CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

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

FOR

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

DRAFT FINAL STAFF REPORT

APPENDIX D: BACKGROUND SALT AND BORON LOADING

AND

APPENDIX E: ALTERNATE METHODS FOR CALCULATING SALT LOADING FROM THE NORTHWEST SIDE OF THE LOWER SAN JOAQUIN RIVER

10 September 2004

State of California

California Environmental Protection Agency

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D I S C L A I M E R

This publication is a report by staff of the California Regional Water Quality Control Board, Central Valley Region. This report contains the evaluation of alternatives and technical support for the adoption of an amendment to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (Resolution No. R5-2004-0108). Mention of specific products does not represent endorsement of those products by the Regional Board.

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Final Staff Report
10 September 2004

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APPENDIX D: ESTIMATES OF BACKGROUND SALT AND BORON LOADS IN THE LOWER SAN JOAQUIN RIVER

This appendix summarizes the methods used to estimate background salt and boron loads for each of the LSJR sub-areas. Background salt and boron loads are the loads passed through a sub-area from upstream sources. Background loads include the loads associated with natural runoff from areas upstream of the agricultural areas within each sub-area and loads associated with releases from the major reservoirs upstream of the TMDL project area. Background loads, as defined here, do not account for the loads associated with groundwater. Groundwater salt contributions can be estimated for the entire TMDL project area; however, the data do not support the determination of groundwater salt and boron loading on a sub-area by sub-area basis nor does the data support the separation of anthropogenic groundwater loads from background groundwater loads. Anthropogenic or controllable loads are loads generated within the sub-areas, inclusive of all groundwater salt and boron contributions. The methods presented below are intended to provide approximate estimates of background salt and boron loading to the LSJR.

Background salt and boron loads for the Merced River, Tuolumne River, Stanislaus River, and LSJR upstream of Salt Slough sub-areas were estimated using the core data set (Appendix A) by summing all of the loads attributable to flood flows and base flows (Tables D-3 through D-10). Graphs of monthly flow versus TDS concentrations at each location (Figures D-1, D-2, D-3, D-4) show that TDS concentration remained relatively constant during high flow regimes. In lower flow regimes, TDS concentrations increased rapidly as flows decreased. The graphs were visually inspected to determine the flow at which the TDS/flow relationship changed from being relatively stable (flat) to rapidly increasing (steep); this is the threshold flow. The monthly flow and TDS data pairs were sorted by flow in descending order and all of the TDS concentrations for flows above the noted threshold flow were averaged to estimate the TDS concentration of the base and flood flows. This method assumes that base TDS concentration (background concentration) is similar to the rivers concentration during high flow periods. This is a reasonable assumption given that the vast majority of the flow coming into Merced, Tuolumne, and Stanislaus River sub-areas originates from upstream reservoirs. Additionally, Fraint Dam Releases account for most of the flow into the LSJR upstream of Salt Slough sub-area during high flow events. Background concentration is therefore similar to the reservoir concentration. It follows that concentrations in these rivers should roughly approximate the concentration in the contributing reservoir during high flows when reservoir releases comprise the majority of the river's flow. The average base TDS concentration for the Merced, Tuolumne, and Stanislaus Rivers was determined to be approximately 52 mg/L and the average base TDS concentration for the LSJR above Salt Slough was determined to be approximately 79 mg/L.

Once the average base TDS concentration for the east-side tributaries and the LSJR upstream of Salt Slough was estimated, a spreadsheet model was set up to calculate base loads and loads attributable to floods using monthly flow and monthly TDS concentrations as input variables. An algorithm was established to attribute all loads to flood conditions when the monthly concentrations were less than the base concentration (Figure D-5). The monthly base load was calculated by multiplying the monthly flow by the base concentration for the months when the monthly concentration was greater than

the base concentration. The monthly loads from agriculture, wetlands, and groundwater are equal to the total monthly load minus the base loads and the flood loads.

Background boron loads for the Merced, Tuolumne, and Stanislaus River sub-areas were estimated using a slightly different approach because only limited boron data was available for these Rivers. Daily flow data and boron data collected by the USGS between water years 1985 and 1988 (USGS, 1988 and 1991) was used to determine the average base boron value for each river. Daily flow and boron concentration pairs were sorted in a spreadsheet in descending order. The Microsoft Excel™ percentile function was used to determine the 75th percentile flow values for each river using the entire 21-year record of monthly flow. In general, flow above the 75th percentile is considered to be above normal. The flow-weighted average boron concentration corresponding to flows in or above the 75th percentile was calculated for each river. The mean of these flow-weighted averages was used to estimate base boron concentration (Table D-1).

Table D-1 Base Boron Concentration for East-side Tributaries

River/Reach	Flow-weighted-average boron concentration corresponding to 75th percentile flows
Merced River	0.010
Tuolumne River	0.010
Stanislaus River	0.025
Mean of FWA	**0.015 (mg/L)**

Once again, a spreadsheet model was set up to accept monthly flow and monthly boron concentrations as input variables and to calculate base loads and loads attributable to floods flows. The boron spreadsheet model used the same algorithm as the salt model described above except the 0.015 mg/L boron concentration was used as the base (threshold) concentration. A base boron concentration of 0.12 mg/L was used for the LSJR upstream of Salt Slough sub-area, which approximately corresponds to the 79 mg/L base TDS concentration. The resultant background salt and boron loads are shown in Table D-2.

Background loads for the East Valley Floor sub-area were determined using an estimated mean annual flow of 97,000 acre-feet, a base TDS concentration of 51 mg/L and a base boron concentration of 0.015 mg/L (average of Merced, Tuolumne, and Stanislaus river's base concentrations). The East Valley floor estimated mean annual flow was based on the unit area discharge from the Harding Drain (TID Lateral No. 5), applied to the entire land area of the East Valley Floor and adjusted to consider Waste Water Treatment Plant Discharges. East Valley Floor annual flows reflect fluctuations in annual precipitation totals observed in adjacent LSJR watershed sub-areas.

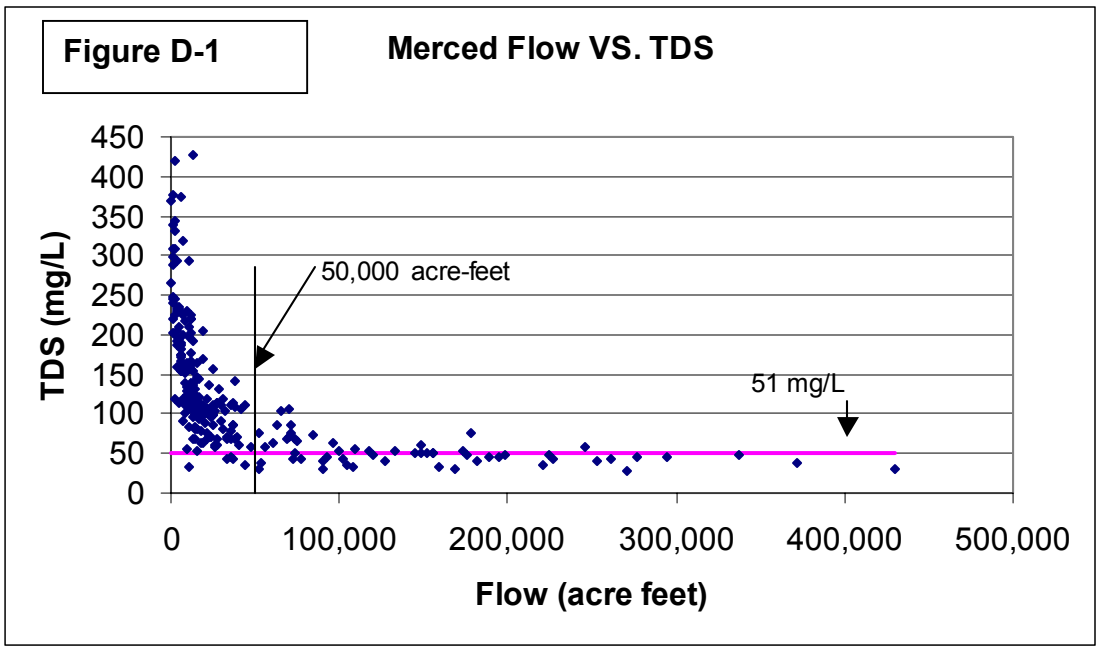
Monthly background salt loads from the Northwest Side sub-area were estimated using daily flow data from water-years 1977 through 1997 for Orestimba Creek at Newman (USGS site no. 11274500) in conjunction with a base electrical conductivity (EC) value of 353 µS/cm and a base boron concentration of 0.18 mg/L. The base EC and boron concentrations used here are flow-weighted averages obtained from a limited sample set

(n=17) for upper Orestimba Creek at Orestimba Creek Road (Westcot et. al., 1991). The Orestimba Creek at Newman flow gage has a contributing drainage area of 85,800 acres (USGS, 1994) most of which is upstream of the major agricultural areas in Orestimba Creek Watershed. This upper section of Orestimba Creek was assumed to be representative of the remainder of the NWS above the agricultural areas. The estimated salt loading from Orestimba Creek was multiplied by a factor of 2.6, which is the ratio of the area of upper Orestimba Creek to the area of the upper Northwest side sub-area.

The available data did not permit calculation of background loads for the Grasslands sub-area. For the purposes of this source analysis it was determined that background loads to Grasslands sub-area were insignificant relative to the influence of Delta salt imports. Salt importations to the Grasslands sub-area from the Delta are quantified in the source analysis section 3.4.

Table D-2: Mean annual background Salt and Boron Loads

Sub-Area	Background Salt Load (thousand tons)	Background Boron Load (tons)
SJR above Salt Slough	78	48
Grasslands	N/A	N/A
North West Side	14	11
East Valley Floor	7	2
Merced River	34	11
Tuolumne River	62	20
Stanislaus River	46	14
totals	242	106



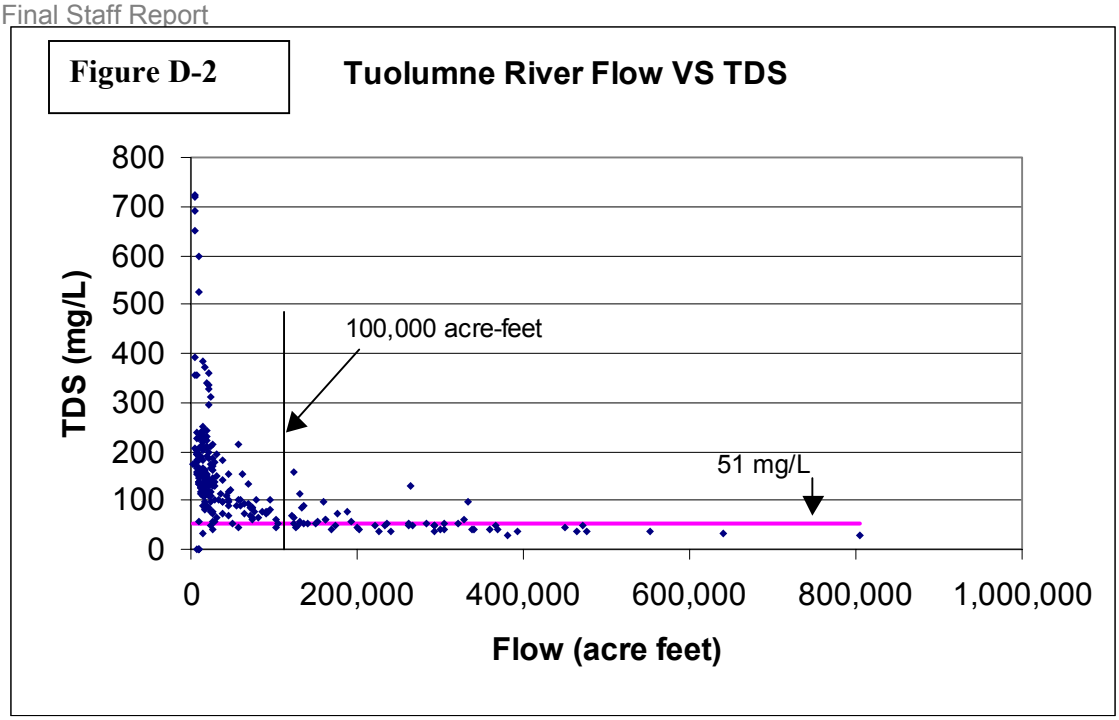


Figure D-2
Tuolumne River Flow VS TDS
TDS (mg/L)
800
700
600
500
400
300
200
100
0
100,000 acre-feet
51 mg/L
0
200,000
400,000
600,000
800,000
1,000,000
Flow (acre feet)

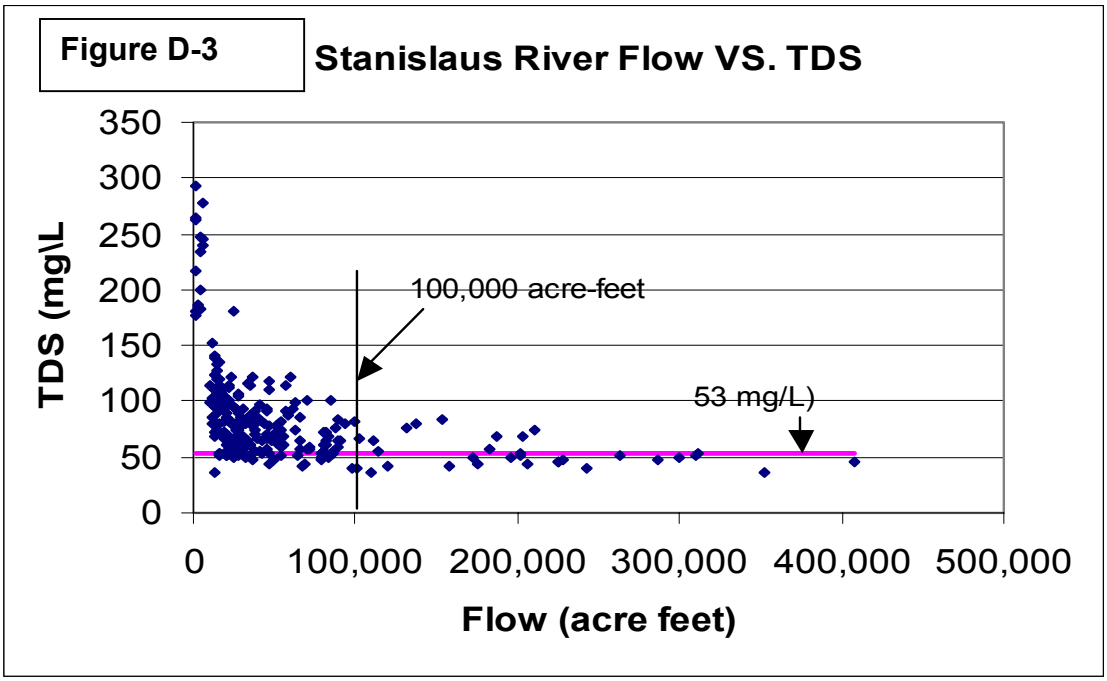


Figure D-3
Stanislaus River Flow VS. TDS
TDS (mg\L
350
300
250
200
150
100
50
0
100,000 acre-feet
53 mg/L)
0
100,000
200,000
300,000
400,000
500,000
Flow (acre feet)

Figure D- 4

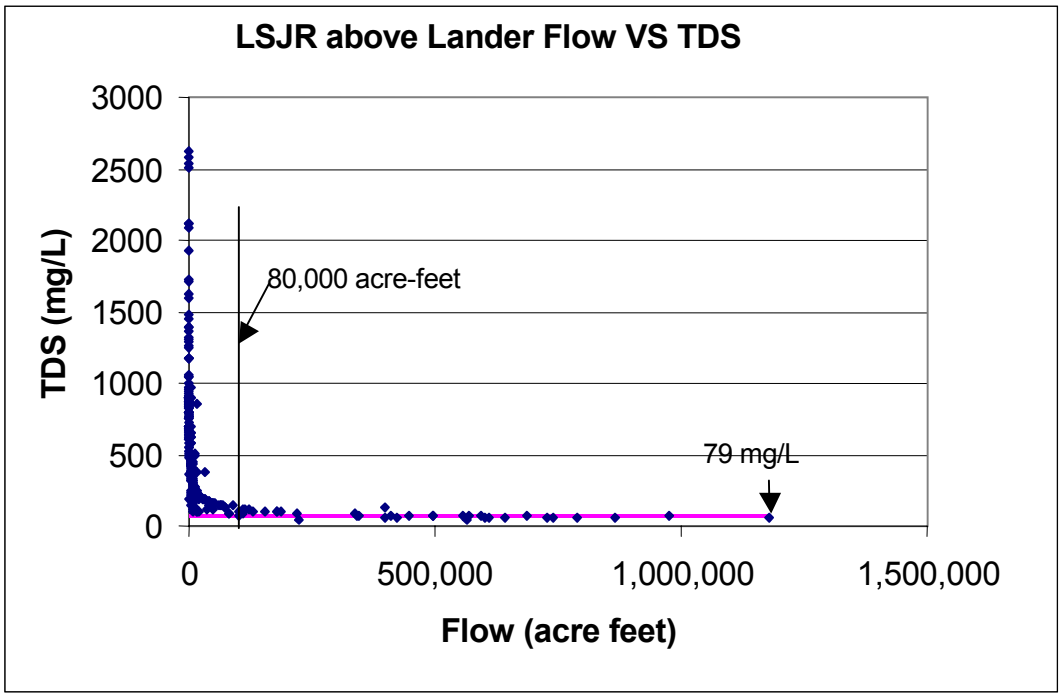


Figure D-5: Algorithm used to determine background salt loads

If $C_m,i \leq C_b$
Then $L_f,i = C_m,iQ_m,i$

If $C_m,i > C_b$
Then $L_b,i = Q_m,iC_b$

If $C_m,i > Cy$
Then $_{La},i = (Q_m,iC_m,i) - L_b,i$

Where:
C_m,i = Monthly Concentration for month i
C_b = Base Concentration
Q_m,i = Flow for month i
L_f,i = Loads from floods for month i
$_{Lb},i$ = Base loads for month i
L_a,i = Anthropogenic loads for month i

Background Loads= ∑ Base Loads (L_a) + ∑ Flood Loads (L_f)

References:

USGS, 1991b, *Water-Quality Data, San Joaquin Valley California, April 1987 to September 1988*, Open-File Report 91-74

USGS, 1988, *Water-Quality Data, San Joaquin Valley California, March 1985 to March 1987*, Open-File Report 88-479

Westcot, D.W., Enos, C.A., Lowry, P.A., 1991, *Salt and Trace Element Loading to the San Joaquin River by Ephemeral Streams Draining the Coast Range (Diablo Range)*. Regional Water Quality Control Board, Central Valley Region. Sacramento, CA.

USGS, 1993, *Water Resources Data-California, Water Year 1997, Volume 3, Southern Central Valley Basins and The Great Basin From Walker River to Truckee River*. Sacramento CA

Table D-3: Merced River Sub-area Salt Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Salt Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	8,720	162	1,920		1,920	612	1,309
Nov-76	9,430	125	1,603		1,603	662	941
Dec-76	12,030	106	1,734		1,734	844	890
Jan-77	10,590	126	1,814		1,814	743	1,071
Feb-77	6,730	160	1,464		1,464	472	992
Mar-77	5,800	181	1,427		1,427	407	1,020
Apr-77	4,110	192	1,073		1,073	288	784
May-77	4,000	186	1,011		1,011	281	731
Jun-77	1,140	246	381		381	80	301
Jul-77	1,000	247	336		336	70	266
Aug-77	548	266	198		198	38	160
Sep-77	670	309	281		281	47	234
Oct-77	699	298	283		283	49	234
Nov-77	7,220	120	1,178		1,178	506	671
Dec-77	11,250	84	1,285		1,285	789	496
Jan-78	21,410	106	3,085		3,085	1,502	1,583
Feb-78	36,910	114	5,720		5,720	2,589	3,131
Mar-78	70,810	86	8,279		8,279	4,967	3,312
Apr-78	133,000	54	9,764		9,764	9,330	434
May-78	99,790	53	7,190		7,190	7,000	190
Jun-78	76,710	44	4,589	4,589			
Jul-78	13,730	110	2,053		2,053	963	1,090
Aug-78	17,010	115	2,659		2,659	1,193	1,466
Sep-78	64,840	103	9,079		9,079	4,549	4,531
Oct-78	90,310	30	3,683	3,683			
Nov-78	69,330	69	6,504		6,504	4,864	1,640
Dec-78	28,060	131	4,997		4,997	1,968	3,029
Jan-79	38,360	67	3,494		3,494	2,691	803
Feb-79	74,180	67	6,757		6,757	5,204	1,553
Mar-79	117,400	53	8,459		8,459	8,236	223
Apr-79	26,610	103	3,726		3,726	1,867	1,859
May-79	29,120	111	4,394		4,394	2,043	2,352
Jun-79	31,200	81	3,436		3,436	2,189	1,247
Jul-79	14,190	105	2,026		2,026	995	1,030
Aug-79	13,650	95	1,763		1,763	958	805
Sep-79	21,870	76	2,260		2,260	1,534	725
Oct-79	33,570	68	3,103		3,103	2,355	748
Nov-79	26,070	59	2,091		2,091	1,829	262
Dec-79	27,130	60	2,213		2,213	1,903	310
Jan-80	178,600	76	18,453		18,453	12,529	5,924
Feb-80	155,800	50	10,591	10,591			
Mar-80	252,500	41	14,074	14,074			
Apr-80	93,220	46	5,830	5,830			
May-80	90,670	41	5,054	5,054			
Jun-80	39,440	71	3,807		3,807	2,767	1,040

Table D-3: Merced River Sub-area Salt Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Salt Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jul-80	18,970	98	2,527		2,527	1,331	1,197
Aug-80	23,680	71	2,286		2,286	1,661	625
Sep-80	53,590	37	2,696	2,696			
Oct-80	44,270	35	2,106	2,106			
Nov-80	33,830	43	1,978	1,978			
Dec-80	32,690	70	3,111		3,111	2,293	818
Jan-81	24,060	95	3,107		3,107	1,688	1,420
Feb-81	16,710	99	2,249		2,249	1,172	1,077
Mar-81	22,670	107	3,298		3,298	1,590	1,707
Apr-81	15,380	112	2,342		2,342	1,079	1,263
May-81	15,400	101	2,115		2,115	1,080	1,034
Jun-81	10,700	111	1,615		1,615	751	864
Jul-81	9,280	135	1,703		1,703	651	1,052
Aug-81	10,050	110	1,503		1,503	705	798
Sep-81	10,380	110	1,552		1,552	728	824
Oct-81	10,290	127	1,777		1,777	722	1,055
Nov-81	14,710	99	1,980		1,980	1,032	948
Dec-81	15,310	104	2,165		2,165	1,074	1,091
Jan-82	21,410	119	3,464		3,464	1,502	1,962
Feb-82	70,240	72	6,875		6,875	4,927	1,948
Mar-82	120,500	49	8,027	8,027			
Apr-82	276,500	46	17,291	17,291			
May-82	245,800	59	19,716		19,716	17,243	2,473
Jun-82	84,270	73	8,363		8,363	5,912	2,452
Jul-82	62,980	86	7,363		7,363	4,418	2,945
Aug-82	31,040	118	4,979		4,979	2,177	2,802
Sep-82	47,490	59	3,809		3,809	3,331	478
Oct-82	107,500	34	4,969	4,969			
Nov-82	70,430	106	10,149		10,149	4,941	5,209
Dec-82	148,900	61	12,348		12,348	10,445	1,903
Jan-83	173,800	52	12,287		12,287	12,192	95
Feb-83	260,700	43	15,240	15,240			
Mar-83	336,900	47	21,527	21,527			
Apr-83	294,500	45	18,017	18,017			
May-83	224,900	49	14,982	14,982			
Jun-83	270,500	27	9,929	9,929			
Jul-83	220,900	36	10,811	10,811			
Aug-83	73,270	50	4,981	4,981			
Sep-83	102,100	44	6,107	6,107			
Oct-83	168,400	31	7,097	7,097			
Nov-83	44,010	111	6,641		6,641	3,087	3,554
Dec-83	148,600	51	10,303	10,303			
Jan-84	198,200	48	12,934	12,934			
Feb-84	71,410	76	7,378		7,378	5,009	2,369
Mar-84	37,820	109	5,604		5,604	2,653	2,951
Apr-84	26,910	113	4,134		4,134	1,888	2,246

