Appendix Q

Preliminary Results for Spatial and Temporal Dynamics of Major Cations and Anions in the San Joaquin River Watershed, 2005-2006

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March, 2007

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Abstract

Preliminary analysis of major cation and anion data is presented for 54 sampling locations within the San Joaquin River watershed for the period March 2005 to December 2007. The major cations and anions are an important water quality constituent as they contribute to the salt load and Br is an important disinfection byproduct precursor in drinking waters. Concentrations of major cations followed the general order: Na > Ca > Mg > K. For the three anions examined, the order followed: Cl > SO_4 >> Br. Major cation/anion concentrations decreased downstream along the mainstem San Joaquin River sites due to dilution from the three east-side tributaries (Merced, Tuolumne, and Stanislaus). Concentrations of Na, Ca, Mg, Cl, and SO_4 in the mainstem sites were highly predictable from electrical conductivity (EC) with r^2 values generally greater than 0.95. Thus, EC can be used as a proxy for major cations and anions in the San Joaquin River and many of its tributaries and drains.

Introduction

Major cation and anion concentrations are of considerable interest in the San Joaquin Valley as part of the Salt TMDL and the role of bromide as a precursor for disinfection byproducts. The salt TMDL has a water quality standard for electrical conductivity at Vernalis of <0.7 dS/m during the irrigation season and <1.0 dS/m during the remainder of the year. In terms of drinking water, bromide is of great concern as it forms disinfection byproducts during chlorination. The CALFED water quality program has set a guideline of <50 ppb for Br concentrations in waters exported from the Delta for drinking water purposes. In addition, major cations and anions maybe useful for determining sources of groundwater and missing agricultural drainage inputs along the San Joaquin River. In particular, the ratios of various ions can be very effective in defining the source of the waters, in particular those originating from east-side versus west-side water sources. This preliminary analysis provides information on major cations (Na, K, Ca, Mg) and anions (Cl, SO_4, Br) for 54 sampling locations within the San Joaquin Valley. Relationships between the major cations/anions and electrical conductivity are developed so that EC can be utilized as a proxy for cation/anion concentrations for selected sampling sites. Future analysis will advance these preliminary analyses.

Methods

Study area

Water samples were taken from 7 locations along the mainstem of the San Joaquin River and 47 locations in tributaries and drains (Analysis 1). Detailed sampling protocols are described in the DO TMDL QAPP (Stringfellow, 2005). Mud Slough, Salt Slough, Los Banos Creek, and San Luis Drain receive discharge from the Grasslands. Mud Slough receives tile drainage from 393 km^2 of the Grasslands Ecological Area, which includes not only wetlands, but also pasture of native vegetation. Drainage canals, such as Harding Drain (east-side), TID Laterals 6/7 (east-side), MID Lateral 5 (east-side), MID Main Drain (east-side), Westport Drain (east-side), Ramona Lake (west-side), Orestimba Creek (west-side), and Hospital Creek (west-side), run through agricultural fields to the San Joaquin River. The west-side drains (Orestimba Creek, Ramona Lake, Ingram

Creek, Del Puerto Creek, and Hospital Creek) receive mainly surface runoff from row crops and orchards, and Hospital Creek contains some tile drainage as well. The east-side Harding Drain receives treated effluent from the City of Turlock wastewater treatment plant in addition to runoff from agricultural areas.

Analytical analyses

Dissolved constituents were determined on a sample filtered through a 0.2 μm polycarbonate membrane (Millipore – formerly Nuclepore). Ion chromatography was utilized for both major anions (Cl^- and SO_4^{2-}, AS18 analytical column), and cations (Na^+, K^+, Ca^{2+}, and Mg^{2+}, CS17 analytical column) using a Dionex ICS-2000 Ion Chromatograph (Dionex Corporation, Sunnyvale, CA). Minimum detection limits were as follows (mg L^{-1}): Cl^- (0.02), Br (0.03), SO_4^{2-} (0.05), Na^+ (0.05), K^+ (0.05), Ca^{2+} (0.08) and Mg^{2+} (0.08). Because of the high ionic strength of many samples, dilutions were necessary for most samples using the following EC criteria:

Conductivity (μS/cm)	Dilution
< 150	1x
150 – 600	5x
600 – 1200	10x
1200 – 2500	20x
> 2500	50x
> 10000	100x

Thus, the actual detection limit for individual samples is the instrument detection limit multiplied by the dilution factor.

Laboratory quality assurance/quality control followed the Surface Water Ambient Monitoring Program protocols (SWAMP) set by the California State Water Resources Control Board (http://www.swrcb.ca.gov/swamp/qapp.html). This includes implementation of standard laboratory procedures including replicates, spikes, reference materials, setting of control limits, criteria for rejection, and data validation methods. Detailed sampling, handling and analytical protocols are described in the DO TMDL QAPP (Stringfellow, 2005).

Results

A summary of the overall major cation and anion concentrations for 7 mainstem sites and 19 tributaries and drains is shown in Tables 1 & 2.

A summary of the regression analyses for major cation and anion concentrations as a function of electrical conductivity are shown in Tables 3a-3f.

Analysis 1 provides summary statistics for all 54 sampling locations.

Table 1: Summary of major cation concentrations for the 7 mainstem sites along the San Joaquin River and the 19 tributaries and drains monitored in this study for the period March 2005 to December 2007. The mean (X), standard deviation (SD), minimum (min), maximum (max), and number of samples (n) are listed for each site.

	River mile	Na (mg/L)			K (mg/L)			Mg (mg/L)			Ca (mg/L)		
		X± SD	Min Max	n	X± SD	Min Max	n	X± SD	Min Max	n	X± SD	Min Max	n
SJR-Mossdale	56.2	57.9 (28.2)	9.2 102.2	65	2.7 (1.0)	1.1 5.2	65	14.0 (6.4)	3.2 24.8	65	29.4 (12.6)	8.2 52.4	65
SJR- Vernalis	72.2	57.8 (27.3)	8.5 100.0	73	2.6 (1.0)	1.0 5.1	73	14.3 (6.5)	3.1 24.5	73	29.1 (12.0)	8.1 48.5	73
SJR – Maze	77.4	81.6 (40.6)	9.5 145.1	70	3.4 (1.5)	1.1 7.5	70	18.8 (9.0)	3.2 33.4	70	37.1 (16.3)	8.4 59.5	70
SJR – Laird Park	91.0	119.5 (157.1)	13.4 801.6	22	3.5 (1.9)	0.6 10.5	22	23.6 (22.0)	2.3 114.8	22	53.1 (65.7)	5.1 338.6	22
SJR – Patterson	99.4	118.5 (54.7)	11.4 216.4	75	4.6 (2.0)	1.2 9.3	75	24.1 (10.5)	3.1 41.5	75	50.2 (20.2)	8.8 84.2	75
SJR – Crows Landing	108.6	121.7 (54.6)	13.7 235.2	80	3.9 (1.6)	1.1 7.9	80	24.8 (10.5)	3.1 45.8	80	49.9 (19.5)	8.6 85.7	80
SJR – Lander Ave.	131.9	130.8 (78.0)	4.0 280.1	83	4.6 (2.2)	0.6 9.9	83	20.3 (10.3)	1.3 38.7	83	52.6 (24.7)	5.4 90.7	83
Stanislaus	74.9	4.7 (1.6)	2.7 11.2	67	1.1 (0.3)	0.7 2.2	67	3.6 (1.3)	2.2 9.7	67	9.1 (1.6)	6.3 15.0	67
Tuolumne	83.8	11.3 (7.1)	2.2 26.4	68	1.6 (1.5)	0.5 11.0	68	4.9 (2.3)	1.9 9.9	68	12.1 (5.7)	4.6 22.9	68
Merced	118.2	13.7 (12.0)	2.0 52.5	67	1.2 (0.6)	0.4 3.3	67	4.5 (2.8)	1.4 13.2	67	13.4 (8.5)	4.7 41.0	67
Salt Slough	129	175.4 (56.1)	91.8 394.7	103	5.9 (1.6)	3.1 14.7	103	33.9 (9.6)	19.3 66.7	103	69.4 (16.5)	43.4 120.5	103
Salt Slough -Wolfsen	-	172.8 (39.6)	110.8 262.5	30	6.0 (1.7)	3.8 10.9	30	40.3 (7.9)	26.9 54.3	30	76.5 (14.4)	41.8 102.8	30
San Luis Drain	-	691.5 (148.9)	55.1 1043.9	73	11.5 (3.9)	3.3 27.8	73	110.8 (102.2)	15.6 957.3	73	294.9 (61.3)	25.9 403.3	73
Mud Slough	122.7	416.6 (174.7)	12.6 762.9	77	8.6 (2.3)	1.2 14.3	77	66.8 (23.2)	4.4 117.7	77	156.7 (61.2)	13.3 292.2	77

