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Baby Fac #

From: Les Grober
To: Wilson, Craig J.
Date: Mon, Mar 20, 2006 1:01 PM
Subject: San Joaquin River Salinity

Craig,

Here is data and analyses to help you respond to comments on the 303(d) listing for Electrical Conductivity in the San Joaquin River.
Please let Matt know if you need anything else.

There are four major lines of evidence to support the listing:

1. Increase in mean annual EC levels in the San Joaquin River at Vernalis over a 75-year period
2. Exceedance of Vernalis salinity water quality objectives
3. Attainment of EC objectives at Vernalis from 1995 through 2004 resulted from above-average flow and releases of high quality water from New Melones Reservoir
4. Elevated salinity upstream of the Stanislaus River confluence

Vernalis salinity water quality objectives are contained in the State Water Board's Bay-Delta Plan. They are 700 uS/cm, April 1 - August 31 (30-day running average) and 1,000 uS/cm, September 1 - March 31 (30-day running average).

We have included two attachments for your review to support the evidence. The first attachment (Attachment 1) is an excerpt from the administrative draft TMDL report currently being developed for salt and boron discharges into the lower San Joaquin River upstream of Vernalis. The second attachment (Attachment 2) is an excerpt from the July 2004 technical TMDL report that was included as Appendix 1 in the Basin Plan amendment for salt and boron discharges into the lower San Joaquin River (approved by the State Water Board in November 2005). The third attachment (Attachment 3) is Appendix A from Attachment 1 mentioned above.

<u>1. Increase in mean annual EC levels in the San Joaquin River at Vernalis over a 75-year period</u>
Annual EC levels at Vernalis have shown an increasing trend in EC levels based on data from 1930 to 2004 water years. Mean annual EC has nearly doubled since the 1940s as a result of many factors, including the diversion of high quality water originating in the Sierra Nevada, importation of low quality water from the Delta, and other agricultural impacts. Refer to Figure 5 on page 17 in Attachment 1 presenting the increase in mean annual EC and a 15-year moving average EC. Figure 6 from page 18 in Attachment 1 shows the variability of EC levels with a 30-day running average EC along with seasonal water quality objectives.

<u>2. Exceedance of Vernalis salinity water quality objectives</u>
As documented on page 1-11 in Attachment 2, salinity objectives were exceeded 49% of the time at the San Joaquin River at Vernalis during the irrigation season from 1985 to 1998. The non-irrigation season objective was exceeded 11% of the time at the same site. Figure 1-3 on page 1-16 in Attachment 2 presents EC levels for irrigation and non-irrigation seasons from 1985 to 1998.

Exceedance of the salinity objectives is most likely to occur during critically dry years when flows are low and salinity sources account for most flow volume. There have been no critically dry years since 1994. Critically dry years, however, have accounted for 16% of all year types on average since 1901. The objectives are exceeded 45% of the time during these critically dry years, and since critically dry years occur 16% of the time, this translates into an exceedance rate of 7% (45% of 16%) assuming that exceedances will continue to occur during critically dry years. Refer to Table 3 on page 19 from Attachment 1 that describes the occurrence of critically dry years. This table is based on the data contained in Attachment 3.

<u>3. Attainment of EC objectives at Vernalis from 1995 through 2004 resulted from above-average flow and</u>

releases of high quality water from New Melones Reservoir
Salinity objectives have been attained from Water Year 1995 through 2004 as a result of higher than normal flows and ongoing releases from New Melones Reservoir on the Stanislaus River. These releases contain high quality (low salinity) water that provides a dilution effect and results in lower salinity numbers at Vernalis. Table 4 on page 19 in Attachment 1 describes the statistical comparison of the 1901 through 2001 period of record versus the 1995 through 2004 recent period of record.

Arguments that EC standards will be consistently met in the future based on CALSIM II model analyses are incorrect and premature based on the ability of the model to correctly estimate salinity. The recent CALSIM II model review found that the model consistently underestimates salinity (page 9 of 12 January 2006 Review Panel Report). The full review panel report can be found at:

http://science.calwater.ca.gov/workshop/calsim_05.shtml

4. Elevated salinity upstream of the Stanislaus River confluence
The San Joaquin River at Vernalis, as a result of its location downstream of the Stanislaus River, does not necessarily represent the water quality conditions present in the rest of the upstream reaches of the river. As mentioned before, releases from New Melones Reservoir for water quality and fisheries compliance provides a large amount of dilution water for the San Joaquin River. Proposed compliance sites upstream of this confluence present a starkly different view of the water quality conditions. Refer to Table 5 on page 20 in Attachment 1 for a table and text that describes the exceedance rates of the Vernalis objectives at upstream mainstem locations if applied at these locations. They show that the Vernalis objectives, if applied to these upstream locations, would be exceeded up to 86% of the time at some sites.

Les

CC: Bruns, Jerry; Joe Karkoski; McCarthy, Matthew; Schnagl, Rudy

Attachment 1

Excerpts (p 17 to 21) from

Administrative Draft TMDL Report for the Control of Salt and Boron Discharges in the lower San Joaquin River Upstream of Vernalis

This is a Working Draft Copy

Water quality of the Lower San Joaquin River: Lander Avenue to Vernalis, October 1997 through September 1998 (Water Year 1998).

Water quality of the Lower San Joaquin River: Lander Avenue to Vernalis, October 1998 through September 2000 (Water Years 1999 and 2000). Regional Water Quality Control Board, Central Valley Region Report. April 2002.

Additionally, the USGS and DWR have collected extensive flow and water quality data from the TMDL project area. The USGS and DWR data used in the report is discussed in the source analysis.

1.5 Historical Water Quality

Combined datasets of flow, EC, TDS, and boron data from Central Valley Water Board, USGS, DWR monitoring are combined to better assess the spatial and temporal extent of the salinity and boron impairment in the lower SJR. This combined dataset of calculated monthly salinity and boron are provided in Appendix A.

Salinity in the San Joaquin River Near Vernalis

Figure 5 shows the mean annual EC in the lower SJR near Vernalis for water years 1930 to 2004 as well as the 15-year moving average for the data. (based on data from USBR, 1980; Chilcott et al., 1998; Grober et al., 1998; Crader et al., 2002; DWR, 2005; USGS, 2005a; USBR, 2006). Mean annual EC is calculated by dividing the total annual salt load by the total annual discharge in the lower SJR near Vernalis. The 15-year moving average helps identify long-term trends that may be obscured by the annual variability of discharge and salt load. The data shows an increasing trend in EC levels, with mean annual EC nearly doubling since the mid 1940s. The increase in EC is due to a number of factors, including diversion of high quality water from major tributaries (the Merced, Tuolumne, and Stanislaus Rivers, and the lower SJR upstream of Lander Avenue), importation of low quality (i.e., high salinity) water from the Delta, groundwater accretions, and surface and subsurface agricultural discharges.

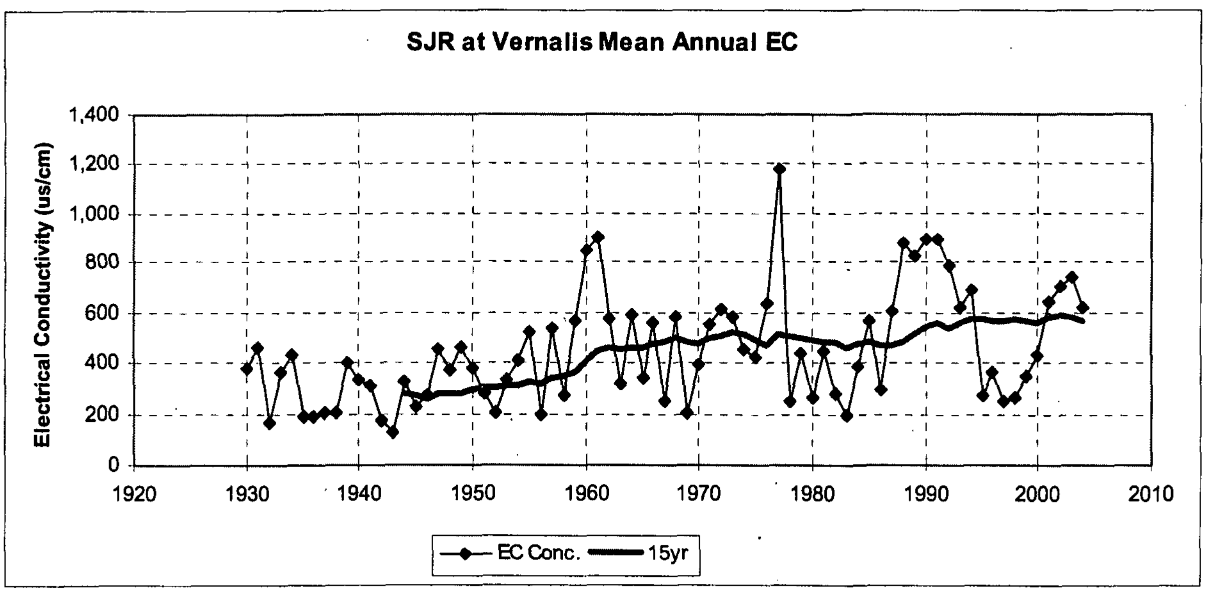


Figure 5. Mean annual salinity in the San Joaquin River at Vernalis, 1930-2004

A more detailed look at salinity in the lower SJR near Vernalis shows that there is much seasonal and annual variability. Figure 6 shows the 30-day running average EC in the lower SJR near Vernalis for 18 years from 1985 through 2003. Superimposed on this data are the seasonal water quality objectives at Vernalis of 700 µs/cm for April through August and 1,000 µs/cm for September through March. The highly variable EC is attributable to 1) seasonal and annual variability in flows and salt loads and 2) flow augmentation from the Stanislaus River made to attain salinity objectives. The USBR has been releasing water from New Melones Reservoir on the Stanislaus River specifically to attain Vernalis salinity objectives per State Water Board Water Rights Decisions[1]. Over this 18-year period, the 30-day running average electrical conductivity objectives at Vernalis were exceeded 14 percent of the time during the irrigation season and 5 percent of the time during the non-irrigation season.

Although water quality objectives have been attained from 1995 through 2004, 15-year running average annual EC levels remain elevated. Water Years 2001, 2002, and 2004, classified as dry years according to the San Joaquin Valley Water Year Index (SJVWYI) of unimpaired flows[2], had the highest mean annual EC of the 13 dry years in the 75-year record. Water Year (WY) 2003, a below-normal year, had the highest EC of the 11 below-normal years.

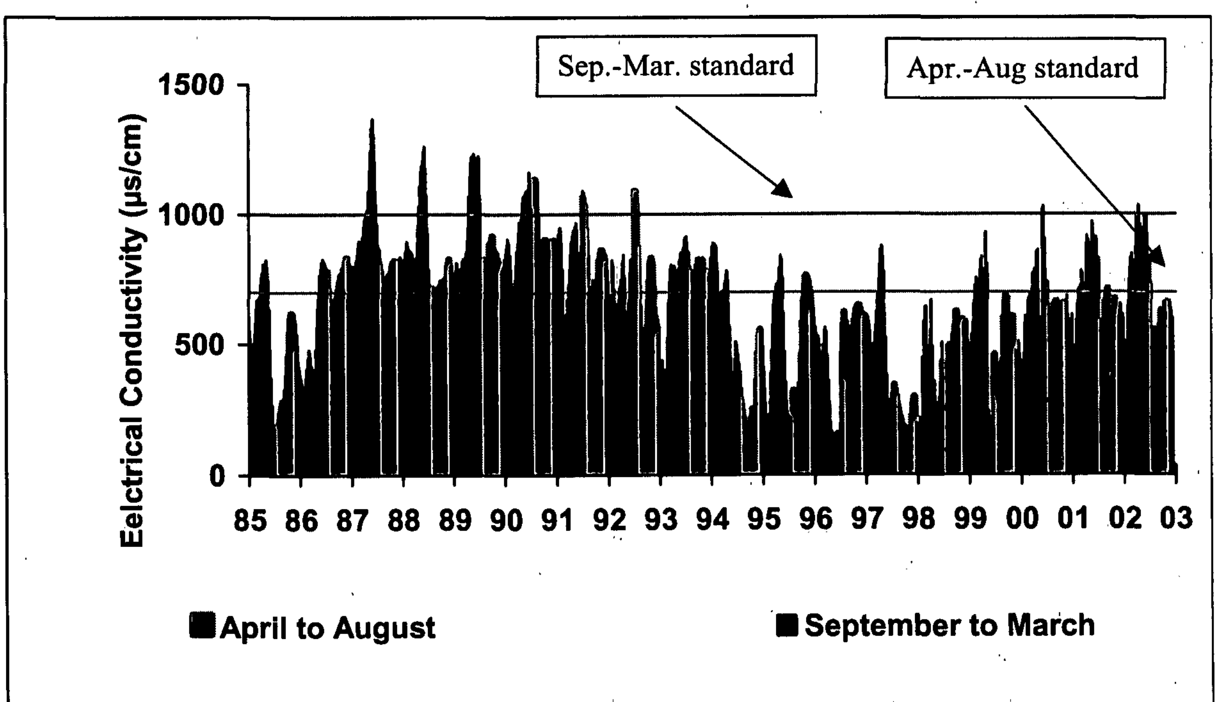


Figure 6. Electrical conductivity for the lower San Joaquin River at Vernalis, 1985-2003

[1] Most recently, in State Water Board Water Rights Decision 1641 (State Water Board D-1641), the State Water Board conditioned the water rights of the USBR upon implementation of the water quality objectives in the lower SJR at Airport Way Bridge near Vernalis.

[2] The SJVWYI, as described in the Bay-Delta Plan, is used to determine the San Joaquin Valley water year type as implemented in State Water Board D-1641. Final determination for lower SJR flow objectives is based on the May 1 75% exceedance forecast. The index includes five water year types: wet; above normal; below normal; dry; and critically dry and is calculated as follows: 0.6 * Current April-July Runoff Forecast (in million acre-feet or maf) + 0.2 * Current October-March Runoff (maf) + 0.2 * Previous Water Year's Index (if the Previous Water Year's Index exceeds 4.5, then 4.5 is used).

Exceedance of salinity objectives is most likely to occur during critically dry years when flows are low and high salinity sources account for a larger percent of the total flow volume than during wetter years. There have been no critically dry years in the lower SJR since WY 1994. Critically dry years, however, have accounted for 16% of all year types, on average, since WY 1901 (CALFED-CWEMF 2006) (Table 3). Appendix A shows the monthly average concentration of total dissolved solids (TDS) and EC for the lower SJR near Vernalis for WY 1977 through WY 2004. Water Years 1977, 1987 through 1992, and WY 1994 were all critically dry WYs as defined by the SJVWYI. The data indicate that the Vernalis salinity water quality objectives were exceeded in 70 months or 21% percent of the time during critically dry years.

Salinity objectives at Vernalis have been attained from WY 1995 through WY 2004 as a result of higher than normal flows and on-going releases of high quality water from New Melones Reservoir required under Water Rights Decision 1641. The ten-year period from October 1994 through September 2004 was wetter than the full period of record. None of the years from WY 1995 through WY 2004 were classified as critically dry according to the SJVWYI. This ten-year period consisted of four wet, two above normal, one below normal, and three dry years. The summary statistics in Table 4 compare the 1901 to 2004 record to the 1995 to 2004 period, showing that the 1995 to 2004 period is wetter. Annual unimpaired flows in the lower SJR were 300,000 acre-feet higher, on average, from 1995 to 2004 than during the full historical record. The minimum flow from 1995 to 2004 was also 300,000 acre-feet higher than the 10th percentile of flow for the full record. Water from New Melones Reservoir was available for water quality releases in the last ten years. A return to dry conditions that better represent the full historical record could result in a reduction in New Melones Reservoir storage available to make water quality releases.

Table 3. Comparison of water year types for historical and 1995 to 2004 periods

Time Period		Year Type						Mean Index
		Wet	Above Normal	Below Normal	Dry	Critically Dry	Total	
1901 to 2004	No. years	34	21	17	15	17	104	3.34
	%	33%	20%	16%	14%	16%	100%	
1995 to 2004	No. years	4	2	1	3	0	10	3.64
	%	40%	20%	10%	30%	0%	100%	

Table 4. Water year index statistics for the lower San Joaquin River basin

SJVWYI	1901 to 2004	1995 to 2004
Mean	3.34	3.64
Median	3.24	3.49
Standard Deviation	1.31	1.35
Skewness	0.63	0.68
Min	0.84	2.20
10th Percentile	1.89	2.21

Salinity in San Joaquin River Upstream of Stanislaus River Confluence

Salinity in the lower SJR generally increases in the reaches upstream of the dilution effects of the major east side tributaries. Overall salinity gets progressively higher upstream of the confluences of the Stanislaus, Tuolumne, and Merced Rivers, as the river is more and more dominated by saline discharges.

Table 5 provides summary information, compiled from numerous sources[3], for six locations on the lower SJR for water year 1995 through 2004. Vernalis salinity objectives, if applied to these upstream reaches, would have been exceeded, with increasing frequency as you move upstream of the east side tributaries. As shown earlier, water year 1995 through 2004 was a period of relatively high flows in the lower SJR basin compared to the full period of record. Flow augmentation from the Stanislaus River, in conjunction with relatively wet conditions allowed for attainment of the Vernalis water quality objectives. Flow augmentation and the relatively wet conditions during this period still resulted in elevated salinity in a 60-mile reach of the river from the vicinity of Bear Creek, upstream of Lander Avenue, to the Stanislaus River confluence.

Flow at Lander consists of groundwater accretions, infrequent flood flows from Bear Creek, and various localized tail water flow. Water quality at Hills Ferry is heavily influenced by saline discharges from Mud and Salt Sloughs. Downstream of the Merced River, water quality tends to improve as a result of high quality dilution flows from the major east side tributaries (the Merced, Tuolumne, and Stanislaus Rivers).

Summary statistics for six sites representative of these reaches are shown in Table 6.

Table 5. Salinity exceedance rates at upstream gages along the lower San Joaquin River

Site: San Joaquin River @	Period of Record Water Year	Exceedance Rate[1] Period of Record (percent)			Exceedance Rate WY 1995 to 2004 (percent)		
		irr[2]	non-irr	all	irr	non-irr	all
Lander	1977-2004	62	31	44	66	24	48
Fremont Ford	1986-2004	86	82	84	82	76	79
Hills Ferry	1986-2004	83	83	83	78	76	77
Hills Ferry w/o GBP	1986-2004	79	77	78	70	63	66
Crows Landing/Patterson	1977-2004	83	60	70	80	49	68
Maze	1986-2004	68	38	50	52	15	31
Vernalis	1977-2004	34	11	21	10	3	6

[1]For all sites but Vernalis, this is the rate of exceedance if Vernalis objectives were applied to the site; there currently are no objectives for sites upstream of Vernalis
[2]Irrigation (irr) = April 1-August 31, Non-irrigation (non-irr) = September 1-March 31, All Dates (all)

[3] Salinity and flow information taken from Appendix A

Table 6. Summary statistics for Electrical Conductivity at monitoring stations along the lower San Joaquin River (uS/cm)

Site: San Joaquin River @	Season[1]	n	Max	Percentile 99th	Percentile 95th	Percentile 90th	Mean
Lander[2]	irr	140	2,696	2,481	1,981	1,755	958
	non-irr	196	4,089	3,957	2,364	1,594	828
Fremont Ford[3]	irr	94	3,160	3,054	2,870	2,684	1,616
	non-irr	132	3,954	3,578	2,882	2,668	1,675
Hills Ferry[3,4]	irr	92	3,230	3,141	2,953	2,712	1,644
	non-irr	122	3,890	3,639	2,970	2,729	1,777
Hills Ferry[3]	irr	93	3,230	3,140	2,955	2,887	1,865
	non-irr	122	3,890	3,639	2,970	2,729	1,894
Crows Landing[6]	irr	44	1,533	1,492	1,433	1,420	1,039
	non-irr	62	1,788	1,728	1,612	1,412	947
Patterson[7]	irr	95	2,480	2,265	2,027	1,766	1,174
	non-irr	133	2,933	2,518	1,942	1,879	1,193
Maze[3]	irr	95	1,528	1,518	1,403	1,336	877
	non-irr	133	1,688	1,580	1,447	1,344	901
Vernalis[2]	irr	140	1,662	1,625	903	824	597
	non-irr	196	1,708	1,572	1,140	1,028	640

[1] *Irrigation (irr) = April 1 to August 31, Non-irrigation (non-irr) = September 1 to March 31*
[2] *Period of Record: WY 1977-WY 2004*
[3] *Period of Record: WY 1986-WY 2004*
[4] *EC calculated with Grassland Bypass Loads removed*
[6] *Period of Record: WY 1996-WY 2004*
[7] *Period of Record: WY 1977-WY 1995*

Attachment 2

Excerpts (p 1-11 to 1-16) from

July 2004 Technical TMDL Report included as Appendix 1 in the Basin Plan Amendment for the Control of Salt and Boron Discharges into the Lower San Joaquin River

This Basin Plan amendment was approved by the State Board in November 2005

organophosphorus pesticides, diazinon and chlorpyrifos, and selenium. The Delta is also listed for dissolved oxygen. This technical TMDL focuses exclusively on the salinity and boron impairment. Technical TMDLs for the remaining pollutants are being developed separately to better address the specific needs of those pollutants.

Water quality data collected by Regional Board staff over the past 15 years indicates that water quality objectives (WQOs) have been routinely exceeded throughout the lower river. Figure 1-3 shows the 30-day running average electrical conductivity (EC) at Vernalis for Water Years 1986 through 1998. Superimposed on this figure are the seasonal WQOs. The non-irrigation season salinity objective (applies 1 Sep.- 31 Mar.), was exceeded 11 percent of the time and the irrigation season salinity objective (applies 1 Apr.- 31 Aug.), was exceeded 49 percent of the time. This rate of exceedance occurred even though releases were made from New Melones Reservoir on the Stanislaus River during much of this period, specifically to help meet WQOs at Vernalis. If the Vernalis objectives were applied upstream at Crows Landing, the non-irrigation season objective would have been exceeded 67 percent of the time and the irrigation season objective would have been exceeded 78 percent of the time. This higher rate of exceedance at Crows Landing is due to reduced dilution flows, as Crows Landing is upstream of both the Stanislaus and the Tuolumne River inflows.

Surface and subsurface agricultural drainage represent the largest sources of salt and boron loading to the LSJR. The vast majority of this agriculturally derived salt and boron loading to the river originates from lands on the west side of the LSJR watershed. Soils on the west side of the San Joaquin Valley are derived from rocks of marine origin in the Coast Range that are high in salts and boron. Dry conditions make irrigation necessary for nearly all crops grown commercially in the watershed. Salt and boron are leached from these west side soils when irrigation water is applied. The mobilized salts move into the shallow groundwater and subsurface drainage is produced when farmers drain the shallow groundwater from the root zone to protect their crops. The discharge of subsurface drainage has resulted in elevated salt and boron concentrations in the LSJR and certain tributaries. Large quantities of water are imported from the Delta to irrigate much of the west side of the basin. The imported water supplies are relatively high in salts and the water imported to the basin represents a significant portion of the SJR's total salt load. Groundwater accretions to the river are another significant source of salt and boron loading to the LSJR, as ongoing irrigation practices have led to accumulation of salts in the unconfined and semi-confined aquifer that underlies most of the west side of the San Joaquin Valley and lands on the east side of the San Joaquin Valley directly adjacent to the river.

Discharges from managed wetlands also contribute to the LSJR's salt and boron load. The LSJR watershed contains over 130 thousand acres of wetland habitat, most of which are located in the Grassland Watershed. These wetlands are either managed by the California Department of Fish and Game (DFG), United States Fish and Wildlife Service (USFWS) or by water districts on behalf of privately owned duck and gun clubs. Water is applied to maintain the wetlands, and saline discharges occur when flooded wetlands are drained. Other less significant sources of salt and boron loading include municipal and industrial discharges as well as loading from the higher quality east side tributaries. The sources of salt and boron loading and their relative contribution to cumulative water quality degradation are discussed in more detail in the source analysis section.

TMDL development for salt and boron in the LSJR presents unique challenges because of the nature of the pollutants being addressed and because of the way water is managed in the basin. Land management and water delivery practices have exacerbated salt and boron loading to the LSJR. Salt and boron, however, are not conventional pollutants in that they are naturally occurring in the water and soils of the region and their concentrations increase, through evapoconcentration, with each sequential re-use of water in the basin. Additionally, the LSJR flows to the Delta and salts are re-circulated to the basin when Delta water is pumped and delivered back to lands that drain to the LSJR. Supply water from the Delta is relatively high in salts. The salts imported to the LSJR basin from the Delta need to be exported; simply limiting saline discharges through static LAs/reductions could result in a net build-up of salt in the watershed and further deterioration of surface and groundwater quality. Therefore, this TMDL must recognize the unique nature of the LSJR watershed, the need to account for salt inputs to the basin as well as outputs, and the need to export salts by utilizing the assimilative capacity of the river.

Historical Agricultural Drainage Issues

Agricultural drainage problems are not new to the San Joaquin Valley. Concerns regarding inadequate drainage and salt accumulations arose around the turn of the century and date as far back as the 1880s and 1890s (San Joaquin Valley Drainage Program, 1990b). Early irrigation practices involved the intentional over-irrigation of fields to raise the local water table so that subsurface water would be available to crops during a portion of the dry summer season, however, water was applied in excess of plant uptake and consequently some areas became waterlogged. Additionally, evapotranspiration of applied water resulted in salt build up in the soil and shallow groundwater. By the late 1800s, salt accumulations and poor drainage had already adversely impacted agricultural productivity and some areas had to be removed from production (SWRCB, 1987).

Advancements in pumping technology during the 1920's and 1930's led to increased groundwater pumping and accelerated agricultural production in the region. Groundwater withdrawals were mining the groundwater basin (overdrafting) resulting in lowering the water table, which temporarily alleviated the waterlogging problem and allowed for salts to be leached below the crop root zone. In 1951, because of the continued groundwater overdraft, the Delta Mendota Canal (DMC) of the CVP began delivering surface water from northern California and the Delta to the northern SJR Basin. Water delivered by the CVP essentially replaced and supplemented natural river flows that were diverted out of the San Joaquin Basin at Friant Dam (Millerton Lake) and reduced the groundwater overdraft. Large-scale surface and ground water development projects resulted in the rapid expansion of irrigated agriculture on the west side of the SJR; irrigated agriculture increased from 293 thousand acres in 1950 to 402 thousand acres by 1957 (SWRCB, 1987).

