Appendix 6E Water Quality Data

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6E.1 Water Quality Standards for Metals

Concentration data for multiple types of metals were compared to water quality standards in order to assess whether concentrations are relatively high compared to the standards. High concentrations would generally increase level of concern for any potential changes in concentration under the Project.

Table 6E-1. Metals Water Quality Standards

Metal	California MCL (µg/L)	California Secondary MCL (µg/L)[a]	Freshwater Chronic Standard for Aquatic Life Protection (µg/L)[b]
Aluminum	1,000	200	620 T[c]
Arsenic	10		150 D
Cadmium	5		0.45 T[d]
Chromium	50		49 T[d] Chromium III
Copper	1,300	1000	5 T[d]
Iron		300	1,000 T[e]
Lead	15		1.3 T[d]
Manganese		50	
Nickel	100		29 T[d]
Selenium	50		1.5 D for standing water, 3.1 D for flowing – 30-day average, not more than 1X per 3 years
Silver		100	0.12 T (not a well-established standard)
Zinc		5,000	67 T[d]

Sources for table data: California Division of Drinking Water 2018, 2020. State Water Resources Control Board 2021. U.S. Environmental Protection Agency 1980:B-13; 1986:40, 2016:xv; 2018:K-7; and 2020.

[a] Secondary MCLs are for taste or aesthetics. Because drinking water generally does not contain high concentrations of suspended sediment, these standards are most applicable to measurements of dissolved concentrations. Because dissolved concentrations are lower, the lack of health-related effects, and the long distance and inflows between Sites Reservoir and drinking water intakes, the standard for aquatic life protection was used in the metals evaluation instead of the lower secondary MCLs for iron and aluminum.

[b] T=total concentration, D=dissolved concentration. U.S. Environmental Protection Agency guidance (2020) indicates that all standards except aluminum and iron are for concentrations of dissolved metals. However, in many cases, standards are also provided for total concentrations based on conversion factors. The values for total concentrations are shown in this table because they are more conservative. In the Sacramento River, the standards for total concentrations are harder to meet than the standards for dissolved concentrations because the standards are based on conversion factors that do not accurately represent differences between dissolved and total concentrations in the river.

[c] Assumes hardness = 50 mg/L, pH = 7.5, and DOC = 1 mg/L. The pH and DOC values are conservative values (resulting in lower standard) and are based on the low end of values measured in the Sacramento River (Domagalski and Dileanis 2000: 34, 39, 50).
[d] Assumes hardness = 50 mg/L.
[e] Total (T) because for iron U.S. Environmental Protection Agency (2020) refers to the Gold Book (U.S. Environmental Protection Agency 1986:40), which suggests use of total concentration for evaluation of water quality.

6E.2 Metals Data by Month

The graphs below show metals data from the California Department of Water Resources Water Data Library for measurements of total concentration (i.e., not filtered) taken during 2000 through 2020 at four stations:

- Sacramento River below Red Bluff - Stations A0275890 and A0275500
- Sacramento River at Hamilton City - Station A0263000
- Sacramento River above Colusa Basin Drain - Station A0223002, and
- Colusa Basin Drain near Knights Landing - Station A0294710

The measurements are shown by month in order to show seasonal trends.