Table 1: (continued)	River mile	Na (mg/L)			K (mg/L)			Mg (mg/L)			Ca (mg/L)		
		X± SD	Min Max	n	X± SD	Min Max	n	X± SD	Min Max	n	X± SD	Min Max	n
Los Banos	121.0	202.6 (105.1)	53.0 560.6	66	8.3 (2.9)	3.6 17.3	66	49.6 (22.8)	16.8 118.3	66	67.6 (22.2)	30.5 134.7	66
TID Lat. 6/7	110.9	57.5 (22.7)	25.6 125.0	35	5.7 (2.4)	3.1 12.5	35	16.0 (4.5)	9.5 32.9	35	52.7 (14.7)	29.4 112.2	35
Orestimba Crk	109.3	62.5 (25.8)	13.2 160.4	58	3.5 (1.4)	1.6 9.3	58	27.4 (11.3)	5.3 48.9	58	52.8 (21.4)	11.3 94.8	58
Ramona Lake - In	-	190.0 (41.3)	112.0 276.3	16	6.2 (1.5)	4.2 9.5	16	42.3 (9.0)	24.6 58.6	16	87.8 (17.3)	53.4 121.9	16
Ramona Lake - Out	108	172.8 (39.6)	110.8 262.5	29	6.0 (1.7)	3.8 10.9	29	40.3 (7.9)	26.9 54.3	29	76.5 (14.4)	41.8 102.8	29
Harding Drain	101	84.6 (32.8)	16.0 157.8	64	11.8 (6.2)	1.3 29.4	64	12.3 (3.5)	5.1 20.5	64	46.7 (14.9)	18.6 90.6	64
Del Puerto Crk	93.3	101.9 (39.3)	33.3 183.6	58	4.4 (2.0)	1.4 10.0	58	36.2 (14.9)	8.1 75.2	58	48.3 (15.7)	19.8 92.1	58
Westport Drain	93	60.1 (69.5)	12.8 145.8	50	3.6 (4.6)	1.0 33.1	50	14.6 (16.9)	3.9 33.4	50	56.5 (60.1)	13.6 112.8	50
MID Lat. 5 - Tuol.	83	12.2 (16.1)	1.8 66.5	29	1.6 (1.4)	0.4 5.6	29	4.6 (5.2)	1.2 20.2	29	11.7 (10.6)	3.1 46.2	29
Ingram Crk	82.8	116.9 (55.8)	24.0 278.0	44	4.4 (1.9)	1.9 11.1	44	29.2 (13.6)	6.8 66.0	44	62.2 (29.9)	18.0 151.2	44
Hospital Crk	82.8	49.1 (25.3)	14.6 87.2	17	4.1 (1.8)	1.9 7.7	17	13.0 (5.4)	4.1 23.3	17	29.4 (12.3)	10.6 57.8	17
MID Main – Stan.	76.0	30.7 (26.2)	4.3 158.1	41	5.4 (3.4)	0.7 18.0	41	14.4 (7.5)	2.2 37.6	41	32.8 (14.9)	6.2 69.2	41

Table 2: Summary of major anion concentrations for the 7 mainstem sites along the San Joaquin River and the 19 tributaries and drains monitored in this study for the period March 2005 to December 2007. The mean (X), standard deviation (SD), minimum (min), maximum (max), and number of samples (n) are listed for each site.

	River mile	Cl (mg/L)			SO_4 (mg/L)			Br (mg/L)		
		X± SD	Min Max	n	X± SD	Min Max	n	X± SD	Min Max	n
SJR-Mossdale	56.2	64.1 (34.3)	7.2 123.3	65	57.7 (26.0)	8.4 99.8	65	0.7 (0.4)	0.1 1.7	65
SJR- Vernalis	72.2	62.9 (31.9)	6.3 112.3	73	57.2 (24.9)	8.0 98.4	73	0.5 (0.3)	0.1 1.5	73
SJR – Maze	77.4	89.7 (47.8)	7.2 160.2	70	82.3 (38.8)	8.7 159.9	70	0.9 (0.6)	0.1 3.5	70
SJR – Laird Park	91.0	113.9 (121.3)	12.6 624.8	22	173.2 (364.6)	15.2 1794.5	22	1.2 (2.1)	0.1 10.5	22
SJR – Patterson	99.4	122.6 (59.0)	8.8 231.6	75	131.4 (59.3)	11.3 251.4	75	1.2 (0.7)	0.1 2.7	75
SJR – Crows Landing	108.6	125.0 (58.2)	11.3 244.9	80	139.4 (64.7)	16.6 294.7	80	1.2 (0.7)	0.1 3.2	80
SJR - Lander	131.9	157.1 (99.1)	2.2 334.1	83	82.0 (48.8)	2.8 192.7	83	1.0 (0.7)	0.1 4.2	83
Stanislaus	74.9	3.2 (1.8)	1.0 9.6	67	3.8 (1.3)	1.9 10.3	67	<0.1 (0.1)	<0.1 0.3	67
Tuolumne	83.8	10.7 (8.0)	0.9 (35.7)	68	6.2 (3.4)	1.8 13.5	68	0.2 (0.2)	<0.1 0.6	68
Merced	118.2	10.9 (10.3)	0.8 44.3	67	9.8 (7.7)	1.7 35.9	67	0.2 (0.2)	<0.1 0.8	67
Salt Slough	129	201.1 (68.2)	89.0 476.2	103	180.6 (66.1)	73.3 430.5	103	1.7 (0.9)	0.3 4.8	103
Salt Slough -Wolfsen	-	198.9 (62.3)	67.6 317.7	30	191.6 (69.9)	60.7 328.2	30	1.6 (0.8)	0.6 3.9	30
San Luis Drain	-	548.0 (105.8)	64.1 832.8	73	1513.6 (304.2)	43.9 2107.6	73	6.1 (3.0)	0.5 13.4	73

