to detect them from the field or the photographs. For crops planted after the survey date, the surveyor could not account for these crops. Thus, although the data is very accurate for that point in time, it may not be an accurate determination of what was grown in the fields for the whole year. If the area being surveyed does have double or multicropping systems, it is likely that there are more crops grown than could be surveyed with a "snapshot".

3. If the data is to be brought into a GIS for analysis of cropped (or planted) acreage, two things must be understood:

    a. The acreage of each field delineated is the gross area of the field. The amount of actual planted and irrigated acreage will always be less than the gross acreage, because of ditches, farm roads, other roads, farmsteads, etc. Thus, a delineated corn field may have a GIS calculated acreage of 40 acres but will have a smaller cropped (or net) acreage, maybe 38 acres.

    b. Double and multicropping must be taken into account. A delineated field of 40 acres might have been cropped first with grain, then with corn, and coded as such. To estimate actual cropped acres, the two crops are added together (38 acres of grain and 38 acres of corn) which results in a total of 76 acres of net crop (or planted) acres.

4. Water source and irrigation type information was not collected for this survey.

METADATA FOR THE 1995 MADERA COUNTY LAND USE SURVEY DATA

Originator:

California Department of Water Resources

Abstract:

The 1995 Madera County land use survey data set was developed by DWR through it's Division of Planning and Local Assistance. The data was gathered using aerial photography and extensive field visits, the land use boundaries and attributes were digitized, and the resultant data went through standard quality control procedures before finalizing. The land uses that were gathered were detailed agricultural land uses, and lesser detailed urban and native vegetation land uses. The data was gathered and digitized by staff of DWR's San Joaquin District and the quality control procedures were performed jointly by staff at DWR's DPLA headquarters from San Joaquin District.

The finalized data include DWG files (land use vector data) and shape files (land use vector data).

Purpose:

This data was developed to aid in DWR's efforts to continually monitor land use for the main purpose of determining the amount of and changes in the use of water.

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Data Development:

1. The aerial photography used for this survey was taken in late June of 1995. The photographs (natural color slides taken from an altitude of about 5,500 feet above ground), were visually interpreted and land use boundaries were drawn on USGS paper 1:24,000 quadrangles.

2. The quad maps were taken to the field as field sheets, and virtually all the areas were visited to positively identify the land use. The site visits occurred in July through September 1995. Land use codes were printed within each area on the field sheets.

3. Using AUTOCAD, the land use boundaries and attributes were digitized (using a standardized digitizing process) from the field sheets on a digitizing tablet.

4. After quality control/assurance procedures were completed on each file (DWG), the data was finalized.

5. The linework and attributes from each DWG quad file were brought into ARCINFO and both quad and surveywide coverages were created, and underwent quality checks. These coverages were converted to shape files using ARCVIEW.

Data Accuracy:

The land use boundaries were hand drawn onto USGS 1:24,000 quads, and digitized on a digitizing tablet using AUTOCAD. For those areas where the lines were drawn onto USGS quads and digitized, the accuracy is less than that of the quads (about 50 foot accuracy).

The land use attribute accuracy is very high, because almost every delineated field was visited in the field. The accuracy is less than 100 percent because some errors must have occurred. There are three possible sources of attribute errors which are:

1) Misidentification of land use in the field (and entering that incorrect attribute on the field sheet);
2) Correct identification of land use, but entering an incorrect attribute on the field sheet, or;
3) Accidentally affixing an incorrect attribute during the digitizing process.

Projection Information:

The data (DWG and shape files) is in a transverse mercator projection, with identical parameters to UTM projections, except the central meridian is -120 degrees (120 degrees west). For comparison, UTM 10 has a central meridian of 123 degrees west, and UTM 11 has a central meridian of 117 degrees west. This projection allows virtually all of the geographic area of California to be in one 6 degree zone (as opposed to two zones, UTM 10 and 11).

Projection:	Transverse Mercator
Datum:	NAD27
Units:	Meter
Scale Reduction:	0.9996
Central Meridian:	120 degrees west
Origin Latitude:	0.00 N
False Easting:	500,000
False Northing:	0.00

Land Use Attributes:

All land use attributes were coded using the Department's Standard Land Use Legend dated July 1993 (93legend.pdf). The legend explains in detail how each delineated area is attributed in the field, and what the coding system is.

The actual land use code that is printed onto the field maps is different in arrangement than the codes that result from the digitizing process. The file attributes.pdf is a detailed explanation of the coding system used for both coding the field sheets, and the codes that end up in digitized form in the database files associated with the shape files.

Information on the AUTOCAD (DWG) Files:

The land use data is available in AUTOCAD 12 format by quad, with one file per quad. The file naming convention is 95MAXXXX.DWG, where XXXX is the DWR quadrangle number. For example, file 95MA4035.DWG is the AUTOCAD drawing file for the 1995 Madera County land use survey for quadrangle 4035 (the Berenda quad).

Every quadrangle file has identical layers, nomenclature, and line colors. They are as follows:

Layer	Description	Color
0	AutoCAD's default layer	White
CQN	California DWR quad number	Cyan
GSN	USGS quad number	Cyan
LUB	Land use boundary lines	Yellow
LUC	Land use codes for GRASS	White
LUT	Visible land use text	Green
QB	The quad's boundary	White
QN	Quad name	Cyan

Following is an explanation of the attributes (for each delineated area) in the LUC layer of each quad file:

ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1:	Irrigated or non-irrigated, and irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2:	Irrigated or non-irrigated, and irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3:	Irrigated or non-irrigated, and irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use

Information on the Shape Files:

Shape files were created for each quad, and one for the whole survey area. The naming conventions used for the quad DWG files is used for the quad shape files (for example, 95MA4035.shp, 95MA4035.shx, and 95MA4035.dbf for quad number 4035, the Berenda quad). The name of the shape file for the whole survey area is 95MA.shp (and .dbf and .shx). Following is an explanation of the land use attributes in the DBF files:

BL_X:	This is the X coordinate of the interior point in the delineated area
BL_Y:	This is the Y coordinate of the interior point in the delineated area
ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1A:	Irrigated or non-irrigated for the first land use
IRR_TYP1B:	Irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2A:	Irrigated or non-irrigated for the second land use
IRR_TYP2B:	Irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3A:	Irrigated or non-irrigated for the third land use
IRR_TYP3B:	Irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use
UCF_ATT:	Concatenated attributes from MULTIUSE to PCNT3

Important Points about Using this Data Set:

1. The land use boundaries were hand drawn directly on USGS quad maps and then digitized. They were drawn to depict observable areas of the same land use. They were not drawn to represent legal parcel (ownership) boundaries, or meant to be used as parcel boundaries.

2. This survey was a "snapshot" in time. The indicated land use attributes of each delineated area (polygon) were based upon what the surveyor saw in the field at that time, and, to an extent possible, whatever additional information the aerial photography might provide. For example, the surveyor might have seen a cropped field in the photograph, and the field visit showed a field of corn, so the field was given a corn attribute. In

another field, the photograph might have shown a crop that was golden in color (indicating grain prior to harvest), and the field visit showed newly planted corn. This field would be given an attribute showing a double crop, grain followed by corn. The DWR land use attribute structure allows for up to three attributes per delineated area (polygon).

In the cases where there were crops grown before the survey took place, the surveyor may or may not have been able to detect them from the field or the photographs. For crops planted after the survey date, the surveyor could not account for these crops. Thus, although the data is very accurate for that point in time, it may not be an accurate determination of what was grown in the fields for the whole year. If the area being surveyed does have double or multicropping systems, it is likely that there are more crops grown than could be surveyed with a "snapshot".

3. If the data is to be brought into a GIS for analysis of cropped (or planted) acreage, two things must be understood:

    a. The acreage of each field delineated is the gross area of the field. The amount of actual planted and irrigated acreage will always be less than the gross acreage, because of ditches, farm roads, other roads, farmsteads, etc. Thus, a delineated corn field may have a GIS calculated acreage of 40 acres but will have a smaller cropped (or net) acreage, maybe 38 acres.

    c. Double and multicropping must be taken into account. A delineated field of 40 acres might have been cropped first with grain, then with corn, and coded as such. To estimate actual cropped acres, the two crops are added together (38 acres of grain and 38 acres of corn) which results in a total of 76 acres of net crop (or planted) acres.

4. Water source and irrigation type information was not collected for this survey.

METADATA FOR THE 1996 SAN JOAQUIN COUNTY LAND USE SURVEY DATA

Originator:

California Department of Water Resources

Abstract:

The 1996 San Joaquin County land use survey data set was developed by DWR through it's Division of Planning and Local Assistance. The data was gathered using aerial photography and extensive field visits, the land use boundaries and attributes were digitized, and the resultant data went through standard quality control procedures before finalizing. The land uses that were gathered were detailed agricultural land uses, and lesser detailed urban and native vegetation land uses. The data was gathered and digitized by staff of DWR's Central District and the quality control procedures were performed jointly by staff at DWR's DPLA headquarters from Central District.

The finalized data include DWG files (land use vector data), shape files (land use vector data), and JPEG files (raster data from aerial imagery).

Purpose:

This data was developed to aid in DWR's efforts to continually monitor land use for the main purpose of determining the amount of and changes in the use of water.

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Data Development:

1. The aerial photography used for this survey was taken in late June of 1996. The photos (natural color, 9" by 9", flown at 18,000' above ground with a 6" lens) were scanned at 300 DPI and plotted to a size of about 20" x 20".

2. The plotted images were taken to the field as field sheets, and virtually all the areas were visited to positively identify the land use. The site visits occurred in July through September 1996. Land use codes were printed within each area on the field sheets.

2. For those areas where the elevation changes were minimal, the scanned images were brought into an image processing system, the images were ratio-rectified (rubbersheeted) into a projection and mosiaced into USGS 1:24,000 quad sized files (photoquads).

4. Using AUTOCAD (using a standardized digitizing process), the photoquads were used as a backdrop to delineate land use boundaries on-screen. For those areas where corrected imagery was not produced (because of excess elevation changes), land use boundaries were drawn onto USGS 1:24,000 quads, and those quad maps digitized on a digitizing tablet. The land use attributes were entered from the field sheets.

5. After quality control/assurance procedures were completed on each file (DWG), the data was finalized.

6. The linework and attributes from each DWG quad file were brought into ARCINFO and both quad and surveywide coverages were created, and underwent quality checks. These coverages were converted to shape files using ARCVIEW.

Data Accuracy:

Linework for those areas where photoquads were developed:

The land use boundaries were drawn on-screen in AUTOCAD using the photoquads as a backdrop. The resultant digital linework for those areas is at best 100 foot accuracy.

Linework for those areas where photoquads were not developed:

The land use boundaries were hand drawn onto USGS 1:24,000 quads, and digitized on a digitizing tablet using AUTOCAD. For those areas where the lines were drawn onto USGS quads and digitized, the accuracy is less than that of the quads (about 50 foot accuracy).

The land use attribute accuracy is very high, because almost every delineated field was visited in the field. The accuracy is less than 100 percent because some errors must have occurred. There are three possible sources of attribute errors which are:

1) Misidentification of land use in the field (and entering that incorrect attribute on the field sheet);
2) Correct identification of land use, but entering an incorrect attribute on the field sheet, or;
3) Accidentally affixing an incorrect attribute during the digitizing process.

The corrected imagery (photoquads) was developed using between 12 and 15 ground control points established from terrain corrected satellite imagery with a stated accuracy of about 30 feet. The imagery has never been fully evaluated for positional accuracy, however we believe that the images have about 100 foot accuracy (90 percent of the time, the data is within 100 feet of it's true position).