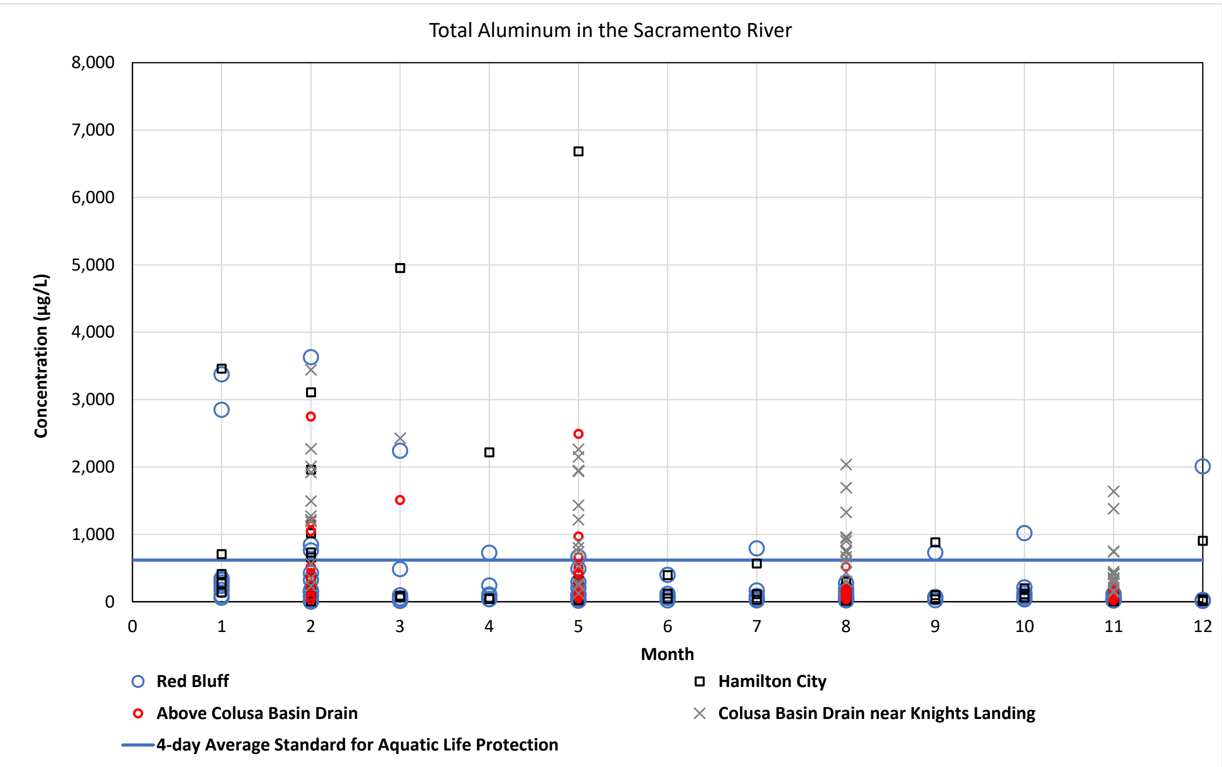

Figure 6E-1. Measured Total Aluminum in the Sacramento River and Colusa Basin Drain