Table D-3: Merced River Sub-area Salt Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Salt Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
May-84	24,510	111	3,699		3,699	1,719	1,979
Jun-84	22,290	137	4,152		4,152	1,564	2,588
Jul-84	18,230	101	2,503		2,503	1,279	1,224
Aug-84	17,010	93	2,151		2,151	1,193	957
Sep-84	17,980	95	2,322		2,322	1,261	1,061
Oct-84	27,480	115	4,296		4,296	1,928	2,369
Nov-84	32,350	104	4,574		4,574	2,269	2,305
Dec-84	71,930	44	4,303	4,303			
Jan-85	41,790	106	6,022		6,022	2,932	3,091
Feb-85	17,770	103	2,488		2,488	1,247	1,242
Mar-85	19,250	105	2,748		2,748	1,350	1,397
Apr-85	17,770	103	2,488		2,488	1,247	1,242
May-85	17,800	102	2,468		2,468	1,249	1,220
Jun-85	15,070	145	2,971		2,971	1,057	1,914
Jul-85	13,520	139	2,555		2,555	948	1,606
Aug-85	11,890	109	1,762		1,762	834	928
Sep-85	13,530	122	2,244		2,244	949	1,295
Oct-85	15,820	117	2,516		2,516	1,110	1,407
Nov-85	14,120	111	2,131		2,131	991	1,140
Dec-85	18,850	170	4,357		4,357	1,322	3,034
Jan-86	12,970	137	2,416		2,416	910	1,506
Feb-86	25,360	87	2,999		2,999	1,779	1,220
Mar-86	182,200	41	10,156	10,156			
Apr-86	158,600	32	6,900	6,900			
May-86	104,400	36	5,110	5,110			
Jun-86	39,880	60	3,253		3,253	2,798	455
Jul-86	16,760	144	3,281		3,281	1,176	2,105
Aug-86	15,620	146	3,100		3,100	1,096	2,005
Sep-86	18,730	110	2,801		2,801	1,314	1,487
Oct-86	27,790	69	2,607		2,607	1,949	657
Nov-86	14,700	121	2,418		2,418	1,031	1,387
Dec-86	14,060	118	2,256		2,256	986	1,269
Jan-87	14,180	131	2,525		2,525	995	1,531
Feb-87	13,130	119	2,124		2,124	921	1,203
Mar-87	18,080	98	2,409		2,409	1,268	1,141
Apr-87	10,820	198	2,913		2,913	759	2,154
May-87	11,980	157	2,557		2,557	840	1,717
Jun-87	10,060	130	1,778		1,778	706	1,072
Jul-87	7,620	92	953		953	535	419
Aug-87	7,680	153	1,597		1,597	539	1,059
Sep-87	9,030	165	2,026		2,026	633	1,392
Oct-87	6,420	175	1,527		1,527	450	1,077
Nov-87	11,780	201	3,219		3,219	826	2,393
Dec-87	13,360	192	3,487		3,487	937	2,550
Jan-88	15,280	107	2,223		2,223	1,072	1,151
Feb-88	12,420	108	1,824		1,824	871	952

Table D-3: Merced River Sub-area Salt Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Salt Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Mar-88	11,640	130	2,057		2,057	817	1,241
Apr-88	10,800	126	1,850		1,850	758	1,092
May-88	10,900	157	2,327		2,327	765	1,562
Jun-88	7,710	200	2,096		2,096	541	1,555
Jul-88	3,790	205	1,056		1,056	266	790
Aug-88	4,230	113	650		650	297	353
Sep-88	2,130	226	654		654	149	505
Oct-88	2,330	343	1,086		1,086	163	923
Nov-88	8,080	140	1,538		1,538	567	971
Dec-88	11,960	139	2,260		2,260	839	1,421
Jan-89	12,350	163	2,737		2,737	866	1,870
Feb-89	11,360	167	2,579		2,579	797	1,782
Mar-89	18,960	205	5,284		5,284	1,330	3,954
Apr-89	11,760	219	3,501		3,501	825	2,676
May-89	9,630	229	2,998		2,998	676	2,323
Jun-89	6,540	225	2,001		2,001	459	1,542
Jul-89	2,110	330	947		947	148	799
Aug-89	1,470	376	751		751	103	648
Sep-89	3,030	294	1,211		1,211	213	999
Oct-89	5,080	211	1,457		1,457	356	1,101
Nov-89	10,300	294	4,117		4,117	723	3,394
Dec-89	11,670	226	3,586		3,586	819	2,767
Jan-90	11,930	177	2,871		2,871	837	2,034
Feb-90	13,590	153	2,827		2,827	953	1,873
Mar-90	10,220	209	2,904		2,904	717	2,187
Apr-90	8,250	218	2,445		2,445	579	1,866
May-90	7,870	152	1,626		1,626	552	1,074
Jun-90	5,970	168	1,364		1,364	419	945
Jul-90	1,700	203	469		469	119	350
Aug-90	1,170	240	382		382	82	300
Sep-90	1,470	287	574		574	103	470
Oct-90	1,825	419	1,040		1,040	128	912
Nov-90	7,540	319	3,270		3,270	529	2,741
Dec-90	10,151	119	1,642		1,642	712	930
Jan-91	7,811	111	1,179		1,179	548	631
Feb-91	3,598	160	783		783	252	530
Mar-91	19,676	88	2,354		2,354	1,380	974
Apr-91	7,810	100	1,062		1,062	548	514
May-91	5,774	187	1,468		1,468	405	1,063
Jun-91	1,447	338	665		665	102	563
Jul-91	371	368	186		186	26	160
Aug-91	1,011	219	301		301	71	230
Sep-91	4,242	235	1,355		1,355	298	1,058
Oct-91	4,266	194	1,125		1,125	299	826
Nov-91	12,222	219	3,639		3,639	857	2,781
Dec-91	13,644	426	7,902		7,902	957	6,945

Table D-3: Merced River Sub-area Salt Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Salt Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jan-92	13,928	67	1,269		1,269	977	292
Feb-92	17,795	64	1,548		1,548	1,248	300
Mar-92	16,691	121	2,746		2,746	1,171	1,575
Apr-92	9,354	56	712		712	656	56
May-92	5,609	154	1,174		1,174	393	781
Jun-92	3,552	229	1,106		1,106	249	857
Jul-92	2,063	308	864		864	145	719
Aug-92	2,348	246	785		785	165	621
Sep-92	2,471	118	396		396	173	223
Oct-92	10,635	33	477	477			
Nov-92	14,888	54	1,093		1,093	1,044	49
Dec-92	12,670	69	1,189		1,189	889	300
Jan-93	35,689	78	3,784		3,784	2,504	1,281
Feb-93	21,166	101	2,906		2,906	1,485	1,421
Mar-93	21,386	107	3,111		3,111	1,500	1,611
Apr-93	60,270	63	5,162		5,162	4,228	934
May-93	56,011	59	4,493		4,493	3,929	563
Jun-93	35,316	69	3,313		3,313	2,477	835
Jul-93	22,294	70	2,122		2,122	1,564	558
Aug-93	36,817	44	2,202	2,202			
Sep-93	35,566	45	2,176	2,176			
Oct-93	51,914	31	2,188	2,188			
Nov-93	14,765	99	1,987		1,987	1,036	951
Dec-93	13,922	84	1,590		1,590	977	613
Jan-94	14,757	80	1,605		1,605	1,035	570
Feb-94	17,947	79	1,928		1,928	1,259	669
Mar-94	15,215	82	1,696		1,696	1,067	629
Apr-94	21,561	69	2,023		2,023	1,513	510
May-94	25,726	60	2,098		2,098	1,805	294
Jun-94	10,487	130	1,853		1,853	736	1,118
Jul-94	19,081	63	1,634		1,634	1,339	296
Aug-94	5,683	153	1,182		1,182	399	783
Sep-94	4,880	189	1,254		1,254	342	912
Oct-94	20,875	105	2,992		2,992	1,464	1,528
Nov-94	13,159	125	2,245		2,245	923	1,322
Dec-94	12,774	127	2,204		2,204	896	1,307
Jan-95	36,541	85	4,242		4,242	2,563	1,678
Feb-95	14,617	121	2,397		2,397	1,025	1,371
Mar-95	155,045	50	10,438	10,438			
Apr-95	195,306	45	12,053	12,053			
May-95	226,578	43	13,221	13,221			
Jun-95	188,762	46	11,799	11,799			
Jul-95	151,900	50	10,306	10,306			
Aug-95	30,223	92	3,768		3,768	2,120	1,648
Sep-95	37,175	85	4,287		4,287	2,608	1,679
Oct-95	109,095	57	8,385		8,385	7,653	732

Table D-3: Merced River Sub-area Salt Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Salt Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Nov-95	24,599	99	3,315		3,315	1,726	1,589
Dec-95	24,813	99	3,333		3,333	1,741	1,592
Jan-96	21,305	105	3,031		3,031	1,495	1,536
Feb-96	144,343	51	9,983	9,983			
Mar-96	175,793	47	11,288	11,288			
Apr-96	52,226	75	5,299		5,299	3,664	1,635
May-96	74,642	65	6,619		6,619	5,236	1,383
Jun-96	15,110	119	2,447		2,447	1,060	1,387
Jul-96	5,394	176	1,288		1,288	378	909
Aug-96	3,918	198	1,055		1,055	275	780
Sep-96	5,674	172	1,329		1,329	398	931
Oct-96	25,517	156	5,394		5,394	1,790	3,604
Nov-96	15,513	163	3,443		3,443	1,088	2,355
Dec-96	127,188	40	6,867	6,867			
Jan-97	430,351	29	17,077	17,077			
Feb-97	371,694	37	18,769	18,769			
Mar-97	96,624	64	8,403		8,403	6,778	1,625
Apr-97	38,526	141	7,388		7,388	2,703	4,686
May-97	35,847	110	5,364		5,364	2,515	2,849
Jun-97	5,591	375	2,849		2,849	392	2,457
Jul-97	5,167	233	1,636		1,636	362	1,273
Aug-97	3,925	233	1,244		1,244	275	969
Sep-97	5,470	191	1,418		1,418	384	1,034

Table D-4: Tuolumne River Sub-area Salt Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Salt Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	18,470	341	8562		8,562	1,296	7,267
Nov-76	21,630	294	8645		8,645	1,517	7,128
Dec-76	21,080	329	9429		9,429	1,479	7,950
Jan-77	17,560	371	8857		8,857	1,232	7,625
Feb-77	15,440	385	8081		8,081	1,083	6,998
Mar-77	21,620	359	10552		10,552	1,517	9,035
Apr-77	10,060	526	7194		7,194	706	6,488
May-77	8,510	600	6942		6,942	597	6,345
Jun-77	5,620	691	5280		5,280	394	4,885
Jul-77	4,850	720	4747		4,747	340	4,407
Aug-77	4,150	722	4073		4,073	291	3,782
Sep-77	4,320	652	3829		3,829	303	3,526
Oct-77	4,810	391	2557		2,557	337	2,219
Nov-77	5,540	355	2674		2,674	389	2,285
Dec-77	6,750	356	3267		3,267	474	2,793
Jan-78	17,890	244	5934		5,934	1,255	4,679
Feb-78	23,340	212	6727		6,727	1,637	5,090
Mar-78	38,470	140	7322		7,322	2,699	4,623
Apr-78	89,540	72	8765		8,765	6,281	2,483
May-78	200,100	43	11698	11,698			
Jun-78	30,730	149	6225		6,225	2,156	4,069
Jul-78	13,900	243	4592		4,592	975	3,617
Aug-78	14,220	225	4350		4,350	998	3,352
Sep-78	25,940	187	6595		6,595	1,820	4,775
Oct-78	43,330	110	6480		6,480	3,040	3,440
Nov-78	73,450	83	8288		8,288	5,153	3,135
Dec-78	72,960	61	6051		6,051	5,118	932
Jan-79	177,200	73	17586		17,586	12,431	5,155
Feb-79	202,000	40	10985	10,985			
Mar-79	222,400	49	14815	14,815			
Apr-79	68,340	92	8548		8,548	4,794	3,753
May-79	15,100	249	5112		5,112	1,059	4,052
Jun-79	14,160	233	4485		4,485	993	3,492
Jul-79	21,060	198	5669		5,669	1,477	4,192
Aug-79	21,970	186	5555		5,555	1,541	4,014
Sep-79	25,920	161	5673		5,673	1,818	3,855
Oct-79	72,620	64	6319		6,319	5,094	1,224
Nov-79	64,210	73	6372		6,372	4,504	1,868
Dec-79	74,890	84	8552		8,552	5,254	3,299
Jan-80	305,100	54	22398		22,398	21,403	995
Feb-80	322,200	52	22778		22,778	22,602	175
Mar-80	359,400	39	19056	19,056			
Apr-80	153,500	56	11686		11,686	10,768	918
May-80	161,200	62	13587		13,587	11,308	2,279
Jun-80	129,100	49	8600	8,600			
Jul-80	26,160	215	7646		7,646	1,835	5,811

Table D-4: Tuolumne River Sub-area Salt Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Salt Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Aug-80	17,020	228	5276		5,276	1,194	4,082
Sep-80	91,880	77	9618		9,618	6,445	3,173
Oct-80	124,600	53	8978		8,978	8,741	237
Nov-80	102,100	60	8328		8,328	7,162	1,166
Dec-80	104,100	54	7642		7,642	7,303	340
Jan-81	129,800	58	10235		10,235	9,105	1,129
Feb-81	80,060	66	7184		7,184	5,616	1,567
Mar-81	72,560	85	8385		8,385	5,090	3,295
Apr-81	27,480	176	6575		6,575	1,928	4,647
May-81	15,610	244	5178		5,178	1,095	4,083
Jun-81	15,680	205	4370		4,370	1,100	3,270
Jul-81	15,230	204	4224		4,224	1,068	3,155
Aug-81	15,130	212	4361		4,361	1,061	3,299
Sep-81	14,270	220	4268		4,268	1,001	3,267
Oct-81	23,300	165	5227		5,227	1,634	3,592
Nov-81	29,490	136	5452		5,452	2,069	3,384
Dec-81	44,240	118	7097		7,097	3,103	3,994
Jan-82	95,440	79	10250		10,250	6,695	3,555
Feb-82	173,000	50	11760	11,760			
Mar-82	299,200	40	16270	16,270			
Apr-82	465,400	38	24043	24,043			
May-82	392,200	37	19728	19,728			
Jun-82	135,600	53	9770		9,770	9,512	258
Jul-82	133,500	84	15245		15,245	9,365	5,880
Aug-82	57,320	99	7715		7,715	4,021	3,694
Sep-82	160,200	97	21126		21,126	11,238	9,888
Oct-82	227,100	36	11115	11,115			
Nov-82	123,700	65	10931		10,931	8,678	2,253
Dec-82	333,900	95	43124		43,124	23,423	19,701
Jan-83	329,300	60	26861		26,861	23,100	3,761
Feb-83	341,300	42	19488	19,488			
Mar-83	470,900	48	30729	30,729			
Apr-83	551,500	37	27741	27,741			
May-83	640,800	33	28749	28,749			
Jun-83	338,200	39	17932	17,932			
Jul-83	260,900	52	18444		18,444	18,302	142
Aug-83	136,800	90	16738		16,738	9,597	7,142
Sep-83	240,500	35	11444	11,444			
Oct-83	292,700	35	13927	13,927			
Nov-83	124,300	159	26869		26,869	8,720	18,149
Dec-83	263,300	131	46892		46,892	18,471	28,422
Jan-84	366,600	48	23923	23,923			
Feb-84	267,700	49	17833	17,833			
Mar-84	188,300	78	19968		19,968	13,209	6,758
Apr-84	56,200	214	16350		16,350	3,942	12,408
May-84	38,580	182	9546		9,546	2,706	6,839

Table D-4: Tuolumne River Sub-area Salt Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Salt Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jun-84	18,550	229	5775		5,775	1,301	4,474
Jul-84	18,450	210	5267		5,267	1,294	3,973
Aug-84	18,980	191	4928		4,928	1,331	3,597
Sep-84	23,070	172	5395		5,395	1,618	3,776
Oct-84	62,430	153	12986		12,986	4,379	8,606
Nov-84	69,420	134	12646		12,646	4,870	7,777
Dec-84	131,200	115	20512		20,512	9,204	11,308
Jan-85	96,330	100	13096		13,096	6,758	6,338
Feb-85	76,290	77	7986		7,986	5,352	2,634
Mar-85	46,510	121	7651		7,651	3,263	4,388
Apr-85	23,200	310	9778		9,778	1,627	8,150
May-85	20,640	335	9400		9,400	1,448	7,952
Jun-85	19,220	222	5801		5,801	1,348	4,452
Jul-85	16,750	134	3051		3,051	1,175	1,876
Aug-85	15,810	86	1848		1,848	1,109	739
Sep-85	15,250	31	643	643			
Oct-85	28,520	99	3839		3,839	2,001	1,838
Nov-85	33,340	99	4487		4,487	2,339	2,148
Dec-85	37,780	98	5033		5,033	2,650	2,383
Jan-86	37,320	95	4820		4,820	2,618	2,202
Feb-86	139,800	51	9693	9,693			
Mar-86	380,100	27	13952	13,952			
Apr-86	305,300	40	16602	16,602			
May-86	170,200	39	9024	9,024			
Jun-86	102,600	46	6416	6,416			
Jul-86	21,870	110	3271		3,271	1,534	1,736
Aug-86	21,340	130	3772		3,772	1,497	2,275
Sep-86	55,810	89	6753		6,753	3,915	2,838
Oct-86	77,540	102	10752		10,752	5,439	5,313
Nov-86	72,140	67	6571		6,571	5,061	1,510
Dec-86	127,300	45	7788	7,788			
Jan-87	56,400	45	3450	3,450			
Feb-87	26,330	130	4653		4,653	1,847	2,806
Mar-87	45,650	98	6082		6,082	3,202	2,880
Apr-87	44,760	70	4260		4,260	3,140	1,120
May-87	26,820	171	6235		6,235	1,881	4,354
Jun-87	12,060	235	3853		3,853	846	3,007
Jul-87	10,730	211	3078		3,078	753	2,325
Aug-87	12,030	189	3091		3,091	844	2,247
Sep-87	10,860	227	3351		3,351	762	2,590
Oct-87	16,560	160	3602		3,602	1,162	2,440
Nov-87	18,130	128	3155		3,155	1,272	1,883
Dec-87	18,520	142	3575		3,575	1,299	2,276
Jan-88	18,450	152	3813		3,813	1,294	2,518
Feb-88	13,240	164	2952		2,952	929	2,023
Mar-88	14,680	161	3213		3,213	1,030	2,183

Table D-4: Tuolumne River Sub-area Salt Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Salt Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Apr-88	22,020	117	3503		3,503	1,545	1,958
May-88	8,840	187	2247		2,247	620	1,627
Jun-88	6,670	179	1623		1,623	468	1,155
Jul-88	5,980	201	1634		1,634	419	1,215
Aug-88	6,410	239	2083		2,083	450	1,633
Sep-88	6,580	228	2040		2,040	462	1,578
Oct-88	8,280	0	0	0			
Nov-88	9,650	0	0	0			
Dec-88	11,400	151	2340		2,340	800	1,541
Jan-89	11,390	153	2369		2,369	799	1,570
Feb-89	9,440	147	1887		1,887	662	1,224
Mar-89	16,010	129	2808		2,808	1,123	1,685
Apr-89	21,250	85	2456		2,456	1,491	965
May-89	10,380	136	1919		1,919	728	1,191
Jun-89	8,390	207	2361		2,361	589	1,773
Jul-89	8,480	0	0	0			
Aug-89	8,840	135	1622		1,622	620	1,002
Sep-89	10,210	0	0	0			
Oct-89	15,120	115	2364		2,364	1,061	1,303
Nov-89	17,760	90	2173		2,173	1,246	927
Dec-89	16,350	98	2178		2,178	1,147	1,031
Jan-90	15,010	108	2204		2,204	1,053	1,151
Feb-90	14,780	118	2371		2,371	1,037	1,334
Mar-90	16,070	120	2622		2,622	1,127	1,494
Apr-90	16,110	108	2365		2,365	1,130	1,235
May-90	14,270	88	1707		1,707	1,001	706
Jun-90	7,110	192	1856		1,856	499	1,357
Jul-90	7,260	183	1806		1,806	509	1,297
Aug-90	8,350	164	1862		1,862	586	1,276
Sep-90	8,780	163	1946		1,946	616	1,330
Oct-90	11,558	131	2058		2,058	811	1,248
Nov-90	11,408	126	1954		1,954	800	1,154
Dec-90	10,582	132	1899		1,899	742	1,157
Jan-91	9,548	139	1804		1,804	670	1,134
Feb-91	8,619	138	1617		1,617	605	1,012
Mar-91	22,629	118	3630		3,630	1,587	2,043
Apr-91	22,863	50	1554	1,554			
May-91	26,085	77	2731		2,731	1,830	901
Jun-91	7,741	164	1726		1,726	543	1,183
Jul-91	3,001	173	706		706	211	495
Aug-91	6,954	169	1598		1,598	488	1,110
Sep-91	6,864	201	1876		1,876	482	1,394
Oct-91	9,574	161	2096		2,096	672	1,424
Nov-91	11,919	115	1863		1,863	836	1,027
Dec-91	11,203	125	1904		1,904	786	1,118
Jan-92	11,915	117	1895		1,895	836	1,059

Table D-4: Tuolumne River Sub-area Salt Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Salt Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Feb-92	25,696	55	1921		1,921	1,803	119
Mar-92	15,780	80	1716		1,716	1,107	609
Apr-92	18,988	114	2943		2,943	1,332	1,611
May-92	21,794	140	4148		4,148	1,529	2,619
Jun-92	6,585	195	1746		1,746	462	1,284
Jul-92	5,972	195	1583		1,583	419	1,164
Aug-92	5,950	205	1658		1,658	417	1,241
Sep-92	7,016	196	1869		1,869	492	1,377
Oct-92	9,890	165	2219		2,219	694	1,525
Nov-92	12,426	151	2551		2,551	872	1,679
Dec-92	12,516	237	4033		4,033	878	3,155
Jan-93	46,282	152	9564		9,564	3,247	6,317
Feb-93	24,972	108	3667		3,667	1,752	1,915
Mar-93	18,101	143	3519		3,519	1,270	2,249
Apr-93	49,053	52	3468		3,468	3,441	27
May-93	45,128	88	5399		5,399	3,166	2,233
Jun-93	28,536	55	2134		2,134	2,002	132
Jul-93	19,795	208	5598		5,598	1,389	4,209
Aug-93	30,424	192	7941		7,941	2,134	5,807
Sep-93	59,389	100	8074		8,074	4,166	3,908
Oct-93	45,672	100	6209		6,209	3,204	3,005
Nov-93	23,461	77	2456		2,456	1,646	810
Dec-93	27,035	74	2720		2,720	1,897	823
Jan-94	38,327	72	3752		3,752	2,689	1,063
Feb-94	23,124	95	2987		2,987	1,622	1,364
Mar-94	19,819	89	2398		2,398	1,390	1,008
Apr-94	31,000	63	2655		2,655	2,175	480
May-94	27,099	40	1474	1,474			
Jun-94	8,485	55	634		634	595	39
Jul-94	7,081	154	1482		1,482	497	986
Aug-94	7,692	156	1631		1,631	540	1,092
Sep-94	7,645	193	2006		2,006	536	1,470
Oct-94	8,464	226	2600		2,600	594	2,007
Nov-94	12,858	188	3281		3,281	902	2,379
Dec-94	13,931	181	3430		3,430	977	2,453
Jan-95	73,121	87	8620		8,620	5,129	3,491
Feb-95	234,847	52	16488		16,488	16,475	14
Mar-95	292,385	47	18624	18,624			
Apr-95	369,036	42	21197	21,197			
May-95	476,971	38	24446	24,446			
Jun-95	293,153	47	18651	18,651			
Jul-95	193,682	56	14813		14,813	13,587	1,227
Aug-95	64,912	91	8068		8,068	4,554	3,515
Sep-95	122,157	69	11466		11,466	8,569	2,896
Oct-95	89,755	77	9369		9,369	6,296	3,072
Nov-95	18,478	148	3730		3,730	1,296	2,434