Projection Information:

The data (DWG, shape files, and corrected imagery) is in a transverse mercator projection, with identical parameters to UTM projections, except the central meridian is -120 degrees (120 degrees west). For comparison, UTM 10 has a central meridian of 123 degrees west, and UTM 11 has a central meridian of 117 degrees west. This projection allows virtually all of the geographic area of California to be in one 6 degree zone (as opposed to two zones, UTM 10 and 11).

Projection:	Transverse Mercator
Datum:	NAD27
Units:	Meter
Scale Reduction:	0.9996
Central Meridian:	120 degrees west
Origin Latitude:	0.00 N
False Easting:	500,000
False Northing:	0.00

Land Use Attributes:

All land use attributes were coded using the Department's Standard Land Use Legend dated July 1993 (93legend.pdf). The legend explains in detail how each delineated area is attributed in the field, and what the coding system is.

The actual land use code that is printed onto the field maps is different in arrangement than the codes that result from the digitizing process. The file attributes.pdf is a detailed explanation of the coding system used for both coding the field sheets, and the codes that end up in digitized form in the database files associated with the shape files.

Information on the AUTOCAD (DWG) Files:

The land use data is available in AUTOCAD 12 format by quad, with one file per quad. The file naming convention is 96SJXXXX.DWG, where XXXX is the DWR quadrangle number. For example, file 96SJ3327.DWG is the AUTOCAD drawing file for the 1996 San Joaquin County land use survey for quadrangle 3327 (the Stockton East quad).

Every quadrangle file has identical layers, nomenclature, and line colors. They are as follows:

Layer	Description	Color
0	AutoCAD's default layer	White
CQN	California DWR quad number	Cyan
GSN	USGS quad number	Cyan
LUB	Land use boundary lines	Yellow
LUC	Land use codes for GRASS	White
LUT	Visible land use text	Green

QB	The quad's boundary	White
QN	Quad name	Cyan

Following is an explanation of the attributes (for each delineated area) in the LUC layer of each quad file:

ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1:	Irrigated or non-irrigated, and irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2:	Irrigated or non-irrigated, and irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3:	Irrigated or non-irrigated, and irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use

Information on the Shape Files:

Shape files were created for each quad, and one for the whole survey area. The naming convention used for the quad DWG files is used for the quad shape files (for example, 96SJ3327.shp, 96SJ3327.shx, and 96SJ3327.dbf for quad number 3327, the Stockton East quad). The name of the shape file for the whole survey area is 96SJ.shp (and .dbf and .shx). Following is an explanation of the land use attributes in the DBF files:

BL_X:	This is the X coordinate of the interior point in the delineated area
BL_Y:	This is the Y coordinate of the interior point in the delineated area
ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1A:	Irrigated or non-irrigated for the first land use

IRR_TYP1B:	Irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2A:	Irrigated or non-irrigated for the second land use
IRR_TYP2B:	Irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3A:	Irrigated or non-irrigated for the third land use
IRR_TYP3B:	Irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use
UCF_ATT:	Concatenated attributes from MULTIUSE to PCNT3

Information on the JPEG Files:

JPEG files were created for each quad where there was a minimum of elevation changes. The naming convention used for the quad DWG files is used for the quad JPEG photoquad files (for example, 96SJ3327.jpg and 96SJ3327.jgw for quad number 3327, the Stockton East quad). The .jgw file is the JPEG world file.

Important Points about Using this Data Set:

1. The land use boundaries were either drawn on-screen using developed photoquads, or hand drawn directly on USGS quad maps and then digitized. They were drawn to depict observable areas of the same land use. They were not drawn to represent legal parcel (ownership) boundaries, or meant to be used as parcel boundaries.

2. This survey was a "snapshot" in time. The indicated land use attributes of each delineated area (polygon) were based upon what the surveyor saw in the field at that time, and, to an extent possible, whatever additional information the aerial photography might provide. For example, the surveyor might have seen a cropped field in the photograph, and the field visit showed a field of corn, so the field was given a corn attribute. In another field, the photograph might have shown a crop that was golden in color (indicating grain prior to harvest), and the field visit showed newly planted corn. This field would be given an attribute showing a double crop, grain followed by corn. The DWR land use attribute structure allows for up to three attributes per delineated area (polygon).

   In the cases where there were crops grown before the survey took place, the surveyor may or may not have been able to detect them from the field or the photographs. For crops planted after the survey date, the surveyor could not account for these crops. Thus, although the data is very accurate for that point in time, it may not be an accurate determination of what was grown in the fields for the whole year. If the area being surveyed does have double or multicropping systems, it is likely that there are more crops grown than could be surveyed with a "snapshot".

3. If the data is to be brought into a GIS for analysis of cropped (or planted) acreage, two things must be understood:

   a. The acreage of each field delineated is the gross area of the field. The amount of actual planted and irrigated acreage will always be less than the gross acreage, because of ditches, farm roads, other roads, farmsteads, etc. Thus, a delineated corn field may have a GIS calculated acreage of 40 acres but will have a smaller cropped (or net) acreage, maybe 38 acres.

   d. Double and multicropping must be taken into account. A delineated field of 40 acres might have been cropped first with grain, then with corn, and coded as such. To estimate actual cropped acres, the two crops are added together (38 acres of grain and 38 acres of corn) which results in a total of 76 acres of net crop (or planted) acres.

METADATA FOR THE 1994 FRESNO COUNTY LAND USE SURVEY DATA

Originator:

California Department of Water Resources

Abstract:

The 1994 Fresno County land use survey data set was developed by DWR through it's Division of Planning and Local Assistance. The data was gathered using aerial photography and extensive field visits, the land use boundaries and attributes were digitized, and the resultant data went through standard quality control procedures before finalizing. The land uses that were gathered were detailed agricultural land uses, and lesser detailed urban and native vegetation land uses. The data was gathered and digitized by staff of DWR's San Joaquin District and the quality control procedures were performed jointly by staff at DWR's DPLA headquarters from San Joaquin District.

The finalized data include DWG files (land use vector data) and shape files (land use vector data).

Purpose:

This data was developed to aid in DWR's efforts to continually monitor land use for the main purpose of determining the amount of and changes in the use of water.

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Data Development:

1. The aerial photography used for this survey was taken in late June of 1994. The photographs (natural color slides taken from an altitude of about 5,500 feet above ground), were visually interpreted and land use boundaries were drawn on USGS paper 1:24,000 quadrangles.

2. The quad maps were taken to the field as field sheets, and virtually all the areas were visited to positively identify the land use. The site visits occurred in July through September 1994. Land use codes were printed within each area on the field sheets.

3. Using AUTOCAD, the land use boundaries and attributes were digitized (using a standardized digitizing process) from the field sheets on a digitizing tablet.

4. After quality control/assurance procedures were completed on each file (DWG), the data was finalized.

5. The linework and attributes from each DWG quad file were brought into ARCINFO and both quad and surveywide coverages were created, and underwent quality checks. These coverages were converted to shape files using ARCVIEW.

Data Accuracy:

The land use boundaries were hand drawn onto USGS 1:24,000 quads, and digitized on a digitizing tablet using AUTOCAD. For those areas where the lines were drawn onto USGS quads and digitized, the accuracy is less than that of the quads (about 50 foot accuracy).

The land use attribute accuracy is very high, because almost every delineated field was visited in the field. The accuracy is less than 100 percent because some errors must have occurred. There are three possible sources of attribute errors which are:

1) Misidentification of land use in the field (and entering that incorrect attribute on the field sheet);
2) Correct identification of land use, but entering an incorrect attribute on the field sheet, or;
3) Accidentally affixing an incorrect attribute during the digitizing process.

Projection Information:

The data (DWG and shape files) is in a transverse mercator projection, with identical parameters to UTM projections, except the central meridian is -120 degrees (120 degrees west). For comparison, UTM 10 has a central meridian of 123 degrees west, and UTM 11 has a central meridian of 117 degrees west. This projection allows virtually all of the geographic area of California to be in one 6 degree zone (as opposed to two zones, UTM 10 and 11).

Projection:	Transverse Mercator
Datum:	NAD27
Units:	Meter
Scale Reduction:	0.9996
Central Meridian:	120 degrees west
Origin Latitude:	0.00 N
False Easting:	500,000
False Northing:	0.00

Land Use Attributes:

All land use attributes were coded using the Department's Standard Land Use Legend dated July 1993 (93legend.pdf). The legend explains in detail how each delineated area is attributed in the field, and what the coding system is.

The actual land use code that is printed onto the field maps is different in arrangement than the codes that result from the digitizing process. The file attributes.pdf is a detailed explanation of the coding system used for both coding the field sheets, and the codes that end up in digitized form in the database files associated with the shape files.

Information on the AUTOCAD (DWG) Files:

The land use data is available in AUTOCAD 12 format by quad, with one file per quad. The file naming convention is 94FRXXXX.DWG, where XXXX is the DWR quadrangle number. For example, file 94FR4340.DWG is the AUTOCAD drawing file for the 1994 Fresno County land use survey for quadrangle 4340 (the Sanger quad).

Every quadrangle file has identical layers, nomenclature, and line colors. They are as follows:

Layer	Description	Color
0	AutoCAD's default layer	White
CQN	California DWR quad number	Cyan
GSN	USGS quad number	Cyan
LUB	Land use boundary lines	Yellow
LUC	Land use codes for GRASS	White
LUT	Visible land use text	Green
QB	The quad's boundary	White
QN	Quad name	Cyan

Following is an explanation of the attributes (for each delineated area) in the LUC layer of each quad file:

ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1:	Irrigated or non-irrigated, and irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2:	Irrigated or non-irrigated, and irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3:	Irrigated or non-irrigated, and irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use

Information on the Shape Files:

Shape files were created for each quad, and one for the whole survey area. The naming conventions used for the quad DWG files is used for the quad shape files (for example, 94FR4340.shp, 94FR4340.shx, and 94FR4340.dbf for quad number 4340, the Sanger quad). The name of the shape file for the whole survey area is 94FR.shp (and .dbf and .shx). Following is an explanation of the land use attributes in the DBF files:

BL_X:	This is the X coordinate of the interior point in the delineated area
BL_Y:	This is the Y coordinate of the interior point in the delineated area
ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1A:	Irrigated or non-irrigated for the first land use
IRR_TYP1B:	Irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use
SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2A:	Irrigated or non-irrigated for the second land use
IRR_TYP2B:	Irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3A:	Irrigated or non-irrigated for the third land use
IRR_TYP3B:	Irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use
UCF_ATT:	Concatenated attributes from MULTIUSE to PCNT3

Important Points about Using this Data Set:

1. The land use boundaries were hand drawn directly on USGS quad maps and then digitized. They were drawn to depict observable areas of the same land use. They were not drawn to represent legal parcel (ownership) boundaries, or meant to be used as parcel boundaries.

2. This survey was a "snapshot" in time. The indicated land use attributes of each delineated area (polygon) were based upon what the surveyor saw in the field at that time, and, to an extent possible, whatever additional information the aerial photography might provide. For example, the surveyor might have seen a cropped field in the photograph, and the field visit showed a field of corn, so the field was given a corn attribute. In

another field, the photograph might have shown a crop that was golden in color (indicating grain prior to harvest), and the field visit showed newly planted corn. This field would be given an attribute showing a double crop, grain followed by corn. The DWR land use attribute structure allows for up to three attributes per delineated area (polygon).

In the cases where there were crops grown before the survey took place, the surveyor may or may not have been able to detect them from the field or the photographs. For crops planted after the survey date, the surveyor could not account for these crops. Thus, although the data is very accurate for that point in time, it may not be an accurate determination of what was grown in the fields for the whole year. If the area being surveyed does have double or multicropping systems, it is likely that there are more crops grown than could be surveyed with a "snapshot".