Land Use

Agriculture is the primary land use in the LSJR watershed with lesser acreages of wetland and urban areas. According to the latest (1996) complete crop survey information from the Department of Water Resources (DWR), there are approximately 1 million acres of agricultural land use in the LSJR watershed. The LSJR watershed also contains approximately 130 thousand acres of wetlands within the Grassland Ecological Area (GEA). Additional acreage is in either urban, fallow farmland, or in upland wildlife areas that are not wetlands. Urban areas within the LSJR watershed are expanding and the population of the 13 largest cities in the LSJR watershed increased an average of 1.5 percent between 1998 and 1999 (CDF, 1999). Modesto is the largest city in the LSJR watershed, with a current population about 184,600. Other larger urban areas in the LSJR watershed include the cities of Merced (pop. 62,800), Turlock (pop. 51,900), Ceres (pop. 32,400), Atwater (pop. 22,250), and Los Banos (pop. 22,200).

The LSJR Basin consists of areas with markedly different supply water quality, land use patterns, and other factors that may affect water quality. For the purpose of describing these differences, the LSJR basin has been divided into seven subareas. These subareas vary greatly with respect to their land use patterns and relative contribution of salt and boron loads to the LSJR, as discussed in detail in the source analysis.

Hydrology

Precipitation is unevenly distributed throughout the SJR Watershed. About 90 percent of the precipitation falls during the months of November through April. Normal annual precipitation ranges from an average of 8 inches on the valley floor (in the trough of the basin) to about seventy inches at the headwaters in the Sierra Nevada. Precipitation at the higher elevations primarily occurs as snow. Potential evaporation on the valley floor is over 50 inches annually.

The hydrology of the SJR is complex and highly managed through the operation of dams, diversions, and supply conveyances. Water development has fragmented the watershed and greatly altered the natural hydrograph of the river. Runoff from the Sierra Nevada and foothills is regulated and stored in a series of reservoirs on the east side of the SJR. There are fifty-seven major reservoirs in the basin that have the capacity to store over 1 thousand acre-feet (taf) of water; four of these can store over 1 million acre-feet (MAF) each. Friant Dam (Millerton Lake) on the main stem of the upper SJR, which was built in 1942, has a capacity of just over 500 taf. Operation of these reservoirs greatly influence the water quality of the LSJR.

Most of the natural flows from the Upper SJR and its headwaters are diverted at the Friant Dam via the Friant-Kern Canal to irrigate crops outside the SJR Basin. This leaves much of the river dry between Friant Dam and the Mendota Pool, except during periods of wet weather flow and major snow melt. Water is imported to the basin from the southern Delta via the DMC to replace the flows that are diverted out of the basin to the south. Some water in the DMC is delivered directly to the west side of the SJR for agricultural supply, but the majority of DMC water is delivered to the Mendota Pool. Storage in the Mendota Pool is augmented by groundwater pumping from the adjacent aquifer and from incidental upstream releases from Millerton Lake. Water is discharged from the Mendota Pool to irrigation canals that supply farmlands on the west side of the basin. Water is also directly released to the LSJR, and various agricultural users divert water from the SJR between the Mendota Pool and the Sack Dam. Most or all of the remaining flow in the river is diverted at Sack Dam. As a result, the SJR downstream of Sack Dam and upstream of Bear Creek frequently has little or no flow except during flood flows. During non flood-flow periods, this reach of the SJR flows intermittently and is composed of groundwater accretions and agricultural return flows. The SJR downstream of Bear Creek once again becomes a permanent stream that flows all year. The flow in the reach of the SJR downstream of Bear Creek and upstream of the Merced River confluence, however, is dominated by agricultural and wetland return flows and by groundwater accretions. Downstream, the Merced, Tuolumne, and Stanislaus Rivers add substantial flow in the LSJR.

The mean annual discharge for the SJR Basin, as measured at a gaging station near Vernalis, was a little over 3 million acre-feet per year (maf/yr) between 1930 and 1998, but there were large seasonal and annual variations (Figure 1-4). The lowest annual discharge, of approximately 400 taf, occurred in Water Year 1977. The highest annual discharge, of over 15 maf occurred in Water Year 1983. Superimposed on the annual data in Figure 1-4 is the fifteen-year moving average discharge. The fifteen-year moving average helps identify the long-term trends that may be obscured by the annual variability of discharge. There was a significant decrease in the moving average in the 1950s, particularly during the summer irrigation season. This drop in annual and irrigation season discharge occurred following completion of Friant Dam in 1948 when SJR water was diverted for use outside of the SJR Basin. The moving average of the mean annual discharge increased again in the 1970s and early 1980s. In the late 1990s, the fifteen-year moving average was approximately 800 thousand acre-feet per year (taf/yr) lower than in the late 1940s. Reductions in Basin discharge generally occur during the April through August irrigation season.

The actual annual discharge shown in Figure 1-4 is considerably lower than the unimpaired runoff in the Basin. Unimpaired runoff is the runoff that would occur if there were no reservoirs or consumptive use of water. Between 1979 and 1992 the mean annual unimpaired runoff in the basin was 2.4 maf higher than the actual mean annual discharge of 3.7 maf (United States Geological Survey, 1997). The difference is due to consumptive use, attributable mostly to losses from agriculture (DWR, 1994).

Hydrogeology

A 20 to 120 foot clay layer, known as the Corcoran Clay, underlies most of the San Joaquin Valley. The Corcoran Clay ranges in depth from about 200 to 800 feet below the ground surface (Kratzer, 1985). The relatively impervious Corcoran Clay layer creates a boundary between a confined aquifer lying below the clay, and a semi-confined aquifer above the clay. The semi-confined aquifer is comprised of three basic hydrogeologic units that include the Coast Range alluvium, Sierra Nevada sediments, and flood basin deposits. These three fundamental hydrogeologic units each have a different texture, hydrologic property and chemical characteristic. The Coast Range alluvium, which is primarily located on the west side of the LSJR, was derived from the marine rock parent material the makes up the Coast Range. These marine sediments contain naturally high levels of salts, boron and other trace elements. Soils on the east side of the valley trough were predominately derived from the igneous parent material of the Sierra Nevada and, consequently, contain relatively low levels of salts and trace elements. The floodplain deposits consist of a relatively thin and more recent deposit that is mainly located in the valley trough.

The California DWR collected water quality data from wells in the LSJR Basin until 1990 (DWR, 1999). Observation, domestic, and agricultural supply wells of varying depth were sampled. The USGS conducted a comprehensive groundwater quality study that spanned the west side of the San Joaquin Valley in 1984 (Deverel, *et al.,* 1984). Observation wells ranging from 10 to 30 feet below ground surface were sampled. Between these two data sets, a total of 74 shallow wells were sampled between 1980 and 1990; thirty-seven each by the USGS and DWR. The wells were located either adjacent to the LSJR, or in the vicinity of drainages that terminate at the SJR. A number of wells were near Mud Slough (north) and Salt Slough.

Groundwater quality on the west side of the LSJR was found to be of significantly poorer quality than groundwater on the east side of the river. On the west side of the LSJR the average EC was approximately 5,800 micro Siemens per centimeter (μS/cm), and ranged from 570 to 59 thousand μS/cm; the median EC was 1,900 μS/cm. The average boron concentration was 7.7 milligrams per liter (mg/L) and ranged from 0.2 to 120 mg/L; the median boron concentration was 1.2 mg/L. Wells on the east side of the SJR had an average EC of approximately 900 μS/cm and ranged from 290 to 3,200 μS/cm; the median EC was 630 μS/cm. The average boron concentration was 0.3 mg/L, with a range of 0.1 to 0.8 mg/L; the median boron concentration was 0.2 mg/L. Groundwater salinity is highest in the south. Salinity ranged from 800 to 2,300 μS/cm in wells less than five miles from the SJR, in the reach from Mendota Dam to the confluence of the Tuolumne River. North of the Tuolumne River, salinity ranged from 310 to 780 μS/cm in wells within five miles of the SJR.

1.4 Available Data

Since May of 1985 the Regional Board has conducted water quality monitoring in the SJR basin to evaluate the impact of agricultural drainage on the SJR and to assess the water quality of the river with respect to compliance with WQOs. The Regional Board's monitoring program in the LSJR watershed has primarily focused on salinity, boron, and selenium. There have been up to 37 stations monitored in the LSJR watershed at various frequencies since 1985. This monitoring data is available in a series of annual staff reports published by the Regional Board (Chilcott, 2000). In addition to these annual staff reports, extensive water quality data is also available in the following Regional Board staff reports:

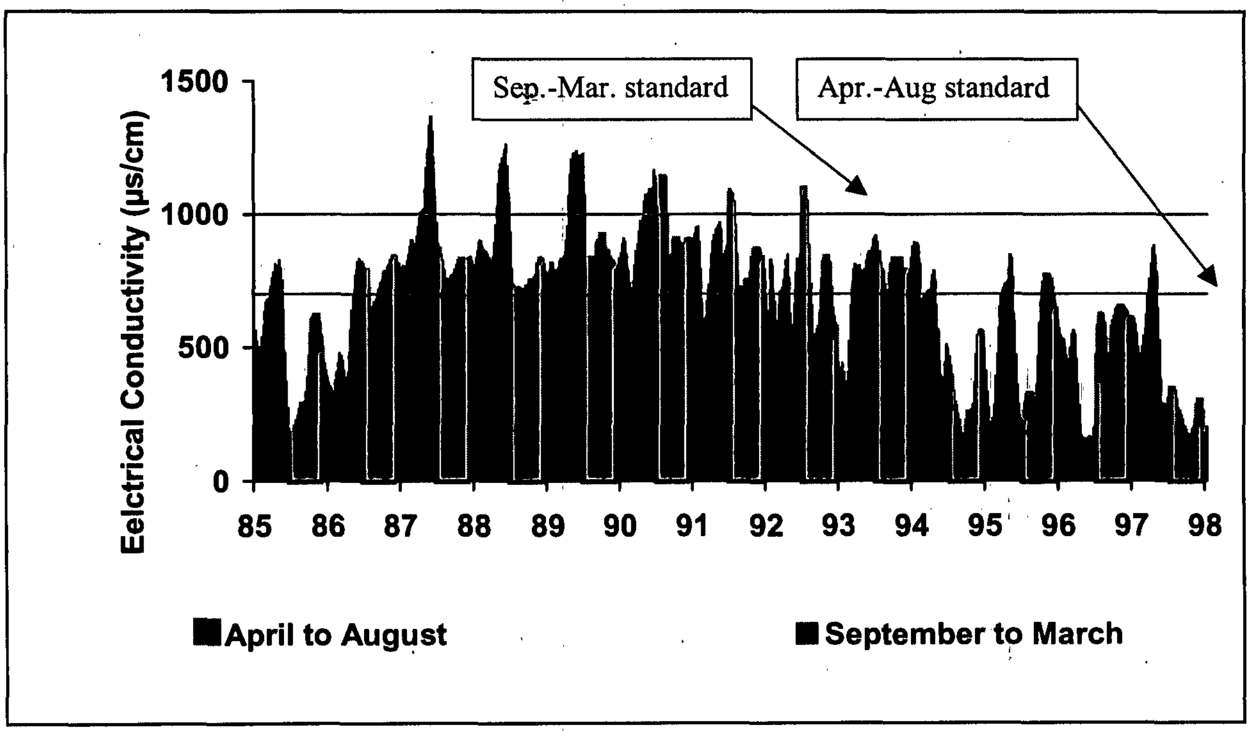
Agricultural Drainage Contribution To Water Quality In The Grassland Watershed of Western Merced County, California: October 1995-September 1997

Loads of Salt, Boron, and Selenium in the Grassland Watershed and LSJR October 1985 to September 1995: Volumes I and II

Compilation of EC, Boron, and Selenium Water Quality Data for the Grassland Watershed and LSJR May 1985 - September 1995

Additionally, the USGS and DWR have collected extensive flow and water quality data from the TMDL project area. The USGS and DWR data used in the report is discussed in the Source analysis.

Figure 1-3: EC for LSJR at Vernalis, 1985-1998



Attachment 3

Appendix A. TDS/EC Data and Sources for six mainstream sites

Appendix to the

Administrative Draft TMDL Report for the Control of Salt and Boron Discharges in the lower San Joaquin River Upstream of Vernalis

This is a Working Draft Copy

Appendix A: TDS/EC Data and Sources for six mainstream sites

The following table provides EC and TDS data from various sites on the San Joaquin River. The numbers and letters in the source data and methods column of the table refer to the descriptions listed below. The following table describes the periods of record for the data at each site.

Site San Joaquin River @	Period of Record Water Year
Lander	1977-2004
Fremont Ford	1986-2004
Hills Ferry	1986-2004
Patterson/Crows Landing	1977-2004
Maze	1986-2004
Vernalis	1977-2004

Data Sources:

1. Oppenheimer, E.I. and L.F. Grober. 2004. Technical TMDL Report, Appendix 1 to the 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 Lower San Joaquin River-Draft Final Staff Report. Appendix A: Methods and Sources. April 2004. Regional Water Quality Control Board, Central Valley Region. Sacramento, CA.

2. Grober, L.F., J. Karkoski, and L. Dinkler. 1998. Loads of Salt, Boron, and Selenium in the Grassland Watershed and Lower San Joaquin River, October 1985 to September 1995 – Volume I: Load Calculations. February 1998. Regional Water Quality Control Board, Central Valley Region. Sacramento, CA.

3. RWQCB. 2006. Surface Water Ambient Monitoring Program (SWAMP). Website: http://www.waterboards.ca.gov/centralvalley/programs/agunit/swamp/ sjrsites.html. Website accessed on 15 March 2006. Regional Water Quality Control Board, Central Valley Region. Sacramento, CA.

4. DWR. 2005. California Data Exchange Center. Website http://cdec.water.ca.gov. Website accessed on 15 March 2006. California Department of Water Resources. Sacramento, CA.

5. Chilcott, J.E., L.F. Grober, J.L. Eppinger, and A. Ramirez. 1998. Water Quality of the Lower San Joaquin River: Lander Avenue to Vernalis, October 1995 through September 1997. December 1998. Regional Water Quality Control Board, Central Valley Region Report. Sacramento, CA.

6. Chilcott, J.E. 2000. Water Quality of the Lower San Joaquin River: Lander Avenue to Vernalis October 1997- September 1998. May 2000. Regional Water Quality Control Board, Central Valley Region. Sacramento, CA.

7. Crader, P.G., J.L. Eppinger, and J.E. Chilcott. 2002. Agricultural Drainage Contribution to Water Quality in the Grassland Watershed of Western Merced County, California: October 1998 - September 2000; Water Years 1999 & 2000. April 2002. Regional Water Quality Control Board, Central Valley Region. Sacramento, CA.

Data Methods:

A. TDS/EC Conversions

- Calculations:
    1. EC = TDS/Conversion Factor
    2. TDS = EC(Conversion Factor)

Conversion Table

Site	Conversion Factor	Source
SJR at Lander	0.64	85-1 Report
SJR at Fremont Ford	0.64	85-1 Report
SJR at Hills Ferry	0.62	85-1 Report
SJR near Patterson/Crows Landing	0.62	10 Year Load Report
SJR at Maze	0.60	85-1 Report
SJR near Vernalis	0.61	10 Year Load Report

B. SWAMP/CDEC EC Data Converted to Monthly EC Average

C. Flow Weighted EC – Equation from 10 Year Load Report:
"When establishing a representative concentration [of a constituent] for a flowing stream over a given period of time, the concentration data should be flow weighted." The calculation for a monthly flow weighted EC value is the sum of the flow values multiplied by the sum of the EC values, divided by the sum of the flow values (Grober, L.F., et al, 1998).

D. Flow Data from DWR

E. Flow Data from USGS

F. SWAMP EC: October 85 – September 95 Lab EC used from unpublished data (Crader, Phil). October 95 – September 04 Field EC used from online SWAMP database.

G. Hills Ferry Grassland Bypass Loads Subtracted

San Joaquin River at Lander Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Oct-76	659	1,029	
Nov-76	515	805	
Dec-76	603	942	
Jan-77	513	802	
Feb-77	673	1,051	
Mar-77	546	853	**1, A**
Apr-77	699	1,092	
May-77	793	1,240	
Jun-77	1,171	1,830	
Jul-77	1,725	2,696	
Aug-77	931	1,455	
Sep-77	1,037	1,620	
Oct-77	1,398	2,184	
Nov-77	1,001	1,565	
Dec-77	747	1,167	
Jan-78	168	263	
Feb-78	93	145	
Mar-78	75	116	**1, A**
Apr-78	61	95	
May-78	70	109	
Jun-78	137	213	
Jul-78	427	667	
Aug-78	443	692	
Sep-78	259	404	
Oct-78	294	460	
Nov-78	428	669	
Dec-78	327	510	
Jan-79	146	228	
Feb-79	140	219	
Mar-79	157	245	**1, A**
Apr-79	228	356	
May-79	275	429	
Jun-79	459	717	
Jul-79	418	653	
Aug-79	468	731	
Sep-79	267	418	
Oct-79	283	442	
Nov-79	517	807	
Dec-79	423	660	
Jan-80	98	153	
Feb-80	79	124	
Mar-80	65	102	**1, A**
Apr-80	137	214	
May-80	117	183	
Jun-80	223	349	
Jul-80	182	285	
Aug-80	355	554	
Sep-80	247	387	
Oct-80	274	428	
Nov-80	469	733	
Dec-80	473	739	
Jan-81	345	539	
Feb-81	318	497	
Mar-81	217	339	**1, A**

San Joaquin River at Lander Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Apr-81	376	587	
May-81	395	617	
Jun-81	581	908	
Jul-81	602	941	
Aug-81	550	859	
Sep-81	434	679	
Oct-81	377	589	
Nov-81	358	559	
Dec-81	317	496	
Jan-82	163	255	
Feb-82	154	241	
Mar-82	143	224	**1, A**
Apr-82	65	102	
May-82	80	124	
Jun-82	170	266	
Jul-82	255	399	
Aug-82	380	594	
Sep-82	188	294	
Oct-82	188	293	
Nov-82	115	180	
Dec-82	67	104	
Jan-83	66	104	
Feb-83	57	89	
Mar-83	51	80	**1, A**
Apr-83	59	92	
May-83	65	101	
Jun-83	64	99	
Jul-83	72	113	
Aug-83	161	251	
Sep-83	119	185	
Oct-83	100	156	
Nov-83	100	157	
Dec-83	80	125	
Jan-84	70	109	
Feb-84	181	283	
Mar-84	240	375	**1, A**
Apr-84	254	397	
May-84	280	437	
Jun-84	335	524	
Jul-84	482	753	
Aug-84	350	546	
Sep-84	260	406	
Oct-84	100	156	
Nov-84	213	333	
Dec-84	325	508	
Jan-85	438	684	
Feb-85	443	692	
Mar-85	514	803	**1, A**
Apr-85	585	914	
May-85	657	1,027	
Jun-85	617	964	
Jul-85	799	1,248	
Aug-85	429	670	
Sep-85	120	188	
Oct-85	189	295	

San Joaquin River at Lander Monthly Average TDS and EC for WY 1977-2004

Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Nov-85	431	673	
Dec-85	262	409	
Jan-86	431	673	
Feb-86	84	131	
Mar-86	70	109	**1, A**
Apr-86	51	80	
May-86	123	192	
Jun-86	116	181	
Jul-86	383	598	
Aug-86	187	292	
Sep-86	100	156	
Oct-86	126	197	
Nov-86	498	778	
Dec-86	453	708	
Jan-87	401	627	
Feb-87	245	383	
Mar-87	495	773	**1, A**
Apr-87	1,180	1,844	
May-87	726	1,134	
Jun-87	690	1,078	
Jul-87	803	1,255	
Aug-87	831	1,298	
Sep-87	237	370	
Oct-87	362	566	
Nov-87	881	1,377	
Dec-87	579	905	
Jan-88	315	492	
Feb-88	694	1,084	
Mar-88	768	1,200	**1, A**
Apr-88	964	1,506	
May-88	844	1,319	
Jun-88	1,060	1,656	
Jul-88	973	1,520	
Aug-88	956	1,494	
Sep-88	875	1,367	
Oct-88	900	1,406	
Nov-88	900	1,406	
Dec-88	900	1,406	
Jan-89	900	1,406	
Feb-89	900	1,406	
Mar-89	900	1,406	**1, A**
Apr-89	900	1,406	
May-89	900	1,406	
Jun-89	900	1,406	
Jul-89	900	1,406	
Aug-89	900	1,406	
Sep-89	900	1,406	
Oct-89	1,709	2,670	
Nov-89	641	1,002	
Dec-89	845	1,320	
Jan-90	854	1,334	
Feb-90	473	739	
Mar-90	866	1,353	**1, A**
Apr-90	1,319	2,061	
May-90	1,297	2,027	

San Joaquin River at Lander Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jun-90	833	1,302	
Jul-90	1,595	2,492	
Aug-90	1,392	2,175	
Sep-90	1,450	2,266	
Oct-90	2,080	3,250	
Nov-90	2,116	3,306	
Dec-90	2,118	3,309	
Jan-91	1,930	3,016	
Feb-91	1,479	2,311	
Mar-91	208	325	**1, A**
Apr-91	698	1,091	
May-91	1,356	2,119	
Jun-91	1,259	1,967	
Jul-91	1,173	1,833	
Aug-91	1,252	1,956	
Sep-91	1,616	2,525	
Oct-91	2,500	3,906	
Nov-91	800	1,250	
Dec-91	700	1,094	
Jan-92	700	1,094	
Feb-92	850	1,328	
Mar-92	650	1,016	**1, A**
Apr-92	800	1,250	
May-92	1,050	1,641	
Jun-92	900	1,406	
Jul-92	750	1,172	
Aug-92	700	1,094	
Sep-92	750	1,172	
Oct-92	2,585	4,039	
Nov-92	2,617	4,089	
Dec-92	2,530	3,953	
Jan-93	107	167	
Feb-93	147	230	
Mar-93	376	588	**1, A**
Apr-93	207	323	
May-93	974	1,522	
Jun-93	628	981	
Jul-93	828	1,294	
Aug-93	783	1,223	
Sep-93	871	1,361	
Oct-93	186	291	
Nov-93	185	289	
Dec-93	621	970	
Jan-94	466	728	
Feb-94	206	322	
Mar-94	400	625	**1, A**
Apr-94	634	991	
May-94	697	1,089	
Jun-94	880	1,375	
Jul-94	914	1,428	
Aug-94	876	1,369	
Sep-94	944	1,475	
Oct-94	1,301	2,033	
Nov-94	678	1,059	
Dec-94	866	1,354	

San Joaquin River at Lander Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jan-95	80	126	
Feb-95	382	597	
Mar-95	129	202	**1, A**
Apr-95	59	92	
May-95	44	68	
Jun-95	105	164	
Jul-95	39	62	
Aug-95	193	301	
Sep-95	104	162	
Oct-95	97	151	
Nov-95	189	295	
Dec-95	222	347	
Jan-96	371	580	
Feb-96	149	233	
Mar-96	96	151	**1, A**
Apr-96	353	552	
May-96	67	104	
Jun-96	306	479	
Jul-96	304	475	
Aug-96	283	443	
Sep-96	164	257	
Oct-96	144	225	
Nov-96	243	380	
Dec-96	89	138	
Jan-97	66	103	
Feb-97	60	94	
Mar-97	142	222	
Apr-97	502	784	**1, A**
May-97	859	1,343	
Jun-97	763	1,192	
Jul-97	667	1,042	
Aug-97	682	1,065	
Sep-97	853	1,332	
Oct-97	408	637	
Nov-97	439	686	
Dec-97	419	655	
Jan-98	186	290	
Feb-98	114	177	
Mar-98	113	176	**3, A, B, C, D**
Apr-98	87	137	
May-98	57	90	
Jun-98	44	69	
Jul-98	42	65	
Aug-98	215	336	
Sep-98	149	233	
Oct-98	137	214	
Nov-98	263	411	
Dec-98	85	132	
Jan-99	461	721	
Feb-99	279	436	
Mar-99	604	944	**3, A, B, C, D**
Apr-99	334	523	
May-99	812	1,268	
Jun-99	862	1,347	
Jul-99	868	1,356	

San Joaquin River at Lander Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Aug-99	734	1,147	
Sep-99	565	882	
Oct-99	1,019	1,592	
Nov-99	681	1,064	
Dec-99	960	1,500	
Jan-00	138	215	
Feb-00	117	182	
Mar-00	145	226	3, A, B, C, D
Apr-00	337	527	
May-00	578	903	
Jun-00	678	1,059	
Jul-00	489	764	
Aug-00	743	1,162	
Sep-00	522	816	
Oct-00	561	877	
Nov-00	129	202	
Dec-00	704	1,100	
Jan-01	433	677	
Feb-01	486	760	
Mar-01	483	754	4, A, B, C, D
Apr-01	532	832	
May-01	991	1,548	
Jun-01	1,026	1,603	
Jul-01	843	1,317	
Aug-01	821	1,283	
Sep-01	882	1,378	
Oct-01	851	1,330	
Nov-01	700	1,094	
Dec-01	417	651	
Jan-02	304	474	
Feb-02	622	972	
Mar-02	1,021	1,596	4, A, B, C, D
Apr-02	966	1,510	
May-02	961	1,501	
Jun-02	1,127	1,762	
Jul-02	1,266	1,978	
Aug-02	1,576	2,463	
Sep-02	1,079	1,686	
Oct-02	1,091	1,704	
Nov-02	625	976	
Dec-02	267	417	
Jan-03	251	392	
Feb-03	851	1,329	4, A, B, C, D
Mar-03	1,152	1,800	
Apr-03	670	1,047	
May-03	921	1,439	
Jun-03	1,123	1,755	
Jul-03	937	1,464	
Aug-03	805	1,258	
Sep-03	1,137	1,776	
Oct-03	764	1,194	
Nov-03	584	912	
Dec-03	299	467	
Jan-04	207	323	
Feb-04	328	513	