Table D-4: Tuolumne River Sub-area Salt Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Salt Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Dec-95	17,607	148	3542		3,542	1,235	2,307
Jan-96	26,820	145	5291		5,291	1,881	3,409
Feb-96	261,756	47	16807	16,807			
Mar-96	293,881	47	18865	18,865			
Apr-96	161,218	62	13497		13,497	11,309	2,187
May-96	232,963	50	15942	15,942			
Jun-96	35,974	114	5553		5,553	2,524	3,029
Jul-96	10,405	190	2681		2,681	730	1,951
Aug-96	17,123	158	3672		3,672	1,201	2,471
Sep-96	17,072	155	3589		3,589	1,198	2,391
Oct-96	28,071	128	4869		4,869	1,969	2,899
Nov-96	23,348	137	4350		4,350	1,638	2,712
Dec-96	284,328	51	19803	19,803			
Jan-97	803,690	29	31643	31,643			
Feb-97	450,657	43	26373	26,373			
Mar-97	150,175	53	10885		10,885	10,535	351
Apr-97	86,663	77	9023		9,023	6,079	2,944
May-97	58,552	90	7142		7,142	4,107	3,035
Jun-97	15,993	144	3125		3,125	1,122	2,003
Jul-97	17,809	137	3318		3,318	1,249	2,069
Aug-97	17,629	144	3459		3,459	1,237	2,222
Sep-97	16,941	142	3269		3,269	1,188	2,080

Table D-5: Stanislaus Sub-area Salt Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Salt Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	5,554	245	1850		1,850	390	1,460
Nov-76	4,429	248	1493		1,493	311	1,183
Dec-76	5,379	278	2033		2,033	377	1,656
Jan-77	5,153	239	1674		1,674	361	1,313
Feb-77	3,876	234	1233		1,233	272	961
Mar-77	4,068	200	1106		1,106	285	821
Apr-77	3,074	185	773		773	216	557
May-77	3,792	182	938		938	266	672
Jun-77	2,947	187	749		749	207	542
Jul-77	1,444	181	355		355	101	254
Aug-77	1,348	177	324		324	95	230
Sep-77	834	216	245		245	59	186
Oct-77	801	292	318		318	56	262
Nov-77	1,254	264	450		450	88	362
Dec-77	1,636	263	585		585	115	470
Jan-78	25,420	180	6221		6,221	1,783	4,437
Feb-78	87,390	76	9029		9,029	6,130	2,899
Mar-78	186,700	68	17260		17,260	13,097	4,163
Apr-78	202,300	54	14851		14,851	14,191	660
May-78	225,700	45	13808	13,808			
Jun-78	158,300	41	8824	8,824			
Jul-78	34,560	88	4135		4,135	2,424	1,710
Aug-78	15,160	107	2205		2,205	1,063	1,142
Sep-78	17,280	97	2279		2,279	1,212	1,067
Oct-78	17,020	111	2568		2,568	1,194	1,374
Nov-78	16,020	115	2505		2,505	1,124	1,381
Dec-78	26,780	74	2694		2,694	1,879	816
Jan-79	81,830	70	7787		7,787	5,740	2,047
Feb-79	99,180	82	11056		11,056	6,957	4,099
Mar-79	132,000	76	13639		13,639	9,260	4,379
Apr-79	35,120	115	5491		5,491	2,464	3,027
May-79	70,450	101	9673		9,673	4,942	4,731
Jun-79	51,920	79	5576		5,576	3,642	1,934
Jul-79	15,760	113	2421		2,421	1,106	1,316
Aug-79	15,820	109	2344		2,344	1,110	1,235
Sep-79	14,270	110	2134		2,134	1,001	1,133
Oct-79	17,670	112	2691		2,691	1,240	1,451
Nov-79	14,560	128	2534		2,534	1,021	1,512
Dec-79	27,060	105	3863		3,863	1,898	1,964
Jan-80	203,300	68	18794		18,794	14,262	4,533
Feb-80	183,200	57	14196		14,196	12,852	1,345
Mar-80	153,000	83	17264		17,264	10,733	6,531
Apr-80	228,400	47	14594	14,594			
May-80	242,400	39	12852	12,852			
Jun-80	65,460	85	7564		7,564	4,592	2,972
Jul-80	72,060	57	5584		5,584	5,055	529

Table D-5: Stanislaus Sub-area Salt Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Salt Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Aug-80	21,680	101	2977		2,977	1,521	1,456
Sep-80	28,720	82	3202		3,202	2,015	1,187
Oct-80	28,000	92	3502		3,502	1,964	1,538
Nov-80	20,770	89	2513		2,513	1,457	1,056
Dec-80	13,770	141	2640		2,640	966	1,674
Jan-81	15,710	135	2883		2,883	1,102	1,781
Feb-81	12,130	153	2523		2,523	851	1,672
Mar-81	21,600	112	3289		3,289	1,515	1,774
Apr-81	62,370	74	6275		6,275	4,375	1,899
May-81	45,590	71	4401		4,401	3,198	1,202
Jun-81	32,290	64	2809		2,809	2,265	544
Jul-81	24,080	80	2619		2,619	1,689	930
Aug-81	26,680	64	2321		2,321	1,872	450
Sep-81	16,800	102	2330		2,330	1,179	1,151
Oct-81	16,575	119	2682		2,682	1,163	1,519
Nov-81	17,393	107	2530		2,530	1,220	1,310
Dec-81	14,657	134	2670		2,670	1,028	1,642
Jan-82	36,245	122	6012		6,012	2,543	3,469
Feb-82	61,271	94	7830		7,830	4,298	3,532
Mar-82	81,480	72	7976		7,976	5,716	2,260
Apr-82	46,752	110	6992		6,992	3,280	3,712
May-82	27,631	107	4019		4,019	1,938	2,081
Jun-82	80,330	60	6553		6,553	5,635	917
Jul-82	80,945	56	6163		6,163	5,678	484
Aug-82	88,561	64	7706		7,706	6,213	1,493
Sep-82	81,500	60	6648		6,648	5,717	931
Oct-82	79,300	54	5822		5,822	5,563	259
Nov-82	79,890	56	6082		6,082	5,604	478
Dec-82	81,140	73	8053		8,053	5,692	2,361
Jan-83	84,430	101	11593		11,593	5,923	5,670
Feb-83	60,270	122	9996		9,996	4,228	5,768
Mar-83	210,600	75	21473		21,473	14,774	6,700
Apr-83	309,900	51	21487	21,487			
May-83	262,950	52	18589		18,589	18,446	143
Jun-83	196,500	49	13090	13,090			
Jul-83	225,700	45	13808	13,808			
Aug-83	172,840	49	11514	11,514			
Sep-83	113,790	56	8663		8,663	7,982	681
Oct-83	111,260	65	9832		9,832	7,805	2,027
Nov-83	137,310	79	14747		14,747	9,632	5,115
Dec-83	311,010	54	22832		22,832	21,817	1,015
Jan-84	299,400	50	20352	20,352			
Feb-84	101,610	66	9117		9,117	7,128	1,989
Mar-84	89,290	83	10075		10,075	6,264	3,812
Apr-84	56,760	91	7022		7,022	3,982	3,040
May-84	57,780	88	6913		6,913	4,053	2,859

Table D-5: Stanislaus Sub-area Salt Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Salt Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jun-84	33,650	116	5307		5,307	2,361	2,946
Jul-84	31,260	93	3952		3,952	2,193	1,759
Aug-84	37,100	78	3934		3,934	2,603	1,332
Sep-84	52,100	64	4533		4,533	3,655	878
Oct-84	53,806	81	5925		5,925	3,775	2,151
Nov-84	23,738	121	3905		3,905	1,665	2,240
Dec-84	46,992	118	7539		7,539	3,296	4,242
Jan-85	62,876	98	8377		8,377	4,411	3,966
Feb-85	40,762	97	5375		5,375	2,859	2,516
Mar-85	38,612	92	4829		4,829	2,709	2,121
Apr-85	51,209	78	5430		5,430	3,592	1,838
May-85	45,217	91	5594		5,594	3,172	2,422
Jun-85	38,132	80	4147		4,147	2,675	1,472
Jul-85	86,598	56	6593		6,593	6,075	518
Aug-85	79,777	53	5748		5,748	5,596	152
Sep-85	31,210	79	3352		3,352	2,189	1,163
Oct-85	28,116	90	3440		3,440	1,972	1,468
Nov-85	24,918	67	2270		2,270	1,748	522
Dec-85	27,481	74	2765		2,765	1,928	837
Jan-86	28,796	86	3367		3,367	2,020	1,347
Feb-86	93,552	80	10175		10,175	6,563	3,612
Mar-86	286,790	48	18715	18,715			
Apr-86	119,544	42	6826	6,826			
May-86	83,048	50	5645	5,645			
Jun-86	79,557	50	5408	5,408			
Jul-86	55,490	69	5205		5,205	3,893	1,313
Aug-86	81,433	64	7085		7,085	5,713	1,373
Sep-86	89,177	59	7153		7,153	6,256	897
Oct-86	45,283	93	5725		5,725	3,177	2,549
Nov-86	31,426	80	3418		3,418	2,205	1,213
Dec-86	55,250	60	4507		4,507	3,876	631
Jan-87	38,577	71	3724		3,724	2,706	1,017
Feb-87	45,451	58	3584		3,584	3,188	395
Mar-87	71,911	59	5768		5,768	5,045	723
Apr-87	66,331	65	5862		5,862	4,653	1,208
May-87	49,380	71	4766		4,766	3,464	1,302
Jun-87	50,729	63	4345		4,345	3,559	786
Jul-87	37,478	74	3770		3,770	2,629	1,141
Aug-87	32,692	80	3556		3,556	2,293	1,262
Sep-87	27,461	80	2987		2,987	1,926	1,060
Oct-87	17,508	107	2547		2,547	1,228	1,319
Nov-87	18,331	94	2343		2,343	1,286	1,057
Dec-87	14,188	120	2315		2,315	995	1,319
Jan-88	13,450	138	2523		2,523	944	1,580
Feb-88	13,793	124	2325		2,325	968	1,358
Mar-88	70,022	57	5426		5,426	4,912	514

Table D-5: Stanislaus Sub-area Salt Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Salt Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Apr-88	53,399	59	4283		4,283	3,746	537
May-88	55,020	60	4488		4,488	3,860	628
Jun-88	54,012	62	4553		4,553	3,789	764
Jul-88	45,433	67	4138		4,138	3,187	951
Aug-88	47,580	64	4140		4,140	3,338	802
Sep-88	42,817	65	3784		3,784	3,004	780
Oct-88	28,719	56	2186		2,186	2,015	172
Nov-88	25,968	56	1977		1,977	1,822	155
Dec-88	27,398	61	2272		2,272	1,922	350
Jan-89	15,921	80	1732		1,732	1,117	615
Feb-89	12,488	36	611	611			
Mar-89	63,888	51	4430	4,430			
Apr-89	54,292	52	3838		3,838	3,809	30
May-89	65,193	57	5052		5,052	4,573	479
Jun-89	50,136	48	3272	3,272			
Jul-89	39,477	66	3542		3,542	2,769	773
Aug-89	25,936	55	1939		1,939	1,819	120
Sep-89	26,803	56	2041		2,041	1,880	160
Oct-89	18,760	81	2066		2,066	1,316	750
Nov-89	14,140	89	1711		1,711	992	719
Dec-89	13,070	96	1706		1,706	917	789
Jan-90	11,310	112	1722		1,722	793	929
Feb-90	10,910	114	1691		1,691	765	926
Mar-90	51,150	65	4520		4,520	3,588	932
Apr-90	32,590	65	2880		2,880	2,286	594
May-90	33,920	64	2951		2,951	2,379	572
Jun-90	35,790	60	2919		2,919	2,511	409
Jul-90	37,380	56	2846		2,846	2,622	224
Aug-90	32,770	59	2628		2,628	2,299	330
Sep-90	19,120	73	1898		1,898	1,341	556
Oct-90	21,640	69	2030		2,030	1,518	512
Nov-90	23,820	64	2073		2,073	1,671	402
Dec-90	12,600	96	1644		1,644	884	761
Jan-91	11,640	102	1614		1,614	817	798
Feb-91	10,560	99	1421		1,421	741	680
Mar-91	16,010	110	2394		2,394	1,123	1,271
Apr-91	13,860	110	2073		2,073	972	1,100
May-91	24,110	81	2655		2,655	1,691	964
Jun-91	14,980	99	2016		2,016	1,051	965
Jul-91	19,990	61	1658		1,658	1,402	255
Aug-91	15,090	75	1539		1,539	1,059	480
Sep-91	15,060	79	1617		1,617	1,056	561
Oct-91	19,980	52	1412		1,412	1,402	11
Nov-91	22,760	58	1795		1,795	1,597	198
Dec-91	11,610	80	1263		1,263	814	448
Jan-92	10,990	85	1270		1,270	771	499

Table D-5: Stanislaus Sub-area Salt Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Salt Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Feb-92	19,550	95	2525		2,525	1,371	1,153
Mar-92	17,120	70	1629		1,629	1,201	428
Apr-92	43,100	53	3106		3,106	3,023	82
May-92	22,480	55	1681		1,681	1,577	104
Jun-92	15,920	54	1169		1,169	1,117	52
Jul-92	15,560	53	1121		1,121	1,092	30
Aug-92	16,550	52	1170		1,170	1,161	9
Sep-92	19,580	53	1411		1,411	1,374	37
Oct-92	21,970	56	1673		1,673	1,541	131
Nov-92	13,280	69	1246		1,246	932	314
Dec-92	13,580	72	1329		1,329	953	377
Jan-93	38,770	86	4533		4,533	2,720	1,813
Feb-93	17,710	111	2673		2,673	1,242	1,430
Mar-93	21,770	114	3374		3,374	1,527	1,847
Apr-93	30,010	84	3427		3,427	2,105	1,322
May-93	86,800	53	6254		6,254	6,089	165
Jun-93	36,500	53	2630		2,630	2,560	69
Jul-93	25,270	49	1683	1,683			
Aug-93	24,170	57	1873		1,873	1,696	177
Sep-93	27,070	51	1877	1,877			
Oct-93	40,580	56	3089		3,089	2,847	243
Nov-93	19,650	69	1843		1,843	1,378	465
Dec-93	19,420	72	1901		1,901	1,362	539
Jan-94	19,790	86	2314		2,314	1,388	926
Feb-94	17,830	111	2691		2,691	1,251	1,440
Mar-94	56,860	114	8812		8,812	3,989	4,824
Apr-94	33,680	84	3846		3,846	2,363	1,484
May-94	37,160	53	2678		2,678	2,607	71
Jun-94	31,380	53	2261		2,261	2,201	60
Jul-94	32,720	49	2180	2,180			
Aug-94	26,700	57	2069		2,069	1,873	196
Sep-94	20,450	51	1418	1,418			
Oct-94	26,265	93	3334		3,334	1,842	1,491
Nov-94	18,376	104	2602		2,602	1,289	1,313
Dec-94	19,061	103	2669		2,669	1,337	1,332
Jan-95	43,305	80	4716		4,716	3,038	1,678
Feb-95	20,984	100	2853		2,853	1,472	1,381
Mar-95	47,243	78	5010		5,010	3,314	1,696
Apr-95	54,485	75	5531		5,531	3,822	1,709
May-95	90,762	64	7881		7,881	6,367	1,514
Jun-95	41,724	81	4,596		4,596	2,927	1,669
Jul-95	28,422	91	3,521		3,521	1,994	1,528
Aug-95	25,097	95	3,230		3,230	1,761	1,470
Sep-95	26,130	94	3,322		3,322	1,833	1,489
Oct-95	34,550	60	2,818		2,818	2,424	395
Nov-95	18,769	66	1,694		1,694	1,317	377

Table D-5: Stanislaus Sub-area Salt Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Salt Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Dec-95	20,409	71	1,964		1,964	1,432	532
Jan-96	25,674	80	2,800		2,800	1,801	999
Feb-96	83,962	69	7,917		7,917	5,890	2,027
Mar-96	206,351	43	12,167	12,167			
Apr-96	109,144	36	5,401	5,401			
May-96	97,246	41	5,383	5,383			
Jun-96	66,585	41	3,749	3,749			
Jul-96	46,464	43	2,707	2,707			
Aug-96	36,535	48	2,400	2,400			
Sep-96	31,383	57	2,430		2,430	2,202	229
Oct-96	40,304	55	2,997		2,997	2,827	170
Nov-96	46,117	52	3,283		3,283	3,235	48
Dec-96	202,147	51	14,115	14,115			
Jan-97	407,665	45	24,954	24,954			
Feb-97	352,994	36	17,182	17,182			
Mar-97	175,638	44	10,543	10,543			
Apr-97	79,213	48	5,173	5,173			
May-97	100,657	40	5,465	5,465			
Jun-97	69,298	43	4,053	4,053			
Jul-97	32,208	66	2,872		2,872	2,259	613
Aug-97	30,211	68	2,799		2,799	2,119	680
Sep-97	29,731	68	2,757		2,757	2,086	671

Table D-6: San Joaquin River above Salt Slough Sub-area Salt Loads

Month-Year	SJR abv Salt Q (acre-feet) *Qm*	SJR abv Salt Salt Conc. (mg/L) *Cm*	SJR abv Salt Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	877	659	785		785	94	691
Nov-76	1,751	515	1,227		1,227	188	1,039
Dec-76	1,125	603	922		922	121	801
Jan-77	1,775	513	1,238		1,238	191	1,047
Feb-77	827	673	756		756	89	667
Mar-77	1,490	546	1,106		1,106	160	946
Apr-77	742	699	705		705	80	625
May-77	519	793	560		560	56	504
Jun-77	173	1,171	275		275	19	257
Jul-77	58	1,725	136		136	6	130
Aug-77	330	931	418		418	35	382
Sep-77	244	1,037	344		344	26	318
Oct-77	105	1,398	200		200	11	188
Nov-77	269	1,001	366		366	29	337
Dec-77	615	747	625		625	66	559
Jan-78	41,330	168	9,442		9,442	4,439	5,003
Feb-78	221,200	93	27,878		27,878	23,757	4,121
Mar-78	409,000	75	41,453	41,453			
Apr-78	726,200	61	60,046	60,046			
May-78	494,800	70	46,875	46,875			
Jun-78	74,100	137	13,763		13,763	7,958	5,804
Jul-78	2,977	427	1,728		1,728	320	1,409
Aug-78	2,692	443	1,620		1,620	289	1,331
Sep-78	12,240	259	4,305		4,305	1,315	2,990
Oct-78	8,499	294	3,402		3,402	913	2,489
Nov-78	2,953	428	1,719		1,719	317	1,402
Dec-78	6,337	327	2,815		2,815	681	2,134
Jan-79	61,830	146	12,245		12,245	6,641	5,604
Feb-79	69,380	140	13,190		13,190	7,451	5,739
Mar-79	50,050	157	10,683		10,683	5,375	5,308
Apr-79	17,510	228	5,424		5,424	1,881	3,543
May-79	10,320	275	3,856		3,856	1,108	2,747
Jun-79	2,428	459	1,515		1,515	261	1,255
Jul-79	3,170	418	1,800		1,800	340	1,459
Aug-79	2,305	468	1,465		1,465	248	1,218
Sep-79	11,160	267	4,056		4,056	1,199	2,857
Oct-79	9,527	283	3,662		3,662	1,023	2,639
Nov-79	1,741	517	1,223		1,223	187	1,036
Dec-79	3,066	423	1,762		1,762	329	1,432
Jan-80	188,200	98	25,117		25,117	20,213	4,905
Feb-80	344,600	79	37,113		37,113	37,010	103
Mar-80	592,100	65	52,633	52,633			
Apr-80	73,620	137	13,705		13,705	7,907	5,798
May-80	114,400	117	18,215		18,215	12,287	5,929
Jun-80	18,580	223	5,636		5,636	1,996	3,640
Jul-80	32,770	182	8,128		8,128	3,520	4,609
Aug-80	5,024	355	2,423		2,423	540	1,883
Sep-80	13,880	247	4,669		4,669	1,491	3,178
Oct-80	10,430	274	3,882		3,882	1,120	2,762
Nov-80	2,280	469	1,455		1,455	245	1,210
Dec-80	2,230	473	1,434		1,434	240	1,195

Table D-6: San Joaquin River above Salt Slough Sub-area Salt Loads

Month-Year	SJR abv Salt Q (acre-feet) *Qm*	SJR abv Salt Salt Conc. (mg/L) *Cm*	SJR abv Salt Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jan-81	5,430	345	2,547		2,547	583	1,964
Feb-81	6,850	318	2,960		2,960	736	2,224
Mar-81	20,170	217	5,942		5,942	2,166	3,776
Apr-81	4,270	376	2,181		2,181	459	1,723
May-81	3,710	395	1,992		1,992	398	1,594
Jun-81	1,250	581	987		987	134	853
Jul-81	1,130	602	925		925	121	804
Aug-81	1,460	550	1,091		1,091	157	934
Sep-81	2,840	434	1,677		1,677	305	1,372
Oct-81	4,240	377	2,172		2,172	455	1,716
Nov-81	4,901	358	2,384		2,384	526	1,858
Dec-81	6,878	317	2,967		2,967	739	2,229
Jan-82	44,897	163	9,960		9,960	4,822	5,138
Feb-82	52,813	154	11,060		11,060	5,672	5,388
Mar-82	64,942	143	12,639		12,639	6,975	5,664
Apr-82	600,257	65	53,100	53,100			
May-82	339,913	80	36,787		36,787	36,507	280
Jun-82	40,000	170	9,244		9,244	4,296	4,948
Jul-82	12,714	255	4,412		4,412	1,365	3,046
Aug-82	4,129	380	2,135		2,135	443	1,691
Sep-82	30,111	188	7,696		7,696	3,234	4,462
Oct-82	30,260	188	7,721		7,721	3,250	4,471
Nov-82	120,330	115	18,819		18,819	12,924	5,896
Dec-82	557,450	67	50,624	50,624			
Jan-83	570,800	66	51,403	51,403			
Feb-83	865,470	57	67,246	67,246			
Mar-83	1,179,000	51	82,097	82,097			
Apr-83	790,410	59	63,422	63,422			
May-83	608,750	65	53,584	53,584			
Jun-83	642,760	64	55,498	55,498			
Jul-83	448,410	72	43,989	43,989			
Aug-83	46,770	161	10,226		10,226	5,023	5,203
Sep-83	110,140	119	17,775		17,775	11,829	5,945
Oct-83	178,160	100	24,244		24,244	19,134	5,110
Nov-83	177,740	100	24,207		24,207	19,089	5,118
Dec-83	338,060	80	36,657		36,657	36,308	349
Jan-84	494,800	70	46,875	46,875			
Feb-84	33,430	181	8,233		8,233	3,590	4,643
Mar-84	15,080	240	4,925		4,925	1,620	3,306
Apr-84	12,920	254	4,458		4,458	1,388	3,070
May-84	9,800	280	3,729		3,729	1,053	2,677
Jun-84	5,900	335	2,688		2,688	634	2,054
Jul-84	2,120	482	1,388		1,388	228	1,161
Aug-84	5,230	350	2,487		2,487	562	1,925
Sep-84	12,100	260	4,273		4,273	1,300	2,973
Oct-84	17,812	100	2,422		2,422	1,913	509
Nov-84	2,731	213	791		791	293	498
Dec-84	4,748	325	2,098		2,098	510	1,588
Jan-85	4,024	438	2,396		2,396	432	1,964
Feb-85	6,190	443	3,728		3,728	665	3,063
Mar-85	11,940	514	8,343		8,343	1,282	7,061