3. If the data is to be brought into a GIS for analysis of cropped (or planted) acreage, two things must be understood:

    a. The acreage of each field delineated is the gross area of the field. The amount of actual planted and irrigated acreage will always be less than the gross acreage, because of ditches, farm roads, other roads, farmsteads, etc. Thus, a delineated corn field may have a GIS calculated acreage of 40 acres but will have a smaller cropped (or net) acreage, maybe 38 acres.

    e. Double and multicropping must be taken into account. A delineated field of 40 acres might have been cropped first with grain, then with corn, and coded as such. To estimate actual cropped acres, the two crops are added together (38 acres of grain and 38 acres of corn) which results in a total of 76 acres of net crop (or planted) acres.

4. Water source and irrigation type information was not collected for this survey.

METADATA FOR THE 1996 STANISLAUS COUNTY LAND USE SURVEY DATA

Originator:

California Department of Water Resources

Date of Metadata:

August 1, 2000

Abstract:

The 1996 Stanislaus County land use survey data set was developed by DWR through it's Division of Planning and Local Assistance. The data was gathered using aerial photography and extensive field visits, the land use boundaries and attributes were digitized, and the resultant data went through standard quality control procedures before finalizing. The land uses that were gathered were detailed agricultural land uses, and lesser detailed urban and native vegetation land uses. The data was gathered and digitized by staff of DWR's San Joaquin District and the quality control procedures were performed jointly by staff at DWR's DPLA headquarters from San Joaquin District.
The finalized data include DWG files (land use vector data) and shape files (land use vector data).

Purpose:

This data was developed to aid in DWR's efforts to continually monitor land use for the main purpose of determining the amount of and changes in the use of water.

DWR Contacts:

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DPLA Headquarters
1416 9th Street
Sacramento, CA 95814
916-653-5573
hawkins@water.ca.gov

Data Development:

1. The aerial photography used for this survey was taken in late June of 1996. The photographs (natural color slides taken from an altitude of about 5,500 feet above ground), were visually interpreted and land use boundaries were drawn on USGS paper 1:24,000 quadrangles.

2. The quad maps were taken to the field as field sheets, and virtually all the areas were visited to positively identify the land use. The site visits occurred in July through September 1996. Land use codes were printed within each area on the field sheets.

3. Using AUTOCAD, the land use boundaries and attributes were digitized from the field sheets on a digitizing tablet.

4. After quality control/assurance procedures were completed on each file (DWG), the data was finalized.

5. The linework and attributes from each DWG quad file were brought into ARCINFO and both quad and surveywide coverages were created, and underwent quality checks. These coverages were converted to shape files using ARCVIEW.

Data Accuracy:

The land use boundaries were hand drawn onto USGS 1:24,000 quads, and digitized (using a standardized digitizing process) on a digitizing tablet using AUTOCAD. For those areas where the lines were drawn onto USGS quads and digitized, the accuracy is less than that of the quads (about 50 foot accuracy).

The land use attribute accuracy is very high, because almost every delineated field was visited in the field. The accuracy is less than 100 percent because some errors must have occurred. There are three possible sources of attribute errors which are:

1) Misidentification of land use in the field (and entering that incorrect attribute on the field sheet);
2) Correct identification of land use, but entering an incorrect attribute on the field sheet, or;
3) Accidentally affixing an incorrect attribute during the digitizing process.

Projection Information:

The data (DWG and shape files) is in a transverse mercator projection, with identical parameters to UTM projections, except the central meridian is -120 degrees (120 degrees west). For comparison, UTM 10 has a central meridian of 123 degrees west, and UTM 11 has a central meridian of 117 degrees west. This projection allows virtually all of the geographic area of California to be in one 6 degree zone (as opposed to two zones, UTM 10 and 11).

Projection: Transverse Mercator
Datum: NAD27
Units: Meter
Scale Reduction: 0.9996
Central Meridian: 120 degrees west
Origin Latitude: 0.00 N
False Easting: 500,000
False Northing: 0.00

Land Use Attributes:

All land use attributes were coded using the Department's Standard Land Use Legend dated July 1993 (93legend.pdf). The legend explains in detail how each delineated area is attributed in the field, and what the coding system is.

The actual land use code that is printed onto the field maps is different in arrangement than the codes that result from the
digitizing process. The file attributes.pdf is a detailed explanation of the coding system used for both coding the field sheets, and the codes that end up in digitized form in the database files associated with the shape files.

Information on the AUTOCAD (DWG) Files:

The land use data is available in AUTOCAD 12 format by quad, with one file per quad. The file naming convention is 96SSXXXX.DWG, where XXXX is the DWR quadrangle number. For example, file 96SS3629.DWG is the AUTOCAD drawing file for the 1996 Stanislaus County land use survey for quadrangle 3629 (the Ceres quad).

Every quadrangle file has identical layers, nomenclature, and line colors. They are as follows:

Layer	Description	Color
0	AutoCAD's default layer	White
CQN	California DWR quad number	Cyan
GSN	USGS quad number	Cyan
LUB	Land use boundary lines	Yellow
LUC	Land use codes for GRASS	White
LUT	Visible land use text	Green
QB	The quad's boundary	White
QN	Quad name	Cyan

Following is an explanation of the attributes (for each delineated area) in the LUC layer of each quad file:

ACRES:	Number of acres in the delineated area (may or may not be present)
WATERSOURC:	The type of water source used for the delineated area
MULTIUSE:	Type of land uses within the delineated area
CLASS1:	The class for the first land use
SUBCLASS1:	The subclass for the first land use
SPECOND1:	The special condition for the first land use
IRR_TYP1:	Irrigated or non-irrigated, and irrigation system type for the first land use
PCNT1:	The percentage of land associated with the first land use
CLASS2:	The class for the second land use

SUBCLASS2:	The subclass for the second land use
SPECOND2:	The special condition for the second land use
IRR_TYP2:	Irrigated or non-irrigated, and irrigation system type for the second land use
PCNT2:	The percentage of land associated with the second land use
CLASS3:	The class for the third land use
SUBCLASS3:	The subclass for the third land use
SPECOND3:	The special condition for the third land use
IRR_TYP3:	Irrigated or non-irrigated, and irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use

Information on the Shape Files:

Shape files were created for each quad, and one for the whole survey area. The naming conventions used for the quad DWG files is used for the quad shape files (for example, 96SS3629.shp, 96SS3629.shx, and 96SS3629.dbf for quad number 3629, the Ceres quad). The name of the shape file for the whole survey area is 96SS.shp (and .dbf and .shx). Following is an explanation of the land use attributes in the DBF files:

BL_X:	This is the X coordinate of the interior point in the delineated area
BL_Y:	This is the Y coordinate of the interior point in the delineated area
ACRES:	Number of acres in the delineated area (may or may not be present)
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IRR_TYP3A:	Irrigated or non-irrigated for the third land use
IRR_TYP3B:	Irrigation system type for the third land use
PCNT3:	The percentage of land associated with the third land use
UCF_ATT:	Concatenated attributes from MULTIUSE to PCNT3

Important Points about Using this Data Set:

1. The land use boundaries were hand drawn directly on USGS quad maps and then digitized. They were drawn to depict observable areas of the same land use. They were not drawn to represent legal parcel (ownership) boundaries, or meant to be used as parcel boundaries.

2. This survey was a "snapshot" in time. The indicated land use attributes of each delineated area (polygon) were based upon what the surveyor saw in the field at that time, and, to an extent possible, whatever additional information the aerial photography might provide. For example, the surveyor might have seen a cropped field in the photograph, and the field visit showed a field of corn, so the field was given a corn attribute. In another field, the photograph might have shown a crop that was golden in color (indicating grain prior to harvest), and the field visit showed newly planted corn. This field would be given an attribute showing a double crop, grain followed by corn. The DWR land use attribute structure allows for up to three attributes per delineated area (polygon). In the cases where there were crops grown before the survey took place, the surveyor may or may not have been able to detect them from the field or the photographs. For crops planted after the survey date, the surveyor could not account for these crops. Thus, although the data is very accurate for that point in time, it may not be an accurate determination of what was grown in the fields for the whole year. If the area being surveyed does have double or multicropping systems, it is likely that there are more crops grown than could be surveyed with a "snapshot".

3. If the data is to be brought into a GIS for analysis of cropped (or planted) acreage, two things must be understood:

    a. The acreage of each field delineated is the gross area of the field. The amount of actual planted and irrigated acreage will always be less than the gross acreage, because of ditches, farm roads, other roads, farmsteads, etc. Thus, a delineated corn field may have a GIS calculated acreage of 40 acres but will have a smaller cropped (or net) acreage, maybe 38 acres.

    b. Double and multicropping must be taken into account. A delineated field of 40 acres might have been cropped first with grain, then with corn, and coded as such. To estimate actual cropped acres, the two crops are added together (38 acres of grain and 38 acres of corn) which results in a total of 76 acres of net crop (or planted) acres.

4. Water source and irrigation type information was not collected for this survey.

County Coverages

LIBRARY : COUNTY, CA
LAYER NAME : COUNTY
COVERAGE NAME : CO100A

COVERAGE DESCRIPTION:

The 'COUNTY' layer contains county lines and features (usually shorelines). The county outline was digitized from 1:100,000 scale mylar USGS quad sheets.

Users can draw this layer instead of using the tile boundary (which is also a county line). Users can display shorelines or legal county lines or both by employing the BAY and DISPLAY items. This is a polygon layer; users should be prepared for counties with multiple polygons.

VITAL STATISTICS:

Datum:	NAD 27
Projection:	Albers
Units:	Meters
1st Std. Parallel:	34 00 00 (34.0 degrees N)
2nd Std. Parallel:	40 30 00 (40.5 degrees N)
Longitude of Origin:	-120 00 00 (120.0 degrees W)
Latitude of Origin:	00 00 00 (0.0 degrees)
Latitude of Origin:	00 00 00
False Easting (X shift):	0
False Northing (Y shift):	-4,000,000
Source:	USGS digital line graph (DLG) digital series
Source Media:	Mylar maps
Source Projection:	Universal Transverse Mercator Zones 10 & 11
Source Units:	Digitizer inches
Source Scale:	1:100,000 derived from 1:24,000 sources
Capture Method:	Digitized on Calcomp 9100

Conversion Software:	ARC/INFO rev. 5.0.1
Data Structure:	Vector
ARC/INFO Coverage Type:	Polygon
ARC/INFO Precision:	Single
ARC/INFO Tolerances:	5 meters
Number of Features:	112
Layer Size:	6.191 MB
Data Updated:	April 1999 (County swaps Kern/Ventura and Orange/Riverside)

DATA DICTIONARY:

DATAFILE NAME:	CO100A.PAT
RECORD LENGTH:	49

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC
1	AREA	8	18	F	5
9	PERIMETER	8	18	F	5
17	CO100A#	4	5	B	-
21	CO100A-ID	4	5	B	-
25	NAME	20	20	C	-
45	NUM	2	2	I	-
47	BAY	1	1	I	-
48	DISPLAY	2	2	I	-

AREA : The area of the polygon in square coverage units.

PERIMETER : The length of the polygon perimeter of the polygon in coverage units.

CO100A# : The software-assigned unique integer identification number.

CO100A-ID : A user-assigned identifier number.