San Joaquin River at Lander Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Mar-04	403	630	**4, A, B, C, D**
Apr-04	625	977	
May-04	659	1,029	
Jun-04	627	979	
Jul-04	546	853	
Aug-04	554	865	
Sep-04	759	1,186	

San Joaquin River at Fremont Ford Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Oct-85	922	1,440	
Nov-85			
Dec-85	1,194	1,865	
Jan-86	1,291	2,017	
Feb-86	746	1,165	
Mar-86	141	220	**3, A, B, F**
Apr-86	104	162	
May-86	218	340	
Jun-86	386	603	
Jul-86			
Aug-86	602	940	
Sep-86	502	785	
Oct-86			
Nov-86			
Dec-86			
Jan-87	1,408	2,200	
Feb-87	1,843	2,880	
Mar-87			**3, A, B, F**
Apr-87	1,402	2,190	
May-87	1,075	1,680	
Jun-87	1,018	1,590	
Jul-87	1,067	1,667	
Aug-87	1,030	1,610	
Sep-87	989	1,545	
Oct-87	928	1,450	
Nov-87	1,221	1,908	
Dec-87	1,667	2,605	
Jan-88	1,845	2,883	
Feb-88	1,728	2,700	
Mar-88	1,446	2,260	**3, A, B, F**
Apr-88	1,344	2,100	
May-88	1,248	1,950	
Jun-88	1,112	1,738	
Jul-88	1,328	2,075	
Aug-88	1,151	1,798	
Sep-88	1,092	1,706	
Oct-88	959	1,498	
Nov-88	1,343	2,098	
Dec-88	1,587	2,480	
Jan-89	1,792	2,800	
Feb-89	1,570	2,453	
Mar-89	1,585	2,476	**3, A, B, F**
Apr-89	1,539	2,405	
May-89	1,330	2,078	
Jun-89	1,264	1,975	
Jul-89	1,141	1,783	
Aug-89	947	1,480	
Sep-89	1,033	1,614	
Oct-89	1,042	1,628	
Nov-89	1,122	1,753	
Dec-89	1,564	2,443	
Jan-90	1,877	2,933	
Feb-90	1,709	2,670	
Mar-90	1,670	2,610	**3, A, B, F**

San Joaquin River at Fremont Ford Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Apr-90	1,766	2,760	
May-90	1,656	2,588	
Jun-90	1,718	2,685	
Jul-90	1,213	1,895	
Aug-90	1,120	1,750	
Sep-90	860	1,343	
Oct-90	864	1,350	
Nov-90	1,071	1,673	
Dec-90	2,301	3,595	
Jan-91	2,523	3,942	
Feb-91	2,266	3,540	
Mar-91	1,200	1,875	**3, A, B, F**
Apr-91	1,924	3,006	
May-91	1,861	2,908	
Jun-91	1,715	2,680	
Jul-91	1,096	1,712	
Aug-91	907	1,417	
Sep-91	1,330	2,078	
Oct-91	1,642	2,566	
Nov-91	1,126	1,760	
Dec-91	1,757	2,746	
Jan-92	2,216	3,462	
Feb-92	1,514	2,365	
Mar-92	1,674	2,616	**3, A, B, F**
Apr-92	1,768	2,763	
May-92	2,022	3,160	
Jun-92	1,746	2,728	
Jul-92	1,228	1,918	
Aug-92	1,180	1,843	
Sep-92	1,517	2,370	
Oct-92	1,490	2,328	
Nov-92	1,734	2,710	
Dec-92	2,069	3,233	
Jan-93	618	966	
Feb-93	1,104	1,725	
Mar-93	1,125	1,758	**3, A, B, F**
Apr-93	1,171	1,829	
May-93	1,687	2,636	
Jun-93	1,520	2,375	
Jul-93	1,335	2,086	
Aug-93	1,197	1,870	
Sep-93	1,047	1,636	
Oct-93	906	1,416	
Nov-93	1,025	1,601	
Dec-93	1,283	2,004	
Jan-94	1,516	2,368	
Feb-94	1,218	1,903	
Mar-94	1,664	2,600	**3, A, B, F**
Apr-94	1,836	2,868	
May-94	1,839	2,874	
Jun-94	1,949	3,046	
Jul-94	1,668	2,606	
Aug-94	1,477	2,308	
Sep-94	1,578	2,465	
Oct-94	1,381	2,158	

San Joaquin River at Fremont Ford Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Nov-94	1,645	2,570	
Dec-94	1,756	2,744	
Jan-95	1,619	2,530	
Feb-95	1,698	2,653	
Mar-95	1,135	1,773	**3, A, B, F**
Apr-95	99	154	
May-95	49	77	
Jun-95	394	615	
Jul-95	285	445	
Aug-95	733	1,145	
Sep-95	574	897	
Oct-95	437	683	
Nov-95	988	1,543	
Dec-95	1,007	1,573	
Jan-96	1,311	2,048	
Feb-96	682	1,065	
Mar-96	511	798	**3, A, B, F**
Apr-96	1,082	1,690	
May-96	1,113	1,739	
Jun-96	1,122	1,753	
Jul-96	1,112	1,738	
Aug-96	879	1,374	
Sep-96	666	1,041	
Oct-96	569	889	
Nov-96	745	1,164	
Dec-96	374	585	
Jan-97	80	125	
Feb-97	61	96	
Mar-97	433	677	**3, A, B, F**
Apr-97	1,149	1,795	
May-97	1,132	1,768	
Jun-97	1,043	1,630	
Jul-97	762	1,191	
Aug-97	639	999	
Sep-97	844	1,318	
Oct-97	772	1,206	
Nov-97	986	1,540	
Dec-97	1,114	1,740	
Jan-98	968	1,512	
Feb-98	146	228	
Mar-98	218	340	**3, A, B, F**
Apr-98	105	164	
May-98	59	92	
Jun-98	46	72	
Jul-98	101	158	
Aug-98	417	652	
Sep-98	388	607	
Oct-98	474	741	
Nov-98	646	1,009	
Dec-98	447	698	
Jan-99	806	1,260	
Feb-99	589	920	
Mar-99	950	1,484	**3, A, B, F**
Apr-99	982	1,535	
May-99	970	1,515	

San Joaquin River at Fremont Ford Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jun-99	927	1,448	
Jul-99	717	1,120	
Aug-99	646	1,010	
Sep-99	645	1,008	
Oct-99	778	1,215	
Nov-99	949	1,483	
Dec-99	1,290	2,016	
Jan-00	1,245	1,945	
Feb-00	745	1,164	
Mar-00	522	816	3, A, B, F
Apr-00	891	1,392	
May-00	911	1,423	
Jun-00	768	1,200	
Jul-00	604	943	
Aug-00	636	994	
Sep-00	733	1,145	
Oct-00	772	1,207	
Nov-00	885	1,383	
Dec-00	1,096	1,713	
Jan-01	1,098	1,715	
Feb-01	986	1,540	
Mar-01	844	1,318	3, A, B, F
Apr-01	1,066	1,665	
May-01	1,033	1,614	
Jun-01	818	1,278	
Jul-01	822	1,285	
Aug-01	796	1,244	
Sep-01	1,315	2,055	
Oct-01	995	1,554	
Nov-01	989	1,545	
Dec-01	1,216	1,900	
Jan-02	640	1,000	
Feb-02	1,026	1,603	
Mar-02	1,252	1,957	3, A, B, F
Apr-02	1,574	2,459	
May-02	1,112	1,738	
Jun-02	841	1,314	
Jul-02	765	1,196	
Aug-02	751	1,174	
Sep-02	950	1,484	
Oct-02	750	1,172	
Nov-02	857	1,339	
Dec-02	1,103	1,724	
Jan-03	712	1,113	
Feb-03	1,457	2,277	
Mar-03	1,002	1,565	3, A, B, F
Apr-03	1,240	1,938	
May-03	1,298	2,028	
Jun-03	959	1,499	
Jul-03	760	1,188	
Aug-03	694	1,085	
Sep-03	799	1,249	
Oct-03	1,551	2,424	
Nov-03	879	1,373	
Dec-03	1,052	1,643	

San Joaquin River at Fremont Ford Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jan-04	1,207	1,886	
Feb-04	1,125	1,758	
Mar-04	1,020	1,593	**3, A, B, F**
Apr-04	1,044	1,632	
May-04	1,427	2,230	
Jun-04	1,096	1,712	
Jul-04	852	1,331	
Aug-04	729	1,139	
Sep-04	1,007	1,574	

San Joaquin River at Hills Ferry Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Oct-85	912	1,471	
Nov-85	1,200	1,935	
Dec-85	1,440	2,323	
Jan-86	1,500	2,419	
Feb-86	1,050	1,694	
Mar-86	336	542	A
Apr-86	249	402	
May-86	342	552	
Jun-86	538	868	
Jul-86			
Aug-86	720	1,161	
Sep-86	498	803	
Oct-86			
Nov-86			
Dec-86			
Jan-87	1,320	2,129	
Feb-87	1,560	2,516	
Mar-87			A
Apr-87			
May-87			
Jun-87	1,026	1,655	
Jul-87	1,000	1,613	
Aug-87	1,158	1,868	
Sep-87	1,002	1,616	
Oct-87	927	1,495	
Nov-87	1,155	1,863	
Dec-87	1,422	2,294	
Jan-88	1,730	2,790	
Feb-88	1,785	2,879	
Mar-88	1,494	2,410	A
Apr-88	1,344	2,168	
May-88	1,146	1,848	
Jun-88	1,145	1,847	
Jul-88	1,196	1,929	
Aug-88	1,085	1,750	
Sep-88	1,030	1,661	
Oct-88	912	1,471	
Nov-88	1,308	2,110	
Dec-88	1,425	2,298	
Jan-89	1,722	2,777	
Feb-89	1,578	2,545	
Mar-89	1,558	2,513	A
Apr-89	1,298	2,094	
May-89	1,138	1,835	
Jun-89	1,170	1,887	
Jul-89	1,068	1,723	
Aug-89	914	1,474	
Sep-89	977	1,576	
Oct-89	945	1,524	
Nov-89	1,022	1,648	
Dec-89	1,322	2,132	
Jan-90	1,721	2,776	
Feb-90	1,728	2,787	
Mar-90	1,823	2,940	A

San Joaquin River at Hills Ferry Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Apr-90	1,793	2,892	
May-90	1,594	2,571	
Jun-90	1,620	2,613	
Jul-90	1,161	1,873	
Aug-90	1,117	1,802	
Sep-90	774	1,248	
Oct-90	872	1,406	
Nov-90	1,100	1,774	
Dec-90	2,165	3,492	
Jan-91	2,334	3,765	
Feb-91	2,189	3,531	
Mar-91	1,226	1,977	A
Apr-91	1,880	3,032	
May-91	1,771	2,856	
Jun-91	1,625	2,621	
Jul-91	1,271	2,050	
Aug-91	1,181	1,905	
Sep-91	1,386	2,235	
Oct-91	1,499	2,418	
Nov-91	1,037	1,673	
Dec-91	1,698	2,739	
Jan-92	1,852	2,987	
Feb-92	1,410	2,274	
Mar-92	1,613	2,602	A
Apr-92	1,747	2,818	
May-92	1,938	3,126	
Jun-92	1,737	2,802	
Jul-92	1,470	2,371	
Aug-92	1,298	2,094	
Sep-92	1,458	2,352	
Oct-92	1,404	2,265	
Nov-92	1,640	2,645	
Dec-92	1,917	3,092	
Jan-93	630	1,016	
Feb-93	1,032	1,665	
Mar-93	1,502	2,423	A
Apr-93	1,130	1,823	
May-93	1,624	2,619	
Jun-93	1,484	2,394	
Jul-93	1,268	2,045	
Aug-93	1,057	1,705	
Sep-93	1,166	1,881	
Oct-93	818	1,319	
Nov-93	937	1,511	
Dec-93	1,127	1;818	
Jan-94	1,331	2,147	
Feb-94	1,106	1,784	
Mar-94	1,597	2,576	A
Apr-94	1,773	2,860	
May-94	1,712	2,761	
Jun-94	1,774	2,861	
Jul-94	1,424	2,297	
Aug-94	1,296	2,090	
Sep-94	1,422	2,294	
Oct-94	1,217	1,963	

San Joaquin River at Hills Ferry Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Nov-94	1,424	2,297	A
Dec-94	1,463	2,360	
Jan-95	777	1,253	
Feb-95	1,608	2,594	
Mar-95	1,083	1,747	
Apr-95	305	492	
May-95	211	340	
Jun-95	379	611	
Jul-95	318	513	
Aug-95	664	1,071	
Sep-95	614	990	
Oct-95	379	612	3, A, B, C, E
Nov-95	816	1,316	
Dec-95	975	1,573	
Jan-96	1,352	2,181	
Feb-96	485	783	
Mar-96	480	774	
Apr-96	1,096	1,768	
May-96	821	1,324	
Jun-96	1,192	1,922	
Jul-96	1,090	1,758	
Aug-96	844	1,362	
Sep-96	722	1,164	
Oct-96	786	1,267	3, A, B, C, E
Nov-96	833	1,343	
Dec-96	480	774	
Jan-97	340	548	
Feb-97	218	352	
Mar-97	756	1,219	
Apr-97	1,555	2,508	
May-97	1,402	2,261	
Jun-97	1,488	2,400	
Jul-97	1,061	1,712	
Aug-97	926	1,494	
Sep-97	1,022	1,648	
Oct-97	951	1,534	3, A, B, C, E
Nov-97	1,062	1,713	
Dec-97	1,105	1,783	
Jan-98	677	1,092	
Feb-98	537	866	
Mar-98	510	823	
Apr-98	383	617	
May-98	267	431	
Jun-98	162	262	
Jul-98	200	322	
Aug-98	715	1,154	
Sep-98	704	1,135	
Oct-98	635	1,024	3, A, B, C, E
Nov-98	754	1,216	
Dec-98	646	1,042	
Jan-99	932	1,504	
Feb-99	729	1,175	
Mar-99	1,156	1,864	
Apr-99	1,050	1,693	
May-99	1,075	1,734	

San Joaquin River at Hills Ferry Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jun-99	1,364	2,200	
Jul-99	1,213	1,956	
Aug-99	1,043	1,682	
Sep-99	924	1,491	
Oct-99	871	1,405	
Nov-99			
Dec-99			
Jan-00			
Feb-00			
Mar-00	523	843	**3, A, B, C, E**
Apr-00			
May-00			
Jun-00	1,238	1,997	
Jul-00			**4, A, B, C, E**
Aug-00	912	1,471	
Sep-00			
Oct-00	811	1,308	
Nov-00	1,159	1,870	
Dec-00	1,298	2,094	
Jan-01	1,305	2,105	
Feb-01	1,335	2,154	
Mar-01	1,228	1,980	**4, A, B, C, E**
Apr-01	1,158	1,867	
May-01	1,113	1,795	
Jun-01	1,278	2,061	
Jul-01	1,071	1,727	
Aug-01	1,225	1,976	
Sep-01	1,109	1,788	
Oct-01	1,115	1,798	
Nov-01	1,134	1,829	
Dec-01	1,482	2,391	
Jan-02	1,597	2,575	
Feb-02	1,457	2,350	
Mar-02	1,628	2,626	**4, A, B, C, E**
Apr-02	1,571	2,534	
May-02	1,394	2,248	
Jun-02	1,495	2,411	
Jul-02	893	1,441	
Aug-02	1,166	1,880	
Sep-02	1,039	1,676	
Oct-02	1,210	1,951	
Nov-02	1,052	1,696	
Dec-02	925	1,492	
Jan-03	1,355	2,186	
Feb-03			
Mar-03	1,457	2,350	**4, A, B, C, E**
Apr-03	1,837	2,963	
May-03	1,368	2,207	
Jun-03	1,172	1,890	
Jul-03	982	1,584	
Aug-03	944	1,522	
Sep-03	982	1,584	
Oct-03	1,011	1,630	
Nov-03	998	1,610	
Dec-03			

San Joaquin River at Hills Ferry Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jan-04	1,389	2,240	
Feb-04	930	1,500	
Mar-04	1,324	2,135	**4, A, B, C, E**
Apr-04	1,817	2,930	
May-04	1,231	1,985	
Jun-04	949	1,530	
Jul-04	1,175	1,895	
Aug-04	719	1,160	
Sep-04	1,352	2,180	

San Joaquin River at Hills Ferry Monthly Average TDS and EC for WY 1986-2004 (GBP subtracted)			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Oct-95	379	612	
Nov-95	816	1,316	
Dec-95	975	1,573	
Jan-96	1,352	2,181	
Feb-96	485	783	**3,A, B, C, E**
Mar-96	480	774	
Apr-96	1,096	1,768	
May-96	821	1,324	
Jun-96	1,192	1,922	
Jul-96	1,090	1,758	
Aug-96	844	1,362	
Sep-96	715	1,154	**3,A,B,C,E,G**
Oct-96	640	1,033	
Nov-96	716	1,155	
Dec-96	437	705	
Jan-97	324	522	
Feb-97	192	310	
Mar-97	660	1,064	**3,A,B,C,E,G**
Apr-97	1,217	1,963	
May-97	1,088	1,755	
Jun-97	950	1,532	
Jul-97	577	930	
Aug-97	567	915	
Sep-97	836	1,349	
Oct-97	720	1,161	
Nov-97	877	1,415	
Dec-97	950	1,532	
Jan-98	601	970	
Feb-98	500	806	
Mar-98	448	722	**3,A,B,C,E,G**
Apr-98	341	550	
May-98	225	363	
Jun-98	134	216	
Jul-98	153	246	
Aug-98	546	881	
Sep-98	584	942	
Oct-98	534	861	
Nov-98	603	973	
Dec-98	548	884	
Jan-99	830	1,339	
Feb-99	627	1,011	
Mar-99	996	1,606	**3,A,B,C,E,G**
Apr-99	929	1,498	
May-99	885	1,427	
Jun-99	944	1,522	
Jul-99	664	1,071	
Aug-99	555	895	
Sep-99	595	960	
Oct-99	687	1,108	
Nov-99			
Dec-99			
Jan-00			
Feb-00			
Mar-00	448	723	**3,A,B,C,E,G**

San Joaquin River at Hills Ferry Monthly Average TDS and EC for WY 1986-2004 (GBP subtracted)			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Apr-00			
May-00			
Jun-00	867	1,398	
Jul-00			**4,A,B,C,E,G**
Aug-00	522	842	
Sep-00			
Oct-00	725	1,169	
Nov-00	1,079	1,740	
Dec-00	1,156	1,864	
Jan-01	1,135	1,830	
Feb-01	1,063	1,715	
Mar-01	1,045	1,686	**4,A,B,C,E,G**
Apr-01	1,016	1,639	
May-01	972	1,567	
Jun-01	877	1,415	
Jul-01	498	804	
Aug-01	556	896	
Sep-01	613	988	
Oct-01	994	1,604	
Nov-01	1,045	1,685	
Dec-01	1,376	2,220	
Jan-02	1,495	2,412	
Feb-02	1,221	1,970	
Mar-02	1,378	2,222	**4,A,B,C,E,G**
Apr-02	1,333	2,150	
May-02	1,220	1,968	
Jun-02	1,089	1,756	
Jul-02	392	633	
Aug-02	681	1,098	
Sep-02	663	1,070	
Oct-02	1,065	1,718	
Nov-02	937	1,511	
Dec-02	817	1,318	
Jan-03	1,239	1,999	
Feb-03			
Mar-03	1,226	1,977	**4,A,B,C,E,G**
Apr-03	1,624	2,620	
May-03	1,184	1,909	
Jun-03	753	1,215	
Jul-03	481	776	
Aug-03	481	775	
Sep-03	679	1,095	
Oct-03	788	1,271	
Nov-03	714	1,152	
Dec-03			
Jan-04	1,092	1,761	
Feb-04	500	807	
Mar-04	1,146	1,848	**4,A,B,C,E,G**
Apr-04	1,682	2,713	
May-04			
Jun-04	261	421	
Jul-04	474	764	
Aug-04	124	200	
Sep-04			

San Joaquin River near Patterson/Crows Landing Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Oct-76	751	1,211	
Nov-76	775	1,250	
Dec-76	780	1,258	
Jan-77	1,270	2,048	
Feb-77	1,760	2,839	
Mar-77	1,624	2,619	A
Apr-77	1,488	2,400	
May-77	1,351	2,179	
Jun-77	1,215	1,960	
Jul-77	1,079	1,740	
Aug-77	943	1,521	
Sep-77	989	1,595	
Oct-77	1,035	1,669	
Nov-77	1,082	1,745	
Dec-77	1,128	1,819	
Jan-78	1,174	1,894	
Feb-78	1,220	1,968	
Mar-78	1,126	1,816	A
Apr-78	1,031	1,663	
May-78	937	1,511	
Jun-78	842	1,358	
Jul-78	748	1,206	
Aug-78	653	1,053	
Sep-78	652	1,052	
Oct-78	153	247	
Nov-78	186	300	
Dec-78	449	724	
Jan-79	669	1,079	
Feb-79	578	932	
Mar-79	335	540	A
Apr-79	537	866	
May-79	554	894	
Jun-79	495	798	
Jul-79	599	966	
Aug-79	589	950	
Sep-79	504	813	
Oct-79	416	671	
Nov-79	576	929	
Dec-79	592	955	
Jan-80	366	590	
Feb-80	237	382	
Mar-80	147	237	A
Apr-80	290	468	
May-80	205	331	
Jun-80	464	748	
Jul-80	561	905	
Aug-80	578	932	
Sep-80	297	479	
Oct-80	379	611	
Nov-80	514	829	
Dec-80	597	963	
Jan-81	859	1,385	
Feb-81	1,205	1,944	
Mar-81	953	1,537	A

San Joaquin River near Patterson/Crows Landing Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Apr-81	997	1,608	
May-81	699	1,127	
Jun-81	736	1,187	
Jul-81	672	1,084	
Aug-81	722	1,165	
Sep-81	649	1,047	
Oct-81	676	1,090	
Nov-81	717	1,156	
Dec-81	950	1,532	
Jan-82	743	1,198	
Feb-82	688	1,110	
Mar-82	403	650	A
Apr-82	148	239	
May-82	239	385	
Jun-82	331	534	
Jul-82	422	681	
Aug-82	513	827	
Sep-82	318	513	
Oct-82	216	348	
Nov-82	306	494	
Dec-82	173	279	
Jan-83	187	302	
Feb-83	187	302	
Mar-83	178	287	A
Apr-83	165	266	
May-83	126	203	
Jun-83	78	126	
Jul-83	170	274	
Aug-83	324	523	
Sep-83	144	232	
Oct-83	112	181	
Nov-83	290	468	
Dec-83	211	340	
Jan-84	198	319	
Feb-84	558	900	
Mar-84	753	1,215	A
Apr-84	676	1,090	
May-84	560	903	
Jun-84	517	834	
Jul-84	554	894	
Aug-84	496	800	
Sep-84	357	576	
Oct-84	292	471	
Nov-84	518	835	
Dec-84	518	835	
Jan-85	631	1,018	
Feb-85	979	1,579	
Mar-85	849	1,369	A
Apr-85	839	1,353	
May-85	712	1,148	
Jun-85	683	1,102	
Jul-85	677	1,092	
Aug-85	619	998	
Sep-85	480	774	
Oct-85	450	726	

San Joaquin River near Patterson/Crows Landing Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Nov-85	709	1,144	
Dec-85	765	1,234	
Jan-86	973	1,569	
Feb-86	297	479	
Mar-86	159	256	**2, A**
Apr-86	161	260	
May-86	291	469	
Jun-86	372	600	
Jul-86	628	1,013	
Aug-86	544	877	
Sep-86	405	653	
Oct-86	353	569	
Nov-86	648	1,045	
Dec-86	832	1,342	
Jan-87	865	1,395	
Feb-87	999	1,611	
Mar-87	1,026	1,655	**2, A**
Apr-87	1,029	1,660	
May-87	793	1,279	
Jun-87	806	1,300	
Jul-87	779	1,256	
Aug-87	762	1,229	
Sep-87	705	1,137	
Oct-87	770	1,242	
Nov-87	834	1,345	
Dec-87	955	1,540	
Jan-88	1,060	1,710	
Feb-88	1,158	1,868	
Mar-88	1,159	1,869	**2, A**
Apr-88	984	1,587	
May-88	908	1,465	
Jun-88	916	1,477	
Jul-88	1,021	1,647	
Aug-88	920	1,484	
Sep-88	969	1,563	
Oct-88	857	1,382	
Nov-88	962	1,552	
Dec-88	983	1,585	
Jan-89	1,039	1,676	
Feb-89	1,020	1,645	
Mar-89	926	1,494	**2, A**
Apr-89	905	1,460	
May-89	916	1,477	
Jun-89	872	1,406	
Jul-89	894	1,442	
Aug-89	818	1,319	
Sep-89	763	1,231	
Oct-89	717	1,156	
Nov-89	821	1,324	
Dec-89	951	1,534	
Jan-90	1,148	1,852	
Feb-90	1,206	1,945	
Mar-90	1,156	1,865	**2, A**
Apr-90	1,135	1,831	
May-90	972	1,568	