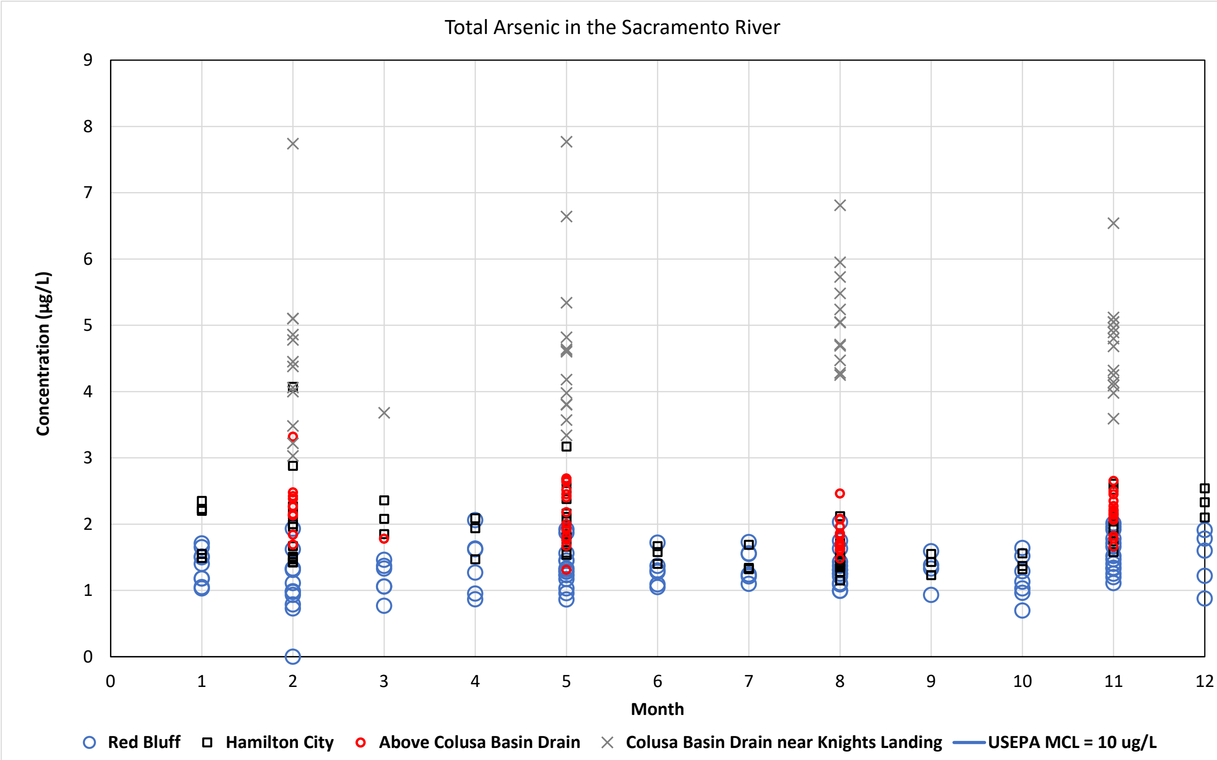

Figure 6E-2. Measured Total Arsenic in the Sacramento River and Colusa Basin Drain