Table 2: (continued)	River mile	Cl (mg/L)			SO_4 (mg/L)			Br (mg/L)		
		X± SD	Min Max	n	X± SD	Min Max	n	X± SD	Min Max	n
Mud Slough	122.7	350.1 (141.2)	10.6 640.7	77	724.2 (372.3)	10.1 1449.1	77	3.6 (2.0)	0.1 9.0	77
Los Banos	121.0	191.2 (92.3)	56.5 459.1	66	200.7 (112.3)	37.8 498.3	66	2.0 (1.2)	0.3 4.6	66
TID Lat. 6/7	110.9	47.3 (17.6)	20.5 97.8	35	33.3 (13.9)	13.7 81.2	35	0.8 (0.5)	<0.1 2.3	35
Orestimba Crk	109.3	72.3 (32.7)	7.9 165.9	58	99.4 (49.2)	16.3 207.5	58	1.0 (0.6)	0.2 2.8	58
Ramona Lake - In	-	191.4 (42.9)	115.2 267.3	16	279.1 (58.1)	173.3 373.5	16	2.2 (1.3)	0.8 5.4	16
Ramona Lake - Out	108	170.4 (40.9)	114.5 259.8	29	248.7 (56.4)	164.8 372.2	29	1.7 (1.1)	0.3 4.6	29
Harding Drain	101	82.5 (37.4)	8.0 176.7	64	37.2 (13.3)	9.7 70.6	64	0.7 (0.5)	<0.1 1.9	64
Del Puerto Crk	93.3	112.7 (48.4)	15.7 202.5	58	128.8 (57.9)	21.2 281.4	58	1.1 (0.7)	<0.1 3.0	58
Westport Drain	93	45.4 (25.0)	5.7 140.8	50	38.5 (20.6)	8.5 84.2	50	0.9 (0.8)	<0.1 2.5	50
MID Lat. 5 - Tuol.	83	12.1 (18.8)	0.7 80.8	29	7.8 (14.1)	1.2 57.4	29	0.1 (0.2)	<0.1 0.9	29
Ingram Crk	82.8	135.3 (71.0)	22.6 323.3	44	135.5 (73.1)	26.7 357.1	44	1.4 (0.9)	<0.1 3.5	44
Hospital Crk	82.8	53.6 (32.3)	12.2 127.0	17	50.8 (31.5)	15.5 108.8	17	0.4 (0.3)	<0.1 1.2	17
MID Main – Stan.	76.0	20.2 (27.5)	1.5 173.0	41	19.2 (24.7)	2.4 158.3	41	0.4 (0.5)	<0.1 2.1	41

Table 3a: Regression analysis for predicting sodium (mg/L) from electrical conductivity (mS/cm) for sites in the San Joaquin Valley (n>30 for each site).

Site Name	Site ID	Regression Equation	r^2
SJR at Mossdale	4	Na = 125.58 EC – 2.93	0.98
SJR at Vernalis	5	Na = 128.31 EC – 4.12	0.98
SJR at Maze	6	Na = 132.68 EC – 4.82	0.99
SJR at Patterson	7	Na = 139.45 EC – 4.69	0.98
SJR at Crows Landing	8	Na = 143.92 EC – 9.12	0.99
SJR at Lander Avenue	10	Na = 155.75 EC – 12.40	0.97
Stanislaus River at Caswell Park	12	Na = 62.95 EC – 0.90	0.84
Tuolumne River at Shiloh Bridge	14	Na = 91.11 EC – 1.81	0.99
Merced River at River Road	16	Na = 105.83 EC – 2.24	0.95
Mud Slough near Gustine	18	Na = 176.96 EC – 47.33	0.98
Salt Slough at Lander Avenue	19	Na = 160.54 EC – 25.68	0.95
Los Banos Creek at Highway 140	20	Na = 181.24 EC – 50.32	0.97
Orestimba Creek at River Road	21	Na = 69.76 EC + 11.49	0.80
MID Main Drain to Stan. R. via Miller Lake	25	Na = 48.93 EC + 9.00	0.12
Turlock ID Westport Drain Flow Station	28	Na = 123.65 EC – 13.52	0.91
Turlock ID Harding Drain	29	Na = 136.63 EC – 9.36	0.93
Turlock ID Lateral 6 & 7 at Levee	30	Na = 139.24 EC – 27.80	0.87
Ingram Creek Flow Station	34	Na = 133.02 EC – 12.20	0.98
Del Puerto Creek Flow Station	36	Na = 118.91 EC – 1.48	0.87
San Luis Drain End	44	Na = 183.67 EC – 98.90	0.84
Salt Slough at Wolfsen Road	53	Na = 165.63 EC – 34.86	0.97
Ramona Lake Drain at Levee	57	Na = 156.65 EC – 34.19	0.95

Table 3b: Regression analysis for predicting potassium (mg/L) from electrical conductivity (mS/cm) for sites in the San Joaquin Valley (n>30 for each site).

Site Name	Site ID	Regression Equation	r^2
SJR at Mossdale	4	K = 3.77 EC + 0.85	0.66
SJR at Vernalis	5	K = 3.74 EC + 0.78	0.67
SJR at Maze	6	K = 4.22 EC + 0.67	0.72
SJR at Patterson	7	K = 4.28 EC + 0.82	0.69
SJR at Crows Landing	8	K = 3.33 EC + 0.89	0.64
SJR at Lander Avenue	10	K = 3.60 EC + 1.20	0.73
Stanislaus River at Caswell Park	12	K = 10.94 EC + 0.12	0.55
Tuolumne River at Shiloh Bridge	14	K = 11.62 EC - 0.05	0.38
Merced River at River Road	16	K = 3.99 EC + 0.58	0.59
Mud Slough near Gustine	18	K = 0.81 EC + 6.55	0.12
Salt Slough at Lander Avenue	19	K = 2.10 EC + 3.29	0.19
Los Banos Creek at Highway 140	20	K = 3.99 EC + 2.80	0.6
Orestimba Creek at River Road	21	K = 2.66 EC + 1.51	0.35
MID Main Drain to Stan. R. via Miller Lake	25	Not significant	
Turlock ID Westport Drain Flow Station	28	Not significant	
Turlock ID Harding Drain	29	K = 22.69 EC – 3.82	0.69
Turlock ID Lateral 6 & 7 at Levee	30	K = 13.00 EC – 2.24	0.59
Ingram Creek Flow Station	34	K = 126.21 EC + 23.49	0.16
Del Puerto Creek Flow Station	36	K = 2.85 EC + 1.96	0.19
San Luis Drain End	44	Not significant	
Salt Slough at Wolfsen Road	53	K = 2.35 EC + 2.71	0.45
Ramona Lake Drain at Levee	57	K = 3.30 EC + 1.73	0.25

Table 3c: Regression analysis for predicting magnesium (mg/L) from electrical conductivity (mS/cm) for sites in the San Joaquin Valley (n>30 for each site).