NAME: County name

NUM: County number (sequence number when counties are listed alphabetically by name)

01 ALAMEDA
02 ALPINE
03 AMADOR
04 BUTTE
05 CALAVERAS
06 COLUSA
07 CONTRA COSTA
08 DEL NORTE
09 EL DORADO
10 FRESNO
11 GLENN
12 HUMBOLDT
13 IMPERIAL
14 INYO
15 KERN
16 KINGS
17 LAKE
18 LASSEN

19 LOS ANGELES
20 MADERA
21 MARIN
22 MARIPOSA
23 MENDOCINO
24 MERCED
25 MODOC
26 MONO
27 MONTEREY
28 NAPA
29 NEVADA
30 ORANGE
31 PLACER
32 PLUMAS
33 RIVERSIDE
34 SACRAMENTO
35 SAN BENITO
36 SAN BERNARDINO
37 SAN DIEGO
38 SAN FRANCISCO
39 SAN JOAQUIN
40 SAN LUIS OBISPO
41 SAN MATEO
42 SANTA BARBARA
43 SANTA CLARA
44 SANTA CRUZ
45 SHASTA
46 SIERRA
47 SISKIYOU
48 SOLANO
49 SONOMA
50 STANISLAUS
51 SUTTER
52 TEHAMA
53 TRINITY
54 TULARE
55 TUOLUMNE
56 VENTURA
57 YOLO
58 YUBA

BAY: This item differentiates between mainland, island and water polygons within a county.

0 = Mainland
1 = Water
2 = Island

DISPLAY: Counties are sometimes comprised of several polygons. The one largest polygon per county is coded with the number 1 . The remaining polygons are coded with the number 0. This is useful when using polygontext commands so that county names will be displayed only once per county.

DATA QUALITY ASSESSMENT:

The following are subjective comments regarding this data.

This layer is complete and the accuracy is good. Attributes which are present are necessary for resolution of county line subsets, i.e., bay shorelines, and the accuracy is excellent.

DATA CONTACT:

Contact Name: Steve Flatt
Contact's Phone: 916-464-4584

DOCUMENTATION DATES: edited 10/27/1997, 8/1998, 4/1999, 5/1999

NOTE: Quad-specific metadata files are not yet available.

CALIFORNIA CENTRAL VALLEY WETLANDS AND RIPARIAN GIS DEPARTMENT OF FISH AND GAME METADATA

July 2, 1997

NOTES TO USERS:

By accepting the California Central Valley Wetlands and Riparian GIS data, the user agrees to the following terms:

* The data may not be used for regulatory purposes.
* The data may not be redistributed without prior written approval from the Coordinator of the Wetlands Inventory and Conservation Program.
* Graphic or textual representations of this data shall include appropriate references to the source, authors, and agencies.
* The version of the data used shall be listed in any report, analysis, or map using the data.
* The data shall not be amended, edited, or revised, nor shall it be used inappropriately to produce inaccurate, incomplete, or misleading analyses, reports, or maps.

HOW TO OBTAIN MORE INFORMATION

The California Central Valley Wetlands and Riparian GIS data may be obtained either electronically, or by mail.

To obtain the data electronically, please do the following by email to mtuffly@.dfg.ca.gov:

* Provide your name, affiliation, address, telephone number, fax number, and email address.
* Briefly describe how you will use the data.

To obtain the data by mail, please do the following:

Send a written request containing the above information requested for electronic transfers, and a self-addressed envelope with return postage containing a blank 8mm tape or blank writeable compact disc to:

Michael Tuffly
Department of Fish and Game
Wetlands Inventory and Conservation Program
1416 Ninth Street
Sacramento, CA 95814

For additional information about obtaining the data electronically or by mail, please contact Michael Tuffly at (916) 445-6264 or email: mtuffly@.dfg.ca.gov

For information about the methods used to construct this data set, please contact Kari Lewis, Department of Fish and Game, Natural Heritage Division, 1416 Ninth Street, Sacramento, CA 95814. (916) 322-1869 email: klewis@kirk.dfg.ca.gov

IMAGE LAYER NAME:	wetlands	(entire study area; Cental Valley)
	north	(Northern extent of study area)
	bayarea	(San Francisco Bayarea extent of study area)
	central	(Middle Cental Valley extent of Study area)
	south	(Southern extent of Study area)

IMAGE DESCRIPTION:
The Wetlands and Riparian GIS database was developed to inventory wetlands, riparian woody areas, and surrounding landcover in three key regions in California:
1) the Sacramento Valley, 2) the San Francisco Bay/Delta, and 3)the San Joaquin Valley to support cooperative conservation planning and wetland resource protection efforts of state, federal, and local agencies and private organizations. This database was produced using image processing techniques to classify satellite imagery. For the three regions, Landsat

Thematic Mapper satellite imagery was processed to map land cover classes from three broad categories: wetlands, agriculture, and uplands.

A cooperative grant from the Department of Fish and Game (using funds from the U.S. Environmental Protection Agency), the Wildlife Conservation Board, the Resources Agency of California, and the U.S. Bureau of Reclamation funded the development of this GIS database by Ducks Unlimited, Inc. and their subcontractor Pacific Meridian Resources in cooperation with DFG, WCB, and BOR staff.

Note, this is a description for the entire grid (grid name: WETLANDS). STATISTICS, BOUNDARY, and Number of Rows and Number of Columns will vary.COORDINATE SYSTEM, Cell Size, Minimum Value, Maximum Value will be the same.

IMAGE TYPE: Raster

IMAGE FORMAT: ARC/INFO GRID

Cell Size =	30.988	Data Type:	Integer
Number of Rows =	18874	Number of Values =	18
Number of Columns =	13340	Attribute Data (bytes) =	8

BOUNDARY		STATISTICS	
Xmin =	-276494.330	Minimum Value =	0.000
Xmax =	136880.970	Maximum Value =	17.000
Ymin =	-334767.041	Mean =	2.236
Ymax =	250093.934	Standard Deviation =	5.057

COORDINATE SYSTEM DESCRIPTION

Projection	ALBERS		
Units	METERS	Spheroid	CLARKE1866

Parameters:

1st standard parallel	34 0 0.000
2nd standard parallel	40 30 0.000
central meridian	-120 0 0.00
latitude of projection's origin	0 0 0.000
false easting (meters)	0.00000
false northing (meters)	-4000000.0000

Datum: NAD27
Spheroid: Clark 1866

SOURCE: Natural Heritage Division, California Department of Fish and Game

SOURCE DATA: Landsat Thematic Mapper Satellite Imagery and SPOT Multispectral Satellite Imagery. The sensor and dates of image acquisition are listed below.

Area	Summer	Winter
Sacramento Valley	Landsat TM 6/28/93	Landsat TM 1/3/93
San Francisco Bay/Delta	Landsat TM 6/28/93	Landsat TM 1/3/93
N. San Joaquin Valley	Landsat TM 7/7/93	Landsat TM 11/9/86 and SPOT 11/13/90
S. San Joaquin Valley	Landsat TM 6/30/93	Landsat TM 12/20/92
Vina Plains	Landsat TM 6/28/93	Landsat TM 1/3/93

LOOK UP TABLE (named WET_LUT)

Record	VALUE	SYMBOL TEXT
1	0 65	Outside Study Area
2	1 72	Open Water
3	2 67	Seasonally Flooded Estuarine Emergents
4	3 96	Permanently Flooded Estuarine Emergents
5	4 120	Tidal Estuarine Emergents
6	5 109	Seasonally Flooded Palustrine Emergents
7	6 128	Permanently Flooded Palustrine Emergents
8	7 292	Tidal Flats
9	8 355	Non-Tidal Flats
10	9 454	Flooded Agriculture
11	10 451	Seasonally Flooded Agriculture
12	11 457	Non-Flooded Agriculture
13	12 410	Orchards/Vineyards
14	13 408	Riparian Woody
15	14 569	Non-Riparian Woody
16	15 466	Grass
17	16 211	Barren
18	17 202	Other

Descriptions of each of the categories in the classification system are listed below. Note the values in parentheses correspond to the values in the Look Up Table (LUT), Value Attribute Table (VAT), and Image cell values in the VALUE data field.

1. (1) Open Water - Open water features (both fresh and salt water) that were identified on the summer image only.

2.1.1 (2) Seasonally Flooded Estuarine Emergents* - emergent vegetation identified as: a) dry (i.e. no flooding or moist soil) on the summer image, b) inundated on the winter image, and c) within areas classified as Estuarine by the National Wetlands Inventory. Examples of estuarine emergents are pickleweed and saltgrass. This class may include areas which are subject to freshwater runoff or managed by means of fresh water flooding and support brackish or freshwater habitats, such as areas of Suisun Marsh.

2.1.2 (3) Permanently Flooded Estuarine Emergents* - wetland emergent vegetation identified as: a) flooded or having moist soil on the summer image and thus assumed to also be flooded or moist in the winter, and b) within areas classified as Estuarine by the National Wetlands Inventory. Examples of estuarine emergents are pickleweed and saltgrass. This class may include areas which are subject to freshwater runoff or managed by means of freshwater flooding and support brackish or freshwater habitats, such as areas of Suisun Marsh.

*Areas labeled as Estuarine which are managed for brackish or fresh water habitat can vary in seasonality of flooding and in geographic location and extent based on varying management schemes.

2.1.3 (4) Tidal Estuarine Emergents - wetland emergent vegetation identified within areas classified as Tidal by the San Francisco Estuary Institute Baylands Atlas data and classified as Estuarine by the National Wetlands Inventory. Examples of tidal estuarine emergents are pickleweed and saltgrass.

2.2.1 (5) Seasonally Flooded Palustrine Emergents** - emergent vegetation identified as: a) dry (i.e. no flooding or moist soil) on the summer image, b) inundated on the winter image, and c) within areas classified as Palustrine, Lacustrine, or Riverine by the National Wetlands Inventory or outside of any areas classified as Estuarine by the National Wetlands Inventory. This class includes areas that were managed as moist soil habitat for waterfowl. Typical vegetation includes swamp timothy, pricklegrass, and watergrass.

2.2.2 (6) Permanently Flooded Palustrine Emergents** - wetland emergent vegetation identified as: a) flooded or having moist soil on the summer image and thus assumed to also be flooded or moist in the winter, and b) within areas classified as Palustrine, Lacustrine, or Riverine by the National Wetlands Inventory or outside of any areas classified as Estuarine by the National Wetlands inventory. Typical vegetation in this class includes bulrushes and cattails. Managed wetlands where summer water was visible were included in this class.

**Managed areas labeled as seasonally or permanently flooded palustrine can vary in seasonality of flooding and geographic location and extent based on varying management schemes.

2.3.1 (7) Tidal Flats - mud banks, and sand bars that were visible above the water level on the summer image and are subject to tidal influence.

2.3.2 (8) Non-Tidal Flats - mud banks, and sand bars that were visible above the water level on the summer image and are not subject to tidal influence.

3.1 (9) Flooded Agriculture - Agricultural lands where standing water or very moist soil was present on both the winter and summer images. This includes immature rice fields where the rice plant was not yet fully emergent above the water on the summer image and were inundated on the winter image.

3.2 (10) Seasonally Flooded Agriculture - Agricultural lands where standing water was present on the winter image and growing crops were present on the summer image. Mature rice fields and other crops with winter flooding regimes were included in this class.

3.3 (11) Non-Flooded Agriculture - Agricultural lands with growing crops present in the summer and no flooding detected on either the summer or winter image. Row crops and other non-flooded agriculture were included in this class.

3.4 (12) Orchards/Vineyards - Orchards include almonds, walnuts, and various fruits grown in the agricultural areas of the Central Valley and in the valleys north of the Bay area. Vineyards are included in this class.

4.1 (13) Riparian Woody - areas dominated by woody scrub/shrub vegetation and trees that are located within a riparian mask based on proximity to selected hydrography features from the CDFG Rivers Assessment data, NWI data, Natural Diversity Data Base (NDDB), and a hand-digitized floodplain map. The parameters used to define the mask were tailored to reflect differences in riparian forest habitats in three ecological regions found within the project area. These parameters are discussed in detail in Section 8 of the final project report.

4.2 (14) Non-riparian Woody - areas dominated by woody scrub/shrub vegetation and trees that were not included in the Riparian Woody class. Residential areas with significant tree cover are included in this class.

5. (15) Grass - includes managed grasslands, such as pasture, golf courses, and schoolyards, and natural grasslands such as those found in the foothills.