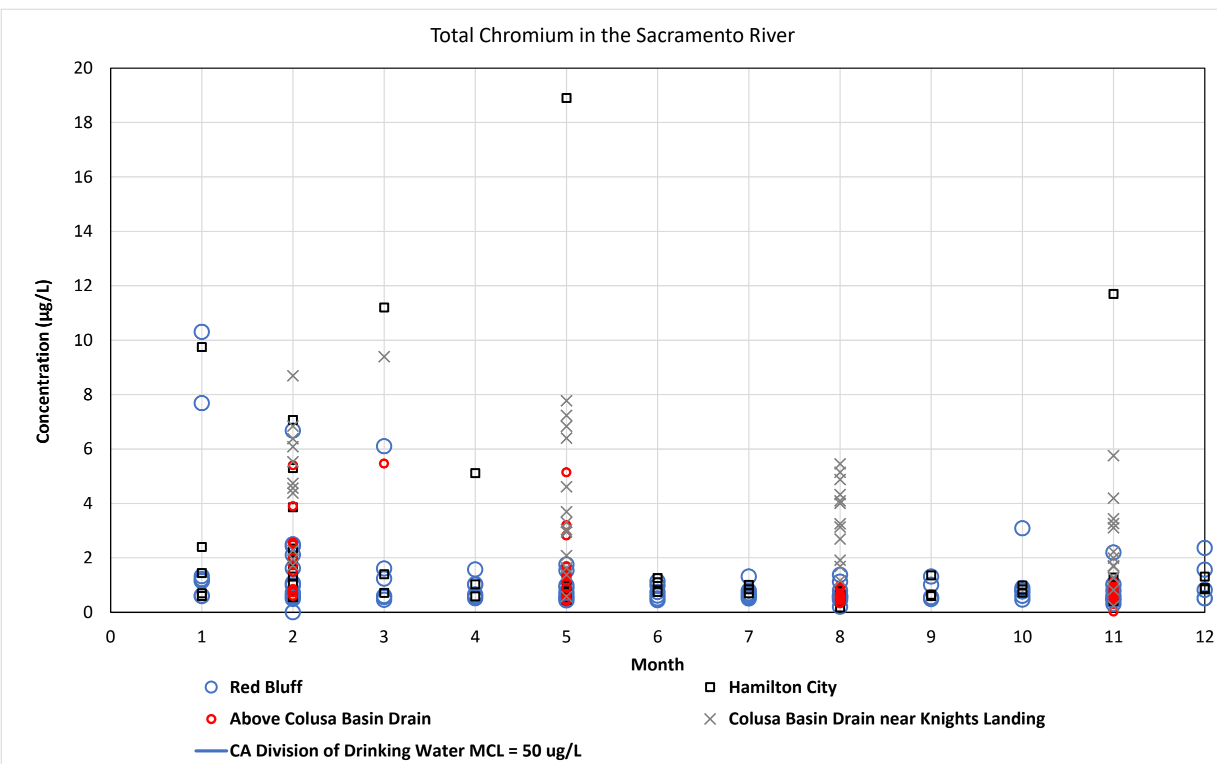

Figure 6E-3. Measured Total Chromium in the Sacramento River and Colusa Basin Drain

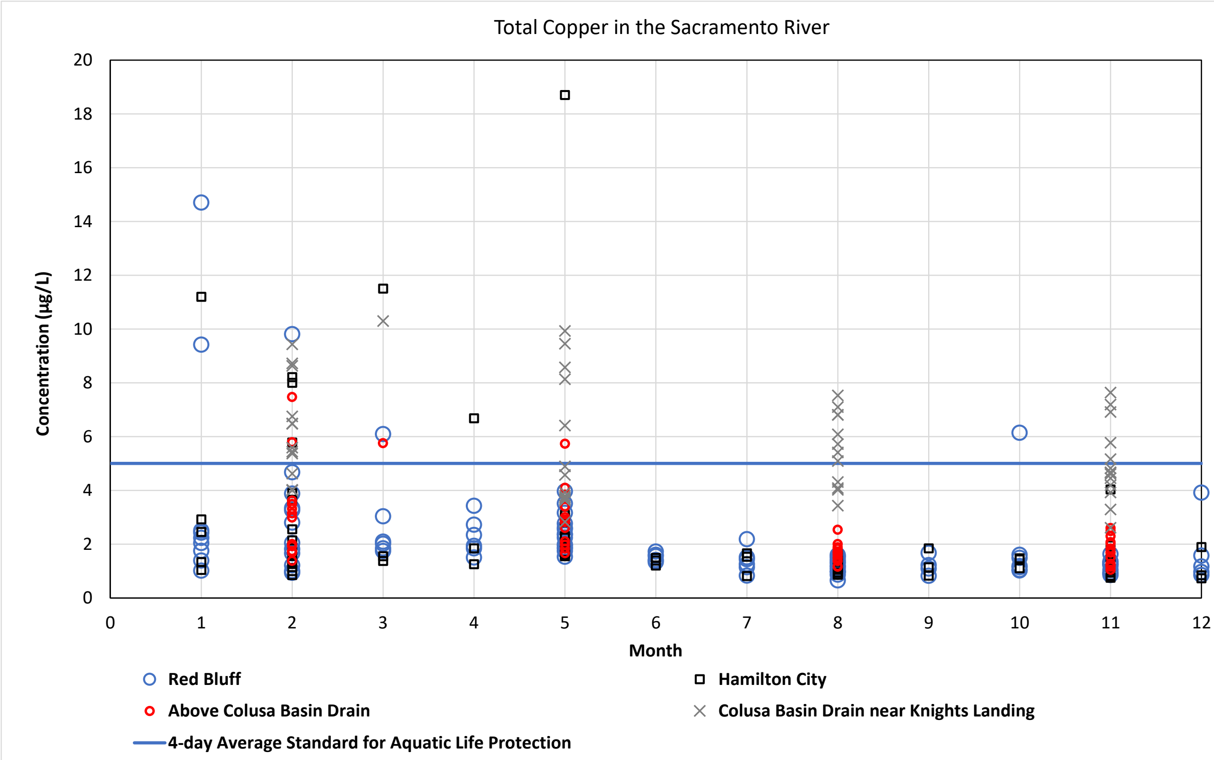

Figure 6E-4. Measured Total Copper in the Sacramento River and Colusa Basin Drain