Table D-6: San Joaquin River above Salt Slough Sub-area Salt Loads

Month-Year	SJR abv Salt Q (acre-feet) *Qm*	SJR abv Salt Salt Conc. (mg/L) *Cm*	SJR abv Salt Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Apr-85	4,540	585	3,611		3,611	488	3,123
May-85	2,763	657	2,468		2,468	297	2,171
Jun-85	3,275	617	2,747		2,747	352	2,395
Jul-85	1,139	799	1,237		1,237	122	1,115
Aug-85	2,136	429	1,246		1,246	229	1,016
Sep-85	8,622	120	1,407		1,407	926	481
Oct-85	5,849	189	1,503		1,503	628	875
Nov-85	2,293	431	1,344		1,344	246	1,097
Dec-85	7,049	262	2,511		2,511	757	1,754
Jan-86	8,245	431	4,831		4,831	886	3,946
Feb-86	82,469	84	9,418		9,418	8,857	561
Mar-86	688,998	70	65,568	65,568			
Apr-86	399,788	51	27,719	27,719			
May-86	49,436	123	8,267		8,267	5,309	2,957
Jun-86	36,159	116	5,702		5,702	3,883	1,819
Jul-86	4,405	383	2,294		2,294	473	1,821
Aug-86	5,829	187	1,482		1,482	626	856
Sep-86	18,349	100	2,495		2,495	1,971	524
Oct-86	14,204	126	2,433		2,433	1,526	908
Nov-86	1,388	498	940		940	149	791
Dec-86	3,488	453	2,148		2,148	375	1,773
Jan-87	6,460	401	3,522		3,522	694	2,828
Feb-87	5,564	245	1,853		1,853	598	1,256
Mar-87	11,000	495	7,402		7,402	1,181	6,221
Apr-87	1,458	1,180	2,339		2,339	157	2,182
May-87	1,902	726	1,877		1,877	204	1,673
Jun-87	1,275	690	1,196		1,196	137	1,059
Jul-87	989	803	1,080		1,080	106	973
Aug-87	1,176	831	1,329		1,329	126	1,202
Sep-87	2,386	237	769		769	256	513
Oct-87	1,240	362	610		610	133	477
Nov-87	1,374	881	1,646		1,646	148	1,498
Dec-87	2,237	579	1,761		1,761	240	1,521
Jan-88	4,314	315	1,847		1,847	463	1,384
Feb-88	2,793	694	2,635		2,635	300	2,335
Mar-88	1,555	768	1,624		1,624	167	1,457
Apr-88	3,353	964	4,394		4,394	360	4,034
May-88	1,238	844	1,421		1,421	133	1,288
Jun-88	533	1,060	768		768	57	711
Jul-88	444	973	587		587	48	540
Aug-88	527	956	685		685	57	628
Sep-88	331	875	394		394	36	358
Oct-88	201	900	246		246	22	224
Nov-88	85	900	104		104	9	95
Dec-88	192	900	235		235	21	214
Jan-89	3,134	900	3,835		3,835	337	3,498
Feb-89	1,918	900	2,347		2,347	206	2,141
Mar-89	4,342	900	5,313		5,313	466	4,846
Apr-89	612	900	749		749	66	683
May-89	676	900	827		827	73	755
Jun-89	391	900	478		478	42	436

Table D-6: San Joaquin River above Salt Slough Sub-area Salt Loads

Month-Year	SJR abv Salt Q (acre-feet) *Qm*	SJR abv Salt Salt Conc. (mg/L) *Cm*	SJR abv Salt Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jul-89	238	900	291		291	26	266
Aug-89	654	900	800		800	70	730
Sep-89	422	900	516		516	45	471
Oct-89	362	1,709	841		841	39	802
Nov-89	74	641	64		64	8	57
Dec-89	52	845	60		60	6	54
Jan-90	574	854	666		666	62	605
Feb-90	1,599	473	1,028		1,028	172	856
Mar-90	1,734	866	2,041		2,041	186	1,855
Apr-90	565	1,319	1,013		1,013	61	952
May-90	454	1,297	801		801	49	752
Jun-90	348	833	394		394	37	357
Jul-90	39	1,595	85		85	4	80
Aug-90	107	1,392	202		202	11	191
Sep-90	29	1,450	57		57	3	54
Oct-90	99	2,080	280		280	11	269
Nov-90	109	2,116	314		314	12	302
Dec-90	8	2,118	23		23	1	22
Jan-91	23	1,930	60		60	2	58
Feb-91	122	1,479	245		245	13	232
Mar-91	15,580	208	4,406		4,406	1,673	2,732
Apr-91	747	698	709		709	80	629
May-91	638	1,356	1,176		1,176	69	1,108
Jun-91	349	1,259	597		597	37	560
Jul-91	611	1,173	974		974	66	909
Aug-91	203	1,252	346		346	22	324
Sep-91	70	1,616	154		154	8	146
Oct-91	1,014	2,500	3,446		3,446	109	3,337
Nov-91	1,020	800	1,109		1,109	110	1,000
Dec-91	66	700	63		63	7	56
Jan-92	195	700	186		186	21	165
Feb-92	16,570	850	19,148		19,148	1,780	17,368
Mar-92	2,188	650	1,933		1,933	235	1,698
Apr-92	1,109	800	1,206		1,206	119	1,087
May-92	489	1,050	698		698	53	646
Jun-92	1,125	900	1,376		1,376	121	1,256
Jul-92	123	750	125		125	13	112
Aug-92	63	700	60		60	7	53
Sep-92	27	750	28		28	3	25
Oct-92	31	2,585	109		109	3	106
Nov-92	20	2,617	71		71	2	69
Dec-92	43	2,530	148		148	5	143
Jan-93	100,400	107	14,605		14,605	10,783	3,822
Feb-93	39,330	147	7,860		7,860	4,224	3,636
Mar-93	31,350	376	16,025		16,025	3,367	12,658
Apr-93	16,420	207	4,621		4,621	1,764	2,857
May-93	2,019	974	2,673		2,673	217	2,457
Jun-93	2,315	628	1,976		1,976	249	1,728
Jul-93	1,802	828	2,028		2,028	194	1,835
Aug-93	1,505	783	1,602		1,602	162	1,440
Sep-93	804	871	952		952	86	866

Table D-6: San Joaquin River above Salt Slough Sub-area Salt Loads

Month-Year	SJR abv Salt Q (acre-feet) *Qm*	SJR abv Salt Salt Conc. (mg/L) *Cm*	SJR abv Salt Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-93	1,278	186	323		323	137	186
Nov-93	2,716	185	683		683	292	391
Dec-93	444	621	375		375	48	327
Jan-94	2,466	466	1,562		1,562	265	1,297
Feb-94	16,760	206	4,694		4,694	1,800	2,894
Mar-94	3,857	400	2,097		2,097	414	1,683
Apr-94	1,598	634	1,377		1,377	172	1,206
May-94	1,778	697	1,685		1,685	191	1,494
Jun-94	1,084	880	1,297		1,297	116	1,180
Jul-94	788	914	979		979	85	895
Aug-94	411	876	489		489	44	445
Sep-94	101	944	130		130	11	119
Oct-94	99	1,301	174		174	11	164
Nov-94	482	678	444		444	52	392
Dec-94	170	866	201		201	18	182
Jan-95	81,164	80	8,870		8,870	8,717	153
Feb-95	14,563	382	7,570		7,570	1,564	6,006
Mar-95	399,164	129	70,142		70,142	42,870	27,271
Apr-95	422,994	59	33,957	33,957			
May-95	566,563	44	33,719	33,719			
Jun-95	152,465	105	21,750		21,750	16,375	5,375
Jul-95	221,961	39	11,881	11,881			
Aug-95	22,015	193	5,769		5,769	2,364	3,404
Sep-95	16,138	104	2,272		2,272	1,733	539
Oct-95	9,965	97	1,313		1,313	1,070	243
Nov-95	2,854	189	732		732	307	425
Dec-95	6,782	222	2,049		2,049	728	1,320
Jan-96	9,504	371	4,800		4,800	1,021	3,779
Feb-96	65,151	149	13,227		13,227	6,997	6,230
Mar-96	129,379	96	16,970		16,970	13,895	3,074
Apr-96	9,947	353	4,776		4,776	1,068	3,707
May-96	103,000	67	9,340	9,340			
Jun-96	9,620	306	4,007		4,007	1,033	2,974
Jul-96	6,233	304	2,578		2,578	669	1,908
Aug-96	6,780	283	2,612		2,612	728	1,884
Sep-96	7,531	164	1,681		1,681	809	873
Oct-96	4,887	144	958		958	525	433
Nov-96	6,281	243	2,077		2,077	675	1,403
Dec-96	109,498	89	13,185		13,185	11,760	1,425
Jan-97	977,619	66	87,347	87,347			
Feb-97	739,243	60	60,156	60,156			
Mar-97	91,248	142	17,607		17,607	9,800	7,807
Apr-97	5,332	502	3,639		3,639	573	3,067
May-97	2,113	859	2,469		2,469	227	2,242
Jun-97	1,995	763	2,069		2,069	214	1,854
Jul-97	1,752	667	1,588		1,588	188	1,400
Aug-97	1,139	682	1,056		1,056	122	933
Sep-97	389	853	451		451	42	409

Table D-7: Merced River Sub-area Background Boron Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Boron Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	8,720	0.030	0.356		0.36	0.18	0.18
Nov-76	9,430	0.030	0.385		0.38	0.19	0.19
Dec-76	12,030	0.030	0.491		0.49	0.25	0.25
Jan-77	10,590	0.030	0.432		0.43	0.22	0.22
Feb-77	6,730	0.030	0.274		0.27	0.14	0.14
Mar-77	5,800	0.030	0.237		0.24	0.12	0.12
Apr-77	4,110	0.030	0.168		0.17	0.08	0.08
May-77	4,000	0.030	0.163		0.16	0.08	0.08
Jun-77	1,140	0.030	0.046		0.05	0.02	0.02
Jul-77	1,000	0.030	0.041		0.04	0.02	0.02
Aug-77	548	0.030	0.022		0.02	0.01	0.01
Sep-77	670	0.030	0.027		0.03	0.01	0.01
Oct-77	699	0.030	0.029		0.03	0.01	0.01
Nov-77	7,220	0.030	0.294		0.29	0.15	0.15
Dec-77	11,250	0.030	0.459		0.46	0.23	0.23
Jan-78	21,410	0.030	0.873		0.87	0.44	0.44
Feb-78	36,910	0.030	1.505		1.51	0.75	0.75
Mar-78	70,810	0.015	1.444	1.44	1.44		
Apr-78	133,000	0.015	2.712	2.71	2.71		
May-78	99,790	0.015	2.035	2.03	2.03		
Jun-78	76,710	0.015	1.564	1.56	1.56		
Jul-78	13,730	0.030	0.560		0.56	0.28	0.28
Aug-78	17,010	0.030	0.694		0.69	0.35	0.35
Sep-78	64,840	0.015	1.322	1.32	1.32		
Oct-78	90,310	0.015	1.842	1.84	1.84		
Nov-78	69,330	0.015	1.414	1.41	1.41		
Dec-78	28,060	0.030	1.144		1.14	0.57	0.57
Jan-79	38,360	0.030	1.565		1.56	0.78	0.78
Feb-79	74,180	0.015	1.513	1.51	1.51		
Mar-79	117,400	0.015	2.394	2.39	2.39		
Apr-79	26,610	0.030	1.085		1.09	0.54	0.54
May-79	29,120	0.030	1.188		1.19	0.59	0.59
Jun-79	31,200	0.030	1.272		1.27	0.64	0.64
Jul-79	14,190	0.030	0.579		0.58	0.29	0.29
Aug-79	13,650	0.030	0.557		0.56	0.28	0.28
Sep-79	21,870	0.030	0.892		0.89	0.45	0.45
Oct-79	33,570	0.030	1.369		1.37	0.68	0.68
Nov-79	26,070	0.030	1.063		1.06	0.53	0.53
Dec-79	27,130	0.030	1.106		1.11	0.55	0.55
Jan-80	178,600	0.015	3.642	3.64	3.64		
Feb-80	155,800	0.015	3.177	3.18	3.18		
Mar-80	252,500	0.015	5.149	5.15	5.15		
Apr-80	93,220	0.015	1.901	1.90	1.90		
May-80	90,670	0.015	1.849	1.85	1.85		
Jun-80	39,440	0.030	1.609		1.61	0.80	0.80
Jul-80	18,970	0.030	0.774		0.77	0.39	0.39
Aug-80	23,680	0.030	0.966		0.97	0.48	0.48
Sep-80	53,590	0.015	1.093	1.09	1.09		

Table D-7: Merced River Sub-area Background Boron Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Boron Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-80	44,270	0.015	0.903	0.90	0.90		
Nov-80	33,830	0.030	1.380		1.38	0.69	0.69
Dec-80	32,690	0.030	1.333		1.33	0.67	0.67
Jan-81	24,060	0.030	0.981		0.98	0.49	0.49
Feb-81	16,710	0.030	0.682		0.68	0.34	0.34
Mar-81	22,670	0.030	0.925		0.92	0.46	0.46
Apr-81	15,380	0.030	0.627		0.63	0.31	0.31
May-81	15,400	0.030	0.628		0.63	0.31	0.31
Jun-81	10,700	0.030	0.436		0.44	0.22	0.22
Jul-81	9,280	0.030	0.378		0.38	0.19	0.19
Aug-81	10,050	0.030	0.410		0.41	0.20	0.20
Sep-81	10,380	0.030	0.423		0.42	0.21	0.21
Oct-81	10,290	0.030	0.420		0.42	0.21	0.21
Nov-81	14,710	0.030	0.600		0.60	0.30	0.30
Dec-81	15,310	0.030	0.624		0.62	0.31	0.31
Jan-82	21,410	0.030	0.873		0.87	0.44	0.44
Feb-82	70,240	0.015	1.432	1.43	1.43		
Mar-82	120,500	0.015	2.457	2.46	2.46		
Apr-82	276,500	0.015	5.639	5.64	5.64		
May-82	245,800	0.015	5.012	5.01	5.01		
Jun-82	84,270	0.015	1.718	1.72	1.72		
Jul-82	62,980	0.015	1.284	1.28	1.28		
Aug-82	31,040	0.030	1.266		1.27	0.63	0.63
Sep-82	47,490	0.015	0.968	0.97	0.97		
Oct-82	107,500	0.015	2.192	2.19	2.19		
Nov-82	70,430	0.015	1.436	1.44	1.44		
Dec-82	148,900	0.015	3.036	3.04	3.04		
Jan-83	173,800	0.015	3.544	3.54	3.54		
Feb-83	260,700	0.015	5.316	5.32	5.32		
Mar-83	336,900	0.015	6.870	6.87	6.87		
Apr-83	294,500	0.015	6.006	6.01	6.01		
May-83	224,900	0.015	4.586	4.59	4.59		
Jun-83	270,500	0.015	5.516	5.52	5.52		
Jul-83	220,900	0.015	4.505	4.50	4.50		
Aug-83	73,270	0.015	1.494	1.49	1.49		
Sep-83	102,100	0.015	2.082	2.08	2.08		
Oct-83	168,400	0.015	3.434	3.43	3.43		
Nov-83	44,010	0.015	0.897	0.90	0.90		
Dec-83	148,600	0.015	3.030	3.03	3.03		
Jan-84	198,200	0.015	4.042	4.04	4.04		
Feb-84	71,410	0.015	1.456	1.46	1.46		
Mar-84	37,820	0.030	1.542		1.54	0.77	0.77
Apr-84	26,910	0.030	1.098		1.10	0.55	0.55
May-84	24,510	0.030	1.000		1.00	0.50	0.50
Jun-84	22,290	0.030	0.909		0.91	0.45	0.45
Jul-84	18,230	0.030	0.744		0.74	0.37	0.37
Aug-84	17,010	0.030	0.694		0.69	0.35	0.35
Sep-84	17,980	0.030	0.733		0.73	0.37	0.37

Table D-7: Merced River Sub-area Background Boron Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Boron Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-84	27,480	0.030	1.121		1.12	0.56	0.56
Nov-84	32,350	0.030	1.319		1.32	0.66	0.66
Dec-84	71,930	0.015	1.467	1.47	1.47		
Jan-85	41,790	0.015	0.852	0.85	0.85		
Feb-85	17,770	0.030	0.725		0.72	0.36	0.36
Mar-85	19,250	0.030	0.785		0.79	0.39	0.39
Apr-85	17,770	0.030	0.725		0.72	0.36	0.36
May-85	17,800	0.030	0.726		0.73	0.36	0.36
Jun-85	15,070	0.030	0.615		0.61	0.31	0.31
Jul-85	13,520	0.030	0.551		0.55	0.28	0.28
Aug-85	11,890	0.030	0.485		0.48	0.24	0.24
Sep-85	13,530	0.030	0.552		0.55	0.28	0.28
Oct-85	15,820	0.030	0.645		0.65	0.32	0.32
Nov-85	14,120	0.030	0.576		0.58	0.29	0.29
Dec-85	18,850	0.030	0.769		0.77	0.38	0.38
Jan-86	12,970	0.030	0.529		0.53	0.26	0.26
Feb-86	25,360	0.030	1.034		1.03	0.52	0.52
Mar-86	182,200	0.015	3.716	3.72	3.72		
Apr-86	158,600	0.015	3.234	3.23	3.23		
May-86	104,400	0.015	2.129	2.13	2.13		
Jun-86	39,880	0.015	0.813	0.81	0.81		
Jul-86	16,760	0.030	0.684		0.68	0.34	0.34
Aug-86	15,620	0.030	0.637		0.64	0.32	0.32
Sep-86	18,730	0.030	0.764		0.76	0.38	0.38
Oct-86	27,790	0.030	1.133		1.13	0.57	0.57
Nov-86	14,700	0.030	0.600		0.60	0.30	0.30
Dec-86	14,060	0.030	0.573		0.57	0.29	0.29
Jan-87	14,180	0.030	0.578		0.58	0.29	0.29
Feb-87	13,130	0.030	0.536		0.54	0.27	0.27
Mar-87	18,080	0.030	0.737		0.74	0.37	0.37
Apr-87	10,820	0.030	0.441		0.44	0.22	0.22
May-87	11,980	0.030	0.489		0.49	0.24	0.24
Jun-87	10,060	0.030	0.410		0.41	0.21	0.21
Jul-87	7,620	0.030	0.311		0.31	0.16	0.16
Aug-87	7,680	0.030	0.313		0.31	0.16	0.16
Sep-87	9,030	0.030	0.368		0.37	0.18	0.18
Oct-87	6,420	0.030	0.262		0.26	0.13	0.13
Nov-87	11,780	0.030	0.480		0.48	0.24	0.24
Dec-87	13,360	0.030	0.545		0.54	0.27	0.27
Jan-88	15,280	0.030	0.623		0.62	0.31	0.31
Feb-88	12,420	0.030	0.507		0.51	0.25	0.25
Mar-88	11,640	0.030	0.475		0.47	0.24	0.24
Apr-88	10,800	0.030	0.440		0.44	0.22	0.22
May-88	10,900	0.030	0.445		0.44	0.22	0.22
Jun-88	7,710	0.030	0.314		0.31	0.16	0.16
Jul-88	3,790	0.030	0.155		0.15	0.08	0.08
Aug-88	4,230	0.030	0.173		0.17	0.09	0.09
Sep-88	2,130	0.030	0.087		0.09	0.04	0.04

Table D-7: Merced River Sub-area Background Boron Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Boron Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-88	2,330	0.030	0.095		0.10	0.05	0.05
Nov-88	8,080	0.030	0.330		0.33	0.16	0.16
Dec-88	11,960	0.030	0.488		0.49	0.24	0.24
Jan-89	12,350	0.030	0.504		0.50	0.25	0.25
Feb-89	11,360	0.030	0.463		0.46	0.23	0.23
Mar-89	18,960	0.030	0.773		0.77	0.39	0.39
Apr-89	11,760	0.030	0.480		0.48	0.24	0.24
May-89	9,630	0.030	0.393		0.39	0.20	0.20
Jun-89	6,540	0.030	0.267		0.27	0.13	0.13
Jul-89	2,110	0.030	0.086		0.09	0.04	0.04
Aug-89	1,470	0.030	0.060		0.06	0.03	0.03
Sep-89	3,030	0.030	0.124		0.12	0.06	0.06
Oct-89	5,080	0.030	0.207		0.21	0.10	0.10
Nov-89	10,300	0.030	0.420		0.42	0.21	0.21
Dec-89	11,670	0.030	0.476		0.48	0.24	0.24
Jan-90	11,930	0.030	0.487		0.49	0.24	0.24
Feb-90	13,590	0.030	0.554		0.55	0.28	0.28
Mar-90	10,220	0.030	0.417		0.42	0.21	0.21
Apr-90	8,250	0.030	0.336		0.34	0.17	0.17
May-90	7,870	0.030	0.321		0.32	0.16	0.16
Jun-90	5,970	0.030	0.243		0.24	0.12	0.12
Jul-90	1,700	0.030	0.069		0.07	0.03	0.03
Aug-90	1,170	0.030	0.048		0.05	0.02	0.02
Sep-90	1,470	0.030	0.060		0.06	0.03	0.03
Oct-90	1,825	0.030	0.074		0.07	0.04	0.04
Nov-90	7,540	0.030	0.308		0.31	0.15	0.15
Dec-90	10,151	0.030	0.414		0.41	0.21	0.21
Jan-91	7,811	0.030	0.319		0.32	0.16	0.16
Feb-91	3,598	0.030	0.147		0.15	0.07	0.07
Mar-91	19,676	0.030	0.802		0.80	0.40	0.40
Apr-91	7,810	0.030	0.319		0.32	0.16	0.16
May-91	5,774	0.030	0.235		0.24	0.12	0.12
Jun-91	1,447	0.030	0.059		0.06	0.03	0.03
Jul-91	371	0.030	0.015		0.02	0.01	0.01
Aug-91	1,011	0.030	0.041		0.04	0.02	0.02
Sep-91	4,242	0.030	0.173		0.17	0.09	0.09
Oct-91	4,266	0.030	0.174		0.17	0.09	0.09
Nov-91	12,222	0.030	0.498		0.50	0.25	0.25
Dec-91	13,644	0.030	0.556		0.56	0.28	0.28
Jan-92	13,928	0.030	0.568		0.57	0.28	0.28
Feb-92	17,795	0.030	0.726		0.73	0.36	0.36
Mar-92	16,691	0.030	0.681		0.68	0.34	0.34
Apr-92	9,354	0.030	0.382		0.38	0.19	0.19
May-92	5,609	0.030	0.229		0.23	0.11	0.11
Jun-92	3,552	0.030	0.145		0.14	0.07	0.07
Jul-92	2,063	0.030	0.084		0.08	0.04	0.04
Aug-92	2,348	0.030	0.096		0.10	0.05	0.05
Sep-92	2,471	0.030	0.101		0.10	0.05	0.05