6. (16) Barren - exposed soil with little or no vegetation present. This class includes fallow or recently plowed fields. Some barren land may have been classified as Other.

7. (17) Other - includes areas of urban and suburban development, industrial complexes, commercial centers, airport runways, and other areas dominated by structures and paved surfaces. Some areas of development may have been classified as Barren.

METHODS:

The Wetland and Riparian GIS database was produced from satellite imagery using image classification techniques. A multi-temporal approach involving the use of imagery from both the summer and the winter was implemented to take advantage of the seasonal wetland characteristics which allow for a more detailed classification than characteristics observed during a single season. Ten Landsat Thematic Mapper images--a summer and winter scene from five scene locations--were acquired to cover the project area. In addition, a SPOT multispectral image was purchased for the N. San Joaquin Valley to provide a more recent winter image for the major wetlands areas than was available from the Landsat TM sensor.

Image processing techniques were used to classify the satellite images to produce the final GIS data layer. Initially, the winter image was classified to produce a digital map of winter standing water. This "winter wet" layer was then used along with Digital National Wetlands Inventory (NWI) data and Department of Conservation Farmlands Mapping and Monitoring data to stratify the summer image into three broad landcover classes: wetlands, agriculture, and non-agriculture uplands. After stratification, each image strata was classified separately using a combination of supervised and unsupervised classification techniques. Field data, aerial photography, and other ancillary data sources were used to assist in the labeling of spectral clusters.

After each of the strata was classified, they were mosaicked together and three GIS modeling operations were performed to further refine the classification. First, modeling with the "winter wet" layer was performed to identify and label seasonally flooded agriculture and seasonally flooded wetlands. Next, NWI data and SFEI Baylands Atlas data were used to apply wetland system labels (Estuarine vs. Palustrine) and a secondary Tidal attribute, respectively, to the wetlands identified during image classification. Finally, GIS modeling was performed to identify a riparian woody class. A mask of potential riparian areas was generated using NWI data, CDFG River Reach Hydrography Data, the Natural Diversity Data Base, and a manually digitized floodplain coverage. This mask was overlaid over the classified map and any woody areas falling within the mask were included in the riparian woody class.

ASSESSMENT OF DATA QUALITY:
Because of the use of multiple dates of imagery, the seasonal nature of many of the classes, and limited access to private lands, it was not possible to acquire the reference data needed for a rigorous, quantitative accuracy assessment. Instead, a review process was adopted in which persons familiar with the landcover of the project area reviewed draft maps and provided

comments on problems they identified in the maps. These comments served as an important qualitative accuracy assessment and targeted systematic errors that were corrected during the final editing process.

APPROPRIATE USE OF COVERAGE/CLASSIFIED IMAGE:
The Wetlands and Riparian GIS database is designed for use in statewide and regional level planning. Due to its scale and scope, the Wetland and Riparian GIS database will meet different needs with various levels of success. Because of the relatively large scope of the database, it will likely meet the needs of coarser level planning efforts (planning efforts over a large area) with greater success than it will for finer level planning efforts, such as those occurring at the local level. For coarse level planning, the database provides information that is relatively uniform in coverage, date, and scale, useful for statewide and regional level planning. The benefits of covering a large area in a uniform manner may come at a cost in terms of accuracy in some cases. Over a large project area such as the Central Valley, it is not possible to consider all areas in great detail, and in some cases, local subtleties in cover or management may not be represented. Thus, for finer level planning, the database will likely best be used as a general baseline to focus gathering of more detailed information and to fill gaps until such information can be assimilated. The effects of error in the data are also related to the scale at which the information is used. Errors may become increasingly significant as the information is used for finer levels of analysis. Classification errors which appear minimal at the state-wide or regional level may be significant when the data are used at a finer level. These issues of scale and accuracy require consideration by those who use the database for conservation planning and resource protection analysis.

In addition, the user should be aware of several limitations of the data. First, the seasonally floodeded wetlands and agriculture classes were identified using a single date of imagery. Second, a number of ancillary data layers were incorporated into the processing either for stratification or for GIS modeling. While these layers contributed greatly to the overall accuracy of the final data base, they also may have introduced error. Finally, the riparian class was modeled based on ancillary data and proximity modeling. Thus accurate representation of riparian habitat may not have been entirely achieved.

The information contained in, or derived from this data layer is unsuited for, and shall not be used for any regulatory purpose or action, nor shall the report or accompanying maps be the basis for any determination relating to impact assessment or mitigation.

USE OF DATA FOR DISPLAY AND ANALYSIS:
To display the classified image in IMAGINE, open a Viewer by clicking on the Viewer icon on the IMAGINE main menu bar. In the menu bar at the top of the Viewer, select File --> Raster --> Open. The Open Raster Layer dialog box will appear. Input the name of the image to be displayed and turn on the Fit to Frame button under Display Options to have the image fit the maximum extent of the Viewer. Click on OK to display the image.

ACCURACY ASSESSMENT:
Currently Accuracy is underway. Results will be completed in the Spring of 1998.

California Central Valley Wetlands and Riparian GIS
Metadata
July, 2, 1997

National Wetlands Inventory (NWI) Metadata

1 Identification Information

1.1 Citation

1.1.1 Originator: U.S. Fish & Wildlife Service, National Wetlands Inventory

1.1.2 Publication Date: Range from Oct. 1981 to present; information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.1.3 Title: Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.1.4 Publication Information

1.1.4.1 Publication Place: St. Petersburg, Florida

1.1.4.2 Publisher: U.S. Fish & Wildlife Service, National Wetlands Inventory

1.2 Description

1.2.1 Abstract: NWI digital data files are records of wetlands location and classification as defined by the U.S. Fish & Wildlife Service. This dataset is one of a series available in 7.5 minute by 7.5 minute blocks containing ground planimetric coordinates of wetlands point, line, and area features and wetlands attributes. When completed, the series will provide coverage for all of the contiguous United States, Hawaii, Alaska, and U.S. protectorates in the Pacific and Caribbean. The digital data as well as the hardcopy maps that were used as the source for the digital data are produced and distributed by the U.S. Fish & Wildlife Service's National Wetlands Inventory project.

1.2.2 Purpose: The data provide consultants, planners, and resource managers with information on wetland location and type. The data were collected to meet U.S. Fish & Wildlife Service's mandate to map the wetland and deepwater habitats of the United States. The purpose of this survey was not to map all wetlands and deepwater habitats of the United States, but rather to use aerial photo interpretation techniques to produce thematic maps that show, in most cases, the larger ones and types that can be identified by such techniques. The objective was to provide better geospatial information on wetlands than found on the U.S. Geological Survey topographic maps. It was not the intent of the NWI to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys. Boundaries are therefore generalized in most cases. Consequently, the quality of the wetland data is variable mainly due to source photography, ease or difficulty of interpreting specific wetland types, and survey methods (e.g., level of field effort and state-of-the-art of wetland delineation) (see section on “Completenesss Report" for more information.

1.3 Time Period of Content

1.3.1 Multiple Dates/Time

1.3.1.1 Calendar Date: Ranges from Feb. 1971 to Dec. 1992. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.3.2 Currentness Reference: source photography date

1.4 Status

1.4.1 Progress: Complete

1.4.2 Maintenance and Update Frequency: Irregular

1.5 Spatial Domain

1.5.1 Bounding Coordinates

1.5.1.1 West Bounding Coordinate: Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.5.1.2 East Bounding Coordinate: Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.5.1.3 North Bounding Coordinate: Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.5.1.4 South Bounding Coordinate: Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.6 Keywords

1.6.1 Theme

1.6.1.1 Theme Keyword Thesaurus: None

1.6.1.2 Theme Keyword: wetlands

1.6.1.2 Theme Keyword: hydrologic

1.6.1.2 Theme Keyword: land cover

1.6.1.2 Theme Keyword: surface and manmade features

1.6.2 Place

1.6.2.1 Place Keyword Thesaurus: None

1.6.2.2 Place Keyword: Range includes all 50 states, Puerto Rico, Virgin Islands. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

1.7 Access Constraints: none

1.8 Use Constraints: Federal, State, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, State, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The NWI maps do not show all wetlands since the maps are derived from aerial photo interpretation with varying limitations due to scale, photo quality, inventory techniques, and other factors. Consequently, the maps tend to show wetlands that are readily photo interpreted given consideration of photo and map scale. In general, the older NWI maps prepared from 1970s-era black and white photography (1:80,000 scale) tend to be very conservative, with many forested and drier-end emergent wetlands (e.g., wet meadows) not mapped. Maps derived from color infrared photography tend to yield more accurate results except when this photography was captured during a dry year, making wetland identification equally difficult. Proper use of NWI maps therefore requires knowledge of the inherent limitations of this mapping. It is suggested that users also consult other information to aid in wetland detection, such as U.S. Department of Agriculture soil survey reports and other wetland maps that may have been produced by state and local governments, and not rely solely on NWI maps. See section on "Completeness Report" for more information. Also see an article in the National Wetlands Newsletter (March-April 1997; Vol. 19/2, pp. 5-12) entitled "NWI Maps: What They Tell Us" (a free copy of this article can be ordered from U.S. Fish and Wildlife Service, ES-NWI, 300 Westgate Center Drive, Hadley, MA 01035).

1.9 Point of Contact

10.2 Contact Organization Primary

10.1.2 Contact Organization: U.S. Fish & Wildlife Service, National Wetlands Inventory

10.3 Contact Position: Chief Cartographer

10.4 Contact Address

10.4.1 Address Type: mailing and physical address

10.4.2 Address: 9720 Executive Center Drive

10.4.3 City: St. Petersburg

10.4.4 State or Province: Florida

10.4.5 Postal Code: 33702

1.13 Native Data Set Environment: NWI uses Wetlands Analytical Mapping System (WAMS) software version 4.06 running under the SUNOS 4.x operating system to digitize wetlands information.

2 Data Quality Information

2.1 Attribute Accuracy

2.1.1 Attribute Accuracy Report: Attribute accuracy is tested by manual comparison of the source with hard copy printouts and/or symbolized display of the digital wetlands data on an interactive computer graphic system. In addition, WAMS software (USFWS-NWI) tests the attributes against a master set of valid wetland attributes.

2.2 Logical Consistency Report: Polygons intersecting the neatline are closed along the border. Segments making up the outer and inner boundaries of a polygon tie end-to-end to completely enclose the area. Line segments are a set of sequentially numbered coordinate pairs. No duplicate features exist nor duplicate points in a data string. Intersecting lines are separated into individual line segments at the point of intersection. Point data are represented by two sets of coordinate pairs, each with the same coordinate values. All nodes are represented by a single coordinate pair which indicates the beginning or end of a line segment. The neatline is generated by connecting the four corners of the digital file, as established during initialization of the digital file. All data crossing the neatline are clipped to the neatline and data within a specified tolerance of the neatline are snapped to the neatline. Tests for logical consistency are performed by WAMS verification software (USFWS-NWI).

2.3 Completeness

All photo interpretable wetlands are mapped given considerations of map and photo scale and state-of-the-art wetland delineation techniques. The target mapping unit is an estimate of the minimum-sized wetland that should be consistently mapped. It is not the smallest wetland that appears on the map, but instead it is the size class of the smallest group of wetlands that NWI attempts to map consistently. Users must realize however that some wetland types are conspicuous and readily identified (e.g., ponds) and smaller wetlands of these types may be mapped. Other types (drier-end wetlands and forested wetlands, especially evergreen types) are more difficult to photo interpret and larger ones may be missed. In forested regions, the target mapping unit varies with the scale of the aerial photographs given acceptable quality (e.g., captured during spring, leaf-off condition for deciduous trees), as follows for the Northeast, Southeast, and Northwest: 1:80,000 = 3-5 acres; 1:58,000 = 1-3 acres, and 1:40,000 = 1 acre.