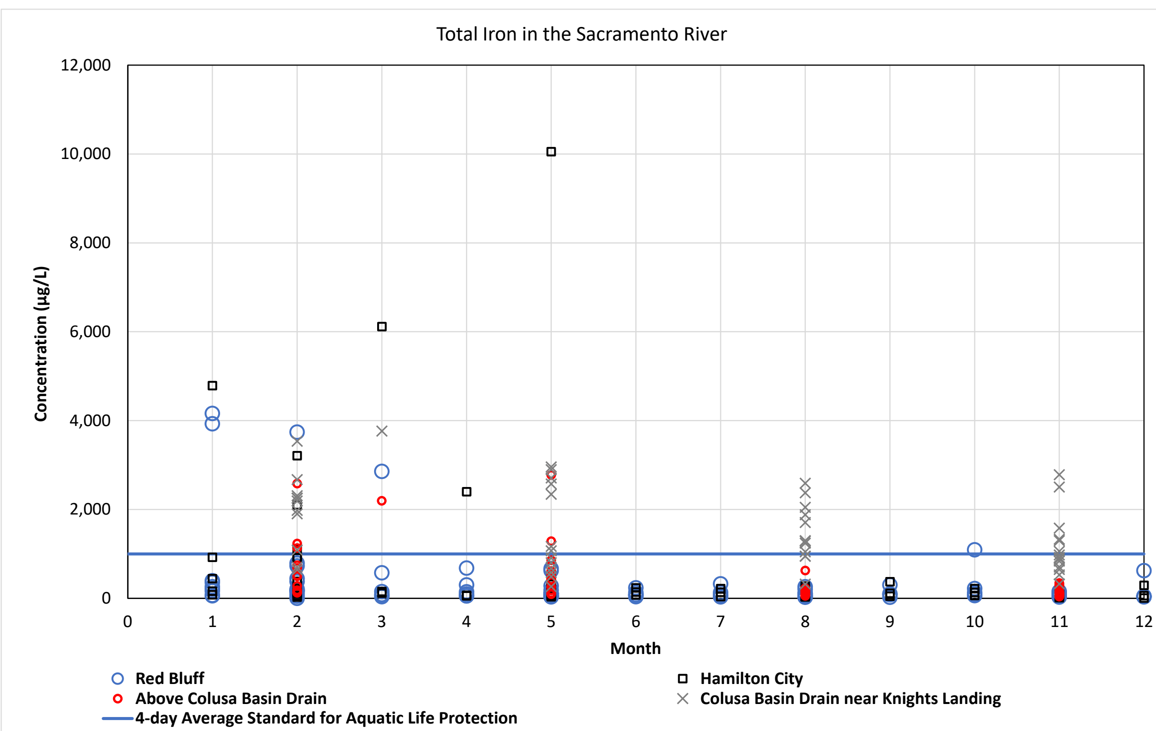

Figure 6E-5. Measured Total Iron in the Sacramento River and Colusa Basin Drain

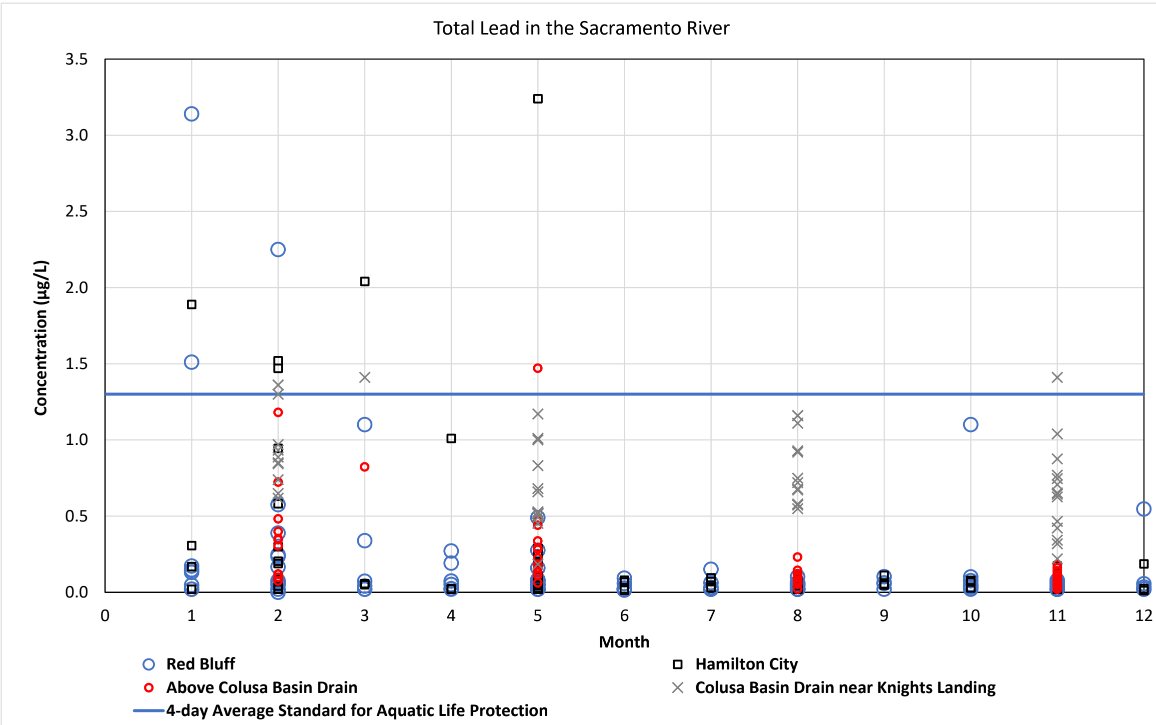