Table D-7: Merced River Sub-area Background Boron Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Boron Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-92	10,635	0.030	0.434		0.43	0.22	0.22
Nov-92	14,888	0.030	0.607		0.61	0.30	0.30
Dec-92	12,670	0.030	0.517		0.52	0.26	0.26
Jan-93	35,689	0.030	1.456		1.46	0.73	0.73
Feb-93	21,166	0.030	0.863		0.86	0.43	0.43
Mar-93	21,386	0.030	0.872		0.87	0.44	0.44
Apr-93	60,270	0.015	1.229	1.23	1.23		
May-93	56,011	0.015	1.142	1.14	1.14		
Jun-93	35,316	0.030	1.440		1.44	0.72	0.72
Jul-93	22,294	0.030	0.909		0.91	0.45	0.45
Aug-93	36,817	0.030	1.502		1.50	0.75	0.75
Sep-93	35,566	0.030	1.451		1.45	0.73	0.73
Oct-93	51,914	0.015	1.059	1.06	1.06		
Nov-93	14,765	0.030	0.602		0.60	0.30	0.30
Dec-93	13,922	0.030	0.568		0.57	0.28	0.28
Jan-94	14,757	0.030	0.602		0.60	0.30	0.30
Feb-94	17,947	0.030	0.732		0.73	0.37	0.37
Mar-94	15,215	0.030	0.621		0.62	0.31	0.31
Apr-94	21,561	0.030	0.879		0.88	0.44	0.44
May-94	25,726	0.030	1.049		1.05	0.52	0.52
Jun-94	10,487	0.030	0.428		0.43	0.21	0.21
Jul-94	19,081	0.030	0.778		0.78	0.39	0.39
Aug-94	5,683	0.030	0.232		0.23	0.12	0.12
Sep-94	4,880	0.030	0.199		0.20	0.10	0.10
Oct-94	20,875	0.030	0.851		0.85	0.43	0.43
Nov-94	13,159	0.030	0.537		0.54	0.27	0.27
Dec-94	12,774	0.030	0.521		0.52	0.26	0.26
Jan-95	36,541	0.030	1.490		1.49	0.75	0.75
Feb-95	14,617	0.030	0.596		0.60	0.30	0.30
Mar-95	155,045	0.015	3.162	3.16	3.16		
Apr-95	195,306	0.015	3.983	3.98	3.98		
May-95	226,578	0.015	4.620	4.62	4.62		
Jun-95	188,762	0.015	3.849	3.85	3.85		
Jul-95	151,900	0.015	3.098	3.10	3.10		
Aug-95	30,223	0.030	1.233		1.23	0.62	0.62
Sep-95	37,175	0.030	1.516		1.52	0.76	0.76
Oct-95	109,095	0.015	2.225	2.22	2.22		
Nov-95	24,599	0.030	1.003		1.00	0.50	0.50
Dec-95	24,813	0.030	1.012		1.01	0.51	0.51
Jan-96	21,305	0.030	0.869		0.87	0.43	0.43
Feb-96	144,343	0.015	2.944	2.94	2.94		
Mar-96	175,793	0.015	3.585	3.58	3.58		
Apr-96	52,226	0.015	1.065	1.07	1.07		
May-96	74,642	0.015	1.522	1.52	1.52		
Jun-96	15,110	0.030	0.616		0.62	0.31	0.31
Jul-96	5,394	0.030	0.220		0.22	0.11	0.11
Aug-96	3,918	0.030	0.160		0.16	0.08	0.08
Sep-96	5,674	0.030	0.231		0.23	0.12	0.12

Table D-7: Merced River Sub-area Background Boron Loads

Month-Year	Merced Q (acre-feet) *Qm*	Merced Boron Conc. (mg/L) *Cm*	Merced Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-96	25,517	0.030	1.041		1.04	0.52	0.52
Nov-96	15,513	0.030	0.633		0.63	0.32	0.32
Dec-96	127,188	0.015	2.594	2.59	2.59		
Jan-97	430,351	0.015	8.776	8.78	8.78		
Feb-97	371,694	0.015	7.580	7.58	7.58		
Mar-97	96,624	0.015	1.970	1.97	1.97		
Apr-97	38,526	0.030	1.571		1.57	0.79	0.79
May-97	35,847	0.030	1.462		1.46	0.73	0.73
Jun-97	5,591	0.030	0.228		0.23	0.11	0.11
Jul-97	5,167	0.030	0.211		0.21	0.11	0.11
Aug-97	3,925	0.030	0.160		0.16	0.08	0.08
Sep-97	5,470	0.030	0.223		0.22	0.11	0.11

Table D-8: Tuolumne River Sub-area Background Boron Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Boron Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	18,470	0.030	0.75		0.8	0.4	0.4
Nov-76	21,630	0.030	0.88		0.9	0.4	0.4
Dec-76	21,080	0.030	0.86		0.9	0.4	0.4
Jan-77	17,560	0.030	0.72		0.7	0.4	0.4
Feb-77	15,440	0.030	0.63		0.6	0.3	0.3
Mar-77	21,620	0.030	0.88		0.9	0.4	0.4
Apr-77	10,060	0.030	0.41		0.4	0.2	0.2
May-77	8,510	0.030	0.35		0.3	0.2	0.2
Jun-77	5,620	0.030	0.23		0.2	0.1	0.1
Jul-77	4,850	0.030	0.20		0.2	0.1	0.1
Aug-77	4,150	0.030	0.17		0.2	0.1	0.1
Sep-77	4,320	0.030	0.18		0.2	0.1	0.1
Oct-77	4,810	0.030	0.20		0.2	0.1	0.1
Nov-77	5,540	0.030	0.23		0.2	0.1	0.1
Dec-77	6,750	0.030	0.28		0.3	0.1	0.1
Jan-78	17,890	0.030	0.73		0.7	0.4	0.4
Feb-78	23,340	0.030	0.95		1.0	0.5	0.5
Mar-78	38,470	0.030	1.57		1.6	0.8	0.8
Apr-78	89,540	0.030	3.65		3.7	1.8	1.8
May-78	200,100	0.015	4.08	4.1	4.1		
Jun-78	30,730	0.030	1.25		1.3	0.6	0.6
Jul-78	13,900	0.030	0.57		0.6	0.3	0.3
Aug-78	14,220	0.030	0.58		0.6	0.3	0.3
Sep-78	25,940	0.030	1.06		1.1	0.5	0.5
Oct-78	43,330	0.030	1.77		1.8	0.9	0.9
Nov-78	73,450	0.030	3.00		3.0	1.5	1.5
Dec-78	72,960	0.030	2.98		3.0	1.5	1.5
Jan-79	177,200	0.015	3.61	3.6	3.6		
Feb-79	202,000	0.015	4.12	4.1	4.1		
Mar-79	222,400	0.015	4.54	4.5	4.5		
Apr-79	68,340	0.030	2.79		2.8	1.4	1.4
May-79	15,100	0.030	0.62		0.6	0.3	0.3
Jun-79	14,160	0.030	0.58		0.6	0.3	0.3
Jul-79	21,060	0.030	0.86		0.9	0.4	0.4
Aug-79	21,970	0.030	0.90		0.9	0.4	0.4
Sep-79	25,920	0.030	1.06		1.1	0.5	0.5
Oct-79	72,620	0.030	2.96		3.0	1.5	1.5
Nov-79	64,210	0.030	2.62		2.6	1.3	1.3
Dec-79	74,890	0.030	3.05		3.1	1.5	1.5
Jan-80	305,100	0.015	6.22	6.2	6.2		
Feb-80	322,200	0.015	6.57	6.6	6.6		
Mar-80	359,400	0.015	7.33	7.3	7.3		
Apr-80	153,500	0.015	3.13	3.1	3.1		
May-80	161,200	0.015	3.29	3.3	3.3		
Jun-80	129,100	0.015	2.63	2.6	2.6		
Jul-80	26,160	0.030	1.07		1.1	0.5	0.5
Aug-80	17,020	0.030	0.69		0.7	0.3	0.3

Table D-8: Tuolumne River Sub-area Background Boron Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Boron Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Sep-80	91,880	0.030	3.75		3.7	1.9	1.9
Oct-80	124,600	0.015	2.54	2.5	2.5		
Nov-80	102,100	0.015	2.08	2.1	2.1		
Dec-80	104,100	0.015	2.12	2.1	2.1		
Jan-81	129,800	0.015	2.65	2.6	2.6		
Feb-81	80,060	0.030	3.27		3.3	1.6	1.6
Mar-81	72,560	0.030	2.96		3.0	1.5	1.5
Apr-81	27,480	0.030	1.12		1.1	0.6	0.6
May-81	15,610	0.030	0.64		0.6	0.3	0.3
Jun-81	15,680	0.030	0.64		0.6	0.3	0.3
Jul-81	15,230	0.030	0.62		0.6	0.3	0.3
Aug-81	15,130	0.030	0.62		0.6	0.3	0.3
Sep-81	14,270	0.030	0.58		0.6	0.3	0.3
Oct-81	23,300	0.030	0.95		1.0	0.5	0.5
Nov-81	29,490	0.030	1.20		1.2	0.6	0.6
Dec-81	44,240	0.030	1.80		1.8	0.9	0.9
Jan-82	95,440	0.015	1.95	1.9	1.9		
Feb-82	173,000	0.015	3.53	3.5	3.5		
Mar-82	299,200	0.015	6.10	6.1	6.1		
Apr-82	465,400	0.015	9.49	9.5	9.5		
May-82	392,200	0.015	8.00	8.0	8.0		
Jun-82	135,600	0.015	2.77	2.8	2.8		
Jul-82	133,500	0.015	2.72	2.7	2.7		
Aug-82	57,320	0.030	2.34		2.3	1.2	1.2
Sep-82	160,200	0.015	3.27	3.3	3.3		
Oct-82	227,100	0.015	4.63	4.6	4.6		
Nov-82	123,700	0.015	2.52	2.5	2.5		
Dec-82	333,900	0.015	6.81	6.8	6.8		
Jan-83	329,300	0.015	6.72	6.7	6.7		
Feb-83	341,300	0.015	6.96	7.0	7.0		
Mar-83	470,900	0.015	9.60	9.6	9.6		
Apr-83	551,500	0.015	11.25	11.2	11.2		
May-83	640,800	0.015	13.07	13.1	13.1		
Jun-83	338,200	0.015	6.90	6.9	6.9		
Jul-83	260,900	0.015	5.32	5.3	5.3		
Aug-83	136,800	0.015	2.79	2.8	2.8		
Sep-83	240,500	0.015	4.90	4.9	4.9		
Oct-83	292,700	0.015	5.97	6.0	6.0		
Nov-83	124,300	0.015	2.53	2.5	2.5		
Dec-83	263,300	0.015	5.37	5.4	5.4		
Jan-84	366,600	0.015	7.48	7.5	7.5		
Feb-84	267,700	0.015	5.46	5.5	5.5		
Mar-84	188,300	0.015	3.84	3.8	3.8		
Apr-84	56,200	0.030	2.29		2.3	1.1	1.1
May-84	38,580	0.030	1.57		1.6	0.8	0.8
Jun-84	18,550	0.030	0.76		0.8	0.4	0.4
Jul-84	18,450	0.030	0.75		0.8	0.4	0.4

Table D-8: Tuolumne River Sub-area Background Boron Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Boron Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Aug-84	18,980	0.030	0.77		0.8	0.4	0.4
Sep-84	23,070	0.030	0.94		0.9	0.5	0.5
Oct-84	62,430	0.030	2.55		2.5	1.3	1.3
Nov-84	69,420	0.030	2.83		2.8	1.4	1.4
Dec-84	131,200	0.015	2.68	2.7	2.7		
Jan-85	96,330	0.015	1.96	2.0	2.0		
Feb-85	76,290	0.030	3.11		3.1	1.6	1.6
Mar-85	46,510	0.030	1.90		1.9	0.9	0.9
Apr-85	23,200	0.030	0.95		0.9	0.5	0.5
May-85	20,640	0.030	0.84		0.8	0.4	0.4
Jun-85	19,220	0.030	0.78		0.8	0.4	0.4
Jul-85	16,750	0.030	0.68		0.7	0.3	0.3
Aug-85	15,810	0.030	0.64		0.6	0.3	0.3
Sep-85	15,250	0.030	0.62		0.6	0.3	0.3
Oct-85	28,520	0.030	1.16		1.2	0.6	0.6
Nov-85	33,340	0.030	1.36		1.4	0.7	0.7
Dec-85	37,780	0.030	1.54		1.5	0.8	0.8
Jan-86	37,320	0.030	1.52		1.5	0.8	0.8
Feb-86	139,800	0.015	2.85	2.9	2.9		
Mar-86	380,100	0.015	7.75	7.8	7.8		
Apr-86	305,300	0.015	6.23	6.2	6.2		
May-86	170,200	0.015	3.47	3.5	3.5		
Jun-86	102,600	0.015	2.09	2.1	2.1		
Jul-86	21,870	0.030	0.89		0.9	0.4	0.4
Aug-86	21,340	0.030	0.87		0.9	0.4	0.4
Sep-86	55,810	0.030	2.28		2.3	1.1	1.1
Oct-86	77,540	0.030	3.16		3.2	1.6	1.6
Nov-86	72,140	0.030	2.94		2.9	1.5	1.5
Dec-86	127,300	0.015	2.60	2.6	2.6		
Jan-87	56,400	0.030	2.30		2.3	1.2	1.2
Feb-87	26,330	0.030	1.07		1.1	0.5	0.5
Mar-87	45,650	0.030	1.86		1.9	0.9	0.9
Apr-87	44,760	0.030	1.83		1.8	0.9	0.9
May-87	26,820	0.030	1.09		1.1	0.5	0.5
Jun-87	12,060	0.030	0.49		0.5	0.2	0.2
Jul-87	10,730	0.030	0.44		0.4	0.2	0.2
Aug-87	12,030	0.030	0.49		0.5	0.2	0.2
Sep-87	10,860	0.030	0.44		0.4	0.2	0.2
Oct-87	16,560	0.030	0.68		0.7	0.3	0.3
Nov-87	18,130	0.030	0.74		0.7	0.4	0.4
Dec-87	18,520	0.030	0.76		0.8	0.4	0.4
Jan-88	18,450	0.030	0.75		0.8	0.4	0.4
Feb-88	13,240	0.030	0.54		0.5	0.3	0.3
Mar-88	14,680	0.030	0.60		0.6	0.3	0.3
Apr-88	22,020	0.030	0.90		0.9	0.4	0.4
May-88	8,840	0.030	0.36		0.4	0.2	0.2
Jun-88	6,670	0.030	0.27		0.3	0.1	0.1

Table D-8: Tuolumne River Sub-area Background Boron Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Boron Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jul-88	5,980	0.030	0.24		0.2	0.1	0.1
Aug-88	6,410	0.030	0.26		0.3	0.1	0.1
Sep-88	6,580	0.030	0.27		0.3	0.1	0.1
Oct-88	8,280	0.030	0.34		0.3	0.2	0.2
Nov-88	9,650	0.030	0.39		0.4	0.2	0.2
Dec-88	11,400	0.030	0.46		0.5	0.2	0.2
Jan-89	11,390	0.030	0.46		0.5	0.2	0.2
Feb-89	9,440	0.030	0.39		0.4	0.2	0.2
Mar-89	16,010	0.030	0.65		0.7	0.3	0.3
Apr-89	21,250	0.030	0.87		0.9	0.4	0.4
May-89	10,380	0.030	0.42		0.4	0.2	0.2
Jun-89	8,390	0.030	0.34		0.3	0.2	0.2
Jul-89	8,480	0.030	0.35		0.3	0.2	0.2
Aug-89	8,840	0.030	0.36		0.4	0.2	0.2
Sep-89	10,210	0.030	0.42		0.4	0.2	0.2
Oct-89	15,120	0.030	0.62		0.6	0.3	0.3
Nov-89	17,760	0.030	0.72		0.7	0.4	0.4
Dec-89	16,350	0.030	0.67		0.7	0.3	0.3
Jan-90	15,010	0.030	0.61		0.6	0.3	0.3
Feb-90	14,780	0.030	0.60		0.6	0.3	0.3
Mar-90	16,070	0.030	0.66		0.7	0.3	0.3
Apr-90	16,110	0.030	0.66		0.7	0.3	0.3
May-90	14,270	0.030	0.58		0.6	0.3	0.3
Jun-90	7,110	0.030	0.29		0.3	0.1	0.1
Jul-90	7,260	0.030	0.30		0.3	0.1	0.1
Aug-90	8,350	0.030	0.34		0.3	0.2	0.2
Sep-90	8,780	0.030	0.36		0.4	0.2	0.2
Oct-90	11,558	0.030	0.47		0.5	0.2	0.2
Nov-90	11,408	0.030	0.47		0.5	0.2	0.2
Dec-90	10,582	0.030	0.43		0.4	0.2	0.2
Jan-91	9,548	0.030	0.39		0.4	0.2	0.2
Feb-91	8,619	0.030	0.35		0.4	0.2	0.2
Mar-91	22,629	0.030	0.92		0.9	0.5	0.5
Apr-91	22,863	0.030	0.93		0.9	0.5	0.5
May-91	26,085	0.030	1.06		1.1	0.5	0.5
Jun-91	7,741	0.030	0.32		0.3	0.2	0.2
Jul-91	3,001	0.030	0.12		0.1	0.1	0.1
Aug-91	6,954	0.030	0.28		0.3	0.1	0.1
Sep-91	6,864	0.030	0.28		0.3	0.1	0.1
Oct-91	9,574	0.030	0.39		0.4	0.2	0.2
Nov-91	11,919	0.030	0.49		0.5	0.2	0.2
Dec-91	11,203	0.030	0.46		0.5	0.2	0.2
Jan-92	11,915	0.030	0.49		0.5	0.2	0.2
Feb-92	25,696	0.030	1.05		1.0	0.5	0.5
Mar-92	15,780	0.030	0.64		0.6	0.3	0.3
Apr-92	18,988	0.030	0.77		0.8	0.4	0.4
May-92	21,794	0.030	0.89		0.9	0.4	0.4

Table D-8: Tuolumne River Sub-area Background Boron Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Boron Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jun-92	6,585	0.030	0.27		0.3	0.1	0.1
Jul-92	5,972	0.030	0.24		0.2	0.1	0.1
Aug-92	5,950	0.030	0.24		0.2	0.1	0.1
Sep-92	7,016	0.030	0.29		0.3	0.1	0.1
Oct-92	9,890	0.030	0.40		0.4	0.2	0.2
Nov-92	12,426	0.030	0.51		0.5	0.3	0.3
Dec-92	12,516	0.030	0.51		0.5	0.3	0.3
Jan-93	46,282	0.030	1.89		1.9	0.9	0.9
Feb-93	24,972	0.030	1.02		1.0	0.5	0.5
Mar-93	18,101	0.030	0.74		0.7	0.4	0.4
Apr-93	49,053	0.030	2.00		2.0	1.0	1.0
May-93	45,128	0.030	1.84		1.8	0.9	0.9
Jun-93	28,536	0.030	1.16		1.2	0.6	0.6
Jul-93	19,795	0.030	0.81		0.8	0.4	0.4
Aug-93	30,424	0.030	1.24		1.2	0.6	0.6
Sep-93	59,389	0.030	2.42		2.4	1.2	1.2
Oct-93	45,672	0.030	1.86		1.9	0.9	0.9
Nov-93	23,461	0.030	0.96		1.0	0.5	0.5
Dec-93	27,035	0.030	1.10		1.1	0.6	0.6
Jan-94	38,327	0.030	1.56		1.6	0.8	0.8
Feb-94	23,124	0.030	0.94		0.9	0.5	0.5
Mar-94	19,819	0.030	0.81		0.8	0.4	0.4
Apr-94	31,000	0.030	1.26		1.3	0.6	0.6
May-94	27,099	0.030	1.11		1.1	0.6	0.6
Jun-94	8,485	0.030	0.35		0.3	0.2	0.2
Jul-94	7,081	0.030	0.29		0.3	0.1	0.1
Aug-94	7,692	0.030	0.31		0.3	0.2	0.2
Sep-94	7,645	0.030	0.31		0.3	0.2	0.2
Oct-94	8,464	0.030	0.35		0.3	0.2	0.2
Nov-94	12,858	0.030	0.52		0.5	0.3	0.3
Dec-94	13,931	0.030	0.57		0.6	0.3	0.3
Jan-95	73,121	0.030	2.98		3.0	1.5	1.5
Feb-95	234,847	0.015	4.79	4.8	4.8		
Mar-95	292,385	0.015	5.96	6.0	6.0		
Apr-95	369,036	0.015	7.53	7.5	7.5		
May-95	476,971	0.015	9.73	9.7	9.7		
Jun-95	293,153	0.015	5.98	6.0	6.0		
Jul-95	193,682	0.015	3.95	3.9	3.9		
Aug-95	64,912	0.030	2.65		2.6	1.3	1.3
Sep-95	122,157	0.015	2.49	2.5	2.5		
Oct-95	89,755	0.030	3.66		3.7	1.8	1.8
Nov-95	18,478	0.030	0.75		0.8	0.4	0.4
Dec-95	17,607	0.030	0.72		0.7	0.4	0.4
Jan-96	26,820	0.030	1.09		1.1	0.5	0.5
Feb-96	261,756	0.015	5.34	5.3	5.3		
Mar-96	293,881	0.015	5.99	6.0	6.0		
Apr-96	161,218	0.015	3.29	3.3	3.3		

Table D-8: Tuolumne River Sub-area Background Boron Loads

Month-Year	Tuolumne Q (acre-feet) *Qm*	Tuolumne Boron Conc. (mg/L) *Cm*	Tuolumne Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
May-96	232,963	0.015	4.75	4.8	4.8		
Jun-96	35,974	0.030	1.47		1.5	0.7	0.7
Jul-96	10,405	0.030	0.42		0.4	0.2	0.2
Aug-96	17,123	0.030	0.70		0.7	0.3	0.3
Sep-96	17,072	0.030	0.70		0.7	0.3	0.3
Oct-96	28,071	0.030	1.14		1.1	0.6	0.6
Nov-96	23,348	0.030	0.95		1.0	0.5	0.5
Dec-96	284,328	0.015	5.80	5.8	5.8		
Jan-97	803,690	0.015	16.39	16.4	16.4		
Feb-97	450,657	0.015	9.19	9.2	9.2		
Mar-97	150,175	0.015	3.06	3.1	3.1		
Apr-97	86,663	0.030	3.53		3.5	1.8	1.8
May-97	58,552	0.030	2.39		2.4	1.2	1.2
Jun-97	15,993	0.030	0.65		0.7	0.3	0.3
Jul-97	17,809	0.030	0.73		0.7	0.4	0.4
Aug-97	17,629	0.030	0.72		0.7	0.4	0.4
Sep-97	16,941	0.030	0.69		0.7	0.3	0.3

Table D-9: Stanislaus River Sub-area Background Boron Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Boron Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	5,554	0.030	0.227		0.23	0.11	0.11
Nov-76	4,429	0.030	0.181		0.18	0.09	0.09
Dec-76	5,379	0.030	0.219		0.22	0.11	0.11
Jan-77	5,153	0.030	0.210		0.21	0.11	0.11
Feb-77	3,876	0.030	0.158		0.16	0.08	0.08
Mar-77	4,068	0.030	0.166		0.17	0.08	0.08
Apr-77	3,074	0.030	0.125		0.13	0.06	0.06
May-77	3,792	0.030	0.155		0.15	0.08	0.08
Jun-77	2,947	0.030	0.120		0.12	0.06	0.06
Jul-77	1,444	0.030	0.059		0.06	0.03	0.03
Aug-77	1,348	0.030	0.055		0.05	0.03	0.03
Sep-77	834	0.030	0.034		0.03	0.02	0.02
Oct-77	801	0.030	0.033		0.03	0.02	0.02
Nov-77	1,254	0.030	0.051		0.05	0.03	0.03
Dec-77	1,636	0.030	0.067		0.07	0.03	0.03
Jan-78	25,420	0.030	1.037		1.04	0.52	0.52
Feb-78	87,390	0.015	1.782	1.78			
Mar-78	186,700	0.015	3.807	3.81			
Apr-78	202,300	0.015	4.125	4.13			
May-78	225,700	0.015	4.603	4.60			
Jun-78	158,300	0.015	3.228	3.23			
Jul-78	34,560	0.030	1.410		1.41	0.70	0.70
Aug-78	15,160	0.030	0.618		0.62	0.31	0.31
Sep-78	17,280	0.030	0.705		0.70	0.35	0.35
Oct-78	17,020	0.030	0.694		0.69	0.35	0.35
Nov-78	16,020	0.030	0.653		0.65	0.33	0.33
Dec-78	26,780	0.030	1.092		1.09	0.55	0.55
Jan-79	81,830	0.015	1.669	1.67			
Feb-79	99,180	0.015	2.023	2.02			
Mar-79	132,000	0.015	2.692	2.69			
Apr-79	35,120	0.030	1.432		1.43	0.72	0.72
May-79	70,450	0.015	1.437	1.44			
Jun-79	51,920	0.030	2.118		2.12	1.06	1.06
Jul-79	15,760	0.030	0.643		0.64	0.32	0.32
Aug-79	15,820	0.030	0.645		0.65	0.32	0.32
Sep-79	14,270	0.030	0.582		0.58	0.29	0.29
Oct-79	17,670	0.030	0.721		0.72	0.36	0.36
Nov-79	14,560	0.030	0.594		0.59	0.30	0.30
Dec-79	27,060	0.030	1.104		1.10	0.55	0.55
Jan-80	203,300	0.015	4.146	4.15			
Feb-80	183,200	0.015	3.736	3.74			
Mar-80	153,000	0.015	3.120	3.12			
Apr-80	228,400	0.015	4.658	4.66			
May-80	242,400	0.015	4.943	4.94			
Jun-80	65,460	0.030	2.670		2.67	1.33	1.33
Jul-80	72,060	0.015	1.469	1.47			
Aug-80	21,680	0.030	0.884		0.88	0.44	0.44
Sep-80	28,720	0.030	1.171		1.17	0.59	0.59
Oct-80	28,000	0.030	1.142		1.14	0.57	0.57
Nov-80	20,770	0.030	0.847		0.85	0.42	0.42