This means that where 1:58,000 photography was used, the NWI maps should show most wetlands larger than 1-3 acres. In the treeless prairies (e.g., Upper Midwest), 1/4-acre wetlands are typically mapped due to the openness of the terrain and occurrence of wetlands in distinct depressions. In forested regions, small open water and emergent wetlands may also be mapped where conspicuous. For Alaska, the target mapping unit is 2-5 acres, while for the Southwest, 1-3 acres is the target. Map users must pay close attention to the photo scale used to prepare the maps. Also, users should be aware that black and white imagery tends to yield more conservative interpretations than color infrared imagery, except when the latter was acquired during a dry year, complicating wetland detection. In most areas, farmed wetlands are not mapped, with exceptions including prairie pothole-type wetlands, cranberry bogs, and diked former tidelands in the Sacramento valley. Mucklands and other farmed wetlands are usually not shown on the maps. As mentioned in the "Use Constraints" section, no attempt was made to separate regulated wetlands from other wetlands, as these decisions must be based on criteria established by Federal and state regulatory agencies. Maps produced by photo interpretation techniques will never be as accurate as a detailed on-the-ground delineation, so the boundaries on the NWI maps should be considered generalized, especially in areas of low topographic relief (e.g., coastal plains and glaciolacustrine plains). Partly drained wetlands may also be conservatively mapped, since they may be difficult to photo interpret and in many cases, require site-specific assessment for validation. For more information on the limitations of NWI maps, consult "NWI Maps: What They Tell Us" (National Wetlands Newsletter Vol 19/2, March-April 1997, pp. 7-12; a copy can be obtained from the U.S. Fish and Wildlife Service, ES-NWI, 300 Westgate Center Drive, Hadley, MA 01035).

Positional Accuracy

Horizontal Positional Accuracy

Horizontal Positional Accuracy Report: Horizontal positional accuracy for the digital data is tested by visual comparison of the source with hard copy plots.

2.5 Lineage

2.5.1 Source Information

2.5.1.1 Source Citation

8.1 Originator: Domain includes U.S. Geological Survey (USGS), U.S. Department of Agriculture (USDA), National Aeronautics and Space Administration (NASA), special project. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

8.2 Publication Date: Ranges from Feb. 1971 to Dec. 1992. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

8.4 Title: Domain includes National Aerial Photography Program (NAPP), National High Altitude Photography (NHAP), Agricultural and Stabilization Conservation Service (ASCS), NASA or special project photography. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

8.6 Geospatial Data Presentation Form: aerial photograph

2.5.1.2 Source Scale Denominator: Ranges from 20,000 to 132,000. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.1.3 Type of Source Media: Domain includes black and white, color infrared, or natural color aerial photograph film transparency. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.1.4 Source Time Period of Content

9.2 Multiple Dates/Times

9.1.1 Calendar Date: Ranges from Feb. 1971 to Dec. 1992. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.1.4.1 Source Currentness Reference: photo date

2.5.1.5 Source Citation Abbreviation: NWI1

2.5.1.6 Source Contribution: wetlands spatial and attribute information

2.5.1 Source Information

2.5.1.1 Source Citation

8.1 Originator: U.S. Geological Survey

8.2 Publication Date: Ranges from 1902 to 1992. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

8.4 Title: topographic map

8.6 Geospatial Data Presentation Form: map

8.8 Publication Information

8.8.1 Publication Place: Reston,VA

8.8.2 Publisher: U.S. Geological Survey

2.5.1.2 Source Scale Denominator: Domain includes 20,000, 24000. 25000, 30000, and 62500. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.1.3 Type of Source Media: stable-base material

2.5.1.4 Source Time Period of Content

9.1 Single Date/Time

9.1.1 Calendar Date: Ranges from 1902 to 1992. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.1.4.1 Source Currentness Reference: publication date

2.5.1.5 Source Citation Abbreviation: NWI2

2.5.1.6 Source Contribution: base cartographic data

2.5.1 Source Information

2.5.1.1 Source Citation

8.1 Originator: U.S. Fish & Wildlife Service, National Wetlands Inventory

8.2 Publication Date: Ranges from 1979 to 1994. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

8.4 Title: Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

8.6 Geospatial Data Presentation Form: map

8.8 Publication Information

8.8.1 Publication Place: St.Petersburg,Florida

8.8.2 Publisher: U.S. Fish & Wildlife Service, National Wetlands Inventory

2.5.1.2 Source Scale Denominator: Domain includes 20,000, 24000. 25000, 30000, and 62500. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.1.3 Type of Source Media: stable-base material

2.5.1.4 Source Time Period of Content

9.1 Single Date/Time

9.1.1 Calendar Date: Ranges from 1979 to 1994. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.1.4.1 Source Currentness Reference: publication date

2.5.1.5 Source Citation Abbreviation: NWI3

2.5.1.6 Source Contribution: wetlands location and classification

2.5.2 Process Step

2.5.2.1 Process Description: NWI maps are compiled through manual photo interpretation (using Cartographic Engineering 4X Mirror Stereoscopes) of NHAP or NAPP aerial photography supplemented by Soil Surveys and field checking of wetland photo signatures. Delineated wetland boundaries are manually transferred from interpreted photos to USGS 7.5 minute topographic quadrangle maps and then manually labeled. Quality control steps occur throughout the photo interpretation, map compilation, and map reproduction processes.

2.5.2.2 Source Used Citation Abbreviation: NWI1

2.5.2.2 Source Used Citation Abbreviation: NWI2

2.5.2.3 Process Date: Ranges from 1979 to 1994. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

2.5.2.5 Source Produced Citation Abbreviation: NWI3

2.5.2 Process Step

2.5.2.1 Process Description: Digital wetlands data are either manually digitized or scanned from stable-base copies of the 1:24,000 scale wetlands overlays registered to the standard U.S. Geological Survey (USGS) 7.5 minute quadrangles into topologically correct data files using Wetlands Analytical Mapping System (WAMS) software. Files contain ground planimetric coordinates and wetland attributes. The quadrangles were referenced to the North American Datum of 1927 (NAD27) horizontal datum. The scanning process captured the digital data at a scanning resolution of at least 0.001 inches; the resulting raster data were vectorized and then attributed on an interactive editing station. Manual digitizing used a digitizing table to capture the digital data at a resolution of at least 0.005 inches; attribution was performed as the data were digitized. The determination of scanning versus manual digitizing production method was based on feature density, source map quality, feature symbology, and availability of production systems. The data were checked for position by comparing plots of the digital data to the source material.

2.5.2.2 Source Used Citation Abbreviation: NWI3

2.5.2.3 Process Date: Ranges from Oct. 1981 to present. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

3 Spatial Data Organization Information

3.2 Direct Spatial Reference Method: vector

4 Spatial Reference Information

4.1 Horizontal Coordinate System Definition

4.1.2 Planar

4.1.2.2 Grid Coordinate System

4.1.2.2.1 Grid Coordinate System Name: Universal Transverse Mercator

4.1.2.2.2 Universal Transverse Mercator

4.1.2.2.2.1 UTM Zone Number: Ranges from 4 to 20. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

4.1.2.1.2 Transverse Mercator (Map Projection Parameters)

4.1.2.1.2.17 Scale Factor at Central Meridian: 0.9996

4.1.2.1.2.2 Longitude of Central Meridian: Ranges from -159.0 to -63.0. Information for this element varies for each 7.5' quad. See the quad-specific metadata file.

4.1.2.1.2.3 Latitude of Projection Origin: 0.0

4.1.2.1.2.4 False Easting: 500000.0

4.1.2.1.2.5 False Northing: 0.0

4.1.2.4 Planar Coordinate Information

4.1.2.4.1 Planar Coordinate Encoding Method: coordinate pair

4.1.2.4.2 Coordinate Representation

4.1.2.4.2.1 Abscissa Resolution: 0.61

4.1.2.4.2.2 Ordinate Resolution: 0.61

4.1.2.4.4 Planar Distance Units: meters

4.1.4 Geodetic Model

4.1.4.1 Horizontal Datum Name: North American Datum of 1927

4.1.4.2 Ellipsoid Name: Clarke 1866

4.1.4.3 Semi-major Axis: 6378206.4

4.1.4.4 Denominator of Flattening Ratio: 294.9787

5 Entity and Attribute Information

5.1 Detailed Description

5.1.1 Entity Type

5.1.1.1 Entity Type Label: wetland

5.1.1.2 Entity Type Definition: Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes:

1) at least periodically, the land supports predominantly hydrophytes;

2) the substrate is predominantly undrained hydric soil; and

3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

5.1.1.3 Entity Type Definition Source: Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish Wildlife Service. 103 pp.

5.1.2 Attribute

5.1.2.1 Attribute label: wetland classification

5.1.2.2 Attribute Definition: classification of the wetland

5.1.2.3 Attribute Definition Source: Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish Wildlife Service. 103 pp.

5.1.2.4 Attribute Domain Values

5.1.2.4.3 Codeset Domain

5.1.2.4.3.1 Codeset Name: valid wetland classification code list

5.1.2.4.3.2 Codeset Source: Photo interpretation Conventions for the National Wetlands Inventory, March 1990

5.2 Overview Description

5.2.1 Entity and Attribute Overview: The wetland classification system is hierarchical, with wetlands and deepwater habitats divided among five major systems at the broadest level. The five systems include Marine (open ocean and associated coastline), Estuarine (salt marshes and brackish tidal water), Riverine (rivers, creeks, and streams), Lacustrine (lakes and deep ponds), and Palustrine (shallow ponds, marshes, swamps, sloughs). Systems are further subdivided into subsystems which reflect hydrologic conditions. Below the subsystem is the class which describes the appearance of the wetland in terms of vegetation or substrate. Each class is further subdivided into subclasses; vegetated subclasses are described in terms of life form and substrate subclasses in terms of composition. The classification system also includes modifiers to describe hydrology (water regime), soils, water chemistry (pH, salinity), and special modifiers relating to man's activities (e.g., impounded, partly drained).

5.2.2 Entity and Attribute Detail Citation: Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish Wildlife Service. 103 pp.

5.2.2 Entity and Attribute Detail Citation: Photo interpretation Conventions for the National Wetlands Inventory, March 1990

6 Distribution Information

6.1 Distributor

10.2 Contact Organization Primary

10.1.2 Contact Organization: USGS-Earth Science Information Center

10.4 Contact Address

10.4.1 Address Type: mailing address

10.4.2 Address: 507 National Center

10.4.3 City: Reston

10.4.4 State or Province: Virginia

10.4.5 Postal Code: 22092

10.5 Contact Voice Telephone: 1 800 USA MAPS

10.5 Contact Voice Telephone: 1 703 638 6045

6.3 Distribution Liability: none

6.4 Standard Order Process

6.4.1 Non-digital Form: Hardcopy NWI wetlands maps at various scales, on diazo paper or mylar, composited with or without the USGS base map.

6.4.2 Digital Form

6.4.2.1 Digital Transfer Information

6.4.2.1.1 Format Name: DLG

6.4.2.1.2 Format Version Number: 3

6.4.2.1.4 Format Specification: Optional

6.4.2.2 Digital Transfer Option

6.4.2.2.1 Online Option

6.4.2.2.1.1 Computer Contact Information

6.4.2.2.1.1.1 Network Address

6.4.2.2.1.1.1.1 Network Resource Name: ftp: 192.189.43.33 (dlgdata directory) or http://www.nwi.fws.gov/

6.4.2.2.1.2 Access Instructions: Anyone with access to the Internet may connect to NWI's server via anonymous ftp and download available NWI digital wetlands data in DLG3-Optional format. Indexes for NWI hardcopy maps and digital data are also available as well as digital wetlands data in a variety of other formats (MOSS Export, GRASS vector, DXF, and ARC Export) for 14 sample 7.5 minute quadrangles throughout the USA. To access: ftp to the NWI server, login as anonymous, enter your e-mail address at the password prompt, change to the dlgdata directory for DLG data, change to the maps directory for indexes, change to the samples directory for a sampling of digital data files in formats other than DLG. Use the ftp 'get' command to transfer readme file for further instructions. View the NWI home page by pointing your World Wide Web browser to the http address shown above.