Site Name	Site ID	Regression Equation	r^2
SJR at Mossdale	4	Mg = 28.50 EC + 0.19	0.97
SJR at Vernalis	5	Mg = 29.95 EC – 0.19	0.96
SJR at Maze	6	Mg = 28.96 EC – 0.06	0.97
SJR at Patterson	7	Mg = 26.43 EC + 0.63	0.96
SJR at Crows Landing	8	Mg = 26.92 EC + 0.42	0.94
SJR at Lander Avenue	10	Mg = 19.86 EC + 2.29	0.88
Stanislaus River at Caswell Park	12	Mg = 42.55 EC – 0.27	0.65
Tuolumne River at Shiloh Bridge	14	Mg = 29.58 EC + 0.64	0.98
Merced River at River Road	16	Mg = 22.60 EC + 1.07	0.77
Mud Slough near Gustine	18	Mg = 23.03 EC + 6.57	0.96
Salt Slough at Lander Avenue	19	Mg = 27.14 EC – 0.24	0.91
Los Banos Creek at Highway 140	20	Mg = 38.92 EC – 4.56	0.96
Orestimba Creek at River Road	21	Mg = 43.05 EC – 2.59	0.95
MID Main Drain to Stan. R. via Miller Lake	25	Mg = 29.81 EC + 3.71	0.17
Turlock ID Westport Drain Flow Station	28	Mg = 25.30 EC + 0.10	0.86
Turlock ID Harding Drain	29	Mg = 13.91 EC + 2.65	0.82
Turlock ID Lateral 6 & 7 at Levee	30	Mg = 22.15 EC + 2.16	0.79
Ingram Creek Flow Station	34	Mg = 31.84 EC – 1.67	0.95
Del Puerto Creek Flow Station	36	Mg = 42.21 EC – 1.08	0.74
San Luis Drain End	44	Not significant	
Salt Slough at Wolfsen Road	53	Mg = 30.29 EC – 3.87	0.94
Ramona Lake Drain at Levee	57	Mg = 29.40 EC + 1.11	0.86

Table 3d: Regression analysis for predicting calcium (mg/L) from electrical conductivity (mS/cm) for sites in the San Joaquin Valley (n>30 for each site).

Site Name	Site ID	Regression Equation	r^2
SJR at Mossdale	4	Ca = 55.76 EC + 2.48	0.98
SJR at Vernalis	5	Ca = 56.02 EC + 2.12	0.97
SJR at Maze	6	Ca = 52.80 EC + 2.79	0.98
SJR at Patterson	7	Ca = 51.36 EC + 4.90	0.96
SJR at Crows Landing	8	Ca = 50.73 EC + 3.87	0.98
SJR at Lander Avenue	10	Ca = 49.61 EC + 7.46	0.95
Stanislaus River at Caswell Park	12	Ca = 63.69 EC + 3.37	0.84
Tuolumne River at Shiloh Bridge	14	Ca = 72.25 EC + 1.73	0.99
Merced River at River Road	16	Ca = 66.72 EC + 3.26	0.75
Mud Slough near Gustine	18	Ca = 60.93 EC – 3.02	0.95
Salt Slough at Lander Avenue	19	Ca = 44.45 EC + 13.50	0.87
Los Banos Creek at Highway 140	20	Ca = 36.83 EC + 16.25	0.90
Orestimba Creek at River Road	21	Ca = 82.22 EC – 3.49	0.92
MID Main Drain to Stan. R. via Miller Lake	25	Ca = 73.80 EC + 7.84	0.19
Turlock ID Westport Drain Flow Station	28	Ca = 89.82 EC + 0.48	0.90
Turlock ID Harding Drain	29	Ca = 61.77 EC + 3.93	0.87
Turlock ID Lateral 6 & 7 at Levee	30	Ca = 76.24 EC + 5.48	0.85
Ingram Creek Flow Station	34	Ca = 69.26 EC – 5.52	0.91
Del Puerto Creek Flow Station	36	Ca = 44.79 EC + 9.09	0.75
San Luis Drain End	44	Ca = 64.04 EC + 20.23	0.59
Salt Slough at Wolfsen Road	53	Ca = 50.78 EC + 4.87	0.85
Ramona Lake Drain at Levee	57	Ca = 49.51 EC + 9.90	0.73

Table 3e: Regression analysis for predicting chloride (mg/L) from electrical conductivity (mS/cm) for sites in the San Joaquin Valley (n>30 for each site).

Site Name	Site ID	Regression Equation	r^2
SJR at Mossdale	4	Cl = 152.89 EC – 9.96	0.98
SJR at Vernalis	5	Cl = 150.29 EC – 9.65	0.99
SJR at Maze	6	Cl = 156.39 EC – 12.17	0.99
SJR at Patterson	7	Cl = 151.01 EC – 10.70	0.98
SJR at Crows Landing	8	Cl = 153.02 EC – 13.98	0.99
SJR at Lander Avenue	10	Cl = 200.15 EC – 26.16>	0.97
Stanislaus River at Caswell Park	12	Cl = 72.24 EC – 3.29	0.79
Tuolumne River at Shiloh Bridge	14	Cl = 99.61 EC – 3.60	0.94
Merced River at River Road	16	Cl = 92.06 EC – 3.00	0.97
Mud Slough near Gustine	18	Cl = 141.48 EC – 20.61	0.96
Salt Slough at Lander Avenue	19	Cl = 162.44 EC – 1.28	0.65
Los Banos Creek at Highway 140	20	Cl = 158.57 EC – 30.44	0.96
Orestimba Creek at River Road	21	Cl = 108.34 EC – 4.53	0.83
MID Main Drain to Stan. R. via Miller Lake	25	Not significant	
Turlock ID Westport Drain Flow Station	28	Cl = 60.60 EC + 5.15	0.42
Turlock ID Harding Drain	29	Cl = 152.07 EC – 22.07	0.89
Turlock ID Lateral 6 & 7 at Levee	30	Cl = 102.27 EC – 15.10	0.69
Ingram Creek Flow Station	34	Cl = 166.94 EC – 26.11	0.97
Del Puerto Creek Flow Station	36	Cl = 139.68 EC – 8.24	0.82
San Luis Drain End	44	Cl = 134.35 EC – 33.20	0.79
Salt Slough at Wolfsen Road	53	Cl = 189.62 EC – 48.43	0.95
Ramona Lake Drain at Levee	57	Cl = 163.00 EC – 45.48	0.95

Table 3f: Regression analysis for predicting sulfate (mg/L) from electrical conductivity (mS/cm) for sites in the San Joaquin Valley (n>30 for each site).

Site Name	Site ID	Regression Equation	r^2
SJR at Mossdale	4	SO_4 = 113.86 EC + 2.68	0.95
SJR at Vernalis	5	SO_4 = 114.13 EC + 2.06	0.93
SJR at Maze	6	SO_4 = 124.47 EC + 1.26	0.95
SJR at Patterson	7	SO_4 = 148.36 EC + 0.22	0.93
SJR at Crows Landing	8	SO_4 = 161.44 EC – 7.28	0.88
SJR at Lander Avenue	10	SO_4 = 94.18 EC – 3.71	0.87
Stanislaus River at Caswell Park	12	SO_4 = 48.07 EC – 0.53	0.88
Tuolumne River at Shiloh Bridge	14	SO_4 = 43.92 EC – 0.10	0.98
Merced River at River Road	16	SO_4 = 66.36 EC – 0.24	0.92
Mud Slough near Gustine	18	SO_4 = 378.37 EC – 269.79	0.96
Salt Slough at Lander Avenue	19	SO_4 = 162.38 EC – 23.52	0.78
Los Banos Creek at Highway 140	20	SO_4 = 185.48 EC – 58.03	0.89
Orestimba Creek at River Road	21	SO_4 = 180.38 EC – 25.09	0.86
MID Main Drain to Stan. R. via Miller Lake	25	Not significant	
Turlock ID Westport Drain Flow Station	28	SO_4 = 71.36 EC – 9.37	0.89
Turlock ID Harding Drain	29	SO_4 = 54.12 EC – 0.06	0.88
Turlock ID Lateral 6 & 7 at Levee	30	SO_4 = 68.36 EC – 9.54	0.84
Ingram Creek Flow Station	34	SO_4 = 168.96 EC – 27.32	0.95
Del Puerto Creek Flow Station	36	SO_4 = 172.95 EC – 22.19	0.82
San Luis Drain End	44	SO_4 = 410.58 EC – 265.70	0.94
Salt Slough at Wolfsen Road	53	SO_4 = 207.08 EC – 78.01	0.91
Ramona Lake Drain at Levee	57	SO_4 = 223.79 EC – 49.21	0.92

Analysis 1: Summary statistics for all 54 sampling locations.