San Joaquin River near Patterson/Crows Landing Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jun-90	975	1,573	
Jul-90	924	1,490	
Aug-90	802	1,294	
Sep-90	825	1,331	
Oct-90	809	1,305	
Nov-90	758	1,223	
Dec-90	967	1,560	
Jan-91	1,148	1,852	
Feb-91	1,142	1,842	
Mar-91	1,118	1,803	**2, A**
Apr-91	1,265	2,040	
May-91	1,205	1,944	
Jun-91	1,319	2,127	
Jul-91	918	1,481	
Aug-91	953	1,537	
Sep-91	847	1,366	
Oct-91	825	1,331	
Nov-91	641	1,034	
Dec-91	774	1,248	
Jan-92	868	1,400	
Feb-92	932	1,503	
Mar-92	1,035	1,669	**2, A**
Apr-92	1,219	1,966	
May-92	1,113	1,795	
Jun-92	967	1,560	
Jul-92	977	1,576	
Aug-92	882	1,423	
Sep-92	938	1,513	
Oct-92	768	1,239	
Nov-92	674	1,087	
Dec-92	704	1,135	
Jan-93	374	603	
Feb-93	630	1,016	
Mar-93	802	1,294	**2, A**
Apr-93	573	924	
May-93	523	844	
Jun-93	625	1,008	
Jul-93	700	1,129	
Aug-93	458	739	
Sep-93	436	703	
Oct-93	307	495	
Nov-93	673	1,085	
Dec-93	815	1,315	
Jan-94	922	1,487	
Feb-94	810	1,306	
Mar-94	1074	1,732	**2, A**
Apr-94	845	1,363	
May-94	746	1,203	
Jun-94	1,022	1,648	
Jul-94	716	1,155	
Aug-94	839	1,353	
Sep-94	856	1,381	
Oct-94	605	976	
Nov-94	779	1,256	
Dec-94	762	1,229	

San Joaquin River near Patterson/Crows Landing Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jan-95	502	810	2, A
Feb-95	1,004	1,619	
Mar-95	431	695	
Apr-95	188	303	
May-95	111	179	
Jun-95	165	266	
Jul-95	122	197	
Aug-95	496	800	
Sep-95	348	561	
Oct-95	159	256	5, A
Nov-95	498	803	
Dec-95	581	937	
Jan-96	692	1,116	
Feb-96	349	563	
Mar-96	290	468	
Apr-96	577	931	
May-96	275	444	
Jun-96	758	1,223	
Jul-96	853	1,376	
Aug-96	696	1,123	
Sep-96	553	892	
Oct-96	391	631	5, A
Nov-96	538	868	
Dec-96	201	324	
Jan-97	102	165	
Feb-97	132	213	
Mar-97	314	506	
Apr-97	667	1,076	
May-97	567	915	
Jun-97	847	1,366	
Jul-97	686	1,106	
Aug-97	401	647	
Sep-97	607	979	
Oct-97	643	1,037	6, A
Nov-97	806	1,300	
Dec-97	838	1,352	
Jan-98	425	685	
Feb-98	266	429	
Mar-98	313	505	
Apr-98	210	339	
May-98	151	244	
Jun-98	114	184	
Jul-98	101	163	
Aug-98	321	518	
Sep-98	284	458	
Oct-98	254	410	7, A
Nov-98	526	848	
Dec-98	403	650	
Jan-99	497	802	
Feb-99	380	613	
Mar-99	659	1,063	
Apr-99	470	758	
May-99	481	776	
Jun-99	812	1,310	
Jul-99	802	1,294	

San Joaquin River near Patterson/Crows Landing Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Aug-99	765	1,234	
Sep-99	673	1,085	
Oct-99	542	874	7, A
Nov-99	676	1,090	
Dec-99	823	1,327	
Jan-00	729	1,176	
Feb-00	328	529	
Mar-00	366	590	
Apr-00	517	834	
May-00	525	847	
Jun-00	752	1,213	
Jul-00	712	1,148	
Aug-00	670	1,081	
Sep-00	584	942	
Oct-00	363	585	3, A, B, C, E
Nov-00	460	743	
Dec-00	680	1,097	
Jan-01	763	1,230	
Feb-01	865	1,395	
Mar-01	827	1,333	
Apr-01	674	1,088	
May-01	517	835	
Jun-01	858	1,384	
Jul-01	858	1,384	
Aug-01	820	1,323	
Sep-01	809	1,304	
Oct-01	730	1,178	4, A, B, C, E
Nov-01	525	846	
Dec-01	729	1,175	
Jan-02	988	1,593	
Feb-02	966	1,558	
Mar-02	1,076	1,735	
Apr-02	910	1,467	
May-02	530	855	
Jun-02	887	1,430	
Jul-02	895	1,444	
Aug-02	891	1,438	
Sep-02	866	1,396	
Oct-02	521	840	4, A, B, C, E
Nov-02	681	1,099	
Dec-02	679	1,095	
Jan-03	870	1,403	
Feb-03	1,036	1,671	
Mar-03	1,057	1,706	
Apr-03	788	1,271	
May-03	570	919	
Jun-03	880	1,420	
Jul-03	844	1,362	
Aug-03	820	1,323	
Sep-03	810	1,307	
Oct-03	552	890	
Nov-03	666	1,074	
Dec-03	798	1,287	
Jan-04	820	1,323	
Feb-04	830	1,339	

San Joaquin River near Patterson/Crows Landing Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Mar-04	911	1,470	**4, A, B, C, E**
Apr-04	788	1,271	
May-04	493	795	
Jun-04	946	1,525	
Jul-04	935	1,508	
Aug-04	823	1,327	
Sep-04	793	1,279	

San Joaquin River at Maze Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Oct-85	382	637	
Nov-85	492	820	
Dec-85	541	902	
Jan-86	630	1,051	
Feb-86	457	762	
Mar-86	137	228	**3, A, B, C, D**
Apr-86	121	202	
May-86	190	317	
Jun-86	185	309	
Jul-86	414	690	
Aug-86	472	787	
Sep-86	367	612	
Oct-86	249	415	
Nov-86	288	479	
Dec-86	396	660	
Jan-87	494	823	
Feb-87	635	1,059	
Mar-87	544	907	**3, A, B, C, D**
Apr-87	576	960	
May-87	527	878	
Jun-87	649	1,082	
Jul-87	686	1,143	
Aug-87	645	1,076	
Sep-87	615	1,025	
Oct-87	575	958	
Nov-87	586	977	
Dec-87	662	1,104	
Jan-88	776	1,293	
Feb-88	901	1,502	
Mar-88	901	1,502	**3, A, B, C, D**
Apr-88	809	1,349	
May-88	768	1,279	
Jun-88	799	1,331	
Jul-88	895	1,491	
Aug-88	834	1,390	
Sep-88	874	1,457	
Oct-88	869	1,448	
Nov-88	785	1,308	
Dec-88	777	1,295	
Jan-89	826	1,377	
Feb-89	915	1,526	
Mar-89	834	1,389	**3, A, B, C, D**
Apr-89	792	1,320	
May-89	682	1,137	
Jun-89	773	1,288	
Jul-89	731	1,219	
Aug-89	681	1,135	
Sep-89	773	1,288	
Oct-89	676	1,126	
Nov-89	634	1,056	
Dec-89	666	1,110	
Jan-90	742	1,236	
Feb-90	856	1,426	
Mar-90	836	1,394	**3, A, B, C, D**

San Joaquin River at Maze Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Apr-90	757	1,261	
May-90	781	1,302	
Jun-90	803	1,338	
Jul-90	807	1,345	
Aug-90	686	1,144	
Sep-90	632	1,054	
Oct-90	613	1,021	
Nov-90	625	1,042	
Dec-90	679	1,131	
Jan-91	705	1,175	
Feb-91	963	1,605	
Mar-91	847	1,412	**3, A, B, C, D**
Apr-91	769	1,282	
May-91	524	873	
Jun-91	492	820	
Jul-91	856	1,427	
Aug-91	706	1,177	
Sep-91	800	1,334	
Oct-91	778	1,296	
Nov-91	623	1,038	
Dec-91	581	968	
Jan-92	512	853	
Feb-92	391	651	
Mar-92	650	1,084	**3, A, B, C, D**
Apr-92	858	1,431	
May-92	797	1,328	
Jun-92	745	1,242	
Jul-92	828	1,381	
Aug-92	790	1,317	
Sep-92	753	1,254	
Oct-92	1,013	1,688	
Nov-92	867	1,446	
Dec-92	521	868	
Jan-93	293	488	
Feb-93	453	755	
Mar-93	747	1,244	**3, A, B, C, D**
Apr-93	562	937	
May-93	387	644	
Jun-93	405	675	
Jul-93	524	874	
Aug-93	518	864	
Sep-93	254	423	
Oct-93	221	369	
Nov-93	441	736	
Dec-93	529	881	
Jan-94	536	894	
Feb-94	636	1,059	
Mar-94	726	1,209	**3, A, B, C, D**
Apr-94	742	1,237	
May-94	595	992	
Jun-94	645	1,075	
Jul-94	910	1,517	
Aug-94	917	1,528	
Sep-94	763	1,272	
Oct-94	562	937	

San Joaquin River at Maze Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Nov-94	540	899	
Dec-94	654	1,091	
Jan-95	581	968	
Feb-95	263	439	
Mar-95	463	772	**3, A, B, C, D**
Apr-95	270	450	
May-95	109	182	
Jun-95	112	187	
Jul-95	98	163	
Aug-95	222	369	
Sep-95	298	497	
Oct-95	105	175	
Nov-95	383	639	
Dec-95	501	835	
Jan-96	643	1,072	
Feb-96	288	480	
Mar-96	172	287	**3, A, B, C, D**
Apr-96	267	444	
May-96	246	410	
Jun-96	386	644	
Jul-96	556	927	
Aug-96	527	879	
Sep-96	438	730	
Oct-96	350	583	
Nov-96	444	740	
Dec-96	191	319	
Jan-97	112	187	
Feb-97	132	220	
Mar-97	269	449	**3, A, B, C, D**
Apr-97	442	737	
May-97	368	614	
Jun-97	604	1,007	
Jul-97	495	825	
Aug-97	449	748	
Sep-97	437	728	
Oct-97	385	641	
Nov-97	525	874	
Dec-97	637	1,062	
Jan-98	463	772	
Feb-98	202	336	
Mar-98	238	396	**3, A, B, C, D**
Apr-98	159	265	
May-98	123	205	
Jun-98	93	155	
Jul-98	104	173	
Aug-98	300	501	
Sep-98	233	389	
Oct-98	241	401	
Nov-98	448	747	
Dec-98	297	495	
Jan-99	427	711	
Feb-99	209	348	
Mar-99	251	418	**3, A, B, C, D**
Apr-99	273	455	
May-99	297	495	

San Joaquin River at Maze Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jun-99	514	857	
Jul-99	481	801	
Aug-99	478	796	
Sep-99	449	748	
Oct-99	398	664	
Nov-99	504	840	
Dec-99	591	985	
Jan-00	589	982	
Feb-00	444	740	
Mar-00	184	307	**3, A, B, C, D**
Apr-00	367	612	
May-00	309	514	
Jun-00	498	830	
Jul-00	453	756	
Aug-00	363	605	
Sep-00	326	543	
Oct-00	287	478	
Nov-00	402	670	
Dec-00	532	886	
Jan-01	574	957	
Feb-01	563	938	
Mar-01	531	886	**3, A, B, C, D**
Apr-01	567	945	
May-01	369	615	
Jun-01	625	1,041	
Jul-01	560	934	
Aug-01	552	920	
Sep-01	550	916	
Oct-01	490	817	
Nov-01	460	767	
Dec-01	600	1,000	
Jan-02	575	958	
Feb-02	766	1,277	
Mar-02	792	1,320	**3, A, B, C, D**
Apr-02	562	937	
May-02	384	640	
Jun-02	618	1,029	
Jul-02	606	1,010	
Aug-02	585	975	
Sep-02	587	978	
Oct-02	504	840	
Nov-02	552	920	
Dec-02	576	961	
Jan-03	700	1,167	
Feb-03	807	1,345	
Mar-03	802	1,336	**3, A, B, C, D**
Apr-03	558	930	
May-03	402	670	
Jun-03	514	857	
Jul-03	501	835	
Aug-03	479	799	
Sep-03	505	842	
Oct-03	440	734	
Nov-03	532	887	
Dec-03	623	1,038	

San Joaquin River at Maze Monthly Average TDS and EC for WY 1986-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jan-04	662	1,103	**3, A, B, C, D**
Feb-04	710	1,183	
Mar-04	529	882	
Apr-04	411	685	
May-04	381	635	
Jun-04	602	1,003	
Jul-04	593	989	
Aug-04	540	900	
Sep-04	539	898	

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San Joaquin River near Vernalis Monthly Average TDS and EC for WY 1977-2004

Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Oct-76	624	1,023	
Nov-76	630	1,033	
Dec-76	648	1,062	
Jan-77	973	1,595	
Feb-77	1,042	1,708	
Mar-77	661	1,084	1, A
Apr-77	981	1,608	
May-77	849	1,392	
Jun-77	1,014	1,662	
Jul-77	998	1,636	
Aug-77	958	1,570	
Sep-77	952	1,561	
Oct-77	958	1,570	
Nov-77	743	1,218	
Dec-77	620	1,016	
Jan-78	368	603	
Feb-78	231	379	
Mar-78	206	338	1, A
Apr-78	176	289	
May-78	132	216	
Jun-78	116	190	
Jul-78	332	544	
Aug-78	527	864	
Sep-78	240	393	
Oct-78	183	300	
Nov-78	214	351	
Dec-78	270	443	
Jan-79	170	279	
Feb-79	217	356	
Mar-79	171	280	1, A
Apr-79	357	585	
May-79	360	590	
Jun-79	310	508	
Jul-79	439	720	
Aug-79	463	759	
Sep-79	378	620	
Oct-79	234	384	
Nov-79	322	528	
Dec-79	297	487	
Jan-80	228	374	
Feb-80	149	244	
Mar-80	133	218	1, A
Apr-80	165	270	
May-80	101	166	
Jun-80	150	246	
Jul-80	213	349	
Aug-80	449	736	
Sep-80	310	508	
Oct-80	167	274	
Nov-80	225	369	
Dec-80	304	498	
Jan-81	200	328	
Feb-81	681	1,116	
Mar-81	441	723	1, A

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San Joaquin River near Vernalis Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Apr-81	423	693	
May-81	418	685	
Jun-81	429	703	
Jul-81	423	693	
Aug-81	475	779	
Sep-81	446	731	
Oct-81	342	561	
Nov-81	416	682	
Dec-81	476	780	
Jan-82	396	649	
Feb-82	335	549	
Mar-82	171	280	1, A
Apr-82	128	210	
May-82	90	148	
Jun-82	201	330	
Jul-82	245	402	
Aug-82	261	428	
Sep-82	143	234	
Oct-82	91	149	
Nov-82	155	254	
Dec-82	106	174	
Jan-83	124	203	
Feb-83	141	231	
Mar-83	161	264	1, A
Apr-83	166	272	
May-83	111	182	
Jun-83	84	138	
Jul-83	113	185	
Aug-83	192	315	
Sep-83	93	152	
Oct-83	91	149	
Nov-83	227	372	
Dec-83	121	198	
Jan-84	144	236	
Feb-84	208	341	
Mar-84	228	374	1, A
Apr-84	374	613	
May-84	326	534	
Jun-84	363	595	
Jul-84	419	687	
Aug-84	419	687	
Sep-84	238	390	
Oct-84	211	346	
Nov-84	301	493	
Dec-84	205	336	
Jan-85	277	454	
Feb-85	369	605	
Mar-85	454	744	1, A
Apr-85	482	790	
May-85	460	754	
Jun-85	463	759	
Jul-85	315	516	
Aug-85	312	511	
Sep-85	384	630	
Oct-85	301	493	

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San Joaquin River near Vernalis Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Nov-85	406	666	
Dec-85	455	746	
Jan-86	502	823	
Feb-86	178	292	
Mar-86	107	175	**2, A**
Apr-86	113	185	
May-86	169	277	
Jun-86	192	315	
Jul-86	371	608	
Aug-86	294	482	
Sep-86	228	374	
Oct-86	201	330	
Nov-86	294	482	
Dec-86	221	362	
Jan-87	372	610	
Feb-87	501	821	
Mar-87	474	777	**2, A**
Apr-87	372	610	
May-87	384	630	
Jun-87	442	725	
Jul-87	471	772	
Aug-87	508	833	
Sep-87	481	789	
Oct-87	503	825	
Nov-87	546	895	
Dec-87	590	967	
Jan-88	679	1,113	
Feb-88	824	1,351	
Mar-88	537	880	**2, A**
Apr-88	446	731	
May-88	454	744	
Jun-88	462	757	
Jul-88	498	816	
Aug-88	502	823	
Sep-88	490	803	
Oct-88	542	889	
Nov-88	520	852	
Dec-88	512	839	
Jan-89	696	1,141	
Feb-89	776	1,272	
Mar-89	463	759	**2, A**
Apr-89	440	721	
May-89	410	672	
Jun-89	443	726	
Jul-89	455	746	
Aug-89	483	792	
Sep-89	473	775	
Oct-89	475	779	
Nov-89	508	833	
Dec-89	551	903	
Jan-90	726	1,190	
Feb-90	737	1,208	
Mar-90	493	808	**2, A**
Apr-90	501	821	
May-90	474	777	

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San Joaquin River near Vernalis Monthly Average TDS and EC for WY 1977-2004

Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jun-90	569	933	
Jul-90	505	828	
Aug-90	477	782	
Sep-90	537	880	
Oct-90	489	802	
Nov-90	454	744	
Dec-90	575	943	
Jan-91	656	1,075	
Feb-91	688	1,128	
Mar-91	516	846	2, A
Apr-91	665	1,090	
May-91	389	638	
Jun-91	544	892	
Jul-91	517	848	
Aug-91	550	902	
Sep-91	553	907	
Oct-91	466	764	
Nov-91	375	615	
Dec-91	529	867	
Jan-92	582	954	
Feb-92	433	710	
Mar-92	654	1,072	2, A
Apr-92	455	746	
May-92	340	557	
Jun-92	437	716	
Jul-92	516	846	
Aug-92	500	820	
Sep-92	454	744	
Oct-92	420	689	
Nov-92	418	685	
Dec-92	498	816	
Jan-93	278	456	
Feb-93	475	779	
Mar-93	597	979	2, A
Apr-93	389	638	
May-93	276	452	
Jun-93	357	585	
Jul-93	494	810	
Aug-93	340	557	
Sep-93	247	405	
Oct-93	207	339	
Nov-93	468	767	
Dec-93	491	805	
Jan-94	488	800	
Feb-94	476	780	
Mar-94	472	774	2, A
Apr-94	399	654	
May-94	384	630	
Jun-94	503	825	
Jul-94	430	705	
Aug-94	475	779	
Sep-94	542	889	
Oct-94	457	749	
Nov-94	426	698	
Dec-94	470	770	

San Joaquin River near Vernalis Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Jan-95	240	393	
Feb-95	249	408	
Mar-95	194	318	**2, A**
Apr-95	148	243	
May-95	91	149	
Jun-95	113	185	
Jul-95	135	221	
Aug-95	323	530	
Sep-95	182	298	
Oct-95	156	256	
Nov-95	386	633	
Dec-95	450	738	
Jan-96	454	744	
Feb-96	166	272	
Mar-96	136	223	**5, A**
Apr-96	209	343	
May-96	129	211	
Jun-96	322	528	
Jul-96	403	661	
Aug-96	369	605	
Sep-96	329	539	
Oct-96	266	436	
Nov-96	337	552	
Dec-96	121	198	
Jan-97	91	149	
Feb-97	97	159	
Mar-97	176	289	**5, A**
Apr-97	303	497	
May-97	244	400	
Jun-97	361	592	
Jul-97	394	646	
Aug-97	366	600	
Sep-97	362	593	
Oct-97	282	462	
Nov-97	386	633	
Dec-97	538	882	
Jan-98	232	380	
Feb-98	164	269	
Mar-98	207	339	**6, A**
Apr-98	155	254	
May-98	114	187	
Jun-98	90	148	
Jul-98	102	167	
Aug-98	210	344	
Sep-98	156	256	
Oct-98	166	272	
Nov-98	317	520	
Dec-98	225	369	
Jan-99	283	464	
Feb-99	123	202	
Mar-99	199	326	**7, A**
Apr-99	209	343	
May-99	192	315	
Jun-99	292	479	
Jul-99	272	446	

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San Joaquin River near Vernalis Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Aug-99	349	572	
Sep-99	326	534	
Oct-99	314	515	
Nov-99	400	656	
Dec-99	482	790	
Jan-00	453	743	
Feb-00	209	343	
Mar-00	167	274	7, A
Apr-00	240	393	
May-00	224	367	
Jun-00	351	575	
Jul-00	373	611	
Aug-00	336	551	
Sep-00	306	502	
Oct-00	218	357	
Nov-00	356	584	
Dec-00	469	769	
Jan-01	509	834	
Feb-01	516	846	
Mar-01	428	702	4, A, B, C, E
Apr-01	370	607	
May-01	235	385	
Jun-01	456	748	
Jul-01	425	697	
Aug-01	444	728	
Sep-01	441	723	
Oct-01	344	564	
Nov-01	377	618	
Dec-01	492	807	
Jan-02	467	766	
Feb-02	602	987	
Mar-02	603	989	4, A, B, C, E
Apr-02	324	531	
May-02	256	420	
Jun-02	431	707	
Jul-02	436	715	
Aug-02	484	793	
Sep-02	507	831	
Oct-02	382	626	
Nov-02	473	775	
Dec-02	471	772	
Jan-03	538	882	
Feb-03	637	1,044	
Mar-03	695	1,139	4, A, B, C, E
Apr-03	385	631	
May-03	345	566	
Jun-03	259	425	
Jul-03	374	613	
Aug-03	413	677	
Sep-03	440	721	
Oct-03	275	451	
Nov-03	411	674	
Dec-03	471	772	
Jan-04	496	813	
Feb-04	488	800	

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San Joaquin River near Vernalis Monthly Average TDS and EC for WY 1977-2004			
Date	TDS (mg/L)	EC (µS/cm)	Source Data and Methods
Mar-04	423	693	**4, A, B, C, E**
Apr-04	273	448	
May-04	246	403	
Jun-04	366	600	
Jul-04	380	623	
Aug-04	398	652	
Sep-04	420	689	

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APPENDIX G: LINKAGE ANALYSIS FLOWS, SALT LOADS, ELECTRICAL CONDUCTIVITY, AND BORON CONCENTRATIONS

July 2004 Draft Final Staff Report

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Oct-21	AN	124	6	1,000	103	13	8.3	21.9	2.7	57.1	103	0	1000	0.6	1.0
Nov-21	AN	104	6	1,000	86	14	6.9	18.2	2.7	34.6	76	10	880	0.53	1.0
Dec-21	AN	158	7	1,000	131	15	10.7	28.1	2.7	32.3	89	42	680	0.41	1.0
Jan-22	W	169	7	1,000	140	15	11.4	30.2	2.7	42.2	102	38	730	0.44	1.0
Feb-22	W	375	6	1,000	311	15	26.1	68.6	2.7	86.3	199	112	640	0.38	1.0
Mar-22	W	335	14	1,000	278	30	22.7	59.8	2.7	116.4	232	46	840	0.5	1.0
Apr-22	W	382	15	700	222	32	26.0	68.4	1.3	61.7	189	33	600	0.36	0.8
May-22	W	355	17	700	206	36	23.9	63.0	1.3	67.3	192	14	650	0.39	0.8
Jun-22	W	414	24	700	240	53	27.6	72.6	0.0	0.0	153	87	450	0.27	0.8
Jul-22	W	111	21	700	64	46	6.3	16.7	0.0	0.0	69	-5	750	0.45	0.8
Aug-22	W	107	13	700	62	27	6.7	17.5	0.0	5.1	56	6	630	0.38	0.8
Sep-22	W	117	7	1,000	97	16	7.7	20.4	2.7	43.9	91	6	940	0.56	1.0
Oct-22	W	252	6	1,000	209	13	17.4	45.8	2.7	97.8	177	32	850	0.51	1.0
Nov-22	W	131	6	1,000	109	14	8.8	23.2	2.7	43.7	92	17	850	0.51	1.0
Dec-22	W	233	7	1,000	193	15	16.0	42.1	2.7	35.8	112	81	580	0.35	1.0
Jan-23	AN	268	7	1,000	222	15	18.4	48.6	2.7	44.9	130	92	580	0.35	1.0
Feb-23	AN	244	6	1,000	202	15	16.8	44.2	2.7	86.3	165	37	820	0.49	1.0
Mar-23	AN	166	14	1,000	138	30	10.7	28.3	2.7	64.8	137	1	1000	0.6	1.0
Apr-23	AN	357	15	700	207	32	24.2	63.8	1.3	63.0	184	23	620	0.37	0.8
May-23	AN	344	17	700	200	36	23.1	60.9	1.3	50.5	172	28	600	0.36	0.8
Jun-23	AN	144	24	700	84	53	8.5	22.3	0.0	0.0	84	0	700	0.42	0.8
Jul-23	AN	109	21	700	63	46	6.2	16.3	0.0	0.0	69	-6	760	0.46	0.8
Aug-23	AN	105	13	700	61	27	6.5	17.2	0.0	0.0	51	10	590	0.35	0.8
Sep-23	AN	111	7	1,000	92	16	7.3	19.3	2.7	43.2	89	3	970	0.58	1.0
Oct-23	AN	139	6	1,000	115	13	9.4	24.7	2.7	57.1	107	8	930	0.56	1.0
Nov-23	AN	94	6	1,000	78	14	6.2	16.3	2.7	34.6	74	4	950	0.57	1.0
Dec-23	AN	102	7	1,000	85	15	6.7	17.7	2.7	32.3	74	11	870	0.52	1.0
Jan-24	C	97	7	1,000	80	15	6.4	16.8	2.7	19.5	60	20	750	0.45	1.0
Feb-24	C	102	6	1,000	85	15	6.8	17.8	2.7	15.6	58	27	690	0.41	1.0
Mar-24	C	100	14	1,000	83	30	6.1	16.0	2.7	11.7	67	16	810	0.48	1.0
Apr-24	C	111	15	700	64	32	6.8	17.9	1.3	0.0	58	6	630	0.38	0.8
May-24	C	105	17	700	61	36	6.2	16.4	1.3	0.0	60	1	690	0.41	0.8
Jun-24	C	72	24	700	42	53	3.4	8.9	0.0	0.0	65	-23	1100	0.65	0.8
Jul-24	C	48	21	700	28	46	1.9	4.9	0.0	0.0	53	-25	1300	0.8	0.8
Aug-24	C	49	13	700	28	27	2.6	6.7	0.0	0.0	36	-8	890	0.53	0.8
Sep-24	C	68	7	1,000	56	16	4.3	11.3	2.7	17.8	52	4	920	0.55	1.0
Oct-24	C	80	6	1,000	66	13	5.2	13.8	2.7	29.4	64	2	960	0.58	1.0
Nov-24	C	81	6	1,000	67	14	5.3	13.9	2.7	25.0	61	6	910	0.54	1.0
Dec-24	C	81	7	1,000	67	15	5.2	13.8	2.7	23.4	60	7	890	0.54	1.0
Jan-25	BN	74	7	1,000	61	15	4.7	12.5	2.7	22.6	58	3	950	0.57	1.0
Feb-25	BN	149	6	1,000	124	15	10.1	26.5	2.7	24.0	78	46	630	0.38	1.0