Table D-9: Stanislaus River Sub-area Background Boron Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Boron Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Dec-80	13,770	0.030	0.562		0.56	0.28	0.28
Jan-81	15,710	0.030	0.641		0.64	0.32	0.32
Feb-81	12,130	0.030	0.495		0.49	0.25	0.25
Mar-81	21,600	0.030	0.881		0.88	0.44	0.44
Apr-81	62,370	0.030	2.544		2.54	1.27	1.27
May-81	45,590	0.030	1.859		1.86	0.93	0.93
Jun-81	32,290	0.030	1.317		1.32	0.66	0.66
Jul-81	24,080	0.030	0.982		0.98	0.49	0.49
Aug-81	26,680	0.030	1.088		1.09	0.54	0.54
Sep-81	16,800	0.030	0.685		0.69	0.34	0.34
Oct-81	16,575	0.030	0.676		0.68	0.34	0.34
Nov-81	17,393	0.030	0.709		0.71	0.35	0.35
Dec-81	14,657	0.030	0.598		0.60	0.30	0.30
Jan-82	36,245	0.030	1.478		1.48	0.74	0.74
Feb-82	61,271	0.030	2.499		2.50	1.25	1.25
Mar-82	81,480	0.015	1.662	1.66			
Apr-82	46,752	0.030	1.907		1.91	0.95	0.95
May-82	27,631	0.030	1.127		1.13	0.56	0.56
Jun-82	80,330	0.015	1.638	1.64			
Jul-82	80,945	0.015	1.651	1.65			
Aug-82	88,561	0.015	1.806	1.81			
Sep-82	81,500	0.015	1.662	1.66			
Oct-82	79,300	0.015	1.617	1.62			
Nov-82	79,890	0.015	1.629	1.63			
Dec-82	81,140	0.015	1.655	1.65			
Jan-83	84,430	0.015	1.722	1.72			
Feb-83	60,270	0.030	2.458		2.46	1.23	1.23
Mar-83	210,600	0.015	4.295	4.29			
Apr-83	309,900	0.015	6.320	6.32			
May-83	262,950	0.015	5.362	5.36			
Jun-83	196,500	0.015	4.007	4.01			
Jul-83	225,700	0.015	4.603	4.60			
Aug-83	172,840	0.015	3.525	3.52			
Sep-83	113,790	0.015	2.320	2.32			
Oct-83	111,260	0.015	2.269	2.27			
Nov-83	137,310	0.015	2.800	2.80			
Dec-83	311,010	0.015	6.342	6.34			
Jan-84	299,400	0.015	6.106	6.11			
Feb-84	101,610	0.015	2.072	2.07			
Mar-84	89,290	0.015	1.821	1.82			
Apr-84	56,760	0.030	2.315		2.31	1.16	1.16
May-84	57,780	0.030	2.357		2.36	1.18	1.18
Jun-84	33,650	0.030	1.372		1.37	0.69	0.69
Jul-84	31,260	0.030	1.275		1.27	0.64	0.64
Aug-84	37,100	0.030	1.513		1.51	0.76	0.76
Sep-84	52,100	0.030	2.125		2.12	1.06	1.06
Oct-84	53,806	0.030	2.194		2.19	1.10	1.10
Nov-84	23,738	0.030	0.968		0.97	0.48	0.48
Dec-84	46,992	0.030	1.917		1.92	0.96	0.96
Jan-85	62,876	0.030	2.564		2.56	1.28	1.28

Table D-9: Stanislaus River Sub-area Background Boron Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Boron Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Feb-85	40,762	0.030	1.662		1.66	0.83	0.83
Mar-85	38,612	0.030	1.575		1.57	0.79	0.79
Apr-85	51,209	0.030	2.089		2.09	1.04	1.04
May-85	45,217	0.030	1.844		1.84	0.92	0.92
Jun-85	38,132	0.030	1.555		1.56	0.78	0.78
Jul-85	86,598	0.015	1.766	1.77			
Aug-85	79,777	0.015	1.627	1.63			
Sep-85	31,210	0.030	1.273		1.27	0.64	0.64
Oct-85	28,116	0.030	1.147		1.15	0.57	0.57
Nov-85	24,918	0.030	1.016		1.02	0.51	0.51
Dec-85	27,481	0.030	1.121		1.12	0.56	0.56
Jan-86	28,796	0.030	1.174		1.17	0.59	0.59
Feb-86	93,552	0.015	1.908	1.91			
Mar-86	286,790	0.015	5.848	5.85			
Apr-86	119,544	0.015	2.438	2.44			
May-86	83,048	0.015	1.694	1.69			
Jun-86	79,557	0.015	1.622	1.62			
Jul-86	55,490	0.030	2.263		2.26	1.13	1.13
Aug-86	81,433	0.015	1.661	1.66			
Sep-86	89,177	0.015	1.819	1.82			
Oct-86	45,283	0.030	1.847		1.85	0.92	0.92
Nov-86	31,426	0.030	1.282		1.28	0.64	0.64
Dec-86	55,250	0.030	2.253		2.25	1.13	1.13
Jan-87	38,577	0.030	1.573		1.57	0.79	0.79
Feb-87	45,451	0.030	1.854		1.85	0.93	0.93
Mar-87	71,911	0.015	1.466	1.47			
Apr-87	66,331	0.015	1.353	1.35			
May-87	49,380	0.030	2.014		2.01	1.01	1.01
Jun-87	50,729	0.030	2.069		2.07	1.03	1.03
Jul-87	37,478	0.030	1.529		1.53	0.76	0.76
Aug-87	32,692	0.030	1.333		1.33	0.67	0.67
Sep-87	27,461	0.030	1.120		1.12	0.56	0.56
Oct-87	17,508	0.030	0.714		0.71	0.36	0.36
Nov-87	18,331	0.030	0.748		0.75	0.37	0.37
Dec-87	14,188	0.030	0.579		0.58	0.29	0.29
Jan-88	13,450	0.030	0.549		0.55	0.27	0.27
Feb-88	13,793	0.030	0.563		0.56	0.28	0.28
Mar-88	70,022	0.015	1.428	1.43			
Apr-88	53,399	0.030	2.178		2.18	1.09	1.09
May-88	55,020	0.030	2.244		2.24	1.12	1.12
Jun-88	54,012	0.030	2.203		2.20	1.10	1.10
Jul-88	45,433	0.030	1.853		1.85	0.93	0.93
Aug-88	47,580	0.030	1.941		1.94	0.97	0.97
Sep-88	42,817	0.030	1.746		1.75	0.87	0.87
Oct-88	28,719	0.030	1.171		1.17	0.59	0.59
Nov-88	25,968	0.030	1.059		1.06	0.53	0.53
Dec-88	27,398	0.030	1.117		1.12	0.56	0.56
Jan-89	15,921	0.030	0.649		0.65	0.32	0.32
Feb-89	12,488	0.030	0.509		0.51	0.25	0.25
Mar-89	63,888	0.030	2.606		2.61	1.30	1.30

Table D-9: Stanislaus River Sub-area Background Boron Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Boron Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Apr-89	54,292	0.030	2.214		2.21	1.11	1.11
May-89	65,193	0.030	2.659		2.66	1.33	1.33
Jun-89	50,136	0.030	2.045		2.04	1.02	1.02
Jul-89	39,477	0.030	1.610		1.61	0.81	0.81
Aug-89	25,936	0.030	1.058		1.06	0.53	0.53
Sep-89	26,803	0.030	1.093		1.09	0.55	0.55
Oct-89	18,760	0.030	0.765		0.77	0.38	0.38
Nov-89	14,140	0.030	0.577		0.58	0.29	0.29
Dec-89	13,070	0.030	0.533		0.53	0.27	0.27
Jan-90	11,310	0.030	0.461		0.46	0.23	0.23
Feb-90	10,910	0.030	0.445		0.44	0.22	0.22
Mar-90	51,150	0.030	2.086		2.09	1.04	1.04
Apr-90	32,590	0.030	1.329		1.33	0.66	0.66
May-90	33,920	0.030	1.383		1.38	0.69	0.69
Jun-90	35,790	0.030	1.460		1.46	0.73	0.73
Jul-90	37,380	0.030	1.525		1.52	0.76	0.76
Aug-90	32,770	0.030	1.337		1.34	0.67	0.67
Sep-90	19,120	0.030	0.780		0.78	0.39	0.39
Oct-90	21,640	0.030	0.883		0.88	0.44	0.44
Nov-90	23,820	0.030	0.971		0.97	0.49	0.49
Dec-90	12,600	0.030	0.514		0.51	0.26	0.26
Jan-91	11,640	0.030	0.475		0.47	0.24	0.24
Feb-91	10,560	0.030	0.431		0.43	0.22	0.22
Mar-91	16,010	0.030	0.653		0.65	0.33	0.33
Apr-91	13,860	0.030	0.565		0.57	0.28	0.28
May-91	24,110	0.030	0.983		0.98	0.49	0.49
Jun-91	14,980	0.030	0.611		0.61	0.31	0.31
Jul-91	19,990	0.030	0.815		0.82	0.41	0.41
Aug-91	15,090	0.030	0.615		0.62	0.31	0.31
Sep-91	15,060	0.030	0.614		0.61	0.31	0.31
Oct-91	19,980	0.030	0.815		0.81	0.41	0.41
Nov-91	22,760	0.030	0.928		0.93	0.46	0.46
Dec-91	11,610	0.030	0.474		0.47	0.24	0.24
Jan-92	10,990	0.030	0.448		0.45	0.22	0.22
Feb-92	19,550	0.030	0.797		0.80	0.40	0.40
Mar-92	17,120	0.030	0.698		0.70	0.35	0.35
Apr-92	43,100	0.030	1.758		1.76	0.88	0.88
May-92	22,480	0.030	0.917		0.92	0.46	0.46
Jun-92	15,920	0.030	0.649		0.65	0.32	0.32
Jul-92	15,560	0.030	0.635		0.63	0.32	0.32
Aug-92	16,550	0.030	0.675		0.67	0.34	0.34
Sep-92	19,580	0.030	0.799		0.80	0.40	0.40
Oct-92	21,970	0.030	0.896		0.90	0.45	0.45
Nov-92	13,280	0.030	0.542		0.54	0.27	0.27
Dec-92	13,580	0.030	0.554		0.55	0.28	0.28
Jan-93	38,770	0.030	1.581		1.58	0.79	0.79
Feb-93	17,710	0.030	0.722		0.72	0.36	0.36
Mar-93	21,770	0.030	0.888		0.89	0.44	0.44
Apr-93	30,010	0.030	1.224		1.22	0.61	0.61
May-93	86,800	0.015	1.770	1.77			

Table D-9: Stanislaus River Sub-area Background Boron Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Boron Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jun-93	36,500	0.030	1.489		1.49	0.74	0.74
Jul-93	25,270	0.030	1.031		1.03	0.52	0.52
Aug-93	24,170	0.030	0.986		0.99	0.49	0.49
Sep-93	27,070	0.030	1.104		1.10	0.55	0.55
Oct-93	40,580	0.030	1.655		1.66	0.83	0.83
Nov-93	19,650	0.030	0.801		0.80	0.40	0.40
Dec-93	19,420	0.030	0.792		0.79	0.40	0.40
Jan-94	19,790	0.030	0.807		0.81	0.40	0.40
Feb-94	17,830	0.030	0.727		0.73	0.36	0.36
Mar-94	56,860	0.030	2.319		2.32	1.16	1.16
Apr-94	33,680	0.030	1.374		1.37	0.69	0.69
May-94	37,160	0.030	1.516		1.52	0.76	0.76
Jun-94	31,380	0.030	1.280		1.28	0.64	0.64
Jul-94	32,720	0.030	1.334		1.33	0.67	0.67
Aug-94	26,700	0.030	1.089		1.09	0.54	0.54
Sep-94	20,450	0.030	0.834		0.83	0.42	0.42
Oct-94	26,265	0.030	1.071		1.07	0.54	0.54
Nov-94	18,376	0.030	0.749		0.75	0.37	0.37
Dec-94	19,061	0.030	0.777		0.78	0.39	0.39
Jan-95	43,305	0.030	1.766		1.77	0.88	0.88
Feb-95	20,984	0.030	0.856		0.86	0.43	0.43
Mar-95	47,243	0.030	1.927		1.93	0.96	0.96
Apr-95	54,485	0.030	2.222		2.22	1.11	1.11
May-95	90,762	0.015	1.851	1.85			
Jun-95	41,724	0.030	1.702		1.70	0.85	0.85
Jul-95	28,422	0.030	1.159		1.16	0.58	0.58
Aug-95	25,097	0.030	1.024		1.02	0.51	0.51
Sep-95	26,130	0.030	1.066		1.07	0.53	0.53
Oct-95	34,550	0.030	1.409		1.41	0.70	0.70
Nov-95	18,769	0.030	0.765		0.77	0.38	0.38
Dec-95	20,409	0.030	0.832		0.83	0.42	0.42
Jan-96	25,674	0.030	1.047		1.05	0.52	0.52
Feb-96	83,962	0.015	1.712	1.71			
Mar-96	206,351	0.015	4.208	4.21			
Apr-96	109,144	0.015	2.226	2.23			
May-96	97,246	0.015	1.983	1.98			
Jun-96	66,585	0.015	1.358	1.36			
Jul-96	46,464	0.030	1.895		1.90	0.95	0.95
Aug-96	36,535	0.030	1.490		1.49	0.75	0.75
Sep-96	31,383	0.030	1.280		1.28	0.64	0.64
Oct-96	40,304	0.030	1.644		1.64	0.82	0.82
Nov-96	46,117	0.030	1.881		1.88	0.94	0.94
Dec-96	202,147	0.015	4.122	4.12			
Jan-97	407,665	0.015	8.313	8.31			
Feb-97	352,994	0.015	7.198	7.20			
Mar-97	175,638	0.015	3.582	3.58			
Apr-97	79,213	0.015	1.615	1.62			
May-97	100,657	0.015	2.053	2.05			
Jun-97	69,298	0.015	1.413	1.41			
Jul-97	32,208	0.030	1.314		1.31	0.66	0.66

Table D-9: Stanislaus River Sub-area Background Boron Loads

Month-Year	Stanislaus Q (acre-feet) *Qm*	Stanislaus Boron Conc. (mg/L) *Cm*	Stanislaus Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Aug-97	30,211	0.030	1.232		1.23	0.62	0.62
Sep-97	29,731	0.030	1.213		1.21	0.61	0.61

Table D-10: SJR above Salt Slough River Sub-area Background Boron Loads

Month-Year	SJR above Salt Slough Q (acre-feet) *Qm*	SJR above Salt Slough Boron Conc. (mg/L) *Cm*	SJR above Salt Slough Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Oct-76	877	0.220	0.262		0.26	0.15	0.12
Nov-76	1,751	0.172	0.409		0.41	0.29	0.12
Dec-76	1,125	0.201	0.307		0.31	0.19	0.12
Jan-77	1,775	0.171	0.413		0.41	0.30	0.12
Feb-77	827	0.224	0.252		0.25	0.14	0.11
Mar-77	1,490	0.182	0.369		0.37	0.25	0.12
Apr-77	742	0.233	0.235		0.24	0.12	0.11
May-77	519	0.264	0.187		0.19	0.09	0.10
Jun-77	173	0.390	0.092		0.09	0.03	0.06
Jul-77	58	0.575	0.045		0.05	0.01	0.04
Aug-77	330	0.310	0.139		0.14	0.06	0.08
Sep-77	244	0.346	0.115		0.11	0.04	0.07
Oct-77	105	0.466	0.067		0.07	0.02	0.05
Nov-77	269	0.334	0.122		0.12	0.04	0.08
Dec-77	615	0.249	0.208		0.21	0.10	0.11
Jan-78	41,330	0.056	3.147	3.15			
Feb-78	221,200	0.031	9.293	9.29			
Mar-78	409,000	0.025	13.818	13.82			
Apr-78	726,200	0.020	20.015	20.02			
May-78	494,800	0.023	15.625	15.62			
Jun-78	74,100	0.046	4.588	4.59			
Jul-78	2,977	0.142	0.576		0.58	0.50	0.08
Aug-78	2,692	0.148	0.540		0.54	0.45	0.09
Sep-78	12,240	0.086	1.435	1.43			
Oct-78	8,499	0.098	1.134	1.13			
Nov-78	2,953	0.143	0.573		0.57	0.49	0.08
Dec-78	6,337	0.109	0.938	0.94			
Jan-79	61,830	0.049	4.082	4.08			
Feb-79	69,380	0.047	4.397	4.40			
Mar-79	50,050	0.052	3.561	3.56			
Apr-79	17,510	0.076	1.808	1.81			
May-79	10,320	0.092	1.285	1.29			
Jun-79	2,428	0.153	0.505		0.51	0.41	0.10
Jul-79	3,170	0.139	0.600		0.60	0.53	0.07
Aug-79	2,305	0.156	0.488		0.49	0.39	0.10
Sep-79	11,160	0.089	1.352	1.35			
Oct-79	9,527	0.094	1.221	1.22			
Nov-79	1,741	0.172	0.408		0.41	0.29	0.12
Dec-79	3,066	0.141	0.587		0.59	0.51	0.07
Jan-80	188,200	0.033	8.372	8.37			
Feb-80	344,600	0.026	12.371	12.37			
Mar-80	592,100	0.022	17.544	17.54			
Apr-80	73,620	0.046	4.568	4.57			
May-80	114,400	0.039	6.072	6.07			
Jun-80	18,580	0.074	1.879	1.88			
Jul-80	32,770	0.061	2.709	2.71			

Table D-10: SJR above Salt Slough River Sub-area Background Boron Loads

Month-Year	SJR above Salt Slough Q (acre-feet) *Qm*	SJR above Salt Slough Boron Conc. (mg/L) *Cm*	SJR above Salt Slough Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Aug-80	5,024	0.118	0.808	0.81			
Sep-80	13,880	0.082	1.556	1.56			
Oct-80	10,430	0.091	1.294	1.29			
Nov-80	2,280	0.156	0.485		0.49	0.38	0.10
Dec-80	2,230	0.158	0.478		0.48	0.37	0.11
Jan-81	5,430	0.115	0.849	0.85			
Feb-81	6,850	0.106	0.987	0.99			
Mar-81	20,170	0.072	1.981	1.98			
Apr-81	4,270	0.125	0.727		0.73	0.71	0.01
May-81	3,710	0.132	0.664		0.66	0.62	0.04
Jun-81	1,250	0.194	0.329		0.33	0.21	0.12
Jul-81	1,130	0.201	0.308		0.31	0.19	0.12
Aug-81	1,460	0.183	0.364		0.36	0.24	0.12
Sep-81	2,840	0.145	0.559		0.56	0.47	0.08
Oct-81	4,240	0.126	0.724		0.72	0.71	0.01
Nov-81	4,901	0.119	0.795	0.79			
Dec-81	6,878	0.106	0.989	0.99			
Jan-82	44,897	0.054	3.320	3.32			
Feb-82	52,813	0.051	3.687	3.69			
Mar-82	64,942	0.048	4.213	4.21			
Apr-82	600,257	0.022	17.700	17.70			
May-82	339,913	0.027	12.262	12.26			
Jun-82	40,000	0.057	3.081	3.08			
Jul-82	12,714	0.085	1.471	1.47			
Aug-82	4,129	0.127	0.712		0.71	0.69	0.02
Sep-82	30,111	0.063	2.565	2.57			
Oct-82	30,260	0.063	2.574	2.57			
Nov-82	120,330	0.038	6.273	6.27			
Dec-82	557,450	0.022	16.875	16.87			
Jan-83	570,800	0.022	17.134	17.13			
Feb-83	865,470	0.019	22.415	22.42			
Mar-83	1,179,000	0.017	27.366	27.37			
Apr-83	790,410	0.020	21.141	21.14			
May-83	608,750	0.022	17.861	17.86			
Jun-83	642,760	0.021	18.499	18.50			
Jul-83	448,410	0.024	14.663	14.66			
Aug-83	46,770	0.054	3.409	3.41			
Sep-83	110,140	0.040	5.925	5.92			
Oct-83	178,160	0.033	8.081	8.08			
Nov-83	177,740	0.033	8.069	8.07			
Dec-83	338,060	0.027	12.219	12.22			
Jan-84	494,800	0.023	15.625	15.62			
Feb-84	33,430	0.060	2.744	2.74			
Mar-84	15,080	0.080	1.642	1.64			
Apr-84	12,920	0.085	1.486	1.49			
May-84	9,800	0.093	1.243	1.24			

Table D-10: SJR above Salt Slough River Sub-area Background Boron Loads

Month-Year	SJR above Salt Slough Q (acre-feet) *Qm*	SJR above Salt Slough Boron Conc. (mg/L) *Cm*	SJR above Salt Slough Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Jun-84	5,900	0.112	0.896	0.90			
Jul-84	2,120	0.161	0.463		0.46	0.35	0.11
Aug-84	5,230	0.117	0.829	0.83			
Sep-84	12,100	0.087	1.424	1.42			
Oct-84	17,812	0.033	0.807	0.81			
Nov-84	2,731	0.071	0.264	0.26			
Dec-84	4,748	0.108	0.699	0.70			
Jan-85	4,024	0.146	0.799		0.80	0.67	0.13
Feb-85	6,190	0.148	1.243		1.24	1.04	0.21
Mar-85	11,940	0.171	2.781		2.78	2.00	0.78
Apr-85	4,540	0.195	1.204		1.20	0.76	0.44
May-85	2,763	0.219	0.823		0.82	0.46	0.36
Jun-85	3,275	0.100	0.445	0.45			
Jul-85	1,139	0.360	0.557		0.56	0.19	0.37
Aug-85	2,136	0.155	0.450		0.45	0.36	0.09
Sep-85	8,622	0.003	0.029	0.03			
Oct-85	5,849	0.270	2.147		2.15	0.98	1.17
Nov-85	2,293	0.215	0.670		0.67	0.38	0.29
Dec-85	7,049	0.215	2.060		2.06	1.18	0.88
Jan-86	8,245	0.343	3.848		3.85	1.38	2.47
Feb-86	82,469	0.055	6.166	6.17			
Mar-86	688,998	0.003	2.342	2.34			
Apr-86	399,788	0.070	38.046	38.05			
May-86	49,436	0.030	2.016	2.02			
Jun-86	36,159	0.064	3.154	3.15			
Jul-86	4,405	0.200	1.198		1.20	0.74	0.46
Aug-86	5,829	0.110	0.872	0.87			
Sep-86	18,349	0.080	1.996	2.00			
Oct-86	14,204	0.010	0.193	0.19			
Nov-86	1,388	0.160	0.302		0.30	0.23	0.07
Dec-86	3,488	0.210	0.996		1.00	0.58	0.41
Jan-87	6,460	0.265	2.327		2.33	1.08	1.25
Feb-87	5,564	0.200	1.513		1.51	0.93	0.58
Mar-87	11,000	0.140	2.094		2.09	1.84	0.25
Apr-87	1,458	0.210	0.416		0.42	0.24	0.17
May-87	1,902	0.350	0.905		0.91	0.32	0.59
Jun-87	1,275	0.130	0.225		0.23	0.21	0.01
Jul-87	989	0.280	0.376		0.38	0.17	0.21
Aug-87	1,176	0.310	0.496		0.50	0.20	0.30
Sep-87	2,386	0.190	0.616		0.62	0.40	0.22
Oct-87	1,240	0.035	0.059	0.06			
Nov-87	1,374	0.230	0.430		0.43	0.23	0.20
Dec-87	2,237	0.260	0.791		0.79	0.37	0.42
Jan-88	4,314	0.290	1.701		1.70	0.72	0.98
Feb-88	2,793	0.330	1.253		1.25	0.47	0.79
Mar-88	1,555	0.278	0.588		0.59	0.26	0.33