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
4	SJR at Mossdale	N of cases	65	65	65	65	65	65	65	65
		Minimum	0.042	9.2	1.1	3.2	8.2	7.2	8.4	0.1
		Maximum	0.810	102.2	5.2	24.8	52.4	123.3	99.8	1.7
		Median	0.492	58.8	2.6	14.7	29.3	65.8	58.9	0.5
		Mean	0.478	57.9	2.7	14.0	29.4	64.1	57.7	0.7
		Standard Dev	0.229	28.2	1.0	6.4	12.6	34.3	26.0	0.4
5	SJR at Vernalis	N of cases	74	73	73	73	73	73	73	73
		Minimum	0.094	8.5	1.0	3.1	8.1	6.3	8.0	0.1
		Maximum	0.800	100.0	5.1	24.5	48.5	112.3	98.4	1.5
		Median	0.493	60.4	2.5	14.5	29.7	63.3	62.8	0.4
		Mean	0.478	57.8	2.6	14.3	29.1	62.9	57.2	0.5
		Standard Dev	0.216	27.3	1.0	6.5	12.0	31.9	24.9	0.3
6	SJR at Maze	N of cases	69	70	70	70	70	70	70	70
		Minimum	0.104	9.5	1.1	3.2	8.4	7.2	8.7	0.1
		Maximum	1.080	145.1	7.5	33.4	59.5	160.2	159.9	3.5
		Median	0.656	81.5	3.4	19.4	37.2	88.8	87.9	0.8
		Mean	0.656	81.6	3.4	18.8	37.1	89.7	82.3	0.9
		Standard Dev	0.303	40.6	1.5	9.0	16.3	47.8	38.8	0.6
7	SJR at Patterson	N of cases	76	75	75	75	75	75	75	75
		Minimum	0.117	11.4	1.2	3.1	8.8	8.8	11.3	0.1
		Maximum	1.560	216.4	9.3	41.5	84.2	231.6	251.4	2.7
		Median	0.952	133.6	4.7	26.8	54.8	136.2	145.5	1.0
		Mean	0.868	118.5	4.6	24.1	50.2	122.6	131.1	1.2
		Standard Dev	0.387	54.7	2.0	10.5	20.2	59.0	59.3	0.7
8	SJR at Crows Landing	N of cases	81	80	80	80	80	80	80	80
		Minimum	0.002	13.7	1.1	3.1	8.6	11.3	16.6	0.1
		Maximum	1.660	235.2	7.9	45.8	85.7	244.9	294.7	3.2
		Median	1.005	134.4	4.0	27.1	55.6	140.3	147.3	1.1
		Mean	0.898	121.7	3.9	24.8	49.9	125.0	139.4	1.2
		Standard Dev	0.392	54.6	1.6	10.5	19.5	58.2	64.7	0.7

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
10	SJR at Lander Avenue	N of cases	83	83	83	83	83	83	83	83
		Minimum	0.049	4.0	0.6	1.3	5.4	2.2	2.8	0.1
		Maximum	1.670	280.1	9.9	38.7	90.7	334.1	192.7	4.2
		Median	1.020	152.2	4.6	21.3	56.9	184.5	87.2	1.0
		Mean	0.901	130.8	4.6	20.3	52.6	157.1	82.0	1.0
		Standard Dev	0.485	78.0	2.2	10.3	24.7	99.1	48.8	0.7
11	French Camp Slough	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.099	5.5	1.5	3.2	9.2	3.2	4.5	0.0
		Maximum	0.736	92.2	3.6	18.3	44.7	103.5	97.8	0.8
		Median	0.616	71.8	3.3	16.1	34.1	80.1	73.9	0.5
		Mean	0.477	53.6	3.0	12.8	28.8	58.0	60.5	0.5
		Standard Dev	0.254	35.8	0.8	5.6	13.1	41.1	35.6	0.3
12	Stanislaus River at Caswell Park	N of cases	67	67	67	67	67	67	67	67
		Minimum	0.059	2.7	0.7	2.2	6.3	1.0	1.9	0.0
		Maximum	0.415	11.2	2.2	9.7	15.0	9.6	10.3	0.3
		Median	0.090	4.6	1.0	3.4	8.8	3.2	3.5	0.0
		Mean	0.094	4.7	1.1	3.6	9.1	3.2	3.8	0.0
		Standard Dev	0.046	1.6	0.3	1.3	1.6	1.8	1.3	0.1
14	Tuolumne River at Shiloh Bridge	N of cases	68	68	68	68	68	68	68	68
		Minimum	0.041	2.2	0.5	1.9	4.6	0.9	1.8	0.0
		Maximum	0.494	26.4	11.0	9.9	22.9	35.7	13.5	0.6
		Median	0.140	10.2	1.3	4.7	11.3	9.1	5.8	0.1
		Mean	0.149	11.3	1.6	4.9	12.1	10.7	6.2	0.2
		Standard Dev	0.089	7.1	1.5	2.3	5.7	8.0	3.4	0.2
16	Merced River at River Road	N of cases	67	67	67	67	67	67	67	67
		Minimum	0.036	2.0	0.4	1.4	4.7	0.8	1.7	0.0
		Maximum	0.569	52.5	3.3	13.2	41.0	44.3	35.9	0.8
		Median	0.094	7.4	1.0	3.1	9.3	5.6	5.3	0.1
		Mean	0.152	13.7	1.2	4.5	13.4	10.9	9.8	0.2
		Standard Dev	0.114	12.0	0.6	2.8	8.5	10.3	7.7	0.2

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
18	Mud Slough near Gustine	N of cases	77	77	77	77	77	77	77	77
		Minimum	1.118	12.6	1.2	4.4	13.3	10.6	10.1	0.1
		Maximum	4.710	762.9	14.3	117.7	292.2	640.7	1449.1	9.0
		Median	2.610	410.1	8.5	68.0	157.8	345.1	680.8	3.0
		Mean	2.643	416.6	8.6	66.8	156.7	350.1	724.2	3.6
		Standard Dev	0.943	174.7	2.3	23.2	61.2	141.2	372.3	2.0
19	Salt Slough at Lander Avenue	N of cases	102	103	103	103	103	103	103	103
		Minimum	0.499	91.8	3.1	19.3	43.4	89.0	73.3	0.3
		Maximum	2.379	394.7	14.7	66.7	120.5	476.2	430.5	4.8
		Median	1.183	162.4	5.8	31.8	67.1	188.6	159.6	1.5
		Mean	1.239	175.4	5.9	33.9	69.4	201.1	180.6	1.7
		Standard Dev	0.342	56.1	1.6	9.6	16.5	68.2	66.1	0.9
20	Los Banos Creek at Highway 140	N of cases	66	66	66	66	66	66	66	66
		Minimum	0.499	53.0	3.6	16.8	30.5	56.5	37.8	0.3
		Maximum	3.154	560.6	17.3	118.3	134.7	459.1	498.3	4.6
		Median	1.250	174.8	7.9	45.3	64.8	172.9	180.3	1.6
		Mean	1.386	202.6	8.3	49.6	67.6	191.2	200.7	2.0
		Standard Dev	0.579	105.1	2.9	22.8	22.2	92.3	112.3	1.2
21	Orestimba Creek at River Road	N of cases	58	58	58	58	58	58	58	58
		Minimum	0.090	13.2	1.6	5.3	11.3	7.9	16.3	0.2
		Maximum	1.190	160.4	9.3	48.9	94.8	165.9	207.5	2.8
		Median	0.682	61.7	3.1	26.6	51.1	70.8	90.4	1.0
		Mean	0.676	62.5	3.5	27.4	52.8	72.3	99.4	1.0
		Standard Dev	0.262	25.8	1.4	11.3	21.4	32.7	49.2	0.6
22	Modesto ID Lateral 4 to SJR	N of cases	6	6	6	6	6	6	6	6
		Minimum	0.046	2.3	0.7	1.9	4.9	1.0	1.7	0.1
		Maximum	0.292	21.6	2.9	12.2	28.0	22.7	13.1	1.4
		Median	0.160	12.8	1.2	4.9	12.9	6.0	7.1	0.4
		Mean	0.172	12.4	1.4	6.2	15.5	8.3	7.5	0.5
		Standard Dev	0.114	8.9	0.8	4.4	10.6	8.2	4.9	0.5