Figure 6E-6. Measured Total Lead in the Sacramento River and Colusa Basin Drain

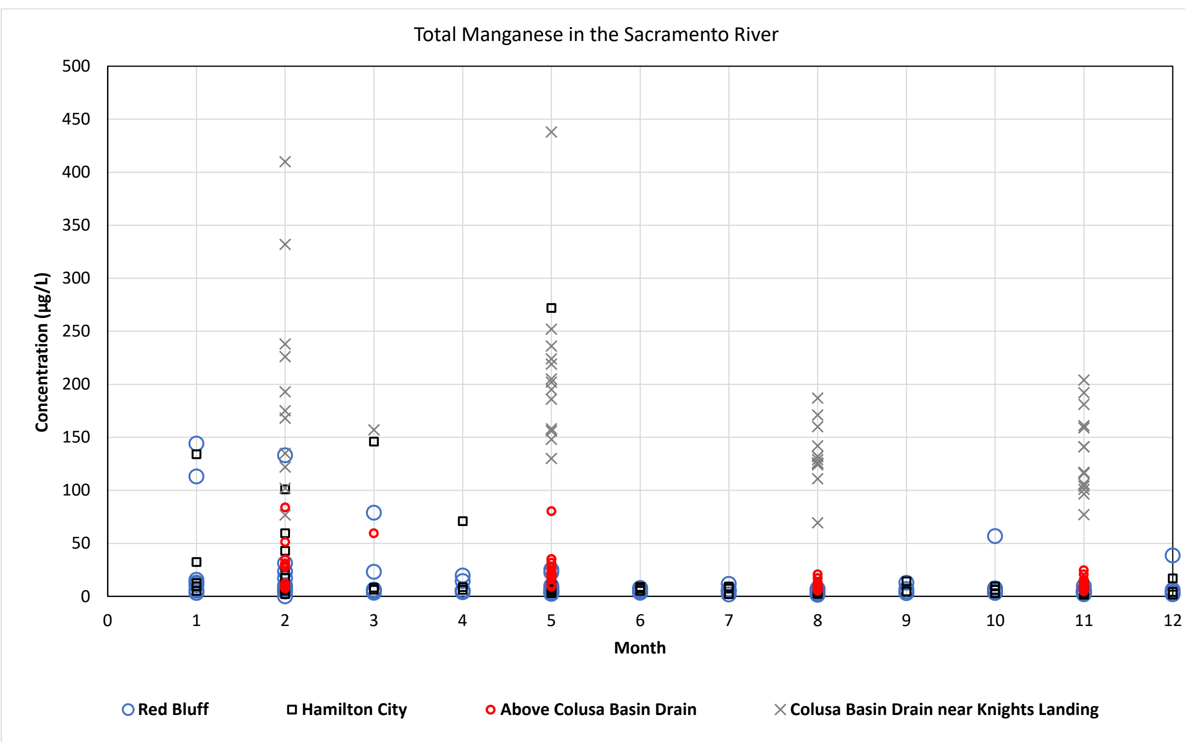

Figure 6E-7. Measured Total Manganese in the Sacramento River and Colusa Basin Drain