6.4.2.2.1.3 Online Computer and Operating System: Sun Model 690MP Unix server. SunOS 4.X operating system.

6.4.2.2.2 Offline Option

6.4.2.2.2.1Offline Media: 8mm cartridge tape (2,5, or 10 Gb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 2

6.4.2.2.2.2.1 Recording Density: 5

6.4.2.2.2.2.1 Recording Density: 10

6.4.2.2.2.2.2 Recording Density Units: gigabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels; the logical record length is 80 bytes; the block size is a multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1Offline Media: 1/4-inch cartridge tape (150 Mb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 150

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 9-track tape

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1600

6.4.2.2.2.2.1 Recording Density: 6250

6.4.2.2.2.2.2 Recording Density Units: characters per inch

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels; the logical record length is 80 bytes; the block size is a multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 3-1/2 inch floppy disk (high density)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1.44

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: MS-DOS

6.4.2 Digital Form

6.4.2.1 Digital Transfer Information

6.4.2.1.1 Format Name: MOSS

6.4.2.1.4 Format Specification: Export

6.4.2.2 Digital Transfer Option

6.4.2.2.2 Offline Option

6.4.2.2.2.1Offline Media: 8mm cartridge tape (2,5, or 10 Gb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 2

6.4.2.2.2.2.1 Recording Density: 5

6.4.2.2.2.2.1 Recording Density: 10

6.4.2.2.2.2.2 Recording Density Units: gigabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels; the logical record length is 80 bytes; the block size is a multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 1/4-inch cartridge tape (150 Mb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 150

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 9-track tape

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1600

6.4.2.2.2.2.1 Recording Density: 6250

6.4.2.2.2.2.2 Recording Density Units: characters per inch

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels; the logical record length is 80 bytes; the block size is a multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 3-1/2 inch floppy disk (high density)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1.44

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: MS-DOS

6.4.2 Digital Form

6.4.2.1 Digital Transfer Information

6.4.2.1.1 Format Name: GRASS

6.4.2.1.2 Format Version Number: 3.0

6.4.2.1.4 Format Specification: Vector

6.4.2.2 Digital Transfer Option

6.4.2.2.2 Offline Option

6.4.2.2.2.1Offline Media: 8mm cartridge tape (2,5, or 10 Gb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 2

6.4.2.2.2.2.1 Recording Density: 5

6.4.2.2.2.2.1 Recording Density: 10

6.4.2.2.2.2.2 Recording Density Units: gigabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels; the logical record length is 80 bytes; the block size is a multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1Offline Media: 1/4-inch cartridge tape (150 Mb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 150

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 9-track tape

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1600

6.4.2.2.2.2.1 Recording Density: 6250

6.4.2.2.2.2.2 Recording Density Units: characters per inch

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels;
the logical record length is 80 bytes; the block size is a
multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 3-1/2 inch floppy disk (high density)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1.44

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: MS-DOS

6.4.2 Digital Form

6.4.2.1 Digital Transfer Information

6.4.2.1.1 Format Name: DXF

6.4.2.2 Digital Transfer Option

6.4.2.2.2 Offline Option

6.4.2.2.2.1Offline Media: 8mm cartridge tape (2,5, or 10 Gb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 2

6.4.2.2.2.2.1 Recording Density: 5

6.4.2.2.2.2.1 Recording Density: 10

6.4.2.2.2.2.2 Recording Density Units: gigabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels;
the logical record length is 80 bytes; the block size is a
multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1Offline Media: 1/4-inch cartridge tape (150 Mb)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 150

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 9-track tape

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1600

6.4.2.2.2.2.1 Recording Density: 6250

6.4.2.2.2.2.2 Recording Density Units: characters per inch

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: ASCII recording mode available with no internal labels;
the logical record length is 80 bytes; the block size is a
multiple of 80 up to 8000 bytes

6.4.2.2.2 Offline Option

6.4.2.2.2.1 Offline Media: 3-1/2 inch floppy disk (high density)

6.4.2.2.2.2 Recording Capacity

6.4.2.2.2.2.1 Recording Density: 1.44

6.4.2.2.2.2.2 Recording Density Units: megabytes

6.4.2.2.2.3 Recording Format: tar

6.4.2.2.2.3 Recording Format: MS-DOS

6.4.3 Fees: Digital Form - The online copy of the DLG data set may be retrieved via ftp at no charge. For delivery of digital data on magnetic tape, the prices are: purchased by single 7.5 minute quad unit: $40 per dataset;
purchased in groups of 2 to 6: $20 per dataset; purchased in groups of 7 or more: $90 base fee plus $7 per dataset. Non-digital Form - $3.50 per diazo paper map; $5.25 per diazo mylar map.

6.4.4 Ordering Instructions: For digital data orders on 3.5" floppy disk, a maximum order of 10 quads is allowed. Data may be ordered in latitude/longitude or State Plane Coordinate System coordinates (Universal Transverse Mercator coordinates are standard). Latitude/longitude coordinates are not available with GRASS format. For this service, the user must order data through USGS-ESIC for delivery on magnetic media. Please specify the desired coordinate system when ordering. Non-digital form: specify wetlands overlay or wetlands overlay composited with USGS base map.

6.6 Technical Prerequisites: Check NWI's ftp site, maps directory for an explanation of the wetland codes. Check NWI's ftp site, software directory for a program that will parse the wetland codes to fixed length format. Check NWI's ftp site, software directory for an AML to convert NWI DLG files to ARC/INFO coverages.

7 Metadata Reference Information

7.1 Metadata Date: 19950711

7.4 Metadata Contact

10.1 Contact Person Primary

10.1.1 Contact Person: Linda Shaffer

10.1.2 Contact Organization: U.S. Fish & Wildlife Service, National Wetlands Inventory

10.3 Contact Position: Chief Cartographer

10.4 Contact Address

10.4.1 Address Type: mailing and physical address

10.4.2 Address: 9720 Executive Center Drive

10.4.3 City: St.Petersburg

10.4.4 State or Province: Florida

10.4.5 Postal Code: 33702

10.5 Contact Voice Telephone: 813 570 5411

10.7 Contact Facsimile Telephone: 813 570 5420

10.8 Contact Electronic Mail Address: linda@wetlands.nwi.fws.gov

7.5 Metadata Standard Name: FGDC Content Standards for Digital Geospatial Metadata

7.6 Metadata Standard Version: 19940608

Calwater MetaData/* DRAFT /* (pveisze 11/13/96)

CALWATER GIS METADATA

COVERAGE NAME: calwater
LOCAL PATH: dfghost /gdata2/project/calwater/calwater (SINGLE)
METADATA FILE: calwater.txt
METADATA DATE: November 13, 1996

This coverage is in development. Contact Teale GIS Technology Center or contact persons below for current information.

COVERAGE DESCRIPTION

CALWATER is a set of standardized watershed boundaries, nested intolarger, previously standardized watersheds, meeting standardized delineation criteria. CALWATER is digital and exists as a 1:24000-scale, ARC/INFO GIS coverage (Brandow, 1995). Originally developed by the California Department of Forestry and Fire Protection (CDF), Planning Watershed identification codes in CALWATER are based on numeric decimal identifiers (see Appendix below) used by the State Water Resources Control Board and Regional Water Quality Control Boards (SWRCB/RWQCB) for reporting of water quality information to the U.S. Environmental Protection Agency (US EPA) and for other purposes. The California Department of Water Resources (DWR) has adopted CALWATER and variations thereof as a basemap for selected DWR water information bulletin series.

CALWATER is under review by the Interagency California Watershed Mapping Committee (Naser Bateni, DWR, Chair). A draft Memorandum of Understanding is in preparation for signature by several state and federal agencies with water resources, water quality, forest and watershed management, and fish and wildlife habitat responsibilities.

UPDATES

11/13/96:
Current draft dated 11/12/96 received from Virginia Wong-Coppin/Roger Ewers. Working coverage name cawastat changed to calwater upon copying from double to single precision. Minor edits performed on DFG copy: polygon codes, names. Metadata revised 11/13/96.

10/15/96:
Draft received from Lee Neher. Working coverage name was cawastat.

9/19/96:
Draft received from Lee Neher. Working coverage name was cawastat.

8/14/96:
Draft received from Lee Neher. Working coverage name was cal0.

RELATED DATA

ARC/INFO coverages, Internet locations of metadata:

CA Teale GIS Technology Center digital hydrograpy (enhanced USGS 100K DLG)
X-URL: http://www.gislab.teale.ca.gov/meta/hydrogra.txt

CA Teale GIS Technology Center hydrologic basins (current SWRCB codes)
X-URL: http://www.gislab.teale.ca.gov/meta/hbasa.txt

US EPA River Reach File, version 3-alpha (RF3-alpha)
X-URL: http://www.epa.gov/OW/rf/

CA DFG-enhanced USGS Hydrologic Unit Codes (hucdfg1d)
contact Email: pveisze@dfg.ca.gov

VITAL STATISTICS

Arc: describe calwater
Description of SINGLE precision coverage calwater

FEATURE CLASSES

Feature Class	Subclass	Number of Features	Attribute data (bytes)	Spatial Index?	Topology?
ARCS		21087	32		
POLYGONS		7052	254		Yes
NODES		14072			
ANNOTATIONS	(blank)	0			

SECONDARY FEATURES

Tics	61
Arc Segments	1399012
Polygon Labels	7053

TOLERANCES

Fuzzy = 0.210 V   Dangle = 100.000 V

COVERAGE BOUNDARY

Xmin = -373899.313   Xmax = 540169.875

Ymin = -604670.875 Ymax = 449866.906

STATUS

The coverage has not been Edited since the last BUILD or CLEAN.

Projection: Albers conic equal-area, standard Teale parameters

Datum: NAD 27
Projection: Albers
Units: meters
1st Std. Parallel: 34 00 00
2nd Std. Parallel: 40 30 00
Longitude of Origin: -120 00 00
Latitude of Origin: 00 00 00
False Easting (X shift): 0
False Northing (Y shift): -4,000,000
Source: manual digitizing
Source Media: delineations on USGS 7.5' quads
Source Projection: as stated on USGS quads
Source Units: meters

DATA DICTIONARY

POLYGON ATTRIBUTE TABLE (.PAT)
(calwater.pat items: Area, Perimeter, #, -ID, not described)

COL	ITEM NAME	WIDTH	TYPE	N.DEC	DESCRIPTION
25	IDNUM	11	N	5	CALWATER-assigned unique id
36	SPWS	10	N	4	Super-Planning Watershed
46	HSA	8	N	2	Hydrologic Sub Area
54	HA	7	N	1	Hydrologic Area
61	HU	5	I	-	Hydrologic Unit; includes RWQCB code
66	RWQCB	1	I	-	Regional Water Qual. Control Board code
67	HREGION	2	I	-	Hydrologic Region
69	RBUA	6	I	-	Integrates HREGION+RWQCB+HU+HA
75	RBUAS	7	I	-	Integrates RBUA+HSA
82	RBUASP	9	I	-	Integrates RBUAS+SPWS
91	RBUASPW	10	I	-	Integrates RBUAS+PWS
101	MAG	1	C	-	CA Dept.Consv./Div.Mines&Geology code
102	SYM	3	I	-	Symbol for plotting purposes
105	ACRES	12	F	0	Acreage calc. from ARC/INFO sq. meters

109	CREAT	1	I	-	Teale edit flag
110	HBPA	2	C	-	Hydrologic Basin Planning Area code
112	HUNAME	35	C	-	Hydrologic Unit name (SWRCB/RWQCB maps)
147	HANAME	35	C	-	Hydrologic Area name
182	HSANAME	35	C	-	Hydrologic Sub Area name
217	PWSNAME	35	C	-	Planning Watershed (PWS) name
252	HDWR	9	N	5	CA Dept. Water Resources ID code

DETAILED PAT ITEM DESCRIPTIONS

IDNUM: Unique identifier for each CALWATER polygon. Developed by California Department of Forestry and Fire Protection (CDF) for subdividing existing SWRCB Hydrologic Sub Areas (HSA) in forest and woodland portions of state into "Planning Watersheds" (PWS)--the most detailed level of watershed boundary. PWSs are not defined in the Central Valley floor and southern coast and deserts. Where PWS are defined, three digits are suffixed to existing SWRCB HSA codes, where PWS are not defined, these three digits are all zeroes. In all cases IDNUM contains the California Department of Water Resources (DWR) Hydrologic Region (HREGION) code (1 - 10) prefixed to the SWRCB code. See analogous item HDWR.