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
23	Modesto ID Lateral 5 to Tuolumne	N of cases	29	29	29	29	29	29	29	29
		Minimum	0.030	1.8	0.4	1.2	3.1	0.7	1.2	0.0
		Maximum	0.536	66.5	5.6	20.2	46.2	80.8	57.4	0.9
		Median	0.088	6.3	1.0	2.5	8.3	5.5	2.6	0.0
		Mean	0.124	12.2	1.6	4.6	11.7	12.1	7.8	0.1
		Standard Dev	0.115	16.1	1.4	5.2	10.6	18.8	14.1	0.2
25	MID Main Drain to Stan. R. via Miller Lake	N of cases	40	41	41	41	41	41	41	41
		Minimum	0.065	4.3	0.7	2.2	6.2	1.5	2.4	0.0
		Maximum	0.968	158.1	18.0	37.6	69.2	173.0	158.3	2.1
		Median	0.300	21.2	4.5	12.2	28.9	11.3	12.9	0.2
		Mean	0.335	30.7	5.4	14.4	32.8	20.2	19.2	0.4
		Standard Dev	0.150	26.2	3.4	7.5	14.9	27.5	24.7	0.5
28	Turlock ID Westport Drain Flow Station	N of cases	50	50	50	50	50	50	50	50
		Minimum	0.140	12.8	1.0	3.9	13.6	5.7	8.5	0.0
		Maximum	1.190	145.8	33.1	33.4	112.8	140.8	84.2	2.5
		Median	0.605	60.1	3.6	14.6	56.5	43.2	31.1	0.7
		Mean	0.668	69.5	4.6	16.9	60.1	45.4	38.5	0.9
		Standard Dev	0.260	35.7	4.5	7.2	25.0	25.0	20.6	0.8
29	Turlock ID Harding Drain	N of cases	65	64	64	64	64	64	64	64
		Minimum	0.298	16.0	1.3	5.1	18.6	8.0	9.7	0.0
		Maximum	1.227	157.8	29.4	20.5	90.6	176.7	70.6	1.9
		Median	0.665	81.3	10.4	12.0	45.3	75.1	34.3	0.6
		Mean	0.694	84.6	11.8	12.3	46.7	82.5	37.2	0.7
		Standard Dev	0.224	32.8	6.2	3.5	14.9	37.4	13.3	0.5
30	Turlock ID Lateral 6 & 7 at Levee	N of cases	35	35	35	35	35	35	35	35
		Minimum	0.366	25.6	3.1	9.5	29.4	20.5	13.7	0.0
		Maximum	1.200	125.0	12.5	32.9	112.2	97.8	81.2	2.3
		Median	0.580	51.6	5.0	14.6	49.8	43.5	30.9	0.7
		Mean	0.616	57.5	5.7	16.0	52.7	47.3	33.3	0.8
		Standard Dev	0.168	22.7	2.4	4.5	14.7	17.6	13.9	0.5

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
31	BCID - New Jerusalem Drain	N of cases	8	8	8	8	8	8	8	9
		Minimum	2.156	298.3	0.0	65.3	126.6	312.1	419.8	0.0
		Maximum	2.550	345.7	11.3	82.8	200.9	340.3	524.1	4.3
		Median	2.437	323.3	5.2	72.6	164.1	328.3	459.5	3.0
		Mean	2.423	320.8	4.1	73.3	164.6	326.7	465.3	2.8
		Standard Dev	0.129	17.2	3.9	6.8	26.6	9.6	40.3	1.4
33	Hospital Creek	N of cases	17	17	17	17	17	17	17	17
		Minimum	0.146	14.6	1.9	4.1	10.6	12.2	15.5	0.0
		Maximum	1.241	87.2	7.7	23.3	57.8	127.0	108.8	1.2
		Median	0.420	44.1	3.8	13.5	24.9	50.4	38.3	0.3
		Mean	0.495	49.1	4.1	13.0	29.4	53.6	50.8	0.4
		Standard Dev	0.283	25.3	1.8	5.4	12.3	32.3	31.5	0.3
34	Ingram Creek Flow Station	N of cases	44	44	44	44	44	44	44	44
		Minimum	0.247	24.0	1.9	6.8	18.0	22.6	26.7	0.0
		Maximum	2.030	278.0	11.1	66.0	151.2	323.3	357.1	3.5
		Median	1.035	118.7	4.2	29.0	60.1	142.4	133.8	1.3
		Mean	0.982	116.9	4.4	29.2	62.2	135.3	135.5	1.4
		Standard Dev	0.413	55.8	1.9	13.6	29.9	71.0	73.1	0.9
35	Westley Wasteway Flow Station	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.550	60.7	2.4	14.4	29.3	68.5	52.0	0.4
		Maximum	0.810	100.9	5.0	39.6	43.3	108.9	113.7	1.1
		Median	0.655	71.4	3.2	17.7	32.3	77.2	80.4	0.9
		Mean	0.644	73.0	3.3	21.5	33.6	83.8	80.3	0.8
		Standard Dev	0.092	14.5	0.9	8.8	4.5	13.4	19.0	0.3
36	Del Puerto Creek Flow Station	N of cases	58	58	58	58	58	58	58	58
		Minimum	0.338	33.3	1.4	8.1	19.8	15.7	21.2	0.0
		Maximum	1.441	183.6	10.0	75.2	92.1	202.5	281.4	3.0
		Median	0.837	92.2	3.9	37.2	47.5	100.4	120.4	1.0
		Mean	0.876	101.9	4.4	36.2	48.3	112.7	128.8	1.1
		Standard Dev	0.302	39.3	2.0	14.9	15.7	48.4	57.9	0.7