1 flow from DWRSIM CALFED study 771
2 values from load allocation
3 two significant figures
4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (μ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (μS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Mar-25	BN	149	14	1,000	124	30	9.5	25.1	2.7	31.7	99	25	800	0.48	1.0
Apr-25	BN	237	15	700	138	32	15.7	41.4	1.3	39.4	130	8	660	0.4	0.8
May-25	BN	215	17	700	125	36	14.0	36.9	1.3	27.2	115	10	640	0.39	0.8
Jun-25	BN	114	24	700	66	53	6.3	16.7	0.0	0.0	76	-10	800	0.48	0.8
Jul-25	BN	100	21	700	58	46	5.6	14.6	0.0	0.0	66	-8	800	0.48	0.8
Aug-25	BN	97	13	700	56	27	5.9	15.7	0.0	0.0	49	7	610	0.37	0.8
Sep-25	BN	101	7	1,000	84	16	6.6	17.4	2.7	37.1	80	4	960	0.57	1.0
Oct-25	BN	101	6	1,000	84	13	6.7	17.7	2.7	40.5	81	3	970	0.58	1.0
Nov-25	BN	86	6	1,000	71	14	5.6	14.8	2.7	33.1	70	1	980	0.59	1.0
Dec-25	BN	87	7	1,000	72	15	5.6	14.9	2.7	30.3	69	3	960	0.57	1.0
Jan-26	D	79	7	1,000	66	15	5.1	13.4	2.7	29.8	66	0	1000	0.6	1.0
Feb-26	D	135	6	1,000	112	15	9.1	23.9	2.7	40.6	91	21	810	0.49	1.0
Mar-26	D	103	14	1,000	85	30	6.3	16.6	2.7	25.5	81	4	950	0.57	1.0
Apr-26	D	217	15	700	126	32	14.3	37.7	1.3	18.7	104	22	580	0.35	0.8
May-26	D	197	17	700	114	36	12.7	33.5	1.3	12.7	96	18	590	0.35	0.8
Jun-26	D	93	24	700	54	53	4.9	12.8	0.0	0.0	71	-17	920	0.55	0.8
Jul-26	D	67	21	700	39	46	3.2	8.5	0.0	0.0	58	-19	1000	0.63	0.8
Aug-26	D	49	13	700	28	27	2.6	6.7	0.0	0.0	36	-8	890	0.53	0.8
Sep-26	D	79	7	1,000	66	16	5.1	13.3	2.7	24.0	61	5	930	0.56	1.0
Oct-26	D	88	6	1,000	73	13	5.8	15.2	2.7	30.8	68	5	930	0.56	1.0
Nov-26	D	113	6	1,000	94	14	7.5	19.9	2.7	27.2	71	23	760	0.45	1.0
Dec-26	D	118	7	1,000	98	15	7.8	20.7	2.7	28.4	75	23	770	0.46	1.0
Jan-27	AN	109	7	1,000	90	15	7.2	19.0	2.7	44.9	89	1	980	0.59	1.0
Feb-27	AN	286	6	1,000	237	15	19.8	52.1	2.7	86.3	176	61	740	0.45	1.0
Mar-27	AN	222	14	1,000	184	30	14.7	38.7	2.7	64.8	151	33	820	0.49	1.0
Apr-27	AN	344	15	700	200	32	23.3	61.3	1.3	63.0	181	19	630	0.38	0.8
May-27	AN	318	17	700	185	36	21.3	56.1	1.3	50.5	165	20	630	0.38	0.8
Jun-27	AN	121	24	700	70	53	6.8	18.0	0.0	0.0	78	-8	780	0.47	0.8
Jul-27	AN	102	21	700	59	46	5.7	15.0	0.0	0.0	67	-8	790	0.48	0.8
Aug-27	AN	100	13	700	58	27	6.2	16.2	0.0	0.0	49	9	590	0.35	0.8
Sep-27	AN	109	7	1,000	90	16	7.2	18.9	2.7	43.2	88	2	970	0.58	1.0
Oct-27	AN	276	6	1,000	229	13	19.1	50.3	2.7	57.1	142	87	620	0.37	1.0
Nov-27	AN	113	6	1,000	94	14	7.5	19.9	2.7	34.6	79	15	840	0.51	1.0
Dec-27	AN	148	7	1,000	123	15	10.0	26.2	2.7	32.3	86	37	700	0.42	1.0
Jan-28	BN	146	7	1,000	121	15	9.8	25.9	2.7	22.6	76	45	630	0.38	1.0
Feb-28	BN	152	6	1,000	126	15	10.3	27.1	2.7	24.0	79	47	630	0.38	1.0
Mar-28	BN	183	14	1,000	152	30	11.9	31.5	2.7	31.7	108	44	710	0.43	1.0
Apr-28	BN	269	15	700	156	32	18.0	47.4	1.3	39.4	138	18	620	0.37	0.8
May-28	BN	244	17	700	142	36	16.0	42.3	1.3	27.2	123	19	610	0.36	0.8
Jun-28	BN	101	24	700	59	53	5.4	14.3	0.0	0.0	73	-14	870	0.52	0.8
Jul-28	BN	88	21	700	51	46	4.7	12.4	0.0	0.0	63	-12	860	0.52	0.8

1 flow from DWRSIM CALFED study 771
2 values from load allocation
3 two significant figures
4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

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TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (μ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (μS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Aug-28	BN	89	13	700	52	27	5.4	14.2	0.0	0.0	47	5	640	0.38	0.8
Sep-28	BN	94	7	1,000	78	16	6.1	16.1	2.7	37.1	78	0	1000	0.6	1.0
Oct-28	BN	95	6	1,000	79	13	6.3	16.5	2.7	40.5	79	0	1000	0.6	1.0
Nov-28	BN	86	6	1,000	71	14	5.6	14.8	2.7	33.1	70	1	980	0.59	1.0
Dec-28	BN	86	7	1,000	71	15	5.6	14.7	2.7	30.3	68	3	950	0.57	1.0
Jan-29	C	80	7	1,000	66	15	5.2	13.6	2.7	19.5	56	10	840	0.51	1.0
Feb-29	C	86	6	1,000	71	15	5.6	14.8	2.7	15.6	54	17	760	0.45	1.0
Mar-29	C	99	14	1,000	82	30	6.0	15.8	2.7	11.7	66	16	800	0.48	1.0
Apr-29	C	154	15	700	89	32	9.9	26.0	1.3	0.0	69	20	540	0.32	0.8
May-29	C	149	17	700	86	36	9.3	24.6	1.3	0.0	71	15	570	0.34	0.8
Jun-29	C	71	24	700	41	53	3.3	8.7	0.0	0.0	65	-24	1100	0.66	0.8
Jul-29	C	45	21	700	26	46	1.7	4.4	0.0	0.0	52	-26	1400	0.84	0.8
Aug-29	C	43	13	700	25	27	2.1	5.6	0.0	0.0	35	-10	980	0.59	0.8
Sep-29	C	68	7	1,000	56	16	4.3	11.3	2.7	17.8	52	4	920	0.55	1.0
Oct-29	C	81	6	1,000	67	13	5.3	13.9	2.7	29.4	64	3	950	0.57	1.0
Nov-29	C	75	6	1,000	62	14	4.8	12.8	2.7	25.0	59	3	950	0.57	1.0
Dec-29	C	71	7	1,000	59	15	4.5	11.9	2.7	23.4	58	1	990	0.59	1.0
Jan-30	C	77	7	1,000	64	15	4.9	13.0	2.7	19.5	55	9	860	0.52	1.0
Feb-30	C	87	6	1,000	72	15	5.7	15.0	2.7	15.6	54	18	750	0.45	1.0
Mar-30	C	112	14	1,000	93	30	6.9	18.2	2.7	11.7	70	23	750	0.45	1.0
Apr-30	C	155	15	700	90	32	9.9	26.1	1.3	0.0	69	21	540	0.32	0.8
May-30	C	150	17	700	87	36	9.4	24.8	1.3	0.0	72	15	580	0.35	0.8
Jun-30	C	70	24	700	41	53	3.2	8.5	0.0	0.0	65	-24	1100	0.67	0.8
Jul-30	C	44	21	700	26	46	1.6	4.2	0.0	0.0	52	-26	1400	0.86	0.8
Aug-30	C	46	13	700	27	27	2.3	6.2	0.0	0.0	36	-9	940	0.57	0.8
Sep-30	C	70	7	1,000	58	16	4.4	11.7	2.7	17.8	53	5	910	0.55	1.0
Oct-30	C	85	6	1,000	70	13	5.6	14.7	2.7	29.4	65	5	920	0.55	1.0
Nov-30	C	71	6	1,000	59	14	4.6	12.0	2.7	25.0	58	1	990	0.59	1.0
Dec-30	C	71	7	1,000	59	15	4.5	11.9	2.7	23.4	58	1	990	0.59	1.0
Jan-31	C	68	7	1,000	56	15	4.3	11.4	2.7	19.5	53	3	940	0.56	1.0
Feb-31	C	65	6	1,000	54	15	4.1	10.9	2.7	15.6	48	6	890	0.53	1.0
Mar-31	C	75	14	1,000	62	30	4.3	11.4	2.7	11.7	60	2	960	0.58	1.0
Apr-31	C	98	15	700	57	32	5.9	15.5	1.3	0.0	55	2	680	0.41	0.8
May-31	C	88	17	700	51	36	5.0	13.2	1.3	0.0	56	-5	770	0.46	0.8
Jun-31	C	51	24	700	30	53	1.9	5.0	0.0	0.0	60	-30	1400	0.85	0.8
Jul-31	C	50	21	700	29	46	2.0	5.3	0.0	0.0	53	-24	1300	0.77	0.8
Aug-31	C	51	13	700	30	27	2.7	7.1	0.0	0.0	37	-7	870	0.52	0.8
Sep-31	C	69	7	1,000	57	16	4.4	11.5	2.7	17.8	52	5	910	0.55	1.0
Oct-31	C	80	6	1,000	66	13	5.2	13.8	2.7	29.4	64	2	960	0.58	1.0
Nov-31	C	76	6	1,000	63	14	4.9	13.0	2.7	25.0	60	3	950	0.57	1.0
Dec-31	C	190	7	1,000	158	15	12.9	34.1	2.7	23.4	88	70	560	0.34	1.0

1 flow from DWRSIM CALFED study 771
2 values from load allocation
3 two significant figures
4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Jul-93	W	118	21	700	68	46	6.8	18.0	0.0	0.0	71	-3	730	0.44	0.8
Aug-93	W	111	13	700	64	27	6.9	18.3	0.0	5.1	57	7	620	0.37	0.8
Sep-93	W	122	7	1,000	101	16	8.1	21.3	2.7	43.9	92	9	910	0.55	1.0
Oct-93	W	256	6	1,000	212	13	17.7	46.5	2.7	97.8	178	34	840	0.5	1.0
Nov-93	W	109	6	1,000	90	14	7.3	19.1	2.7	43.7	87	3	960	0.58	1.0
Dec-93	W	91	7	1,000	75	15	5.9	15.6	2.7	35.8	75	0	990	0.6	1.0
Jan-94	C	85	7	1,000	70	15	5.5	14.5	2.7	19.5	57	13	810	0.49	1.0
Feb-94	C	113	6	1,000	94	15	7.5	19.8	2.7	15.6	61	33	650	0.39	1.0
Mar-94	C	92	14	1,000	76	30	5.5	14.5	2.7	11.7	64	12	840	0.5	1.0
Apr-94	C	155	15	700	90	32	9.9	26.1	1.3	0.0	69	21	540	0.32	0.8
May-94	C	152	17	700	88	36	9.5	25.1	1.3	0.0	72	16	570	0.34	0.8
Jun-94	C	90	24	700	52	53	4.6	12.2	0.0	0.0	70	-18	940	0.56	0.8
Jul-94	C	71	21	700	41	46	3.5	9.2	0.0	0.0	59	-18	1000	0.6	0.8
Aug-94	C	66	13	700	38	27	3.8	9.9	0.0	0.0	41	-3	750	0.45	0.8
Sep-94	C	84	7	1,000	70	16	5.4	14.3	2.7	17.8	56	14	800	0.48	1.0

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4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Feb-90	C	65	6	1,000	54	15	4.1	10.9	2.7	15.6	48	6	890	0.53	1.0
Mar-90	C	78	14	1,000	65	30	4.5	11.9	2.7	11.7	61	4	940	0.57	1.0
Apr-90	C	104	15	700	60	32	6.3	16.6	1.3	0.0	56	4	650	0.39	0.8
May-90	C	91	17	700	53	36	5.2	13.8	1.3	0.0	56	-3	740	0.45	0.8
Jun-90	C	57	24	700	33	53	2.3	6.1	0.0	0.0	61	-28	1300	0.77	0.8
Jul-90	C	44	21	700	26	46	1.6	4.2	0.0	0.0	52	-26	1400	0.86	0.8
Aug-90	C	48	13	700	28	27	2.5	6.5	0.0	0.0	36	-8	900	0.54	0.8
Sep-90	C	71	7	1,000	59	16	4.5	11.8	2.7	17.8	53	6	900	0.54	1.0
Oct-90	C	77	6	1,000	64	13	5.0	13.2	2.7	29.4	63	1	990	0.59	1.0
Nov-90	C	71	6	1,000	59	14	4.6	12.0	2.7	25.0	58	1	990	0.59	1.0
Dec-90	C	69	7	1,000	57	15	4.4	11.5	2.7	23.4	57	0	1000	0.6	1.0
Jan-91	C	61	7	1,000	51	15	3.8	10.0	2.7	19.5	51	0	1000	0.6	1.0
Feb-91	C	56	6	1,000	46	15	3.5	9.2	2.7	15.6	46	0	990	0.59	1.0
Mar-91	C	141	14	1,000	117	30	9.0	23.6	2.7	11.7	77	40	660	0.4	1.0
Apr-91	C	136	15	700	79	32	8.6	22.6	1.3	0.0	65	14	580	0.35	0.8
May-91	C	113	17	700	66	36	6.8	17.9	1.3	0.0	62	4	660	0.4	0.8
Jun-91	C	61	24	700	35	53	2.6	6.8	0.0	0.0	62	-27	1200	0.74	0.8
Jul-91	C	45	21	700	26	46	1.7	4.4	0.0	0.0	52	-26	1400	0.84	0.8
Aug-91	C	45	13	700	26	27	2.3	6.0	0.0	0.0	35	-9	940	0.56	0.8
Sep-91	C	64	7	1,000	53	16	4.0	10.5	2.7	17.8	51	2	960	0.58	1.0
Oct-91	C	76	6	1,000	63	13	4.9	13.0	2.7	29.4	63	0	1000	0.6	1.0
Nov-91	C	81	6	1,000	67	14	5.3	13.9	2.7	25.0	61	6	910	0.54	1.0
Dec-91	C	70	7	1,000	58	15	4.4	11.7	2.7	23.4	57	1	980	0.59	1.0
Jan-92	C	67	7	1,000	56	15	4.2	11.2	2.7	19.5	53	3	950	0.57	1.0
Feb-92	C	128	6	1,000	106	15	8.6	22.6	2.7	15.6	65	41	610	0.37	1.0
Mar-92	C	119	14	1,000	99	30	7.4	19.6	2.7	11.7	71	28	720	0.43	1.0
Apr-92	C	128	15	700	74	32	8.0	21.1	1.3	0.0	62	12	580	0.35	0.8
May-92	C	102	17	700	59	36	6.0	15.8	1.3	0.0	59	0	700	0.42	0.8
Jun-92	C	36	24	700	21	53	0.8	2.2	0.0	0.0	56	-35	1900	1.1	0.8
Jul-92	C	40	21	700	23	46	1.3	3.5	0.0	0.0	51	-28	1500	0.92	0.8
Aug-92	C	38	13	700	22	27	1.8	4.7	0.0	0.0	34	-12	1100	0.65	0.8
Sep-92	C	60	7	1,000	50	16	3.7	9.8	2.7	17.8	50	0	1000	0.6	1.0
Oct-92	C	90	6	1,000	75	13	5.9	15.6	2.7	29.4	67	8	900	0.54	1.0
Nov-92	C	87	6	1,000	72	14	5.7	15.0	2.7	25.0	62	10	860	0.52	1.0
Dec-92	C	93	7	1,000	77	15	6.1	16.0	2.7	23.4	63	14	820	0.49	1.0
Jan-93	W	355	7	1,000	294	15	24.6	64.8	2.7	42.2	149	145	510	0.3	1.0
Feb-93	W	229	6	1,000	190	15	15.7	41.4	2.7	86.3	161	29	850	0.51	1.0
Mar-93	W	255	14	1,000	211	30	17.0	44.9	2.7	116.4	211	0	1000	0.6	1.0
Apr-93	W	283	15	700	164	32	19.0	50.0	1.3	61.7	164	0	700	0.42	0.8
May-93	W	310	17	700	180	36	20.7	54.6	1.3	67.3	180	0	700	0.42	0.8
Jun-93	W	327	24	700	190	53	21.4	56.4	0.0	0.0	131	59	480	0.29	0.8

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TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (μ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (μS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Sep-86	W	121	7	1,000	100	16	8.0	21.2	2.7	43.9	92	8	920	0.55	1.0
Oct-86	W	215	6	1,000	178	13	14.8	38.9	2.7	97.8	167	11	940	0.56	1.0
Nov-86	W	108	6	1,000	90	14	7.2	18.9	2.7	43.7	87	3	970	0.58	1.0
Dec-86	W	101	7	1,000	84	15	6.6	17.5	2.7	35.8	78	6	930	0.56	1.0
Jan-87	C	97	7	1,000	80	15	6.4	16.8	2.7	19.5	60	20	750	0.45	1.0
Feb-87	C	107	6	1,000	89	15	7.1	18.7	2.7	15.6	59	30	660	0.4	1.0
Mar-87	C	120	14	1,000	100	30	7.5	19.7	2.7	11.7	72	28	720	0.43	1.0
Apr-87	C	155	15	700	90	32	9.9	26.1	1.3	0.0	69	21	540	0.32	0.8
May-87	C	148	17	700	86	36	9.3	24.4	1.3	0.0	71	15	580	0.35	0.8
Jun-87	C	77	24	700	45	53	3.7	9.8	0.0	0.0	67	-22	1000	0.63	0.8
Jul-87	C	79	21	700	46	46	4.1	10.7	0.0	0.0	61	-15	930	0.56	0.8
Aug-87	C	80	13	700	46	27	4.7	12.5	0.0	0.0	44	2	660	0.4	0.8
Sep-87	C	80	7	1,000	66	16	5.1	13.5	2.7	17.8	55	11	830	0.5	1.0
Oct-87	C	89	6	1,000	74	13	5.9	15.4	2.7	29.4	66	8	890	0.54	1.0
Nov-87	C	80	6	1,000	66	14	5.2	13.7	2.7	25.0	61	5	920	0.55	1.0
Dec-87	C	75	7	1,000	62	15	4.8	12.6	2.7	23.4	59	3	950	0.57	1.0
Jan-88	C	74	7	1,000	61	15	4.7	12.5	2.7	19.5	54	7	880	0.53	1.0
Feb-88	C	69	6	1,000	57	15	4.4	11.6	2.7	15.6	49	8	860	0.51	1.0
Mar-88	C	74	14	1,000	61	30	4.2	11.2	2.7	11.7	60	1	980	0.59	1.0
Apr-88	C	114	15	700	66	32	7.0	18.5	1.3	0.0	59	7	620	0.37	0.8
May-88	C	110	17	700	64	36	6.6	17.3	1.3	0.0	61	3	670	0.4	0.8
Jun-88	C	71	24	700	41	53	3.3	8.7	0.0	0.0	65	-24	1100	0.66	0.8
Jul-88	C	50	21	700	29	46	2.0	5.3	0.0	0.0	53	-24	1300	0.77	0.8
Aug-88	C	54	13	700	31	27	2.9	7.7	0.0	0.0	38	-7	850	0.51	0.8
Sep-88	C	74	7	1,000	61	16	4.7	12.4	2.7	17.8	54	7	880	0.53	1.0
Oct-88	C	83	6	1,000	69	13	5.4	14.3	2.7	29.4	65	4	940	0.57	1.0
Nov-88	C	70	6	1,000	58	14	4.5	11.8	2.7	25.0	58	0	1000	0.6	1.0
Dec-88	C	76	7	1,000	63	15	4.9	12.8	2.7	23.4	59	4	940	0.56	1.0
Jan-89	C	71	7	1,000	59	15	4.5	11.9	2.7	19.5	54	5	920	0.55	1.0
Feb-89	C	67	6	1,000	56	15	4.3	11.3	2.7	15.6	49	7	880	0.53	1.0
Mar-89	C	93	14	1,000	77	30	5.6	14.7	2.7	11.7	65	12	840	0.51	1.0
Apr-89	C	120	15	700	70	32	7.4	19.6	1.3	0.0	60	10	600	0.36	0.8
May-89	C	107	17	700	62	36	6.4	16.8	1.3	0.0	61	1	690	0.41	0.8
Jun-89	C	74	24	700	43	53	3.5	9.3	0.0	0.0	66	-23	1100	0.65	0.8
Jul-89	C	55	21	700	32	46	2.4	6.2	0.0	0.0	55	-23	1200	0.72	0.8
Aug-89	C	56	13	700	33	27	3.1	8.0	0.0	0.0	38	-5	820	0.49	0.8
Sep-89	C	78	7	1,000	65	16	5.0	13.1	2.7	17.8	55	10	850	0.51	1.0
Oct-89	C	83	6	1,000	69	13	5.4	14.3	2.7	29.4	65	4	940	0.57	1.0
Nov-89	C	74	6	1,000	61	14	4.8	12.6	2.7	25.0	59	2	960	0.58	1.0
Dec-89	C	71	7	1,000	59	15	4.5	11.9	2.7	23.4	58	1	990	0.59	1.0
Jan-90	C	68	7	1,000	56	15	4.3	11.4	2.7	19.5	53	3	940	0.56	1.0

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TMDL Linkage Analysis

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Apr-83	W	1,238	15	700	719	32	86.5	227.9	1.3	61.7	409	310	400	0.24	0.8
May-83	W	1,217	17	700	706	36	84.8	223.5	1.3	67.3	413	293	410	0.25	0.8
Jun-83	W	2,155	24	700	1,251	53	150.6	396.9	0.0	0.0	601	650	340	0.2	0.8
Jul-83	W	960	21	700	557	46	66.3	174.8	0.0	0.0	287	270	360	0.22	0.8
Aug-83	W	189	13	700	110	27	12.5	32.8	0.0	5.1	77	33	490	0.29	0.8
Sep-83	W	453	7	1,000	376	16	31.5	83.0	2.7	43.9	177	199	470	0.28	1.0
Oct-83	W	464	6	1,000	385	13	32.4	85.3	2.7	97.8	231	154	600	0.36	1.0
Nov-83	W	825	6	1,000	684	14	57.9	152.5	2.7	43.7	271	413	400	0.24	1.0
Dec-83	W	1,316	7	1,000	1,091	15	92.5	243.8	2.7	35.8	390	701	360	0.21	1.0
Jan-84	AN	931	7	1,000	772	15	65.3	172.1	2.7	44.9	300	472	390	0.23	1.0
Feb-84	AN	552	6	1,000	458	15	38.6	101.6	2.7	86.3	244	214	530	0.32	1.0
Mar-84	AN	366	14	1,000	304	30	24.9	65.6	2.7	64.8	188	116	620	0.37	1.0
Apr-84	AN	345	15	700	200	32	23.4	61.5	1.3	63.0	181	19	630	0.38	0.8
May-84	AN	282	17	700	164	36	18.7	49.4	1.3	50.5	156	8	670	0.4	0.8
Jun-84	AN	137	24	700	80	53	8.0	21.0	0.0	0.0	82	-2	720	0.43	0.8
Jul-84	AN	107	21	700	62	46	6.0	15.9	0.0	0.0	68	-6	770	0.46	0.8
Aug-84	AN	113	13	700	66	27	7.1	18.7	0.0	0.0	53	13	570	0.34	0.8
Sep-84	AN	123	7	1,000	102	16	8.2	21.5	2.7	43.2	92	10	900	0.54	1.0
Oct-84	AN	126	6	1,000	104	13	8.5	22.3	2.7	57.1	104	0	1000	0.6	1.0
Nov-84	AN	112	6	1,000	93	14	7.5	19.7	2.7	34.6	79	14	850	0.51	1.0
Dec-84	AN	113	7	1,000	94	15	7.5	19.7	2.7	32.3	77	17	820	0.49	1.0
Jan-85	D	100	7	1,000	83	15	6.6	17.3	2.7	29.8	71	12	860	0.51	1.0
Feb-85	D	111	6	1,000	92	15	7.4	19.5	2.7	40.6	85	7	920	0.55	1.0
Mar-85	D	132	14	1,000	109	30	8.3	22.0	2.7	25.5	89	20	810	0.49	1.0
Apr-85	D	213	15	700	124	32	14.0	36.9	1.3	18.7	103	21	580	0.35	0.8
May-85	D	202	17	700	117	36	13.1	34.5	1.3	12.7	98	19	590	0.35	0.8
Jun-85	D	90	24	700	52	53	4.6	12.2	0.0	0.0	70	-18	940	0.56	0.8
Jul-85	D	79	21	700	46	46	4.1	10.7	0.0	0.0	61	-15	930	0.56	0.8
Aug-85	D	87	13	700	51	27	5.2	13.8	0.0	0.0	46	5	640	0.38	0.8
Sep-85	D	85	7	1,000	70	16	5.5	14.4	2.7	24.0	63	7	890	0.54	1.0
Oct-85	D	109	6	1,000	90	13	7.3	19.2	2.7	30.8	73	17	810	0.48	1.0
Nov-85	D	99	6	1,000	82	14	6.5	17.2	2.7	27.2	68	14	830	0.5	1.0
Dec-85	D	103	7	1,000	85	15	6.8	17.9	2.7	28.4	71	14	830	0.5	1.0
Jan-86	W	101	7	1,000	84	15	6.6	17.5	2.7	42.2	84	0	1000	0.6	1.0
Feb-86	W	1,134	6	1,000	940	15	79.7	210.0	2.7	86.3	394	546	420	0.25	1.0
Mar-86	W	1,580	14	1,000	1,310	30	110.7	291.7	2.7	116.4	552	758	420	0.25	1.0
Apr-86	W	593	15	700	344	32	40.9	107.7	1.3	61.7	244	100	500	0.3	0.8
May-86	W	543	17	700	315	36	37.2	98.0	1.3	67.3	240	75	530	0.32	0.8
Jun-86	W	544	24	700	316	53	36.7	96.8	0.0	0.0	187	129	410	0.25	0.8
Jul-86	W	108	21	700	63	46	6.1	16.1	0.0	0.0	68	-5	760	0.46	0.8
Aug-86	W	106	13	700	62	27	6.6	17.4	0.0	5.1	56	6	640	0.38	0.8