Table D-10: SJR above Salt Slough River Sub-area Background Boron Loads

Month-Year	SJR above Salt Slough Q (acre-feet) *Qm*	SJR above Salt Slough Boron Conc. (mg/L) *Cm*	SJR above Salt Slough Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Apr-88	3,353	0.225	1.026		1.03	0.56	0.46
May-88	1,238	0.300	0.505		0.50	0.21	0.30
Jun-88	533	0.300	0.217		0.22	0.09	0.13
Jul-88	444	0.375	0.226		0.23	0.07	0.15
Aug-88	527	0.323	0.231		0.23	0.09	0.14
Sep-88	331	0.300	0.135		0.13	0.06	0.08
Oct-88	201	0.248	0.068		0.07	0.03	0.03
Nov-88	85	0.283	0.033		0.03	0.01	0.02
Dec-88	192	0.260	0.068		0.07	0.03	0.04
Jan-89	3,134	0.407	1.733		1.73	0.52	1.21
Feb-89	1,918	0.120	0.313	0.31			
Mar-89	4,342	0.142	0.838		0.84	0.73	0.11
Apr-89	612	0.318	0.264		0.26	0.10	0.16
May-89	676	0.370	0.340		0.34	0.11	0.23
Jun-89	391	0.360	0.191		0.19	0.07	0.13
Jul-89	238	0.385	0.125		0.12	0.04	0.08
Aug-89	654	0.368	0.327		0.33	0.11	0.22
Sep-89	422	0.258	0.148		0.15	0.07	0.08
Oct-89	362	0.220	0.108		0.11	0.06	0.05
Nov-89	74	0.190	0.019		0.02	0.01	0.01
Dec-89	52	0.240	0.017		0.02	0.01	0.01
Jan-90	574	0.225	0.176		0.18	0.10	0.08
Feb-90	1,599	0.190	0.413		0.41	0.27	0.15
Mar-90	1,734	0.304	0.717		0.72	0.29	0.43
Apr-90	565	0.363	0.278		0.28	0.09	0.18
May-90	454	0.342	0.211		0.21	0.08	0.14
Jun-90	348	0.310	0.147		0.15	0.06	0.09
Jul-90	39	0.610	0.032		0.03	0.01	0.03
Aug-90	107	0.564	0.082		0.08	0.02	0.06
Sep-90	29	0.533	0.021		0.02	0.00	0.02
Oct-90	99	0.668	0.090		0.09	0.02	0.07
Nov-90	109	0.733	0.109		0.11	0.02	0.09
Dec-90	8	0.700	0.008		0.01	0.00	0.01
Jan-91	23	0.693	0.022		0.02	0.00	0.02
Feb-91	122	0.445	0.074		0.07	0.02	0.05
Mar-91	15,580	0.142	3.008		3.01	2.61	0.40
Apr-91	747	0.250	0.254		0.25	0.12	0.13
May-91	638	0.378	0.328		0.33	0.11	0.22
Jun-91	349	0.385	0.183		0.18	0.06	0.12
Jul-91	611	0.330	0.274		0.27	0.10	0.17
Aug-91	203	0.440	0.121		0.12	0.03	0.09
Sep-91	70	0.545	0.052		0.05	0.01	0.04
Oct-91	1,014	0.746	1.028		1.03	0.17	0.86
Nov-91	1,020	0.213	0.296		0.30	0.17	0.13
Dec-91	66	0.483	0.043		0.04	0.01	0.03
Jan-92	195	0.272	0.072		0.07	0.03	0.04

Table D-10: SJR above Salt Slough River Sub-area Background Boron Loads

Month-Year	SJR above Salt Slough Q (acre-feet) *Qm*	SJR above Salt Slough Boron Conc. (mg/L) *Cm*	SJR above Salt Slough Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Feb-92	16,570	0.130	2.928		2.93	2.77	0.16
Mar-92	2,188	0.254	0.756		0.76	0.37	0.39
Apr-92	1,109	0.330	0.498		0.50	0.19	0.31
May-92	489	0.404	0.269		0.27	0.08	0.19
Jun-92	1,125	0.635	0.971		0.97	0.19	0.78
Jul-92	123	0.762	0.127		0.13	0.02	0.11
Aug-92	63	0.890	0.076		0.08	0.01	0.07
Sep-92	27	0.935	0.034		0.03	0.00	0.03
Oct-92	31	0.964	0.041		0.04	0.01	0.04
Nov-92	20	1.033	0.028		0.03	0.00	0.02
Dec-92	43	0.940	0.055		0.05	0.01	0.05
Jan-93	100,400	0.048	6.483	6.48			
Feb-93	39,330	0.085	4.545	4.54			
Mar-93	31,350	0.120	5.114	5.11			
Apr-93	16,420	0.108	2.411	2.41			
May-93	2,019	0.300	0.823		0.82	0.34	0.49
Jun-93	2,315	0.213	0.669		0.67	0.39	0.28
Jul-93	1,802	0.292	0.715		0.72	0.30	0.41
Aug-93	1,505	0.340	0.696		0.70	0.25	0.44
Sep-93	804	0.325	0.355		0.36	0.13	0.22
Oct-93	1,278	0.266	0.462		0.46	0.21	0.25
Nov-93	2,716	0.127	0.469		0.47	0.45	0.01
Dec-93	444	0.213	0.128		0.13	0.07	0.05
Jan-94	2,466	0.355	1.191		1.19	0.41	0.78
Feb-94	16,760	0.110	2.512	2.51			
Mar-94	3,857	0.236	1.239		1.24	0.64	0.59
Apr-94	1,598	0.281	0.610		0.61	0.27	0.34
May-94	1,778	0.266	0.644		0.64	0.30	0.35
Jun-94	1,084	0.315	0.464		0.46	0.18	0.28
Jul-94	788	0.355	0.380		0.38	0.13	0.25
Aug-94	411	0.420	0.235		0.23	0.07	0.17
Sep-94	101	0.365	0.050		0.05	0.02	0.03
Oct-94	99	0.574	0.077		0.08	0.02	0.06
Nov-94	482	0.160	0.105		0.10	0.08	0.02
Dec-94	170	0.320	0.074		0.07	0.03	0.05
Jan-95	81,164	0.280	30.896		30.90	13.57	17.32
Feb-95	14,563	0.100	1.980	1.98			
Mar-95	399,164	0.060	32.560	32.56			
Apr-95	422,994	0.238	137.050		137.05	70.73	66.32
May-95	566,563	0.290	223.370		223.37	94.74	128.63
Jun-95	152,465	0.115	23.837	23.84			
Jul-95	221,961	0.396	119.495		119.50	37.12	82.38
Aug-95	22,015	0.410	12.278		12.28	3.68	8.60
Sep-95	16,138	0.380	8.329		8.33	2.70	5.63
Oct-95	9,965	0.013	0.169	0.17			
Nov-95	2,854	0.110	0.427	0.43			

Table D-10: SJR above Salt Slough River Sub-area Background Boron Loads

Month-Year	SJR above Salt Slough Q (acre-feet) *Qm*	SJR above Salt Slough Boron Conc. (mg/L) *Cm*	SJR above Salt Slough Load (tons) *Lf+Lb+La*	Flood Load (tons) *Lf*	Non-Flood Load (tons) *Lb+La*	Base Loads (tons) *Lb*	Ag + Wet+ GW Loads (tons) *La*
Dec-95	6,782	0.070	0.645	0.65			
Jan-96	9,504	0.050	0.646	0.65			
Feb-96	65,151	0.013	1.107	1.11			
Mar-96	129,379	0.060	10.553	10.55			
Apr-96	9,947	0.090	1.217	1.22			
May-96	103,000	0.013	1.750	1.75			
Jun-96	9,620	0.060	0.785	0.78			
Jul-96	6,233	0.130	1.102		1.10	1.04	0.06
Aug-96	6,780	0.060	0.553	0.55			
Sep-96	7,531	0.013	0.128	0.13			
Oct-96	4,887	0.013	0.083	0.08			
Nov-96	6,281	0.013	0.107	0.11			
Dec-96	109,498	0.013	1.861	1.86			
Jan-97	977,619	0.013	16.613	16.61			
Feb-97	739,243	0.160	160.999		161.00	123.62	37.38
Mar-97	91,248	0.190	23.523		23.52	15.26	8.26
Apr-97	5,332	0.110	0.797	0.80			
May-97	2,113	0.289	0.829		0.83	0.35	0.48
Jun-97	1,995	0.278	0.755		0.76	0.33	0.42
Jul-97	1,752	0.160	0.381		0.38	0.29	0.09
Aug-97	1,139	0.410	0.635		0.64	0.19	0.44
Sep-97	389	0.380	0.201		0.20	0.07	0.14

APPENDIX E: ALTERNATE METHODS FOR CALCULATING SALT LOADING FROM THE NORTHWEST SIDE OF THE LOWER SAN JOAQUIN RIVER SUB-AREA

I. INTRODUCTION

This appendix summarizes two alternate methods used to calculate salt loading from the Northwest Side of the Lower San Joaquin River Watershed. The original method is a surface water mass balance, where salt loading from the Northwest Side is determined by subtracting the sum of the salt loads from all other geographic sub-areas in the Lower San Joaquin River Watershed from the river's total salt load at Vernalis. The first alternate method involves calculating the total annual salt load from the Orestimba Creek watershed and applying the Orestimba Creek unit area loading to the larger Northwest Side Sub-area. The second alternate method is to calculate the total loading for Northwest Side Sub-area using loading values from discrete discharges to the Lower San Joaquin River from subsurface drains, surface return flows and ephemeral tributaries. Based on these methods the annual average salt load from the Northwest Side ranged from 280 thousand tons/year to 313 thousand tons/year, when considering both ground and surface water salt contributions.

II. BACKGROUND:

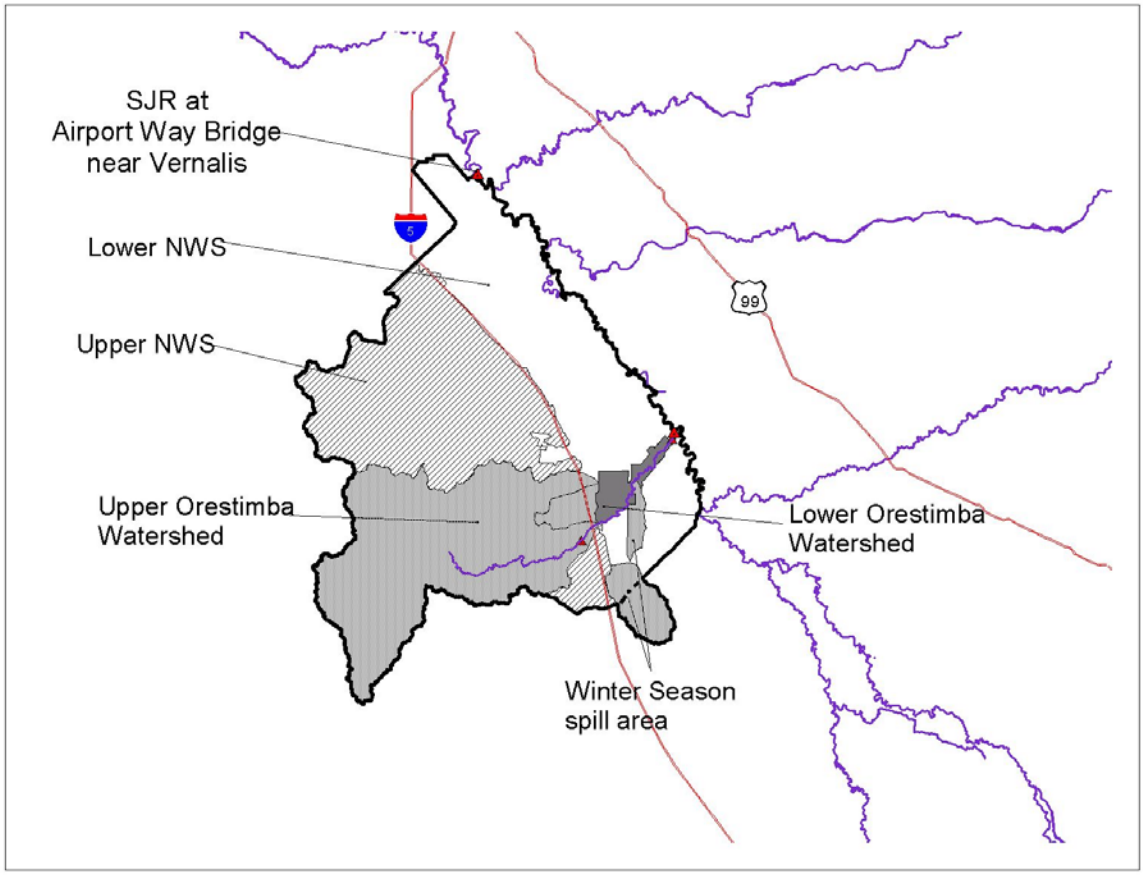
For TMDL planning purposes, the Lower San Joaquin River (LSJR) has been divided up into seven major geographic sub-areas. As its name suggests, the Northwest Side (NWS) Sub-area occupies approximately 365,000 acres in the northwest section of the LSJR Basin. The NWS Sub-area is located in portions of San Joaquin and Stanislaus counties. Orestimba Creek, Del Puerto Creeks, Hospital/Ingram Creek, and other creeks drain the sub-area. These creeks flow intermittently during the rainy season, and are dominated by irrigation return flows during the summer. Communities in the NWS Sub-area include Newman, Crows Landing, Patterson, Westley, and Vernalis. There are approximately 118,000 acres of agriculture within the NWS, according to the Regional Board's Geographic Information System (GIS) analysis, which is primarily based on the CA Dept. Of Water Resource's Land Use Information Survey data. Water supply and drainage is provided by numerous public water agencies within the sub-area, including Patterson W.D., West Stanislaus I.D., Del Puerto W.D., C.C.I.D., and El Solyo W.D.

Complex drainage and water supply operations coupled with a lack of long-term flow and water quality data for most of the creeks and drains in the NWS Sub-area make it difficult to characterize the salt and boron loads originating from the NWS Sub-area. Long-term flow and water quality data is available for the San Joaquin River at Vernalis (downstream of the NWS Sub-area) and for five of the six additional sub-areas that discharge to the LSJR upstream of the NWS Sub-area. Salt loading from the East Valley Floor Sub-area (the sixth sub-area) is also estimated based on data from the Harding Drain. A surface water mass balance method is used to estimate salt loading from the NWS Sub-area by subtracting the sum of the loads from the six contributing upstream sub-areas from the total load at Vernalis. This method yielded a NWS Sub-area salt load estimate of approximately 320,000 tons/year for the 21-year period of record for water-years 1977 through 1997. Based on this method, the NWS Sub-area accounts for approximately 30% of the river's total salt load as measured at the LSJR at the Airport Way Bridge near Vernalis.

Regional Board staff presented these findings to the public during staff workshops held in 2000 and 2001. Staff received extensive public comments indicating that the estimate of salt loading from the NWS Sub-area was too high. Based on these public comments and uncertainties in the original analysis, the salt loading estimate for the NWS Sub-area is re-evaluated using two alternate loading estimates.

III. ORESTIMBA EXTRAPOLATION METHOD (Alternate method 1):
The Orestimba extrapolation method is a method of calculating the salt loads from the NWS Sub-area based on the salt loads from Orestimba Creek. This method is based on the assumption that the Orestimba Creek watershed is representative of the entire NWS Sub-area, and that the unit area salt loading from areas with the Orestimba Creek watershed are similar to those within the rest of the NWS Sub-area. The Orestimba Creek watershed is the single largest drainage basin in the NWS Sub-area and it is approximately 105,000 acres, which represents about 28 percent of the drainage area within the NWS Sub-area (figure E-1).

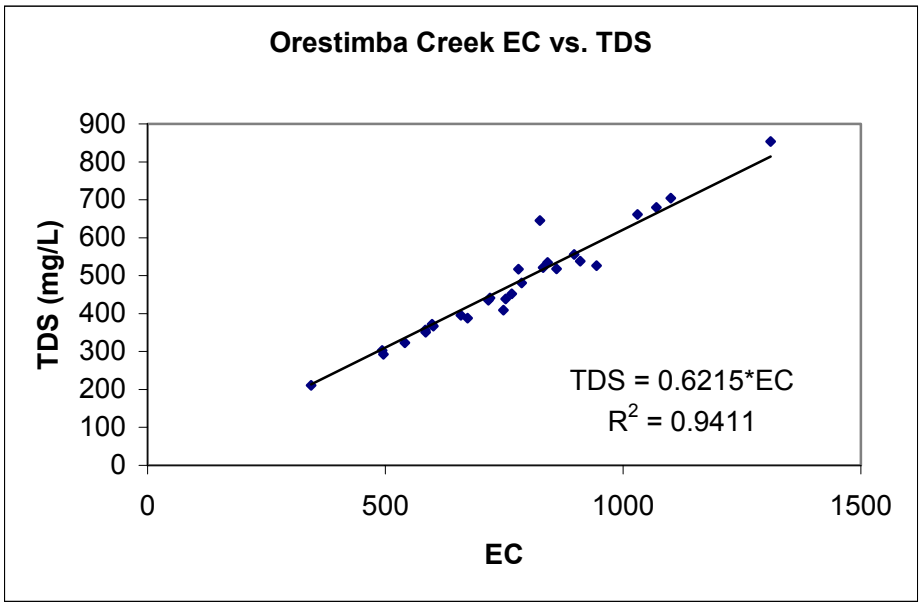
Figure E-1 Northwest Side of the Lower San Joaquin River



Relatively good water quality and flow data are available for Orestimba Creek at River Road, which is a downstream site located about one mile above the creek's confluence with the LSJR. Flow data is also available for Orestimba Creek near the California Aqueduct, which is considered an upstream site in this analysis. All of the data used to

calculate loads was obtained from the USGS. Daily mean flow and EC data was used to calculate daily and annual loads for the two sites on Orestimba Creek. No water quality data was available for the upstream site and EC value of 300 µS/cm was used to calculate upstream loads. The 300 µS/cm value was based on best professional judgment and evaluation of the sparse data set that was available for the upstream site and other sites located along the upper eastern side of the Coastal Range (Westcot, 1991). A site-specific conversion factor of 0.61 is used to convert EC (µS/cm) to TDS in milligrams per liter (figure E-2). The raw water quality and flow data used to calculate loads is available in digital format on request.

Figure E-2. Lower Orestimba Creek Site specific EC to TDS conversion factor



In order to determine loading from the NWS, the Orestimba Creek watershed is partitioned into an upper and a lower section. The upper watershed is considered to be the Orestimba Creek drainage area above the California Aqueduct. This section of the watershed is generally above all of the major agricultural areas in the NWS Sub-area and it is approximately 105,326 acres in size (figure E-1). This upper section of Orestimba Creek was assumed to be representative of the remainder of the NWS Sub-area above the California Aqueduct. Daily loads for the upper Orestimba Creek were calculated for water years 1993-1997 with flow data from USGS site 11274500, Orestimba Creek near Newman, Ca. (Table E-1).

The lower watershed is considered to be the Orestimba Creek watershed below the California Aqueduct. Daily and annual loads for the lower Orestimba Creek watershed were calculated using daily flow and water quality data collected from USGS site 11274538, Orestimba Creek at River Road. Loading data from the upstream site (11274500) was subtracted from the downstream site to determine the loads that originated within the lower Orestimba Creek Watershed. The lower Orestimba Creek watershed primarily consists of agricultural areas and ranges in size from 6,904 (Mar.-Dec.) to 19,777 acres (Jan-Mar). The temporal size difference of the watershed is due to

winter season spill over from the CCID main canal and agricultural areas located on the northern periphery of the NWS Sub-area. According to USGS personnel, there are approximately 12,873 acres of land that only drain to the lower river during January through March. Consequently, the loading from the lower Orestimba Creek watershed was divided into a winter season load (Jan.-Mar.) and a load for the remainder of the year (Table E-1).

Table E-1. Orestimba Creek Salt Loading (in tons)

Water Year	Upper Watershed Load (All Year)	Lower Watershed		Total
		Winter season (Jan-Mar)	Rest of the Year (Apr-Dec)	
1993	8,035	6,429	3,453	17,917
1994	3	5,419	1,514	6,936
1995	7,960	6,197	6,965	21,122
1996	5,961	5,172	4,625	15,758
1997	8,773	5,904	13,855	28,532
Mean	6,146	5,824	6,082	18,053

A GIS was used to determine the size of the upper Orestimba Creek watershed, the lower Orestimba Creek watershed, and the winter season lower Orestimba Creek watershed. The GIS was also used to determine the size of the NWS Sub-area above and below the California Aqueduct, which roughly divides the sub-area into an upper coastal range area and lower agricultural area (Table E-2).

Table E-2. Geographic Areas (in acres)

Upper Orestimba watershed	105,326
Lower Orestimba watershed	6,904
Lower Orestimba watershed-winter season*	19,777
Upper Northwest Side (above the CA Aqueduct)	220,826
Lower Northwest Side (below the CA Aqueduct)	124,811
Winter Season* Lower Northwest Side (below the CA Aqueduct)	134,744
*Winter Season is Jan-Mar	

The upper NWS Sub-area is divided by the upper Orestimba Creek watershed area to develop an area-ratio that is used to apply the upper Orestimba Creek watershed loading values to larger upper NWS Sub-area. Similarly, the lower NWS Sub-area area is divided by the lower Orestimba Creek watershed to develop an area-ratio that is used to apply the lower Orestimba Creek watershed loading values to larger lower NWS Sub-area (Table E-3). For example, the upper NWS Sub-area is roughly twice as big as the upper Orestimba Creek watershed, so we would expect the loads from the upper NWS side to be about twice as large as the loads from upper Orestimba Creek. This process is analogous to developing a unit area load for the upper and lower Orestimba Creek watersheds and then applying those unit area loads to the respective upper and lower NWS areas.

Table E-3. Determination of NWS Sub-area Area-Ratios

Portion of Northwest Side	Column A Area (acres)	Column b Corresponding Orestimba Acreage	Area-Ratio (=Column A/ Column B)
Upper NWS (above California Aqueduct)	220,826	105,326 (Upper Orestimba)	**2.1**
Lower NWS (Apr-Dec) (below California Aqueduct)	124,811	6,904 (Lower Orestimba Apr-Dec)	**18.1**
Winter Season Lower NWS (Jan-Mar) (below California Aqueduct)	134,745	19,777 (Lower Orestimba Jan-Mar)	**6.8**

Each of the area-ratios are multiplied by the corresponding Orestimba Creek salt load to determine the total load for the upper NWS Sub-area, the lower NWS Sub-area and the Lower winter season NWS. The loads from each of these areas were added together to determine the total load from the entire NWS Sub-area (Table E-4). Total average annual salt loading from NWS Sub-area surface water discharges is estimated to be approximately 162,594 tons per year using the Orestimba extrapolation method. This estimate does not include salt contributions from direct ground water accretions to the LSJR.

Table E-4. Calculated Salt Loading From the NWS

SECTION OF NWS	Corresponding Orestimba Creek Load	Area-Ratio	NWS Sub-area Load
Upper NWS (above California Aqueduct)	6,146	2.1	12,907
Lower NWS (below California Aqueduct)	6,082	18.1	110,084
Winter Season Lower NWS (below California Aqueduct)	5,824	6.8	39,603
		Total Loading From NWS	**162,594**

IV. DISCRETE DISCHARGE METHOD (Alternative 2):

This section describes a second method used to quantify how much salt and boron is discharged to the LSJR from the NWS sub-ara using salt loading data from four major types of sources: 1) agricultural surface water drainage; 2) agricultural tile water drainage; 3) ephemeral stream flow from natural runoff; and 4) waste water treatment discharge. The goal of this analysis is to arrive at a reasonable load estimate for the entire NWS Sub-area relative to other sub-areas in the LSJR Basin, and not necessarily to quantify loading on the district and smaller scale. The only major source not evaluated in this section is ground-water inflow to the LSJR, which includes water derived from both natural runoff and agricultural drainage. This load is estimated in Section V.

Because of limited monitoring data, many assumptions and estimates are necessary to fill in data gaps. A lot of the agricultural data is derived from a limited number of measurements in 1987, so discretion is needed when applying it to today's conditions.