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
38	Marshall Road Drain	N of cases	7	8	8	8	8	8	8	8
		Minimum	0.449	52.1	2.0	11.6	24.4	52.9	40.5	0.2
		Maximum	1.370	168.2	7.2	41.0	79.4	184.5	274.3	2.0
		Median	0.785	94.2	4.8	21.7	46.4	90.2	124.6	0.6
		Mean	0.848	97.5	4.6	22.5	44.9	100.3	126.2	0.8
		Standard Dev	0.340	44.5	1.6	10.4	20.0	48.4	83.1	0.6
44	San Luis Drain End	N of cases	73	73	73	73	73	73	73	73
		Minimum	3.090	55.1	3.3	15.6	25.9	64.1	43.9	0.5
		Maximum	5.706	1043.9	27.8	957.3	403.3	832.8	2107.6	13.4
		Median	4.409	694.9	10.9	99.6	298.4	555.6	1536.1	5.8
		Mean	4.392	691.5	11.5	110.8	294.9	548.0	1513.6	6.1
		Standard Dev	0.585	148.9	3.9	102.2	61.3	105.8	304.2	3.0
45	Volta Wasteway at Ingomar Grade	N of cases	11	11	11	11	11	11	11	11
		Minimum	0.325	35.0	2.1	10.3	19.3	37.2	23.1	0.3
		Maximum	1.430	218.0	7.8	49.0	81.6	178.1	163.0	3.8
		Median	0.680	88.6	3.4	22.4	42.5	103.7	75.3	0.7
		Mean	0.839	114.9	3.8	26.4	46.4	106.8	85.3	1.2
		Standard Dev	0.420	68.1	1.6	14.4	23.6	52.3	53.6	1.1
46	Mud Slough at Gun Club Road	N of cases	11	11	11	11	11	11	11	11
		Minimum	0.821	102.6	5.7	24.4	45.3	97.9	92.1	0.9
		Maximum	3.490	608.2	22.2	103.7	118.7	539.9	668.3	6.2
		Median	1.560	273.3	7.6	50.4	83.1	251.2	334.6	1.9
		Mean	1.831	311.5	9.4	56.1	81.5	271.3	325.5	2.4
		Standard Dev	0.932	177.0	4.9	27.7	26.9	149.6	193.3	1.7
53	Salt Slough at Wolfsen Road	N of cases	29	30	30	30	30	30	30	30
		Minimum	0.811	104.7	3.9	21.4	49.2	67.6	60.7	0.6
		Maximum	2.033	303.9	8.1	55.3	108.4	317.7	328.2	3.9
		Median	1.215	166.9	5.9	33.1	62.4	185.0	164.4	1.7
		Mean	1.311	181.1	5.8	35.6	70.9	198.9	191.6	1.6
		Standard Dev	0.324	53.8	1.1	10.0	17.8	62.3	69.9	0.8

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
57	Ramona Lake Drain at Levee	N of cases	29	29	29	29	29	29	29	29
		Minimum	0.957	110.8	3.8	26.9	41.8	114.5	164.8	0.3
		Maximum	1.850	262.5	10.9	54.3	102.8	259.8	372.2	4.6
		Median	1.310	166.7	6.2	41.7	77.0	156.7	245.3	1.2
		Mean	1.337	172.8	6.0	40.3	76.5	170.4	248.7	1.7
		Standard Dev	0.241	39.6	1.7	7.9	14.4	40.9	56.4	1.1
59	SJR Laird Park	N of cases	17	22	22	22	22	22	22	22
		Minimum	0.149	13.4	0.6	2.3	5.1	12.6	15.2	0.1
		Maximum	0.958	801.6	10.5	114.8	338.6	624.8	1794.5	10.5
		Median	0.684	86.1	3.5	19.3	42.9	87.8	98.8	0.7
		Mean	0.592	119.5	3.5	23.6	53.1	113.9	173.2	1.2
		Standard Dev	0.274	157.1	1.9	22.0	65.7	121.3	364.6	2.1
60	Moffit 1 South	N of cases	18	19	19	19	19	19	19	19
		Minimum	0.530	63.2	3.4	15.7	34.5	73.8	39.9	0.4
		Maximum	1.640	230.9	8.3	41.9	87.5	255.6	206.8	3.4
		Median	0.916	112.5	5.6	22.9	48.1	133.0	80.7	0.9
		Mean	0.967	127.4	6.0	26.4	56.0	143.9	98.4	0.9
		Standard Dev	0.351	54.9	1.2	8.5	17.3	58.2	52.5	0.7
61	Deadman's Slough	N of cases	24	23	23	23	23	23	23	23
		Minimum	0.566	67.8	3.7	14.7	29.4	75.6	48.1	0.4
		Maximum	2.019	289.8	13.7	50.5	93.5	335.9	299.6	4.1
		Median	0.997	132.9	6.4	27.0	56.3	144.6	137.5	1.2
		Mean	1.140	161.6	6.8	31.5	63.2	181.7	140.0	1.5
		Standard Dev	0.481	78.8	2.6	12.1	20.9	85.0	80.4	0.9
62	Mallard Slough	N of cases	22	22	22	22	22	22	22	22
		Minimum	0.594	97.1	3.7	21.5	48.6	103.8	74.8	0.5
		Maximum	5.984	913.8	54.7	182.1	304.4	787.2	1389.0	5.1
		Median	1.194	170.2	7.2	34.0	76.0	172.2	149.5	1.1
		Mean	1.630	229.3	10.6	45.6	98.8	223.7	246.3	1.6
		Standard Dev	1.177	179.8	11.6	36.7	64.4	154.4	334.5	1.2

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
63	Inlet C Canal	N of cases	26	27	27	27	27	27	27	27
		Minimum	0.357	39.1	2.1	10.6	24.5	40.5	37.4	0.2
		Maximum	1.551	187.7	6.9	41.4	112.4	226.5	201.0	2.5
		Median	0.658	73.0	3.6	18.0	41.0	95.7	73.8	0.8
		Mean	0.729	87.6	3.6	19.6	46.8	106.1	84.3	0.8
		Standard Dev	0.305	40.9	1.2	7.6	21.6	52.0	43.9	0.5
64	Moran Drain	N of cases	6	6	6	6	6	6	6	6
		Minimum	0.434	47.5	2.0	13.6	30.5	49.7	30.7	0.5
		Maximum	0.950	83.0	4.8	36.1	72.5	114.4	120.9	1.8
		Median	0.771	70.9	3.5	25.2	50.0	86.8	85.3	1.1
		Mean	0.740	67.1	3.5	25.1	51.1	84.0	81.0	1.1
		Standard Dev	0.218	15.7	1.0	10.5	21.9	26.2	39.8	0.6
65	Spanish Grant Drain	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.505	80.8	3.1	20.7	41.1	71.6	74.3	0.1
		Maximum	1.330	158.8	5.9	38.8	87.8	144.1	231.0	2.1
		Median	0.719	111.1	4.8	34.3	73.8	109.9	177.9	0.7
		Mean	0.866	112.9	4.5	30.6	65.5	103.9	150.4	0.9
		Standard Dev	0.313	33.5	1.0	8.6	20.5	28.2	62.0	0.8
67	Newman Wasteway at Brazo Road	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.600	83.2	2.7	20.0	27.7	105.4	30.3	0.4
		Maximum	1.740	216.9	9.2	82.7	107.5	173.9	225.4	2.2
		Median	1.057	132.7	5.5	47.7	69.3	125.1	128.6	1.4
		Mean	1.155	141.8	5.3	48.8	72.7	134.7	139.2	1.3
		Standard Dev	0.383	50.3	2.1	21.7	25.4	28.5	62.6	0.6
80	South Marsh 1 Inlet	N of cases	18	17	17	17	17	17	17	17
		Minimum	0.370	39.6	2.1	10.6	25.2	41.8	38.0	0.2
		Maximum	1.392	129.8	6.7	24.9	65.1	160.7	120.1	3.3
		Median	0.680	68.3	3.2	18.8	39.8	82.2	55.4	0.9
		Mean	0.718	80.1	3.5	18.4	43.1	96.4	70.0	1.0
		Standard Dev	0.275	31.0	1.2	5.1	13.6	40.9	29.0	0.8