1 flow from DWRSIM CALFED study 771
2 values from load allocation
3 two significant figures
4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Nov-79	AN	107	6	1,000	89	14	7.1	18.7	2.7	34.6	77	12	870	0.52	1.0
Dec-79	AN	120	7	1,000	100	15	8.0	21.0	2.7	32.3	79	21	790	0.48	1.0
Jan-80	W	746	7	1,000	619	15	52.2	137.6	2.7	42.2	250	369	400	0.24	1.0
Feb-80	W	1,149	6	1,000	953	15	80.8	212.8	2.7	86.3	398	555	420	0.25	1.0
Mar-80	W	907	14	1,000	752	30	63.1	166.3	2.7	116.4	379	373	500	0.3	1.0
Apr-80	W	414	15	700	240	32	28.2	74.4	1.3	61.7	198	42	580	0.35	0.8
May-80	W	446	17	700	259	36	30.3	79.9	1.3	67.3	215	44	580	0.35	0.8
Jun-80	W	447	24	700	259	53	29.9	78.7	0.0	0.0	162	97	440	0.26	0.8
Jul-80	W	237	21	700	138	46	15.2	40.1	0.0	0.0	101	37	510	0.31	0.8
Aug-80	W	101	13	700	59	27	6.2	16.4	0.0	5.1	55	4	660	0.39	0.8
Sep-80	W	159	7	1,000	132	16	10.7	28.2	2.7	43.9	102	30	770	0.46	1.0
Oct-80	W	301	6	1,000	250	13	20.8	54.9	2.7	97.8	189	61	760	0.45	1.0
Nov-80	W	114	6	1,000	95	14	7.6	20.0	2.7	43.7	88	7	930	0.56	1.0
Dec-80	W	106	7	1,000	88	15	7.0	18.4	2.7	35.8	79	9	900	0.54	1.0
Jan-81	D	138	7	1,000	114	15	9.3	24.4	2.7	29.8	81	33	710	0.42	1.0
Feb-81	D	149	6	1,000	124	15	10.1	26.5	2.7	40.6	95	29	770	0.46	1.0
Mar-81	D	185	14	1,000	153	30	12.1	31.8	2.7	25.5	102	51	660	0.4	1.0
Apr-81	D	268	15	700	156	32	17.9	47.2	1.3	18.7	117	39	530	0.32	0.8
May-81	D	208	17	700	121	36	13.5	35.6	1.3	12.7	99	22	570	0.34	0.8
Jun-81	D	87	24	700	51	53	4.4	11.7	0.0	0.0	69	-18	960	0.57	0.8
Jul-81	D	80	21	700	46	46	4.1	10.9	0.0	0.0	61	-15	920	0.55	0.8
Aug-81	D	86	13	700	50	27	5.2	13.6	0.0	0.0	46	4	640	0.39	0.8
Sep-81	D	85	7	1,000	70	16	5.5	14.4	2.7	24.0	63	7	890	0.54	1.0
Oct-81	D	111	6	1,000	92	13	7.4	19.5	2.7	30.8	73	19	790	0.48	1.0
Nov-81	D	101	6	1,000	84	14	6.7	17.6	2.7	27.2	68	16	810	0.49	1.0
Dec-81	D	103	7	1,000	85	15	6.8	17.9	2.7	28.4	71	14	830	0.5	1.0
Jan-82	W	498	7	1,000	413	15	34.7	91.4	2.7	42.2	186	227	450	0.27	1.0
Feb-82	W	916	6	1,000	760	15	64.3	169.4	2.7	86.3	338	422	440	0.27	1.0
Mar-82	W	939	14	1,000	779	30	65.4	172.3	2.7	116.4	387	392	500	0.3	1.0
Apr-82	W	1,615	15	700	938	32	113.1	298.1	1.3	61.7	506	432	380	0.23	0.8
May-82	W	978	17	700	568	36	67.9	179.0	1.3	67.3	352	216	430	0.26	0.8
Jun-82	W	608	24	700	353	53	41.3	108.7	0.0	0.0	203	150	400	0.24	0.8
Jul-82	W	258	21	700	150	46	16.7	44.1	0.0	0.0	107	43	500	0.3	0.8
Aug-82	W	166	13	700	96	27	10.8	28.5	0.0	5.1	71	25	520	0.31	0.8
Sep-82	W	310	7	1,000	257	16	21.4	56.4	2.7	43.9	140	117	540	0.33	1.0
Oct-82	W	543	6	1,000	450	13	38.0	100.0	2.7	97.8	252	198	560	0.34	1.0
Nov-82	W	533	6	1,000	442	14	37.2	98.1	2.7	43.7	196	246	440	0.27	1.0
Dec-82	W	1,167	7	1,000	968	15	82.0	216.0	2.7	35.8	352	616	360	0.22	1.0
Jan-83	W	1,524	7	1,000	1,264	15	107.2	282.5	2.7	42.2	450	814	360	0.21	1.0
Feb-83	W	2,031	6	1,000	1,684	15	143.1	377.1	2.7	86.3	624	1,060	370	0.22	1.0
Mar-83	W	2,539	14	1,000	2,106	30	178.5	470.3	2.7	116.4	798	1,308	380	0.23	1.0

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6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A Month - Year	B Year-type	C Vernalis Q[1] (TAF)	D Groundwater Q[2] (TAF)	E Salinity Water Quality Objective (µ/S/cm)	F Total Assimilative Capacity (1000 tons)	G Groundwater Salt Load[2] (1000 tons)	H Background Salt Load[2,5] (1000 tons)	I CUA Load[6] (1000 tons)	J M&I Load[2] (1000 tons)	K Load Allocations[2] (1000 tons)	L sum of loads[7] (1000 tons)	M Additional Assimilative Capacity[8] (1000 tons)	N Calculated EC[3] (µS/cm)	O Calculated boron conc. (mg/L)	P Boron water quality objective[4] (mg/L)
Jun-76	C	74	24	700	43	53	3.5	9.3	0.0	0.0	66	-23	1100	0.65	0.8
Jul-76	C	76	21	700	44	46	3.9	10.2	0.0	0.0	60	-16	950	0.57	0.8
Aug-76	C	78	13	700	45	27	4.6	12.1	0.0	0.0	44	1	680	0.41	0.8
Sep-76	C	76	7	1,000	63	16	4.8	12.8	2.7	17.8	54	9	860	0.51	1.0
Oct-76	C	180	6	1,000	149	13	12.3	32.4	2.7	29.4	90	59	600	0.36	1.0
Nov-76	C	129	6	1,000	107	14	8.7	22.8	2.7	25.0	73	34	680	0.41	1.0
Dec-76	C	107	7	1,000	89	15	7.1	18.6	2.7	23.4	67	22	760	0.45	1.0
Jan-77	C	79	7	1,000	66	15	5.1	13.4	2.7	19.5	56	10	850	0.51	1.0
Feb-77	C	71	6	1,000	59	15	4.6	12.0	2.7	15.6	50	9	850	0.51	1.0
Mar-77	C	71	14	1,000	59	30	4.0	10.6	2.7	11.7	59	0	1000	0.6	1.0
Apr-77	C	109	15	700	63	32	6.7	17.6	1.3	0.0	58	5	640	0.38	0.8
May-77	C	107	17	700	62	36	6.4	16.8	1.3	0.0	61	1	690	0.41	0.8
Jun-77	C	70	24	700	41	53	3.2	8.5	0.0	0.0	65	-24	1100	0.67	0.8
Jul-77	C	50	21	700	29	46	2.0	5.3	0.0	0.0	53	-24	1300	0.77	0.8
Aug-77	C	53	13	700	31	27	2.8	7.5	0.0	0.0	37	-6	840	0.51	0.8
Sep-77	C	64	7	1,000	53	16	4.0	10.5	2.7	17.8	51	2	960	0.58	1.0
Oct-77	C	84	6	1,000	70	13	5.5	14.5	2.7	29.4	65	5	930	0.56	1.0
Nov-77	C	79	6	1,000	66	14	5.1	13.5	2.7	25.0	60	6	920	0.55	1.0
Dec-77	C	88	7	1,000	73	15	5.7	15.1	2.7	23.4	62	11	850	0.51	1.0
Jan-78	W	200	7	1,000	166	15	13.6	35.9	2.7	42.2	109	57	660	0.39	1.0
Feb-78	W	397	6	1,000	329	15	27.6	72.7	2.7	86.3	204	125	620	0.37	1.0
Mar-78	W	695	14	1,000	576	30	48.1	126.8	2.7	116.4	324	252	560	0.34	1.0
Apr-78	W	916	15	700	532	32	63.7	167.9	1.3	61.7	327	205	430	0.26	0.8
May-78	W	704	17	700	409	36	48.6	128.0	1.3	67.3	281	128	480	0.29	0.8
Jun-78	W	432	24	700	251	53	28.8	75.9	0.0	0.0	158	93	440	0.26	0.8
Jul-78	W	185	21	700	107	46	11.6	30.5	0.0	0.0	88	19	570	0.34	0.8
Aug-78	W	109	13	700	63	27	6.8	17.9	0.0	5.1	57	6	630	0.38	0.8
Sep-78	W	166	7	1,000	138	16	11.2	29.5	2.7	43.9	103	35	750	0.45	1.0
Oct-78	W	270	6	1,000	224	13	18.7	49.1	2.7	97.8	181	43	810	0.49	1.0
Nov-78	W	119	6	1,000	99	14	8.0	21.0	2.7	43.7	89	10	900	0.54	1.0
Dec-78	W	110	7	1,000	91	15	7.3	19.2	2.7	35.8	80	11	880	0.53	1.0
Jan-79	AN	255	7	1,000	211	15	17.5	46.2	2.7	44.9	126	85	600	0.36	1.0
Feb-79	AN	519	6	1,000	430	15	36.2	95.5	2.7	86.3	236	194	550	0.33	1.0
Mar-79	AN	538	14	1,000	446	30	37.0	97.6	2.7	64.8	232	214	520	0.31	1.0
Apr-79	AN	372	15	700	216	32	25.3	66.6	1.3	63.0	188	28	610	0.37	0.8
May-79	AN	347	17	700	201	36	23.3	61.5	1.3	50.5	173	28	600	0.36	0.8
Jun-79	AN	114	24	700	66	53	6.3	16.7	0.0	0.0	76	-10	800	0.48	0.8
Jul-79	AN	101	21	700	59	46	5.6	14.8	0.0	0.0	66	-7	790	0.47	0.8
Aug-79	AN	100	13	700	58	27	6.2	16.2	0.0	0.0	49	9	590	0.35	0.8
Sep-79	AN	110	7	1,000	91	16	7.3	19.1	2.7	43.2	88	3	960	0.58	1.0
Oct-79	AN	154	6	1,000	128	13	10.5	27.5	2.7	57.1	111	17	870	0.52	1.0

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cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (μS/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (μS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Jan-73	AN	123	7	1,000	102	15	8.2	21.6	2.7	44.9	92	10	900	0.54	1.0
Feb-73	AN	326	6	1,000	270	15	22.6	59.5	2.7	86.3	186	84	690	0.41	1.0
Mar-73	AN	554	14	1,000	459	30	38.2	100.6	2.7	64.8	236	223	510	0.31	1.0
Apr-73	AN	385	15	700	223	32	26.2	69.0	1.3	63.0	192	31	600	0.36	0.8
May-73	AN	376	17	700	218	36	25.4	66.9	1.3	50.5	180	38	580	0.35	0.8
Jun-73	AN	140	24	700	81	53	8.2	21.6	0.0	0.0	83	-2	710	0.43	0.8
Jul-73	AN	107	21	700	62	46	6.0	15.9	0.0	0.0	68	-6	770	0.46	0.8
Aug-73	AN	104	13	700	60	27	6.4	17.0	0.0	0.0	50	10	580	0.35	0.8
Sep-73	AN	113	7	1,000	94	16	7.5	19.7	2.7	43.2	89	5	950	0.57	1.0
Oct-73	AN	209	6	1,000	173	13	14.3	37.8	2.7	57.1	125	48	720	0.43	1.0
Nov-73	AN	149	6	1,000	124	14	10.1	26.6	2.7	34.6	88	36	710	0.43	1.0
Dec-73	AN	178	7	1,000	148	15	12.1	31.8	2.7	32.3	94	54	640	0.38	1.0
Jan-74	W	443	7	1,000	367	15	30.8	81.2	2.7	42.2	172	195	470	0.28	1.0
Feb-74	W	306	6	1,000	254	15	21.2	55.8	2.7	86.3	181	73	710	0.43	1.0
Mar-74	W	445	14	1,000	369	30	30.5	80.3	2.7	116.4	260	109	700	0.42	1.0
Apr-74	W	457	15	700	265	32	31.3	82.4	1.3	61.7	209	56	550	0.33	0.8
May-74	W	393	17	700	228	36	26.6	70.0	1.3	67.3	201	27	620	0.37	0.8
Jun-74	W	188	24	700	109	53	11.6	30.5	0.0	0.0	95	14	610	0.37	0.8
Jul-74	W	110	21	700	64	46	6.3	16.5	0.0	0.0	69	-5	760	0.45	0.8
Aug-74	W	107	13	700	62	27	6.7	17.5	0.0	5.1	56	6	630	0.38	0.8
Sep-74	W	120	7	1,000	100	16	8.0	21.0	2.7	43.9	92	8	920	0.55	1.0
Oct-74	W	221	6	1,000	183	13	15.2	40.0	2.7	97.8	169	14	920	0.55	1.0
Nov-74	W	106	6	1,000	88	14	7.0	18.6	2.7	43.7	86	2	980	0.59	1.0
Dec-74	W	121	7	1,000	100	15	8.1	21.2	2.7	35.8	83	17	830	0.5	1.0
Jan-75	W	130	7	1,000	108	15	8.7	22.9	2.7	42.2	92	16	850	0.51	1.0
Feb-75	W	294	6	1,000	244	15	20.3	53.5	2.7	86.3	178	66	730	0.44	1.0
Mar-75	W	506	14	1,000	420	30	34.8	91.6	2.7	116.4	276	144	660	0.39	1.0
Apr-75	W	404	15	700	235	32	27.5	72.5	1.3	61.7	195	40	580	0.35	0.8
May-75	W	378	17	700	219	36	25.5	67.2	1.3	67.3	197	22	630	0.38	0.8
Jun-75	W	377	24	700	219	53	24.9	65.7	0.0	0.0	144	75	460	0.28	0.8
Jul-75	W	114	21	700	66	46	6.5	17.2	0.0	0.0	70	-4	740	0.44	0.8
Aug-75	W	110	13	700	64	27	6.9	18.1	0.0	5.1	57	7	620	0.37	0.8
Sep-75	W	117	7	1,000	97	16	7.7	20.4	2.7	43.9	91	6	940	0.56	1.0
Oct-75	W	257	6	1,000	213	13	17.7	46.7	2.7	97.8	178	35	840	0.5	1.0
Nov-75	W	113	6	1,000	94	14	7.5	19.9	2.7	43.7	88	6	940	0.56	1.0
Dec-75	W	114	7	1,000	95	15	7.6	19.9	2.7	35.8	81	14	860	0.51	1.0
Jan-76	C	100	7	1,000	83	15	6.6	17.3	2.7	19.5	61	22	740	0.44	1.0
Feb-76	C	116	6	1,000	96	15	7.7	20.4	2.7	15.6	61	35	630	0.38	1.0
Mar-76	C	107	14	1,000	89	30	6.6	17.3	2.7	11.7	68	21	770	0.46	1.0
Apr-76	C	152	15	700	88	32	9.7	25.6	1.3	0.0	69	19	550	0.33	0.8
May-76	C	147	17	700	85	36	9.2	24.2	1.3	0.0	71	14	580	0.35	0.8

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cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µS/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Aug-69	W	179	13	700	104	27	11.7	30.9	0.0	5.1	75	29	510	0.3	0.8
Sep-69	W	201	7	1,000	167	16	13.7	36.1	2.7	43.9	112	55	670	0.4	1.0
Oct-69	W	336	6	1,000	279	13	23.3	61.4	2.7	97.8	198	81	710	0.43	1.0
Nov-69	W	175	6	1,000	145	14	11.9	31.4	2.7	43.7	104	41	720	0.43	1.0
Dec-69	W	217	7	1,000	180	15	14.8	39.1	2.7	35.8	107	73	590	0.36	1.0
Jan-70	AN	1,045	7	1,000	867	15	73.4	193.3	2.7	44.9	329	538	380	0.23	1.0
Feb-70	AN	528	6	1,000	438	15	36.9	97.1	2.7	86.3	238	200	540	0.33	1.0
Mar-70	AN	454	14	1,000	376	30	31.1	81.9	2.7	64.8	211	165	560	0.34	1.0
Apr-70	AN	356	15	700	207	32	24.1	63.6	1.3	63.0	184	23	620	0.37	0.8
May-70	AN	312	17	700	181	36	20.9	54.9	1.3	50.5	164	17	630	0.38	0.8
Jun-70	AN	131	24	700	76	53	7.5	19.9	0.0	0.0	80	-4	740	0.44	0.8
Jul-70	AN	102	21	700	59	46	5.7	15.0	0.0	0.0	67	-8	790	0.48	0.8
Aug-70	AN	106	13	700	62	27	6.6	17.4	0.0	0.0	51	11	580	0.35	0.8
Sep-70	AN	117	7	1,000	97	16	7.7	20.4	2.7	43.2	90	7	930	0.56	1.0
Oct-70	AN	127	6	1,000	105	13	8.5	22.5	2.7	57.1	104	1	990	0.59	1.0
Nov-70	AN	109	6	1,000	90	14	7.3	19.1	2.7	34.6	78	12	860	0.52	1.0
Dec-70	AN	141	7	1,000	117	15	9.5	24.9	2.7	32.3	84	33	720	0.43	1.0
Jan-71	BN	135	7	1,000	112	15	9.0	23.8	2.7	22.6	73	39	650	0.39	1.0
Feb-71	BN	118	6	1,000	98	15	7.9	20.8	2.7	24.0	70	28	720	0.43	1.0
Mar-71	BN	213	14	1,000	177	30	14.1	37.1	2.7	31.7	116	61	660	0.39	1.0
Apr-71	BN	278	15	700	161	32	18.6	49.1	1.3	39.4	140	21	610	0.36	0.8
May-71	BN	257	17	700	149	36	17.0	44.7	1.3	27.2	126	23	590	0.35	0.8
Jun-71	BN	116	24	700	67	53	6.5	17.1	0.0	0.0	77	-10	800	0.48	0.8
Jul-71	BN	98	21	700	57	46	5.4	14.3	0.0	0.0	66	-9	810	0.49	0.8
Aug-71	BN	100	13	700	58	27	6.2	16.2	0.0	0.0	49	9	590	0.35	0.8
Sep-71	BN	107	7	1,000	89	16	7.0	18.5	2.7	37.1	81	8	910	0.55	1.0
Oct-71	BN	113	6	1,000	94	13	7.6	19.9	2.7	40.5	84	10	900	0.54	1.0
Nov-71	BN	93	6	1,000	77	14	6.1	16.1	2.7	33.1	72	5	930	0.56	1.0
Dec-71	BN	103	7	1,000	85	15	6.8	17.9	2.7	30.3	73	12	850	0.51	1.0
Jan-72	D	97	7	1,000	80	15	6.4	16.8	2.7	29.8	71	9	880	0.53	1.0
Feb-72	D	99	6	1,000	82	15	6.5	17.2	2.7	40.6	82	0	1000	0.6	1.0
Mar-72	D	95	14	1,000	79	30	5.7	15.1	2.7	25.5	79	0	1000	0.6	1.0
Apr-72	D	152	15	700	88	32	9.7	25.6	1.3	18.7	87	1	690	0.41	0.8
May-72	D	146	17	700	85	36	9.1	24.0	1.3	12.7	83	2	690	0.41	0.8
Jun-72	D	74	24	700	43	53	3.5	9.3	0.0	0.0	66	-23	1100	0.65	0.8
Jul-72	D	69	21	700	40	46	3.4	8.9	0.0	0.0	58	-18	1000	0.61	0.8
Aug-72	D	81	13	700	47	27	4.8	12.7	0.0	0.0	45	2	670	0.4	0.8
Sep-72	D	73	7	1,000	61	16	4.6	12.2	2.7	24.0	60	1	990	0.59	1.0
Oct-72	D	99	6	1,000	82	13	6.6	17.3	2.7	30.8	70	12	850	0.51	1.0
Nov-72	D	86	6	1,000	71	14	5.6	14.8	2.7	27.2	64	7	900	0.54	1.0
Dec-72	D	88	7	1,000	73	15	5.7	15.1	2.7	28.4	67	6	920	0.55	1.0

1 flow from DWRSIM CALFED study 771
2 values from load allocation
3 two significant figures
4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Mar-66	BN	229	14	1,000	190	30	15.2	40.0	2.7	31.7	120	70	630	0.38	1.0
Apr-66	BN	246	15	700	143	32	16.4	43.1	1.3	39.4	132	11	650	0.39	0.8
May-66	BN	186	17	700	108	36	11.9	31.5	1.3	27.2	108	0	700	0.42	0.8
Jun-66	BN	97	24	700	56	53	5.1	13.6	0.0	0.0	72	-16	900	0.54	0.8
Jul-66	BN	91	21	700	53	46	4.9	13.0	0.0	0.0	64	-11	850	0.51	0.8
Aug-66	BN	94	13	700	55	27	5.7	15.1	0.0	0.0	48	7	620	0.37	0.8
Sep-66	BN	100	7	1,000	83	16	6.5	17.2	2.7	37.1	80	3	960	0.58	1.0
Oct-66	BN	111	6	1,000	92	13	7.4	19.5	2.7	40.5	83	9	900	0.54	1.0
Nov-66	BN	95	6	1,000	79	14	6.3	16.5	2.7	33.1	73	6	930	0.56	1.0
Dec-66	BN	168	7	1,000	139	15	11.4	30.0	2.7	30.3	89	50	640	0.38	1.0
Jan-67	W	184	7	1,000	153	15	12.5	33.0	2.7	42.2	105	48	690	0.41	1.0
Feb-67	W	193	6	1,000	160	15	13.2	34.7	2.7	86.3	152	8	950	0.57	1.0
Mar-67	W	352	14	1,000	292	30	23.9	62.9	2.7	116.4	236	56	810	0.49	1.0
Apr-67	W	812	15	700	471	32	56.4	148.5	1.3	61.7	300	171	450	0.27	0.8
May-67	W	1,028	17	700	597	36	71.5	188.3	1.3	67.3	364	233	430	0.26	0.8
Jun-67	W	897	24	700	521	53	61.7	162.6	0.0	0.0	277	244	370	0.22	0.8
Jul-67	W	554	21	700	322	46	37.6	99.2	0.0	0.0	183	139	400	0.24	0.8
Aug-67	W	107	13	700	62	27	6.7	17.5	0.0	5.1	56	6	630	0.38	0.8
Sep-67	W	177	7	1,000	147	16	12.0	31.6	2.7	43.9	106	41	720	0.43	1.0
Oct-67	W	306	6	1,000	254	13	21.2	55.8	2.7	97.8	191	63	750	0.45	1.0
Nov-67	W	110	6	1,000	91	14	7.3	19.3	2.7	43.7	87	4	950	0.57	1.0
Dec-67	W	118	7	1,000	98	15	7.8	20.7	2.7	35.8	82	16	840	0.5	1.0
Jan-68	D	116	7	1,000	96	15	7.7	20.3	2.7	29.8	76	20	790	0.47	1.0
Feb-68	D	192	6	1,000	159	15	13.1	34.5	2.7	40.6	106	53	670	0.4	1.0
Mar-68	D	175	14	1,000	145	30	11.4	30.0	2.7	25.5	100	45	690	0.41	1.0
Apr-68	D	257	15	700	149	32	17.1	45.1	1.3	18.7	114	35	530	0.32	0.8
May-68	D	190	17	700	110	36	12.2	32.2	1.3	12.7	94	16	600	0.36	0.8
Jun-68	D	87	24	700	51	53	4.4	11.7	0.0	0.0	69	-18	960	0.57	0.8
Jul-68	D	86	21	700	50	46	4.6	12.0	0.0	0.0	63	-13	880	0.53	0.8
Aug-68	D	85	13	700	49	27	5.1	13.4	0.0	0.0	46	3	650	0.39	0.8
Sep-68	D	83	7	1,000	69	16	5.3	14.1	2.7	24.0	62	7	900	0.54	1.0
Oct-68	D	108	6	1,000	90	13	7.2	19.0	2.7	30.8	73	17	820	0.49	1.0
Nov-68	D	93	6	1,000	77	14	6.1	16.1	2.7	27.2	66	11	860	0.51	1.0
Dec-68	D	114	7	1,000	95	15	7.6	19.9	2.7	28.4	74	21	780	0.47	1.0
Jan-69	W	807	7	1,000	669	15	56.6	149.0	2.7	42.2	266	403	400	0.24	1.0
Feb-69	W	1,702	6	1,000	1,411	15	119.9	315.8	2.7	86.3	540	871	380	0.23	1.0
Mar-69	W	1,239	14	1,000	1,027	30	86.6	228.2	2.7	116.4	464	563	450	0.27	1.0
Apr-69	W	1,249	15	700	725	32	87.3	229.9	1.3	61.7	412	313	400	0.24	0.8
May-69	W	1,614	17	700	937	36	112.9	297.4	1.3	67.3	515	422	380	0.23	0.8
Jun-69	W	1,119	24	700	650	53	77.4	203.9	0.0	0.0	334	316	360	0.22	0.8
Jul-69	W	332	21	700	193	46	22.0	57.8	0.0	0.0	126	67	460	0.27	0.8