In the following sections, load estimates are made separately for each of the four types of sources in the NWS. The estimates cover the irrigation season, defined as April through September, and the non-irrigation season, defined as October through March. Annual loads are also computed, which cover both seasons. Table E-5 below summarizes the load contributions from the various sources.

Table E-5: Summary of Load Contributions to the San Joaquin River from Various Sources in Northwest Section

		Non-Irrigation Season (Oct - Mar)			Irrigation Season (April - Sept)			Annual		
Source	**Total Area (acre)**	**Flow (AF)**	**Salt Load (tons)**	**Boron Load (lbs)**	**Flow (AF)**	**Salt Load (tons)**	**Boron Load (lbs)**	**Flow (AF)**	**Salt Load (tons)**	**Boron Load (lbs)**
Surface Water Drainage	118,045	18,472	20,114	38,161	118,945	81,544	149,180	137,417	101,659	187,341
Tile Water Drainage	9,360	969	1,771	3,030	6,241	11,403	19,514	7,210	13,174	22,544
Ephemeral Streams	249,536	23,553	10,336	28,579	3,834	4,776	14,475	27,388	15,113	43,054
TOTAL	376,941	42,995	32,222	69,771	129,020	97,723	183,169	172,015	129,945	252,940

The total annual salt load from the NWS Sub-area is 129,945 tons. Most of this arrives during the irrigation season (97,723 tons) when agricultural discharge is high, and a lesser amount comes during the non-irrigation season (32,222 tons) when watershed runoff to ephemeral streams make up an increased proportion of the load (although agricultural area is still the dominant source). During the irrigation season, surface water plus tile water drainage composes 95 percent of the total load. During the non-irrigation season, they compose only 68 percent of the total load, whereas the ephemeral stream componant is 32 percent. Because relatively few acres are tile drained (9,360 acres), tile water drainage represents only 10 percent of the total annual salt load (which is 11.5 percent of the total agricultural load). (It should be noted again, that this section does not cover groundwater salt contribution, which is also a substantial source.)

The total boron load is 252,940 pounds. The boron load is more evenly split between the irrigation and non-irrigation season: 183,170 pounds during the irrigation season and 129,020 during the non-irrigation season. During the irrigation season, agricultural surface water plus tile water drainage composes 92 percent of the total load. During the non-irrigation season, they compose 59 percent of the total load, whereas ephemeral stream contribution is 31 percent.

Two wastewater treatment plants (WWTP), Newman and Patterson, discharge directly to agricultural fields. They cannot be considered as a separate load to the LSJR because their loads will appear in the agricultural surface water drainage and tile drainage

numbers. The annual amount of salt discharged from these WWTPs to land in 1999 was 5,084 tons, which represents 4.4 percent of the total agricultural load. In other words, of the total annual salt discharged by agriculture in the NWS Sub-area to the LSJR, 4.4 percent of this is derived from the WWTP's.

1. Agricultural Surface Water Drainage

Loading from surface water drainage is based on 1987 flow measurements for various drainage areas in the NWS. Flows were measured in 1987 at fifteen major drains (Table E-6), as part of the Regional Board sampling program (Rashmawi, E.A., et al 1989). Generally, they consist of instantaneous daily readings made once per month. For July and August, more detailed measurements were made that indicate flow can vary greatly depending on the hour of the day. In this analysis, the large variations for individual drains should to some degree cancel each other out as they are summed, so the total flow calculated for the entire sub-area will not be strongly influenced by individual drain fluctuations.

Table E-6. Observed Agricultural Surface Flow Drainage To The San Joaquin River 1987 From the Northwest Side (acre-feet)

		Non-Irrigation Season (Oct - Mar)						Irrigation Season (April - Sep)						Non-Irrig. (Oct - Mar)		Irrigation (April-Sep)	
Rivermile	Location(s)	1986 Oct	Nov	Dec	1987 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Monthly Avg^ (AF)	Season Total** (AF)	Monthly Avg (AF)	Season Total** (AF)
119	Hills Ferry Road Drain (Newman Wasteway)#								242	272	437	299				312	1,873
117	Azevedo Road Drain	2.7	0.3		0.7	0.5			45	242	60	122		1.1	6	117	704
113	Drain 1/2 mile south of Freitas Rd / Freitas Road Drain								151	845	748	450				549	3,291
109	Orestimba Creek at River Road^^		6.6						724	3,984	2,656	2,420				2,446	14,677
105	Spanish Grant Drain	6.0	3.6			60.4				966				23	140		
100	Ramona Lake Main Drain					1.2				755							
98	Patterson Water District Main Drain				906		91	242	151	211	368	181	302	498	2,989	243	1,455
97	Olive Avenue Drain / Eucalyptus Avenue Drain	302							91	1,238	1,107	1,153				897	5,382
94	Magnolia Avenue Drain								2	1	293	236				133	799
92	Del Puerto Creek					320		604	604	1,328	1,302	1,127	1,570			1,089	6,534
91	Richie Slough Drain				2.7		60	121	724	3,320				32	189	1,389	8,331
87	Westley Wasteway / Del Mar Drain / Grayson Road Drain / Minnie Road Drain	755				48		724	815	966	3,294	3,201	302	401	2,408	1,550	9,302
80	Hospital / Ingram Creek	3.4		10.1	13.5	18.5	60	1,328	302		1,917	1,615	483	21	127	1,129	6,774
79	Center Road Drain								151	453	302	217				281	1,684
77	Blewett Drain								181	272	942	420				454	2,722
Total		1,069	11	10	923	449	211	3,018	4,183	14,852	13,427	11,440	2,656		5,859		63,529

The first step is to estimate the volume discharged from each drain during the irrigation season and the non-irrigation season. Because no measurements are available for many months (indicated as empty cells in Table E-6), an average monthly flow is computed using the available data. This monthly average is then multiplied by six (the number of months in a season), to estimate the total flow in a season at a particular drain. Drainage flows, however, were not computed for a drain if less than two measurements were made during the season, to avoid undue bias on any single measurement. Because measurements were less extensive in the non-irrigation season, monthly average flows were computed only for six of the fifteen drains. In contrast, average flows were

computed for thirteen of the fifteen drains for the irrigation season. It should also be noted that a very high flow measurement of 5,554 acre-ft in February 1987 for Orestimba Creek is disregarded. The high volume measured here is likely derived from natural runoff during a storm event from the entire Orestimba watershed, and not simply from the agricultural drainage area. The results are summarized in Table E-6.

Unfortunately, these flow estimates do not cover all drain areas. To determine flows for the total agricultural area (both non-measured and measured areas), an average drainage factor is determined for the areas where measured flow is available (Table E-7). The drainage factor is then applied to the total area. The surface drainage areas for each drain are taken from Westcot et al 1991, shown in Table E-7. The drainage factor per drain is defined as the flow per area:

Drainage Factor = (flow volume during a season) / (drain area)

Table E-7. Agricultural Surface Drainage Areas and Median Concentrations For Northwest Side

			Non-Irrigation Season (Oct 1986 - Mar 1987)			Irrigation Season (April-Sep, 1987)		
Location(s)	Area (acres)	Source of Supply Water	Surface Drainage Factor (AF per acre)	EC (1987 median) (umhos/cm)	Boron (1987 median) (mg/L)	Surface Drainage Factor (AF per acre)	EC (1987 median) (umhos/cm)	Boron (1987 median) (mg/L)
Hills Ferry Road Drain	4,500	N/A, CCID		1625	1.03	0.42	1625	1.03
Azevedo Road Drain	2,800	CCID	0.00	750	0.34	0.25	750	0.34
Drain 1/2 mile south of Freitas Rd / Freitas Road Drain	2,640	*CCID		838	0.41	1.25	838	0.41
Orestimba Creek	9,800	CCID, DMC		700	0.34	1.50	700	0.34
Marsh Rd/Spanish Grant Drain	14,740	CCID, DMC, SJR	0.01	850	0.37		850	0.37
Ramona Lake Main Drain	4,200	SJR		1500	0.86		1500	0.86
Patterson WD Main Drain	230	SJR	12.99	1450	0.94	6.33	1450	0.94
Olive Ave Drain + Eucalyptus Ave Drain	5,100	DMC, SJR		1025	0.67	1.06	1025	0.67
Magnolia Avenue Drain	530	SJR		1425	0.87	1.51	1425	0.87
Del Puerto Creek	6,400	SJR, DMC		825	0.45	1.02	825	0.45
Richie Slough Drain&								
Westley Wasteway + Del Mar Drain + Grayson Road Drain + Minnie Road Drain	8,400	SJR, DMC	0.29	1138	0.62	1.11	1138	0.62
Ingram Creek + Hospital Creek	10,060	SJR, DMC	0.01	1075.00	0.71	0.67	1075.00	0.71
Center Rd Drain	1,100	SJR		1600	1.30	1.53	1600	1.30
Blewett Drain	3,220	SJR, DMC		850	0.50	0.85	850	0.50
Total	**73,720**							
Flow weighted Concentration				**1252**	**0.76**		**788**	**0.46**
Area Weighted Drainage Factor			**0.16**			**1.01**		

For each season, an overall area-weighted average drainage factor is computed for areas measured for flow. This type of average prevents small drainage areas from overly affecting the overall average. It is given by:

$$\textbf{Area Weighted Average Drainage Factor} = \sum \frac{\textbf{(drainage factor) x (drain area)}}{\textbf{(Total Area)}}$$

For the non-irrigation season, approximately 0.16 acre-ft per acre is generated, and 1.01 acre-ft per acre is generated during the irrigation season (Table E-7). This gives an annual yield of 1.16 acre-ft per acre. Multiplying the entire 118,045 acres of agricultural area by these drainage factors, gives 18,472 acre-ft for the non-irrigation season, and 118,945 acre-ft for the irrigation season. 137,417 acre-ft is surface drained annually.

Salt and boron loads are based on a median of concentration measurements for each drain made from 1986 to 1988 (Westcot et al. 1989), as shown in Table E-7. The number of measurements per drain during this period is generally between 23 and 30. Because very few measurements were made during the non-irrigation season, no attempt is made to distinguish concentrations between seasons. This should not introduce a significant error, because the non-irrigation season flow is relatively small. Of the few measurements taken during the non-irrigation season, concentrations tended to be higher than during the irrigation season. This is probably because they were taken from very small flows. Thus using irrigation season concentrations for the non-irrigation season will tend to slightly underestimate the non-irrigation load.

For the entire NWS, a flow weighted average concentration is determined for salinity and boron for each season. It is given by:

$$\textbf{Flow Weighted Average Conc.} = \Sigma \textbf{ (median concentration) x (flow) / (Total Flow)}$$

The flow weighted electrical conductivity is 1252 umhos/cm for the non-irrigation season, and 788 umhos/cm for the irrigation season. The flow weighted concentration for boron is 0.43 mg/L for the non-irrigation season, and 0.50 mg/L for the irrigation season.

The total seasonal flow volumes multiplied by the flow-weighted concentrations give the total loads for the NWS Sub-area. 20,114 tons of salt are discharged in the non-irrigation season, and 81,544 tons in the irrigation season. The annual salt load is 101,659 tons. 38,161 pounds of boron are discharged in the non-irrigation season, and 149,180 pounds in the irrigation season. The annual boron load is 187,341 pounds.

2. Agricultural Tile Drainage

Tile drainage loads are based on flow estimates by the Regional Board staff (Kratzer et al 1987). Seven drainage areas are considered (Table E-8), which amount to a total of 9,360 acres (Table E-8). This represents about 8 percent of the entire agricultural area in the Northwest Side Sub-area. The tile drainage factors were based on 'rule-of-thumb', and range from 0.65 acre-ft/acre to 0.85 acre-ft/acre. Annual flows for each tile area are computed by multiplying the drainage areas by the drainage factors. 7,210 acre-ft of tile drainage is generated annually.

Table E-8. Tile Drainage Areas and Flows in Northwest Side

Rivermile	Location(s)	Tile Drained Area (Acre)	Drainage Factor** (AF/Acre)	Annual Flow (AF)
119.5	Newman D.D. Collector Line A	600	0.85	510
117.6	Newman D.D. Collecto Line I	2500	0.85	2125
105	Spanish Grant, Moran Rd., Marshall Rd. Combined Drain	1550	0.65	1008
100	Ramona Lake Drain	1360	0.75	1020
98.6	Patterson W.D. Main Drain	1650	0.75	1238
91.4	Richie Slough Main Drain	350	0.85	298
80	Hospital Creek - Haggerman Ranch Drain	1350	0.75	1013
Total:		9360		7210
Area Weighted Average:			0.770	

The proportion of water attributed to the non-irrigation and irrigation seasons are based on seasonal patterns for surface drainage flows, derived from information in Section 1 above. 13 percent (969 acre-ft) is generated in the non-irrigation season, and 87 percent (6,241 acre-ft) in the irrigation season.

Salinity and boron concentrations, also measured by the Regional Board staff, included three extensive surveys (April and June 1986, June 1987) of subsurface drainage water being discharged from individual tile drainage systems in the San Joaquin River Basin. For this estimate, a median of all concentrations measured in the region of Stanislaus County west of the San Joaquin River is used. It is applied to both non-irrigation and irrigation season. The median salinity is 2,100 umhos/cm, and the median boron concentration is 1.15 mg/L. These concentrations are considerably higher than the concentrations for surface water drainage during the irrigation season (788 umhos/cm and 0.46 mg/L). This reflects the higher leaching of minerals that occurs as water drains through the soil to the tile drains.

Loads are computed by multiplying the flow volumes by the median concentrations. 1,771 tons of salt are tile drained during the non-irrigation season, and 11,403 tons during the irrigation season. 13,174 tons of salt is discharged annually. 3,030 pounds of boron are tile drained during the non-irrigation season, and 19,514 pounds during the irrigation season. 22,544 pounds of boron is discharged annually.

3. Ephemeral Stream Contribution

Ephemeral streams are another significant source of flow to the San Joaquin River. To make a preliminary estimate of mass loadings from the eastern slope of the Diablo Range, the Regional Board combined water quality data with average stream flow data

(Westcot et al 1991). The estimates cover natural runoff upstream of agricultural influences, with the exception of cattle grazing and grazing ponds that exist throughout much of the area. The NWS Sub-area covers 14 drainage basins, from Lone Tree Creek in the north, to Orestimba Creek in the south (Table E-9). This represents 390 square miles (249,500 acres), which is 66 percent of the total NWS Sub-area (376,941 acres).

Table E-9. Wastershed Sizes and Estimated Flows for Northwest Side

	Basin Size	Flow (acre-ft)				
Watershed Name	**(sq. mi.)**	Method 1	Method 2	Method 3	Method 4	Average
Lone Tree Creek	22.6	1,853	1,481	1,129	927	1,348
Hospital Creek	36.2	2,968	2,532	2,053	1,484	2,259
Arkansas-Martin Crk	12	984	601	352	197	534
Ingram Creek	20.4	1,673	1,201	820	836	1,133
Mile 33 Creek	1.6	131	89	57	26	76
Kern Creek	6.1	500	343	224	100	292
Del Puerto Creek	76.2	5,270	5,270	5,270	5,270	5,270
Black Gulch Creek	3	246	166	108	49	142
Unknown	3.7	303	209	138	61	178
Salado Creek	25.6	2,099	1,655	1,241	1,050	1,511
Little Salado Creek	9.1	746	573	419	149	472
Crow Creek	28.4	2,329	1,843	1,393	1,164	1,682
Unknown	4	328	190	105	66	172
Orestimba Creek	141	12,320	12,320	12,320	12,320	12,320
TOTAL:	**390**					**27,388**

For the larger watersheds, flow records go back as early as 1932 and end in 1987 (eg., Orestimba Creek), but generally for the smaller watersheds, the records are less extensive (eg, Kern Creek only covers 1986 to 1987). Extensive flow data is available for only 8 of the 40 watersheds in the area, so methods were needed to estimate the annual flows from the unmonitored watersheds. The results for four methods of estimation are given in Table E-9. The estimates can differ significantly between different methods. For load estimates here, the average of the four methods are used to determine a flow. The annual total flow from the NWS Sub-area is 27,388 acre-ft. Orestimba Creek represents 45 percent (12,320 acre-ft) of this.

It is estimated that of the total 27,388 acre-ft of annual flow from NWS, approximately 86 percent (23,553 acre-ft) comes during the irrigation season (April to September), and 14 percent (3,834 acre-ft) during the non-irrigation season. This estimate is based on an average monthly flow pattern derived from flow data from ten watersheds in or near the study area (Westcot et al, 1991, p. 20).

The study also estimated annual salt and boron loads for each watershed by multiplying annual flows by median concentrations for each watershed. The concentration measurements are based on Regional Board staff measurements from December 1985 to March 1988, and additional data collected by the California Department of Water

Resources and the United States Geological Survey. The median concentrations, however, are strongly biased to concentrations measured at low flows. Since low flow concentrations tend to be high, the load estimates were over-estimated considerably. The annual median concentration for the entire NWS Sub-area is 1500 uhmos/cm, which is high for natural runoff.

Because of the low flow bias, loads are estimated using flow-weighted average concentrations rather than median concentrations. The average is based on data from Appendix A of Westcot et al 1991. These averages are computed for the irrigation and non-irrigation periods (Table E-10).

Table E-10. Flow-Weighted Average Concentrations and Loads for Salt and Boron from the Northwest Side

	Flow (AF)	TDS Flow-weighted Average EC (uhmos/cm)	Salt Load (tons)	Boron Flow-weighted Average Concentration (mg/L)	Boron (lbs)
Irrigation Season**	3,834	1432	4,776	1.39	14,475
Non-Irrigation Season^	23,553	504	10,336	0.45	28,579
Annual	27,388	580	15,113	0.52	43,054

During the irrigation season, when the flows are generally low and a greater percentage of the water had percolated through the soil, the concentrations are higher: electrical conductivity is 1432 uhmos/cm, boron concentration is 1.39 mg/L. During the non-irrigation season, when runoff is much higher, the concentrations are much lower: electrical conductivity is 504 uhmos/cm, and boron concentration is 0.45 mg/L. Overall the non-irrigation season loads are higher because of the higher volume. 10,336 tons of salt and 28,579 pounds of boron are generated during this period, compared to 4,776 tons of salt and 14,475 pounds of boron in the irrigation season. 15,113 tons of salt are generated annually, which is 12 percent of the total NWS Sub-area load. 48,054 pounds of boron are generated annually, which is 17 percent of the total NWS Sub-area load.

4. Wastewater Treatment Plant Discharges

There are two wastewater treatment plants (WWTP) in the NWS: Newman WWTP and Patterson WWTP. Because discharges are applied directly to the fields, their loads have already been indirectly accounted for in the surface water drainage and tile drainage flows. Therefore, there is no need to account for the loading into the LSJR separately for this analysis. It is worthwhile however, to note what percent of salt load from agriculture is derived from the treatment plants. 1999 data from a CVRWQCB report indicates that the Newman WWTP generates 3,460 tons of salt annually, and Patterson WWTP generates 1,624 tons of salt annually. Together, this represents 5,084 tons of salt, or 4.4 percent of the total agricultural load (101,659 tons from surface water drainage plus 13,174 tons from tile drainage). Much of this salt is generated from the processing of dairy waste.

V. ESTIMATION OF GROUNDWATER SALT CONTRIBUTIONS

The original surface water balance method for calculating loads from the NWS included all groundwater accretions from both the east and west sides of the 50-mile reach of the San Joaquin River from below Mud slough to Vernalis. Groundwater contributions were not considered in the Orestimba extrapolation method (Alternate method 1) or the discrete discharge method (Alternate method 2). Consequently, the groundwater salt contributions from the west side of the river must be added to the results of the Orestimba Creek extrapolation and the discrete discharge methods to determine the total salt loading to the river. The mass balance method (original method) includes groundwater salt contributions from both the east and west sides of the LSJR. The salt contribution from east side groundwater must therefore be subtracted from the total salt loading value derived from the mass balance method in order isolate the salt loads originating from only the NWS Sub-area.

Groundwater flows, salt concentrations, and salt loads are estimated in the TMDL source analysis. These estimates are primarily based on a 1991 USGS Water Resource Investigation Report (USGS, 1991). Regional Board staff estimated that approximately 2,885 tons of salt per mile are added to the LSJR from groundwater each year. Ground water accretions to the river were partitioned into the following three regimes; 1) east side shallow groundwater; 2) west side shallow ground water; and (3) deep ground water. The deep ground water was determined to be originating in the Coast Range and flowing eastward across the valley trough as well as being discharged to the LSJR. Therefore, salt contributions from both shallow west side groundwater and the deep ground water are attributable to the NWS Sub-area. Ground water salt contributions from the east side shallow groundwater, the west side shallow ground water, and the deep ground water are presented in table E-11.

Table E-11. Estimated Groundwater Accretions and Salt Contribution to the LSJR

Groundwater Component	**Flow-weighted Percent of total Flow**	**Flow † (CFS/Mi)**	TDS (mg/L)	**Salt Load (tons/mi/year)**	**Total salt Load†† (tons/year)**
Sallow East Side	14%	0.29	698	199	9,950
Sallow West Side	24%	0.49	438	211	10,550
Deep-Coast Range	62%	1.26	2250	2792	139,60
Total				**3,203**	**160,100**

† Based on a total flow of 2.04 CFS/Mi, ††total salt load from Mud slough confluence to Vernalis based on a 50-mile reach of the LSJR.

The total ground water loading from the NWS Sub-area is approximately 150,150 tons per year, which includes loading from both the west side shallow groundwater and the deep coast range groundwater. Salt loading from the East Valley Floor Sub-area is 9,950 tons per year which is made up entirely of shallow east side groundwater. More information on how groundwater contributions are determined is in the TMDL source analysis (section 3).

VI. RESULTS

The Orestimba Extrapolation method and the Discrete Discharge method resulted in NWS Sub-area salt load estimates of 163,000 tons/year and 130,000 tons/year respectively, excluding groundwater salt contributions. The groundwater adjusted annual average salt load from the Northwest Side ranged from 280,000 tons/year to 313,000 tons/year (Table E-12). Regional Board staff believes that the salt loading from the NWS Sub-area can reasonably be bracketed between 280,000 tons/year and 313,000 tons/year, given that the three independent methods were used to calculate salt loads from the Sub-area.

Table E-12 Comparison of calculated salt loads from the Northwest Side

Load calculation method	**Average Annual Salt Load (1000 tons/year)**	**Groundwater Salt Contribution (1000 tons/year)**	**Total Salt Load (1000 tons/year)**
(1) Mass balance method	320	-10 (east side GW)	310
(2) Orestimba extrapolation method	163	150 (west side GW)	313
(3) Discrete discharge method	130	150 (west side GW)	280

References

Chilcott, J., Westcot, D., Werner, K., Belden, K., 1988. Water Quality Survey of Tile Drainage Discharges in the San Joaquin River Basin. Central Valley Regional Water Quality Control Board Report, 65 pages.

Kratzer, C.R., Pickett, P.J., Elias, A.R., Cross, C.L., Bergeron, K.D., 1987. An Input-Output Model of the San Joaquin River from the Lander Avenue Bridge to the Airport Way Bridge/Appendix C. State Water Resources Control Board, 173 pages.

Rashmawi, E.A., Grober, L., Grismer, M.E., Kratzer, C.R., 1989. Data Refinements and Modeling Results for the Lower San Joaquin River Basin. A Report to The State Water Resources Control Board from the University of California, Davis, 101 pages.

Westcot, D.W., James, E., Waters, R.I., Thomasson, R.R., 1989. Quality of Agricultural Drainage Discharging to the San Joaquin River from the Western Portion of Stanislaus County, California April 1985 to October 1988. Central Valley Regional Water Quality Control Board Report.

Westcot, D.W., Cassandra, A.E., Lowry, P.A., 1991. Preliminary Estimate of Salt and Trace Element Loading to the San Joaquin River by Ephemeral Streams Draining the Eastern Slope of the Coast Range (Diablo Range). Central Valley Regional Water Quality Control Board Report, 188 pages.

USGS, 1991, *Quantity and Quality of Ground-Water Inflow to the San Joaquin River*, California, Water Resources Investigations Report 91-4019