81	South Marsh 1 Outlet	N of cases	20	19	19	19	19	19	19	19
		Minimum	0.379	43.6	2.9	10.5	24.6	47.7	40.0	0.2
		Maximum	1.346	133.3	7.8	25.5	63.7	168.0	118.6	1.6
		Median	0.682	78.4	4.5	18.1	40.4	89.8	57.1	0.6
		Mean	0.715	80.2	4.8	18.2	42.3	95.1	64.3	0.7
		Standard Dev	0.237	25.4	1.4	4.3	10.5	35.3	24.1	0.4
82	South Marsh 3 Inlet	N of cases	25	23	23	23	23	23	23	23
		Minimum	0.427	45.5	2.6	11.4	27.8	49.6	44.3	0.5
		Maximum	1.729	281.0	12.6	47.0	99.6	315.4	243.0	5.4
		Median	1.090	191.0	6.0	20.5	45.5	213.2	100.0	1.1
		Mean	1.091	178.0	6.5	21.0	47.5	190.5	107.8	1.3
		Standard Dev	0.301	64.7	2.5	7.2	14.9	73.1	48.2	1.0
83	South Marsh 3 Outlet	N of cases	28	26	26	26	26	26	26	26
		Minimum	0.630	104.3	4.2	15.0	34.2	107.5	57.2	0.5
		Maximum	1.839	301.7	10.4	26.6	63.2	347.9	300.9	2.0
		Median	1.085	186.1	6.2	19.7	46.2	206.8	99.6	1.0
		Mean	1.127	181.0	6.4	20.2	46.5	201.8	115.7	1.1
		Standard Dev	0.276	55.0	1.6	4.0	9.1	65.7	57.7	0.5
86	Ramona Drain Apple Ave	N of cases	9	9	9	9	9	9	9	9
		Minimum	0.662	42.6	1.3	15.5	27.4	60.1	70.1	0.3
		Maximum	1.594	179.7	10.8	66.2	143.6	192.5	446.0	2.4
		Median	1.280	166.7	7.7	38.5	67.2	176.5	174.4	1.2
		Mean	1.223	137.2	7.7	37.0	70.7	147.5	188.5	1.3
		Standard Dev	0.268	53.4	2.8	13.6	30.7	52.5	105.1	0.8
88	Ramona Drain Apricot Ave	N of cases	9	9	9	9	9	9	9	9
		Minimum	0.438	43.3	3.1	14.0	31.7	41.8	76.5	0.0
		Maximum	1.730	240.5	10.7	48.6	92.9	268.8	275.2	2.6
		Median	1.360	177.8	9.2	39.7	71.9	189.7	180.7	1.5
		Mean	1.242	150.9	8.0	36.1	69.3	160.2	190.6	1.5
		Standard Dev	0.404	63.9	2.9	11.8	20.3	71.8	64.3	1.0

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
92	Paradise Drain Apricot Ave	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.815	105.9	5.5	24.8	54.9	104.8	142.2	1.2
		Maximum	3.053	505.9	19.0	93.9	199.1	433.8	707.8	3.2
		Median	1.240	167.3	7.6	36.7	68.0	170.9	178.5	2.0
		Mean	1.446	206.1	8.6	43.8	88.9	196.5	267.8	2.1
		Standard Dev	0.746	135.1	4.7	23.6	50.7	110.2	198.4	0.8
94	Paradise Drain Almond Ave	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.773	103.5	5.7	22.8	52.1	102.0	137.8	1.2
		Maximum	2.958	477.9	25.5	102.3	205.0	414.9	713.1	11.4
		Median	1.260	168.5	7.3	37.1	70.3	175.9	179.4	2.4
		Mean	1.466	207.5	9.8	45.8	89.7	205.1	268.7	3.4
		Standard Dev	0.704	123.3	7.0	26.4	53.2	98.4	202.4	3.6
95	Ramona Lake Entrance	N of cases	16	16	16	16	16	16	16	16
		Minimum	0.890	112.0	4.2	24.6	53.4	115.2	173.3	0.8
		Maximum	2.372	276.3	9.5	58.6	121.9	267.3	373.5	5.4
		Median	1.590	187.9	5.9	44.3	87.8	194.4	300.4	1.9
		Mean	1.518	190.0	6.2	42.3	87.8	191.4	279.1	2.2
		Standard Dev	0.387	41.3	1.5	9.0	17.3	42.9	58.1	1.3
120	South Marsh 1 Intermediary	N of cases	11	11	11	11	11	11	11	11
		Minimum	0.378	40.4	2.4	10.6	25.3	44.4	40.3	0.2
		Maximum	0.960	129.7	6.6	24.6	61.5	314.3	263.2	1.5
		Median	0.646	69.1	3.9	18.5	42.3	106.2	73.2	0.5
		Mean	0.648	77.2	3.7	17.3	41.4	115.4	86.5	0.7
		Standard Dev	0.230	33.7	1.3	5.4	13.0	79.4	63.3	0.4
121	South Marsh 1 East	N of cases	10	10	10	10	10	10	10	10
		Minimum	0.388	42.1	2.5	11.0	25.0	45.2	39.3	0.2
		Maximum	0.960	131.6	6.4	24.8	56.7	165.1	102.5	1.6
		Median	0.603	72.6	4.8	17.2	39.2	83.9	46.3	0.6
		Mean	0.656	80.4	4.4	17.7	41.0	96.5	60.9	0.7
		Standard Dev	0.240	36.2	1.4	5.9	13.3	48.1	24.7	0.4

Site No.	Site Name		EC dS/m	Na mg/L	K mg/L	Mg mg/L	Ca mg/L	Cl mg/L	SO4 mg/L	Br mg/L
122	South Marsh 1 West	N of cases	9	9	9	9	9	9	9	9
		Minimum	0.453	48.0	5.2	12.0	31.3	54.3	36.8	0.3
		Maximum	1.190	158.4	10.6	29.0	64.9	200.7	90.6	2.6
		Median	0.740	88.6	7.1	20.4	55.0	110.1	48.8	0.6
		Mean	0.782	96.4	7.4	20.4	52.1	119.2	57.7	1.2
		Standard Dev	0.216	33.9	1.7	5.1	10.5	46.9	19.7	0.9
130	Marshall Rd Reservoir Entrance	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.500	50.7	3.0	13.6	33.5	67.0	57.3	0.2
		Maximum	1.240	157.4	6.2	40.6	75.8	162.3	211.9	4.4
		Median	0.810	90.4	4.0	24.0	51.4	102.6	119.0	1.0
		Mean	0.870	102.0	4.2	25.6	51.0	109.4	136.0	1.4
		Standard Dev	0.257	38.4	1.2	9.9	15.1	37.0	60.7	1.4
131	Marshall Rd Reservoir Exit	N of cases	7	7	7	7	7	7	7	7
		Minimum	0.770	87.2	3.0	22.0	46.4	88.6	130.4	0.7
		Maximum	1.250	151.3	6.1	43.3	77.5	162.2	236.4	6.5
		Median	0.970	118.8	4.7	27.2	51.1	120.4	159.7	1.9
		Mean	0.990	118.9	4.5	30.6	57.9	119.9	178.4	2.2
		Standard Dev	0.167	24.1	1.0	8.5	12.7	25.2	40.2	2.0
135	Modesto ID Main Drain Spill	N of cases	6	6	6	6	6	6	6	6
		Minimum	0.160	9.6	2.0	5.3	13.3	5.3	5.9	0.0
		Maximum	0.340	33.7	4.4	13.7	31.1	18.2	13.3	0.8
		Median	0.265	18.3	3.0	10.5	23.8	9.2	12.0	0.2
		Mean	0.250	18.9	3.1	9.9	22.7	9.9	10.5	0.3
		Standard Dev	0.076	8.5	0.9	3.6	7.4	4.6	3.3	0.4