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5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water *Quality* Objective (µ/S/cm)	Total *Assimilative* Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated *boron conc.* (mg/L)	Boron water *quality objective*[4] (mg/L)
Oct-62	BN	100	6	1,000	83	13	6.6	17.5	2.7	40.5	80	3	960	0.58	1.0
Nov-62	BN	85	6	1,000	70	14	5.6	14.6	2.7	33.1	70	0	990	0.6	1.0
Dec-62	BN	81	7	1,000	67	15	5.2	13.8	2.7	30.3	67	0	1000	0.6	1.0
Jan-63	AN	106	7	1,000	88	15	7.0	18.4	2.7	44.9	88	0	1000	0.6	1.0
Feb-63	AN	197	6	1,000	163	15	13.5	35.5	2.7	86.3	153	10	940	0.56	1.0
Mar-63	AN	164	14	1,000	136	30	10.6	27.9	2.7	64.8	136	0	1000	0.6	1.0
Apr-63	AN	360	15	700	209	32	24.4	64.3	1.3	63.0	185	24	620	0.37	0.8
May-63	AN	345	17	700	200	36	23.2	61.1	1.3	50.5	172	28	600	0.36	0.8
Jun-63	AN	167	24	700	97	53	10.1	26.6	0.0	0.0	90	7	650	0.39	0.8
Jul-63	AN	117	21	700	68	46	6.8	17.8	0.0	0.0	71	-3	730	0.44	0.8
Aug-63	AN	106	13	700	62	27	6.6	17.4	0.0	0.0	51	11	580	0.35	0.8
Sep-63	AN	115	7	1,000	95	16	7.6	20.0	2.7	43.2	90	5	940	0.57	1.0
Oct-63	AN	137	6	1,000	114	13	9.2	24.4	2.7	57.1	106	8	930	0.56	1.0
Nov-63	AN	130	6	1,000	108	14	8.7	23.0	2.7	34.6	83	25	770	0.46	1.0
Dec-63	AN	115	7	1,000	95	15	7.6	20.1	2.7	32.3	78	17	820	0.49	1.0
Jan-64	D	117	7	1,000	97	15	7.8	20.5	2.7	29.8	76	21	780	0.47	1.0
Feb-64	D	106	6	1,000	88	15	7.0	18.5	2.7	40.6	84	4	960	0.57	1.0
Mar-64	D	101	14	1,000	84	30	6.1	16.2	2.7	25.5	81	3	970	0.58	1.0
Apr-64	D	156	15	700	91	32	10.0	26.3	1.3	18.7	88	3	680	0.41	0.8
May-64	D	154	17	700	89	36	9.7	25.5	1.3	12.7	85	4	670	0.4	0.8
Jun-64	D	81	24	700	47	53	4.0	10.6	0.0	0.0	68	-21	1000	0.61	0.8
Jul-64	D	56	21	700	33	46	2.4	6.4	0.0	0.0	55	-22	1200	0.71	0.8
Aug-64	D	57	13	700	33	27	3.1	8.2	0.0	0.0	38	-5	800	0.48	0.8
Sep-64	D	78	7	1,000	65	16	5.0	13.1	2.7	24.0	61	4	940	0.57	1.0
Oct-64	D	92	6	1,000	76	13	6.1	16.0	2.7	30.8	69	7	900	0.54	1.0
Nov-64	D	97	6	1,000	80	14	6.4	16.9	2.7	27.2	67	13	830	0.5	1.0
Dec-64	D	242	7	1,000	201	15	16.6	43.8	2.7	28.4	107	94	530	0.32	1.0
Jan-65	W	593	7	1,000	492	15	41.4	109.1	2.7	42.2	210	282	430	0.26	1.0
Feb-65	W	438	6	1,000	363	15	30.5	80.4	2.7	86.3	215	148	590	0.36	1.0
Mar-65	W	290	14	1,000	240	30	19.5	51.4	2.7	116.4	220	20	910	0.55	1.0
Apr-65	W	403	15	700	234	32	27.5	72.3	1.3	61.7	195	39	580	0.35	0.8
May-65	W	352	17	700	204	36	23.7	62.4	1.3	67.3	191	13	650	0.39	0.8
Jun-65	W	148	24	700	86	53	8.7	23.0	0.0	0.0	85	1	690	0.42	0.8
Jul-65	W	110	21	700	64	46	6.3	16.5	0.0	0.0	69	-5	760	0.45	0.8
Aug-65	W	104	13	700	60	27	6.4	17.0	0.0	5.1	56	4	650	0.39	0.8
Sep-65	W	106	7	1,000	88	16	7.0	18.4	2.7	43.9	88	0	1000	0.6	1.0
Oct-65	W	264	6	1,000	219	13	18.2	48.0	2.7	97.8	180	39	820	0.49	1.0
Nov-65	W	208	6	1,000	172	14	14.3	37.5	2.7	43.7	112	60	650	0.39	1.0
Dec-65	W	304	7	1,000	252	15	21.0	55.3	2.7	35.8	130	122	520	0.31	1.0
Jan-66	BN	309	7	1,000	256	15	21.3	56.2	2.7	22.6	118	138	460	0.28	1.0
Feb-66	BN	296	6	1,000	245	15	20.5	53.9	2.7	24.0	116	129	470	0.28	1.0

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7 = Column G + Column H + Column I + Column J
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cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
May-59	D	200	17	700	116	36	12.9	34.1	1.3	12.7	97	19	580	0.35	0.8
Jun-59	D	82	24	700	48	53	4.1	10.8	0.0	0.0	68	-20	1000	0.6	0.8
Jul-59	D	82	21	700	48	46	4.3	11.3	0.0	0.0	62	-14	910	0.55	0.8
Aug-59	D	83	13	700	48	27	5.0	13.1	0.0	0.0	45	3	650	0.39	0.8
Sep-59	D	81	7	1,000	67	16	5.2	13.7	2.7	24.0	62	5	920	0.55	1.0
Oct-59	D	95	6	1,000	79	13	6.3	16.5	2.7	30.8	69	10	880	0.53	1.0
Nov-59	D	84	6	1,000	70	14	5.5	14.5	2.7	27.2	64	6	920	0.55	1.0
Dec-59	D	80	7	1,000	66	15	5.2	13.6	2.7	28.4	65	1	980	0.59	1.0
Jan-60	C	81	7	1,000	67	15	5.2	13.8	2.7	19.5	56	11	830	0.5	1.0
Feb-60	C	111	6	1,000	92	15	7.4	19.5	2.7	15.6	60	32	650	0.39	1.0
Mar-60	C	112	14	1,000	93	30	6.9	18.2	2.7	11.7	70	23	750	0.45	1.0
Apr-60	C	158	15	700	92	32	10.1	26.7	1.3	0.0	70	22	530	0.32	0.8
May-60	C	153	17	700	89	36	9.6	25.3	1.3	0.0	72	17	570	0.34	0.8
Jun-60	C	84	24	700	49	53	4.2	11.1	0.0	0.0	68	-19	980	0.59	0.8
Jul-60	C	74	21	700	43	46	3.7	9.8	0.0	0.0	60	-17	980	0.59	0.8
Aug-60	C	60	13	700	35	27	3.3	8.8	0.0	0.0	39	-4	780	0.47	0.8
Sep-60	C	81	7	1,000	67	16	5.2	13.7	2.7	17.8	55	12	820	0.49	1.0
Oct-60	C	84	6	1,000	70	13	5.5	14.5	2.7	29.4	65	5	930	0.56	1.0
Nov-60	C	80	6	1,000	66	14	5.2	13.7	2.7	25.0	61	5	920	0.55	1.0
Dec-60	C	80	7	1,000	66	15	5.2	13.6	2.7	23.4	60	6	900	0.54	1.0
Jan-61	C	75	7	1,000	62	15	4.8	12.7	2.7	19.5	55	7	880	0.53	1.0
Feb-61	C	71	6	1,000	59	15	4.6	12.0	2.7	15.6	50	9	850	0.51	1.0
Mar-61	C	77	14	1,000	64	30	4.5	11.7	2.7	11.7	61	3	960	0.57	1.0
Apr-61	C	103	15	700	60	32	6.2	16.5	1.3	0.0	56	4	660	0.39	0.8
May-61	C	93	17	700	54	36	5.4	14.2	1.3	0.0	57	-3	740	0.44	0.8
Jun-61	C	74	24	700	43	53	3.5	9.3	0.0	0.0	66	-23	1100	0.65	0.8
Jul-61	C	53	21	700	31	46	2.2	5.9	0.0	0.0	54	-23	1200	0.74	0.8
Aug-61	C	54	13	700	31	27	2.9	7.7	0.0	0.0	38	-7	850	0.51	0.8
Sep-61	C	78	7	1,000	65	16	5.0	13.1	2.7	17.8	55	10	850	0.51	1.0
Oct-61	C	87	6	1,000	72	13	5.7	15.1	2.7	29.4	66	6	910	0.55	1.0
Nov-61	C	77	6	1,000	64	14	5.0	13.1	2.7	25.0	60	4	940	0.56	1.0
Dec-61	C	73	7	1,000	61	15	4.7	12.3	2.7	23.4	58	3	960	0.57	1.0
Jan-62	BN	68	7	1,000	56	15	4.3	11.4	2.7	22.6	56	0	990	0.6	1.0
Feb-62	BN	327	6	1,000	271	15	22.7	59.7	2.7	24.0	124	147	460	0.27	1.0
Mar-62	BN	272	14	1,000	226	30	18.2	48.0	2.7	31.7	131	95	580	0.35	1.0
Apr-62	BN	288	15	700	167	32	19.3	50.9	1.3	39.4	143	24	600	0.36	0.8
May-62	BN	245	17	700	142	36	16.1	42.5	1.3	27.2	123	19	610	0.36	0.8
Jun-62	BN	97	24	700	56	53	5.1	13.6	0.0	0.0	72	-16	900	0.54	0.8
Jul-62	BN	87	21	700	51	46	4.6	12.2	0.0	0.0	63	-12	870	0.52	0.8
Aug-62	BN	82	13	700	48	27	4.9	12.9	0.0	0.0	45	3	660	0.4	0.8
Sep-62	BN	100	7	1,000	83	16	6.5	17.2	2.7	37.1	80	3	960	0.58	1.0

1 flow from DWRSIM CALFED study 771
2 values from load allocation
3 two significant figures
4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Dec-55	D	644	7	1,000	534	15	45.0	118.6	2.7	28.4	210	324	390	0.24	1.0
Jan-56	W	1,292	7	1,000	1,071	15	90.8	239.3	2.7	42.2	390	681	360	0.22	1.0
Feb-56	W	750	6	1,000	622	15	52.6	138.5	2.7	86.3	295	327	470	0.28	1.0
Mar-56	W	392	14	1,000	325	30	26.7	70.4	2.7	116.4	246	79	760	0.45	1.0
Apr-56	W	358	15	700	208	32	24.3	64.0	1.3	61.7	183	25	620	0.37	0.8
May-56	W	400	17	700	232	36	27.1	71.3	1.3	67.3	203	29	610	0.37	0.8
Jun-56	W	455	24	700	264	53	30.5	80.2	0.0	0.0	164	100	430	0.26	0.8
Jul-56	W	129	21	700	75	46	7.6	20.0	0.0	0.0	74	1	690	0.42	0.8
Aug-56	W	106	13	700	62	27	6.6	17.4	0.0	5.1	56	6	640	0.38	0.8
Sep-56	W	120	7	1,000	100	16	8.0	21.0	2.7	43.9	92	8	920	0.55	1.0
Oct-56	W	299	6	1,000	248	13	20.7	54.5	2.7	97.8	189	59	760	0.46	1.0
Nov-56	W	102	6	1,000	85	14	6.8	17.8	2.7	43.7	85	0	1000	0.6	1.0
Dec-56	W	110	7	1,000	91	15	7.3	19.2	2.7	35.8	80	11	880	0.53	1.0
Jan-57	BN	106	7	1,000	88	15	7.0	18.4	2.7	22.6	66	22	750	0.45	1.0
Feb-57	BN	140	6	1,000	116	15	9.4	24.9	2.7	24.0	76	40	650	0.39	1.0
Mar-57	BN	200	14	1,000	166	30	13.1	34.6	2.7	31.7	112	54	680	0.41	1.0
Apr-57	BN	279	15	700	162	32	18.7	49.2	1.3	39.4	141	21	610	0.37	0.8
May-57	BN	273	17	700	158	36	18.1	47.7	1.3	27.2	130	28	570	0.34	0.8
Jun-57	BN	120	24	700	70	53	6.8	17.8	0.0	0.0	78	-8	780	0.47	0.8
Jul-57	BN	98	21	700	57	46	5.4	14.3	0.0	0.0	66	-9	810	0.49	0.8
Aug-57	BN	99	13	700	57	27	6.1	16.0	0.0	0.0	49	8	600	0.36	0.8
Sep-57	BN	105	7	1,000	87	16	6.9	18.2	2.7	37.1	81	6	930	0.56	1.0
Oct-57	BN	119	6	1,000	99	13	8.0	21.0	2.7	40.5	85	14	860	0.52	1.0
Nov-57	BN	100	6	1,000	83	14	6.6	17.4	2.7	33.1	74	9	890	0.54	1.0
Dec-57	BN	100	7	1,000	83	15	6.6	17.3	2.7	30.3	72	11	870	0.52	1.0
Jan-58	W	113	7	1,000	94	15	7.5	19.7	2.7	42.2	87	7	930	0.56	1.0
Feb-58	W	178	6	1,000	148	15	12.1	31.9	2.7	86.3	148	0	1000	0.6	1.0
Mar-58	W	592	14	1,000	491	30	40.9	107.6	2.7	116.4	298	193	610	0.36	1.0
Apr-58	W	889	15	700	516	32	61.8	162.8	1.3	61.7	320	196	430	0.26	0.8
May-58	W	855	17	700	496	36	59.2	156.1	1.3	67.3	320	176	450	0.27	0.8
Jun-58	W	688	24	700	399	53	46.9	123.6	0.0	0.0	224	175	390	0.24	0.8
Jul-58	W	130	21	700	75	46	7.7	20.2	0.0	0.0	74	1	690	0.41	0.8
Aug-58	W	114	13	700	66	27	7.2	18.8	0.0	5.1	58	8	610	0.37	0.8
Sep-58	W	132	7	1,000	109	16	8.8	23.2	2.7	43.9	95	14	870	0.52	1.0
Oct-58	W	302	6	1,000	250	13	20.9	55.1	2.7	97.8	190	60	760	0.46	1.0
Nov-58	W	140	6	1,000	116	14	9.4	24.9	2.7	43.7	95	21	820	0.49	1.0
Dec-58	W	112	7	1,000	93	15	7.4	19.5	2.7	35.8	80	13	860	0.52	1.0
Jan-59	D	139	7	1,000	115	15	9.3	24.6	2.7	29.8	81	34	700	0.42	1.0
Feb-59	D	246	6	1,000	204	15	16.9	44.6	2.7	40.6	120	84	590	0.35	1.0
Mar-59	D	227	14	1,000	188	30	15.1	39.7	2.7	25.5	113	75	600	0.36	1.0
Apr-59	D	212	15	700	123	32	14.0	36.8	1.3	18.7	103	20	590	0.35	0.8

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4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Jul-52	W	265	21	700	154	46	17.2	45.4	0.0	0.0	109	45	500	0.3	0.8
Aug-52	W	181	13	700	105	27	11.9	31.3	0.0	5.1	75	30	500	0.3	0.8
Sep-52	W	202	7	1,000	168	16	13.8	36.2	2.7	43.9	113	55	670	0.4	1.0
Oct-52	W	304	6	1,000	252	13	21.1	55.5	2.7	97.8	190	62	750	0.45	1.0
Nov-52	W	140	6	1,000	116	14	9.4	24.9	2.7	43.7	95	21	820	0.49	1.0
Dec-52	W	183	7	1,000	152	15	12.4	32.8	2.7	35.8	99	53	650	0.39	1.0
Jan-53	BN	302	7	1,000	250	15	20.9	54.9	2.7	22.6	116	134	460	0.28	1.0
Feb-53	BN	312	6	1,000	259	15	21.6	56.9	2.7	24.0	120	139	460	0.28	1.0
Mar-53	BN	230	14	1,000	191	30	15.3	40.2	2.7	31.7	120	71	630	0.38	1.0
Apr-53	BN	284	15	700	165	32	19.0	50.2	1.3	39.4	142	23	600	0.36	0.8
May-53	BN	265	17	700	154	36	17.5	46.2	1.3	27.2	128	26	580	0.35	0.8
Jun-53	BN	122	24	700	71	53	6.9	18.2	0.0	0.0	78	-7	770	0.46	0.8
Jul-53	BN	96	21	700	56	46	5.3	13.9	0.0	0.0	65	-9	820	0.49	0.8
Aug-53	BN	101	13	700	59	27	6.2	16.4	0.0	0.0	50	9	600	0.36	0.8
Sep-53	BN	107	7	1,000	89	16	7.0	18.5	2.7	37.1	81	8	910	0.55	1.0
Oct-53	BN	115	6	1,000	95	13	7.7	20.3	2.7	40.5	84	11	880	0.53	1.0
Nov-53	BN	96	6	1,000	80	14	6.3	16.7	2.7	33.1	73	7	920	0.55	1.0
Dec-53	BN	97	7	1,000	80	15	6.4	16.7	2.7	30.3	71	9	880	0.53	1.0
Jan-54	BN	94	7	1,000	78	15	6.1	16.2	2.7	22.6	63	15	810	0.48	1.0
Feb-54	BN	114	6	1,000	95	15	7.6	20.0	2.7	24.0	69	26	730	0.44	1.0
Mar-54	BN	155	14	1,000	129	30	10.0	26.3	2.7	31.7	101	28	790	0.47	1.0
Apr-54	BN	245	15	700	142	32	16.3	42.9	1.3	39.4	132	10	650	0.39	0.8
May-54	BN	231	17	700	134	36	15.1	39.9	1.3	27.2	120	14	630	0.38	0.8
Jun-54	BN	106	24	700	62	53	5.8	15.2	0.0	0.0	74	-12	840	0.51	0.8
Jul-54	BN	96	21	700	56	46	5.3	13.9	0.0	0.0	65	-9	820	0.49	0.8
Aug-54	BN	102	13	700	59	27	6.3	16.6	0.0	0.0	50	9	590	0.35	0.8
Sep-54	BN	106	7	1,000	88	16	7.0	18.4	2.7	37.1	81	7	920	0.55	1.0
Oct-54	BN	110	6	1,000	91	13	7.3	19.3	2.7	40.5	83	8	910	0.55	1.0
Nov-54	BN	92	6	1,000	76	14	6.1	15.9	2.7	33.1	72	4	940	0.57	1.0
Dec-54	BN	92	7	1,000	76	15	6.0	15.8	2.7	30.3	70	6	920	0.55	1.0
Jan-55	D	106	7	1,000	88	15	7.0	18.4	2.7	29.8	73	15	830	0.5	1.0
Feb-55	D	99	6	1,000	82	15	6.5	17.2	2.7	40.6	82	0	1000	0.6	1.0
Mar-55	D	102	14	1,000	85	30	6.2	16.4	2.7	25.5	81	4	960	0.57	1.0
Apr-55	D	157	15	700	91	32	10.1	26.5	1.3	18.7	89	2	680	0.41	0.8
May-55	D	157	17	700	91	36	9.9	26.1	1.3	12.7	86	5	660	0.4	0.8
Jun-55	D	93	24	700	54	53	4.9	12.8	0.0	0.0	71	-17	920	0.55	0.8
Jul-55	D	80	21	700	46	46	4.1	10.9	0.0	0.0	61	-15	920	0.55	0.8
Aug-55	D	64	13	700	37	27	3.6	9.5	0.0	0.0	40	-3	750	0.45	0.8
Sep-55	D	85	7	1,000	70	16	5.5	14.4	2.7	24.0	63	7	890	0.54	1.0
Oct-55	D	96	6	1,000	80	13	6.4	16.7	2.7	30.8	70	10	880	0.53	1.0
Nov-55	D	86	6	1,000	71	14	5.6	14.8	2.7	27.2	64	7	900	0.54	1.0

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5 = (Column C - Column E) * 52 mg/L * *cf*
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7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Feb-49	BN	83	6	1,000	69	15	5.4	14.2	2.7	24.0	61	8	890	0.53	1.0
Mar-49	BN	157	14	1,000	130	30	10.1	26.6	2.7	31.7	101	29	780	0.47	1.0
Apr-49	BN	220	15	700	128	32	14.5	38.2	1.3	39.4	125	3	690	0.41	0.8
May-49	BN	207	17	700	120	36	13.4	35.4	1.3	27.2	113	7	660	0.39	0.8
Jun-49	BN	99	24	700	57	53	5.3	13.9	0.0	0.0	72	-15	880	0.53	0.8
Jul-49	BN	91	21	700	53	46	4.9	13.0	0.0	0.0	64	-11	850	0.51	0.8
Aug-49	BN	99	13	700	57	27	6.1	16.0	0.0	0.0	49	8	600	0.36	0.8
Sep-49	BN	103	7	1,000	85	16	6.8	17.8	2.7	37.1	80	5	940	0.56	1.0
Oct-49	BN	101	6	1,000	84	13	6.7	17.7	2.7	40.5	81	3	970	0.58	1.0
Nov-49	BN	86	6	1,000	71	14	5.6	14.8	2.7	33.1	70	1	980	0.59	1.0
Dec-49	BN	83	7	1,000	69	15	5.4	14.1	2.7	30.3	68	1	990	0.59	1.0
Jan-50	BN	93	7	1,000	77	15	6.1	16.0	2.7	22.6	62	15	800	0.48	1.0
Feb-50	BN	142	6	1,000	118	15	9.6	25.2	2.7	24.0	77	41	650	0.39	1.0
Mar-50	BN	139	14	1,000	115	30	8.8	23.3	2.7	31.7	97	18	840	0.5	1.0
Apr-50	BN	213	15	700	124	32	14.0	36.9	1.3	39.4	124	0	700	0.42	0.8
May-50	BN	207	17	700	120	36	13.4	35.4	1.3	27.2	113	7	660	0.39	0.8
Jun-50	BN	99	24	700	57	53	5.3	13.9	0.0	0.0	72	-15	880	0.53	0.8
Jul-50	BN	89	21	700	52	46	4.8	12.6	0.0	0.0	63	-11	850	0.51	0.8
Aug-50	BN	98	13	700	57	27	6.0	15.9	0.0	0.0	49	8	600	0.36	0.8
Sep-50	BN	102	7	1,000	85	16	6.7	17.6	2.7	37.1	80	5	950	0.57	1.0
Oct-50	BN	101	6	1,000	84	13	6.7	17.7	2.7	40.5	81	3	970	0.58	1.0
Nov-50	BN	217	6	1,000	180	14	14.9	39.2	2.7	33.1	104	76	580	0.35	1.0
Dec-50	BN	581	7	1,000	482	15	40.6	106.9	2.7	30.3	196	286	410	0.24	1.0
Jan-51	AN	599	7	1,000	497	15	41.8	110.3	2.7	44.9	215	282	430	0.26	1.0
Feb-51	AN	441	6	1,000	366	15	30.7	80.9	2.7	86.3	216	150	590	0.35	1.0
Mar-51	AN	360	14	1,000	299	30	24.5	64.4	2.7	64.8	186	113	620	0.37	1.0
Apr-51	AN	344	15	700	200	32	23.3	61.3	1.3	63.0	181	19	630	0.38	0.8
May-51	AN	287	17	700	167	36	19.1	50.3	1.3	50.5	157	10	660	0.4	0.8
Jun-51	AN	128	24	700	74	53	7.3	19.3	0.0	0.0	80	-6	750	0.45	0.8
Jul-51	AN	101	21	700	59	46	5.6	14.8	0.0	0.0	66	-7	790	0.47	0.8
Aug-51	AN	105	13	700	61	27	6.5	17.2	0.0	0.0	51	10	590	0.35	0.8
Sep-51	AN	115	7	1,000	95	16	7.6	20.0	2.7	43.2	90	5	940	0.57	1.0
Oct-51	AN	130	6	1,000	108	13	8.8	23.1	2.7	57.1	105	3	970	0.58	1.0
Nov-51	AN	108	6	1,000	90	14	7.2	18.9	2.7	34.6	77	13	860	0.52	1.0
Dec-51	AN	166	7	1,000	138	15	11.2	29.6	2.7	32.3	91	47	660	0.4	1.0
Jan-52	W	352	7	1,000	292	15	24.4	64.2	2.7	42.2	149	143	510	0.31	1.0
Feb-52	W	340	6	1,000	282	15	23.6	62.1	2.7	86.3	190	92	670	0.4	1.0
Mar-52	W	700	14	1,000	581	30	48.5	127.8	2.7	116.4	325	256	560	0.34	1.0
Apr-52	W	647	15	700	376	32	44.7	117.8	1.3	61.7	258	118	480	0.29	0.8
May-52	W	994	17	700	577	36	69.1	182.0	1.3	67.3	356	221	430	0.26	0.8
Jun-52	W	649	24	700	377	53	44.2	116.4	0.0	0.0	214	163	400	0.24	0.8