Note: Code structure of IDNUM and HDWR as applied in draft coverage calwater is being reviewed by the Interagency California Watershed Mapping Committee.

SPWS: Super-Planning Watershed code. Aggregates Planning Watersheds (IDNUM) up one level. Where applied, SPWS suffixes two digits to SWRCB HSA code.

(Definitions of HREGION, HU, HA, HSA, designating increasing levels of detail in watershed delineations, taken from R. Neal draft of 6/28/96).

RWQCB: Regional Water Quality Control Board administrative region (1 - 9). See also Hydrologic Basin Planning Areas (HBPA) depicted on SWRCB maps.

HREGION: Hydrologic Region. Divides the state into major geographic areas based on topographic and hydrologic considerations. Nine regions currently coded numerically in the SWRCB-based system, whereas ten regions are coded numerically (formerly alphanumerically) by DWR. DWR identifies three HREGIONS in the Central Valley to SWRCB's one, and SWRCB identifies three RWQCBs in the South Coast HREGION to DWR's one.

DWR HREGION	RWQCB basin	Hydrologic Region Name	State Water Resources Control Board Hydrologic Basin Planning Area (HBPA)
1	1	North Coast	NC = North Coast
2	2	San Francisco Bay	SF = San Francisco Bay
3	3	Central Coast	CC = Central Coast

4	4	South Coast	LA = Los Angeles
5	5	Sacramento	SB = Sacramento
6	5	San Joaquin	SJ = San Joaquin
8	5	Tulare Lake	TL = Tulare Lake
9	6	North Lahontan	NL = North Lahontan
10	6	South Lahontan	SL = South Lahontan
7	7	Colorado River	CR = Colorado River Basin
4	8	South Coast	SA = Santa Ana
4	9	South Coast	SD = San Diego

HU: Hydrologic Unit. Each Hydrologic Region is divided into Hydrologic Units, which are defined by surface drainage as well as topographic and geologic conditions. A Hydrologic Unit may encompass a major river watershed or a major groundwater basin, contiguous watersheds with
similar hydrologic characteristics, or a closed drainage area, such as a desert basin or group of such basins.

HA: Hydrologic Area. Major subdivisions of Hydrologic Units. Best described as major tributaries of a river, large valley groundwater basin, or a component of a stream or desert basin group.

HSA: Hydrologic Sub-Area. Consists of a major segment of a Hydrologic Area having significant geographical characteristics of hydrological homogeneity.

RBUA, RBUAS, RBUASP, RBUASPW: Unique integer codes, extracted from IDNUM, defining successively more detailed watershed delineations. Aggregated HREGION, RWQCB/HU, HA, HSA, SPWS etc, integer codes facilitate polygon dissolving and creating links to data tables in PC-ARC/INFO and PC-ARCVIEW environments where INFO redefined items (normally used on workstations) are not recognized. Workstation users may find polygon selections easier
with these integers as well.

RBUA - HREGION+BASIN/HU+HA
RBUAS - HREGION+BASIN/HU+HA+HSA
RBUASP - HREGION+BASIN/HU+HA+HSA+SPWS
RBUASPW - HREGION+BASIN/HU+HA+HSA+SPWS+PWS (IDNUM w/o decimal)

MAG: CA Dept. Conservation, Division of Mines and Geology code designating erodible watershed rating (erosion hazards). Contact CDF for metadata.

SYM: Symbol code for plotting purposes. Contact CDF for metadata.

ACRES: Calculated acreage of polygon. Source units are square meters in default AREA item in ARC/INFO. (not verified)

CREAT: Teale edit flag:

1 = features as recieved by Teale: digitized by CDF contractor, Tierra Data Systems, plus minor edits performed by Dept. Fish and Game.
2 = reserved
3 = edits made at Teale after 06/20/95.

HBPA: Two-letter code denoting SWRCB Hydrologic Basin Planning Area (see table above).

HUNAME, HANAME, HSANAME: Names of successively more detailed watersheds as assigned by State and Regional Water Boards. Published on 1:500,000-scale map series "Hydrologic Basin Planning Areas" (SWRCB 1986).

PWSNAME: CALWATER-assigned name to a Planning Watershed. Not yet published.

HDWR: California Department of Water Resources hydrologic code. Prototype. This item is equivalent to IDNUM except: a.) dissolving on selected levels of HDWR will eliminate selected reservoir shorelines used by SWRCB as Hydrologic Sub Area boundaries; b.) Similar dissolves on HDWR subsets will divide Central Valley floor differently from SWRCB-based designations
(review in progress).

ARC ATTRIBUTE TABLE (.AAT)
(calwater.aat items #, -ID, etc, not described)

COL	ITEM NAME	WIDTH	TYPE	N.DEC	DESCRIPTION
33	LEVEL	1	I	-	Hierarchial level of boundary
34	CALBY	1	I	-	California state boundary flag
35	CREAT	1	I	-	Teale edit flag

DETAILED AAT ITEM DESCRIPTIONS

LEVEL: Identifies highest level in CALWATER hierarchy at which arc functions:

0 = California State boundary	
1 = Hydrologic Region	(R)
2 = Hydrologic Unit (combines RWQCB or 'Basin' and Hydrologic Unit)	(BU)
3 = Hydrologic Area	(A)
4 = Hydrologic Sub-area	(S)
5 = Super-Planning Watershed	(P)
6 = Planning Watershed	(W)

(see .PAT use of abbeviations in parentheses)

CREAT: Teale edit flag:

1 = features as recieved by Teale: digitized by CDF contractor, Tierra Data Systems, plus minor edits performed by Dept. Fish and Game.
2 = reserved
3 = edits made at Teale after 06/20/95.

DATA QUALITY ASSESSMENT

This coverage is in development. Contact Teale GIS Technology Center or contact persons below for current information. The following comments are subjective remarks.

CALWATER boundaries were digitized on a 1:24,000-scale base and thus very accurately divide surface water features depicted on 1:100,000-scale Digital Line Graph hydrography. However, CALWATER delineations are primarily designed to be administrative reporting units, and the boundaries should not be used to define authoritative drainage area above a given point as a portion of their definition includes non-physical boundaries, particularly in valley floor and urbanized coastal regions.

Attribute completeness is good. Compatibility with existing state and federal watershed delineations is good, except where explicitly different boundary configurations are applied.

APPLICATIONS CONTACTS

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APPENDIX A

CALWATER codes are currently based on SWRCB codes, appearing on published, hardcopy maps of Hydrologic Basin Planning Areas (SWRCB 1986). Where applied, CALWATER codes suffix three digits to existing SWRCB HSA codes. New draft CALWATER code structure also prefixes the DWR Hydrologic Region code to SWRCB codes. These changes have been distributed for review. CALWATER codes enable alternative basin delineations according to specific agency needs. Separate items are included in the polygon attribute tables for this purpose. See above. The discussion below only concerns existing SWRCB codes and nomenclature, not the draft CALWATER codes (except where noted).

SWRCB HYDROLOGIC BASIN CODES (items ..HSA.. etc.)

SWRCB Hydrologic codes are 6-byte strings composed of numbers and a decimal point. The meanings associated with each byte position and the decoding of a typical code are shown below. Allowable value ranges shown in parentheses.

The first byte (first position in the code string) indicates the Hydrologic Region (SWRCB defines 9 Regions statewide, DWR defines 10 Regions, using a number (formerly a letter)). Other byte positions are described below. A code ending in .00 indicates an entire major river basin, called a Hydrologic Unit (HU) (e.g. 105.00 - KLAMATH RIVER HYDROLOGIC UNIT). Large tributaries of major rivers are designated as Hydrologic Areas (HA), and their codes end in a single zero. In turn, HAs are subdivided into Hydrologic Sub-Areas (HSA), and a single digit replaces the last zero in the HA code. HSA codes ending in zero or double zeroes indicates that that the HA or HU is not subdivided (see further explanations under HSANAME below).

Byte(s)	Meaning	Value Range
1	Hydrologic Region	(R) (1 <= R <= 9)
2,3	HYDROLOGIC UNIT	(HU) (00<= HU <=59);(=81)*
4	always a decimal point	(.)
5	Hydrologic Area	(HA) (0 <= HA <= 9)
6	Hydrologic Sub-Area	(HSA)(0 <= HSA<= 9)

Example: Scott Bar HSA (105.41)

1 = North Coast
05 = KLAMATH RIVER (1-digit HUs include leading zero)
4 = Scott River Hydrologic Area
1 = Scott Bar

NOTE:
Regions 4 and 8 use county lines to "split" some of their HUs. * See 481.21, 845.15, etc and REMARKS(4). In Region 5, HU values 28, 29, 30, 46 thru 50 inclusive, are skipped.

Normally, HUs and HAs are subdivided into lower categories (HUs are divided into HAs, HAs are divided into HSAs). Some HUs and HAs are not subdivided. Examples:

Name	Code	Name	Code
LUCERNE LAKE	HU 701.00	Blue Lake HA	109.10
JOHNSON	HU 702.00	Ruth HA	109.40
BESSEMER	HU 703.00	Suisun Bay HA	207.10

(NOTE: Current version of CALWATER does not contain trailing zeroes in HU and HA codes, and DWR HREGION codes are prefixed. For example SWRCB code 538.00 would be shown as HU = 6538; SWRCB code 109.10 would be shown as HA = 1109.1)

Byte position 1 contains the numeric code of the SWRCB Hydrologic Regions:

R Hydrologic Region Name	HBPA (Hydrologic Basin Planning Area)
1 = North Coast	NC
2 = San Francisco Bay	SF
3 = Central Coast	CC
4 = Los Angeles	LA
5 = Central Valley	SB = Sacramento
5 = Central Valley	SJ = San Joaquin
5 = Central Valley	TL = Tulare Lake
6 = Lahontan	NL = North Lahontan
6 = Lahontan	SL = South Lahontan
7 = Colorado River Basin	CR
8 = Santa Ana	SA
9 = San Diego	SD

Note: The Central Valley and Lahontan Hydrologic Regions are subdivided into Hydrologic Basin Planning Areas (HBPA), each with separate names and maps. All other HBPA names are the same as SWRCB Hydrologic Region names. The numeric sequence of Hydrologic Unit (HU) codes is continuous across Central Valley HBPAs, except for skipped values 528, 529, 530, and 546 through 550 inclusive. HUs 535 and 545 have the same name (San Joaquin Valley Floor), as do HUs 551, 557, and 558 (South Valley Floor).

--- end Appendix A ---

```
--- end of file calwater.txt / pveisze 11/13/96 ---
```