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6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µS/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Sep-45	AN	121	7	1,000	100	16	8.0	21.2	2.7	43.2	91	9	910	0.54	1.0
Oct-45	AN	228	6	1,000	189	13	15.7	41.3	2.7	57.1	130	59	690	0.41	1.0
Nov-45	AN	138	6	1,000	114	14	9.3	24.5	2.7	34.6	85	29	740	0.45	1.0
Dec-45	AN	330	7	1,000	274	15	22.8	60.1	2.7	32.3	133	141	490	0.29	1.0
Jan-46	AN	347	7	1,000	288	15	24.0	63.3	2.7	44.9	150	138	520	0.31	1.0
Feb-46	AN	281	6	1,000	233	15	19.4	51.1	2.7	86.3	175	58	750	0.45	1.0
Mar-46	AN	269	14	1,000	223	30	18.0	47.5	2.7	64.8	163	60	730	0.44	1.0
Apr-46	AN	357	15	700	207	32	24.2	63.8	1.3	63.0	184	23	620	0.37	0.8
May-46	AN	312	17	700	181	36	20.9	54.9	1.3	50.5	164	17	630	0.38	0.8
Jun-46	AN	140	24	700	81	53	8.2	21.6	0.0	0.0	83	-2	710	0.43	0.8
Jul-46	AN	108	21	700	63	46	6.1	16.1	0.0	0.0	68	-5	760	0.46	0.8
Aug-46	AN	111	13	700	64	27	6.9	18.3	0.0	0.0	52	12	560	0.34	0.8
Sep-46	AN	123	7	1,000	102	16	8.2	21.5	2.7	43.2	92	10	900	0.54	1.0
Oct-46	AN	125	6	1,000	104	13	8.4	22.1	2.7	57.1	103	1	990	0.6	1.0
Nov-46	AN	115	6	1,000	95	14	7.7	20.2	2.7	34.6	79	16	830	0.5	1.0
Dec-46	AN	155	7	1,000	129	15	10.5	27.5	2.7	32.3	88	41	680	0.41	1.0
Jan-47	D	138	7	1,000	114	15	9.3	24.4	2.7	29.8	81	33	710	0.42	1.0
Feb-47	D	150	6	1,000	124	15	10.1	26.7	2.7	40.6	95	29	760	0.46	1.0
Mar-47	D	116	14	1,000	96	30	7.2	19.0	2.7	25.5	84	12	870	0.52	1.0
Apr-47	D	157	15	700	91	32	10.1	26.5	1.3	18.7	89	2	680	0.41	0.8
May-47	D	151	17	700	88	36	9.5	25.0	1.3	12.7	85	3	680	0.41	0.8
Jun-47	D	84	24	700	49	53	4.2	11.1	0.0	0.0	68	-19	980	0.59	0.8
Jul-47	D	77	21	700	45	46	3.9	10.3	0.0	0.0	60	-15	940	0.56	0.8
Aug-47	D	74	13	700	43	27	4.3	11.4	0.0	0.0	43	0	700	0.42	0.8
Sep-47	D	85	7	1,000	70	16	5.5	14.4	2.7	24.0	63	7	890	0.54	1.0
Oct-47	D	93	6	1,000	77	13	6.1	16.2	2.7	30.8	69	8	890	0.54	1.0
Nov-47	D	81	6	1,000	67	14	5.3	13.9	2.7	27.2	63	4	940	0.56	1.0
Dec-47	D	78	7	1,000	65	15	5.0	13.2	2.7	28.4	64	1	990	0.59	1.0
Jan-48	BN	71	7	1,000	59	15	4.5	11.9	2.7	22.6	57	2	970	0.58	1.0
Feb-48	BN	70	6	1,000	58	15	4.5	11.8	2.7	24.0	58	0	1000	0.6	1.0
Mar-48	BN	106	14	1,000	88	30	6.5	17.1	2.7	31.7	88	0	1000	0.6	1.0
Apr-48	BN	237	15	700	138	32	15.7	41.4	1.3	39.4	130	8	660	0.4	0.8
May-48	BN	229	17	700	133	36	15.0	39.5	1.3	27.2	119	14	630	0.38	0.8
Jun-48	BN	118	24	700	68	53	6.6	17.5	0.0	0.0	77	-9	790	0.47	0.8
Jul-48	BN	101	21	700	59	46	5.6	14.8	0.0	0.0	66	-7	790	0.47	0.8
Aug-48	BN	103	13	700	60	27	6.4	16.8	0.0	0.0	50	10	590	0.35	0.8
Sep-48	BN	108	7	1,000	90	16	7.1	18.7	2.7	37.1	82	8	920	0.55	1.0
Oct-48	BN	103	6	1,000	85	13	6.8	18.0	2.7	40.5	81	4	950	0.57	1.0
Nov-48	BN	88	6	1,000	73	14	5.8	15.2	2.7	33.1	71	2	970	0.58	1.0
Dec-48	BN	83	7	1,000	69	15	5.4	14.1	2.7	30.3	68	1	990	0.59	1.0
Jan-49	BN	76	7	1,000	63	15	4.9	12.8	2.7	22.6	58	5	920	0.55	1.0

1 flow from DWRSIM CALFED study 771
2 values from load allocation
3 two significant figures
4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water *Quality* Objective (μ/S/cm)	Total *Assimilative* Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (μS/cm)	Calculated *boron conc.* (mg/L)	Boron water *quality objective*[4] (mg/L)
Apr-42	W	416	15	700	241	32	28.4	74.8	1.3	61.7	198	43	570	0.34	0.8
May-42	W	414	17	700	240	36	28.1	73.9	1.3	67.3	207	33	600	0.36	0.8
Jun-42	W	399	24	700	232	53	26.5	69.8	0.0	0.0	149	83	450	0.27	0.8
Jul-42	W	155	21	700	90	46	9.4	24.9	0.0	0.0	80	10	620	0.37	0.8
Aug-42	W	115	13	700	67	27	7.2	19.0	0.0	5.1	58	9	610	0.36	0.8
Sep-42	W	150	7	1,000	124	16	10.1	26.6	2.7	43.9	99	25	800	0.48	1.0
Oct-42	W	300	6	1,000	249	13	20.8	54.7	2.7	97.8	189	60	760	0.46	1.0
Nov-42	W	206	6	1,000	171	14	14.1	37.2	2.7	43.7	112	59	660	0.39	1.0
Dec-42	W	214	7	1,000	177	15	14.6	38.5	2.7	35.8	107	70	600	0.36	1.0
Jan-43	W	682	7	1,000	566	15	47.7	125.7	2.7	42.2	233	333	410	0.25	1.0
Feb-43	W	601	6	1,000	498	15	42.0	110.7	2.7	86.3	257	241	520	0.31	1.0
Mar-43	W	1,105	14	1,000	916	30	77.1	203.2	2.7	116.4	429	487	470	0.28	1.0
Apr-43	W	473	15	700	275	32	32.4	85.4	1.3	61.7	213	62	540	0.33	0.8
May-43	W	426	17	700	247	36	28.9	76.2	1.3	67.3	210	37	590	0.36	0.8
Jun-43	W	240	24	700	139	53	15.3	40.2	0.0	0.0	109	30	550	0.33	0.8
Jul-43	W	116	21	700	67	46	6.7	17.6	0.0	0.0	70	-3	730	0.44	0.8
Aug-43	W	111	13	700	64	27	6.9	18.3	0.0	5.1	57	7	620	0.37	0.8
Sep-43	W	124	7	1,000	103	16	8.2	21.7	2.7	43.9	93	10	900	0.54	1.0
Oct-43	W	212	6	1,000	176	13	14.6	38.3	2.7	97.8	166	10	940	0.57	1.0
Nov-43	W	114	6	1,000	95	14	7.6	20.0	2.7	43.7	88	7	930	0.56	1.0
Dec-43	W	123	7	1,000	102	15	8.2	21.6	2.7	35.8	83	19	810	0.49	1.0
Jan-44	BN	129	7	1,000	107	15	8.6	22.7	2.7	22.6	72	35	670	0.4	1.0
Feb-44	BN	183	6	1,000	152	15	12.5	32.9	2.7	24.0	87	65	570	0.34	1.0
Mar-44	BN	197	14	1,000	163	30	12.9	34.1	2.7	31.7	111	52	680	0.41	1.0
Apr-44	BN	331	15	700	192	32	22.4	58.9	1.3	39.4	154	38	560	0.34	0.8
May-44	BN	252	17	700	146	36	16.6	43.8	1.3	27.2	125	21	600	0.36	0.8
Jun-44	BN	108	24	700	63	53	5.9	15.6	0.0	0.0	75	-12	840	0.5	0.8
Jul-44	BN	99	21	700	57	46	5.5	14.4	0.0	0.0	66	-9	800	0.48	0.8
Aug-44	BN	101	13	700	59	27	6.2	16.4	0.0	0.0	50	9	600	0.36	0.8
Sep-44	BN	109	7	1,000	90	16	7.2	18.9	2.7	37.1	82	8	910	0.54	1.0
Oct-44	BN	120	6	1,000	100	13	8.0	21.2	2.7	40.5	85	15	850	0.51	1.0
Nov-44	BN	115	6	1,000	95	14	7.7	20.2	2.7	33.1	78	17	820	0.49	1.0
Dec-44	BN	114	7	1,000	95	15	7.6	19.9	2.7	30.3	76	19	800	0.48	1.0
Jan-45	AN	106	7	1,000	88	15	7.0	18.4	2.7	44.9	88	0	1000	0.6	1.0
Feb-45	AN	399	6	1,000	331	15	27.7	73.1	2.7	86.3	205	126	620	0.37	1.0
Mar-45	AN	496	14	1,000	411	30	34.1	89.8	2.7	64.8	221	190	540	0.32	1.0
Apr-45	AN	398	15	700	231	32	27.1	71.4	1.3	63.0	195	36	590	0.35	0.8
May-45	AN	354	17	700	205	36	23.8	62.8	1.3	50.5	174	31	590	0.36	0.8
Jun-45	AN	147	24	700	85	53	8.7	22.9	0.0	0.0	85	0	700	0.42	0.8
Jul-45	AN	111	21	700	64	46	6.3	16.7	0.0	0.0	69	-5	750	0.45	0.8
Aug-45	AN	108	13	700	63	27	6.7	17.7	0.0	0.0	51	12	570	0.34	0.8

1 flow from DWRSIM CALFED study 771
2 values from load allocation
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4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Nov-38	W	160	6	1,000	133	14	10.9	28.6	2.7	43.7	100	33	750	0.45	1.0
Dec-38	W	136	7	1,000	113	15	9.1	24.0	2.7	35.8	87	26	770	0.46	1.0
Jan-39	D	152	7	1,000	126	15	10.2	27.0	2.7	29.8	85	41	670	0.4	1.0
Feb-39	D	196	6	1,000	163	15	13.4	35.3	2.7	40.6	107	56	660	0.39	1.0
Mar-39	D	172	14	1,000	143	30	11.2	29.4	2.7	25.5	99	44	690	0.42	1.0
Apr-39	D	269	15	700	156	32	18.0	47.4	1.3	18.7	117	39	520	0.31	0.8
May-39	D	216	17	700	125	36	14.1	37.1	1.3	12.7	101	24	560	0.34	0.8
Jun-39	D	91	24	700	53	53	4.7	12.4	0.0	0.0	70	-17	930	0.56	0.8
Jul-39	D	89	21	700	52	46	4.8	12.6	0.0	0.0	63	-11	850	0.51	0.8
Aug-39	D	91	13	700	53	27	5.5	14.6	0.0	0.0	47	6	620	0.37	0.8
Sep-39	D	85	7	1,000	70	16	5.5	14.4	2.7	24.0	63	7	890	0.54	1.0
Oct-39	D	106	6	1,000	88	13	7.1	18.6	2.7	30.8	72	16	820	0.49	1.0
Nov-39	D	93	6	1,000	77	14	6.1	16.1	2.7	27.2	66	11	860	0.51	1.0
Dec-39	D	94	7	1,000	78	15	6.1	16.2	2.7	28.4	68	10	870	0.52	1.0
Jan-40	AN	256	7	1,000	212	15	17.6	46.4	2.7	44.9	127	85	600	0.36	1.0
Feb-40	AN	372	6	1,000	308	15	25.8	68.1	2.7	86.3	198	110	640	0.39	1.0
Mar-40	AN	630	14	1,000	522	30	43.5	114.7	2.7	64.8	256	266	490	0.29	1.0
Apr-40	AN	404	15	700	235	32	27.5	72.5	1.3	63.0	196	39	590	0.35	0.8
May-40	AN	367	17	700	213	36	24.7	65.2	1.3	50.5	178	35	580	0.35	0.8
Jun-40	AN	143	24	700	83	53	8.4	22.1	0.0	0.0	84	-1	710	0.42	0.8
Jul-40	AN	109	21	700	63	46	6.2	16.3	0.0	0.0	69	-6	760	0.46	0.8
Aug-40	AN	110	13	700	64	27	6.9	18.1	0.0	0.0	52	12	570	0.34	0.8
Sep-40	AN	122	7	1,000	101	16	8.1	21.3	2.7	43.2	91	10	900	0.54	1.0
Oct-40	AN	135	6	1,000	112	13	9.1	24.0	2.7	57.1	106	6	950	0.57	1.0
Nov-40	AN	110	6	1,000	91	14	7.3	19.3	2.7	34.6	78	13	860	0.51	1.0
Dec-40	AN	251	7	1,000	208	15	17.2	45.4	2.7	32.3	113	95	540	0.33	1.0
Jan-41	W	281	7	1,000	233	15	19.4	51.0	2.7	42.2	130	103	560	0.33	1.0
Feb-41	W	798	6	1,000	662	15	56.0	147.4	2.7	86.3	307	355	460	0.28	1.0
Mar-41	W	707	14	1,000	586	30	49.0	129.1	2.7	116.4	327	259	560	0.33	1.0
Apr-41	W	603	15	700	350	32	41.6	109.6	1.3	61.7	246	104	490	0.3	0.8
May-41	W	633	17	700	367	36	43.5	114.7	1.3	67.3	263	104	500	0.3	0.8
Jun-41	W	535	24	700	311	53	36.1	95.1	0.0	0.0	184	127	410	0.25	0.8
Jul-41	W	129	21	700	75	46	7.6	20.0	0.0	0.0	74	1	690	0.42	0.8
Aug-41	W	110	13	700	64	27	6.9	18.1	0.0	5.1	57	7	620	0.37	0.8
Sep-41	W	119	7	1,000	99	16	7.9	20.8	2.7	43.9	91	8	920	0.55	1.0
Oct-41	W	312	6	1,000	259	13	21.6	57.0	2.7	97.8	192	67	740	0.45	1.0
Nov-41	W	137	6	1,000	114	14	9.2	24.3	2.7	43.7	94	20	830	0.5	1.0
Dec-41	W	276	7	1,000	229	15	19.0	50.1	2.7	35.8	123	106	540	0.32	1.0
Jan-42	W	471	7	1,000	391	15	32.8	86.4	2.7	42.2	179	212	460	0.27	1.0
Feb-42	W	494	6	1,000	410	15	34.5	90.8	2.7	86.3	229	181	560	0.34	1.0
Mar-42	W	367	14	1,000	304	30	25.0	65.7	2.7	116.4	240	64	790	0.47	1.0

1 flow from DWRSIM CALFED study 771
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4 =EC * 0.0006 (EC to boron relationship)
5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µ/S/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Jun-35	AN	241	24	700	140	53	15.3	40.4	0.0	0.0	109	31	550	0.33	0.8
Jul-35	AN	112	21	700	65	46	6.4	16.9	0.0	0.0	69	-4	740	0.45	0.8
Aug-35	AN	106	13	700	62	27	6.6	17.4	0.0	0.0	51	11	580	0.35	0.8
Sep-35	AN	115	7	1,000	95	16	7.6	20.0	2.7	43.2	90	5	940	0.57	1.0
Oct-35	AN	196	6	1,000	163	13	13.4	35.4	2.7	57.1	122	41	750	0.45	1.0
Nov-35	AN	93	6	1,000	77	14	6.1	16.1	2.7	34.6	74	3	960	0.58	1.0
Dec-35	AN	100	7	1,000	83	15	6.6	17.3	2.7	32.3	74	9	890	0.54	1.0
Jan-36	AN	143	7	1,000	119	15	9.6	25.3	2.7	44.9	98	21	830	0.5	1.0
Feb-36	AN	715	6	1,000	593	15	50.1	132.0	2.7	86.3	286	307	480	0.29	1.0
Mar-36	AN	352	14	1,000	292	30	23.9	62.9	2.7	64.8	184	108	630	0.38	1.0
Apr-36	AN	387	15	700	225	32	26.3	69.4	1.3	63.0	192	33	600	0.36	0.8
May-36	AN	346	17	700	201	36	23.3	61.3	1.3	50.5	172	29	600	0.36	0.8
Jun-36	AN	122	24	700	71	53	6.9	18.2	0.0	0.0	78	-7	770	0.46	0.8
Jul-36	AN	106	21	700	62	46	6.0	15.7	0.0	0.0	68	-6	770	0.46	0.8
Aug-36	AN	103	13	700	60	27	6.4	16.8	0.0	0.0	50	10	590	0.35	0.8
Sep-36	AN	113	7	1,000	94	16	7.5	19.7	2.7	43.2	89	5	950	0.57	1.0
Oct-36	AN	157	6	1,000	130	13	10.7	28.1	2.7	57.1	112	18	860	0.52	1.0
Nov-36	AN	94	6	1,000	78	14	6.2	16.3	2.7	34.6	74	4	950	0.57	1.0
Dec-36	AN	119	7	1,000	99	15	7.9	20.8	2.7	32.3	79	20	800	0.48	1.0
Jan-37	W	168	7	1,000	139	15	11.4	30.0	2.7	42.2	101	38	720	0.43	1.0
Feb-37	W	727	6	1,000	603	15	50.9	134.2	2.7	86.3	289	314	480	0.29	1.0
Mar-37	W	677	14	1,000	561	30	46.9	123.5	2.7	116.4	320	241	570	0.34	1.0
Apr-37	W	486	15	700	282	32	33.3	87.8	1.3	61.7	216	66	540	0.32	0.8
May-37	W	528	17	700	307	36	36.1	95.2	1.3	67.3	236	71	540	0.32	0.8
Jun-37	W	167	24	700	97	53	10.1	26.6	0.0	0.0	90	7	650	0.39	0.8
Jul-37	W	112	21	700	65	46	6.4	16.9	0.0	0.0	69	-4	740	0.45	0.8
Aug-37	W	110	13	700	64	27	6.9	18.1	0.0	5.1	57	7	620	0.37	0.8
Sep-37	W	119	7	1,000	99	16	7.9	20.8	2.7	43.9	91	8	920	0.55	1.0
Oct-37	W	195	6	1,000	162	13	13.3	35.2	2.7	97.8	162	0	1000	0.6	1.0
Nov-37	W	108	6	1,000	90	14	7.2	18.9	2.7	43.7	87	3	970	0.58	1.0
Dec-37	W	317	7	1,000	263	15	21.9	57.7	2.7	35.8	133	130	510	0.3	1.0
Jan-38	W	432	7	1,000	358	15	30.0	79.1	2.7	42.2	169	189	470	0.28	1.0
Feb-38	W	1,251	6	1,000	1,037	15	88.0	231.8	2.7	86.3	424	613	410	0.25	1.0
Mar-38	W	1,926	14	1,000	1,597	30	135.2	356.1	2.7	116.4	640	957	400	0.24	1.0
Apr-38	W	1,078	15	700	626	32	75.2	198.1	1.3	61.7	368	258	410	0.25	0.8
May-38	W	1,518	17	700	881	36	106.1	279.6	1.3	67.3	490	391	390	0.23	0.8
Jun-38	W	787	24	700	457	53	53.9	142.1	0.0	0.0	249	208	380	0.23	0.8
Jul-38	W	236	21	700	137	46	15.2	40.0	0.0	0.0	101	36	520	0.31	0.8
Aug-38	W	113	13	700	66	27	7.1	18.7	0.0	5.1	58	8	620	0.37	0.8
Sep-38	W	203	7	1,000	168	16	13.8	36.4	2.7	43.9	113	55	670	0.4	1.0
Oct-38	W	337	6	1,000	279	13	23.4	61.6	2.7	97.8	199	80	710	0.43	1.0

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5 = (Column C - Column E) * 52 mg/L * *cf*
6 = (Column C - Column E) * (189 - 52 mg/L) * *cf*
7 = Column G + Column H + Column I + Column J
8 = Column F - Column L

cf (conversion factor) = 0.00136

TMDL Linkage Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Month - Year	Year-type	Vernalis Q[1] (TAF)	Groundwater Q[2] (TAF)	Salinity Water Quality Objective (µS/cm)	Total Assimilative Capacity (1000 tons)	Groundwater Salt Load[2] (1000 tons)	Background Salt Load[2,5] (1000 tons)	CUA Load[6] (1000 tons)	M&I Load[2] (1000 tons)	Load Allocations[2] (1000 tons)	sum of loads[7] (1000 tons)	Additional Assimilative Capacity[8] (1000 tons)	Calculated EC[3] (µS/cm)	Calculated boron conc. (mg/L)	Boron water quality objective[4] (mg/L)
Jan-32	AN	212	7	1,000	176	15	14.5	38.2	2.7	44.9	115	61	650	0.39	1.0
Feb-32	AN	421	6	1,000	349	15	29.3	77.2	2.7	86.3	211	138	600	0.36	1.0
Mar-32	AN	276	14	1,000	229	30	18.5	48.8	2.7	64.8	165	64	720	0.43	1.0
Apr-32	AN	286	15	700	166	32	19.2	50.5	1.3	63.0	166	0	700	0.42	0.8
May-32	AN	258	17	700	150	36	17.0	44.9	1.3	50.5	150	0	700	0.42	0.8
Jun-32	AN	108	24	700	63	53	5.9	15.6	0.0	0.0	75	-12	840	0.5	0.8
Jul-32	AN	98	21	700	57	46	5.4	14.3	0.0	0.0	66	-9	810	0.49	0.8
Aug-32	AN	97	13	700	56	27	5.9	15.7	0.0	0.0	49	7	610	0.37	0.8
Sep-32	AN	105	7	1,000	87	16	6.9	18.2	2.7	43.2	87	0	1000	0.6	1.0
Oct-32	AN	172	6	1,000	143	13	11.7	30.9	2.7	57.1	115	28	810	0.48	1.0
Nov-32	AN	87	6	1,000	72	14	5.7	15.0	2.7	34.6	72	0	1000	0.6	1.0
Dec-32	AN	85	7	1,000	70	15	5.5	14.5	2.7	32.3	70	0	990	0.6	1.0
Jan-33	D	101	7	1,000	84	15	6.6	17.5	2.7	29.8	72	12	860	0.52	1.0
Feb-33	D	112	6	1,000	93	15	7.5	19.6	2.7	40.6	85	8	920	0.55	1.0
Mar-33	D	120	14	1,000	100	30	7.5	19.7	2.7	25.5	85	15	850	0.51	1.0
Apr-33	D	156	15	700	91	32	10.0	26.3	1.3	18.7	88	3	680	0.41	0.8
May-33	D	153	17	700	89	36	9.6	25.3	1.3	12.7	85	4	670	0.4	0.8
Jun-33	D	76	24	700	44	53	3.7	9.6	0.0	0.0	66	-22	1000	0.63	0.8
Jul-33	D	44	21	700	26	46	1.6	4.2	0.0	0.0	52	-26	1400	0.86	0.8
Aug-33	D	56	13	700	33	27	3.1	8.0	0.0	0.0	38	-5	820	0.49	0.8
Sep-33	D	71	7	1,000	59	16	4.5	11.8	2.7	24.0	59	0	1000	0.6	1.0
Oct-33	D	78	6	1,000	65	13	5.1	13.4	2.7	30.8	65	0	1000	0.6	1.0
Nov-33	D	73	6	1,000	61	14	4.7	12.4	2.7	27.2	61	0	1000	0.6	1.0
Dec-33	D	77	7	1,000	64	15	4.9	13.0	2.7	28.4	64	0	1000	0.6	1.0
Jan-34	C	75	7	1,000	62	15	4.8	12.7	2.7	19.5	55	7	880	0.53	1.0
Feb-34	C	109	6	1,000	90	15	7.2	19.1	2.7	15.6	60	30	660	0.4	1.0
Mar-34	C	95	14	1,000	79	30	5.7	15.1	2.7	11.7	65	14	830	0.5	1.0
Apr-34	C	113	15	700	66	32	7.0	18.3	1.3	0.0	59	7	630	0.38	0.8
May-34	C	106	17	700	62	36	6.3	16.6	1.3	0.0	60	2	680	0.41	0.8
Jun-34	C	48	24	700	28	53	1.7	4.4	0.0	0.0	59	-31	1500	0.89	0.8
Jul-34	C	47	21	700	27	46	1.8	4.8	0.0	0.0	53	-26	1400	0.82	0.8
Aug-34	C	49	13	700	28	27	2.6	6.7	0.0	0.0	36	-8	890	0.53	0.8
Sep-34	C	72	7	1,000	60	16	4.6	12.0	2.7	17.8	53	7	890	0.53	1.0
Oct-34	C	84	6	1,000	70	13	5.5	14.5	2.7	29.4	65	5	930	0.56	1.0
Nov-34	C	82	6	1,000	68	14	5.3	14.1	2.7	25.0	61	7	900	0.54	1.0
Dec-34	C	86	7	1,000	71	15	5.6	14.7	2.7	23.4	61	10	860	0.51	1.0
Jan-35	AN	182	7	1,000	151	15	12.4	32.6	2.7	44.9	108	43	720	0.43	1.0
Feb-35	AN	178	6	1,000	148	15	12.1	31.9	2.7	86.3	148	0	1000	0.6	1.0
Mar-35	AN	212	14	1,000	176	30	14.0	36.9	2.7	64.8	148	28	840	0.51	1.0
Apr-35	AN	404	15	700	235	32	27.5	72.5	1.3	63.0	196	39	590	0.35	0.8
May-35	AN	391	17	700	227	36	26.4	69.7	1.3	50.5	184	43	570	0.34	0.8

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