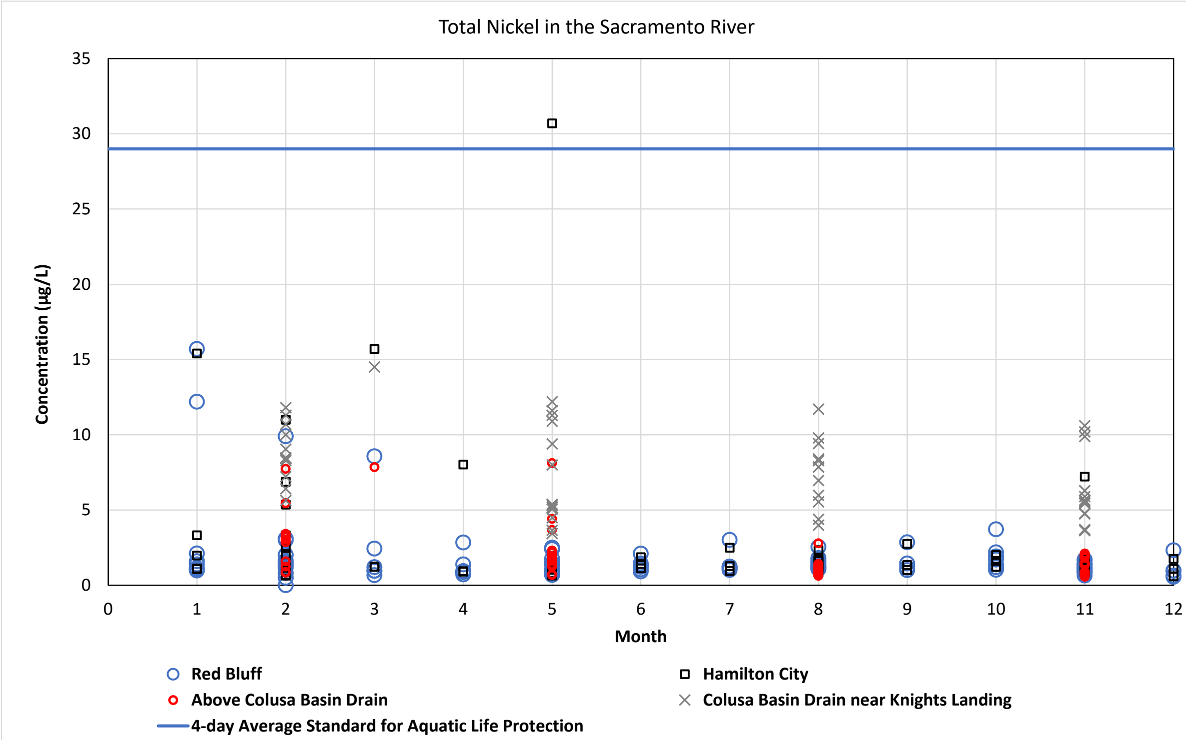

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Figure 6E-8. Measured Total Nickel in the Sacramento River and Colusa Basin Drain

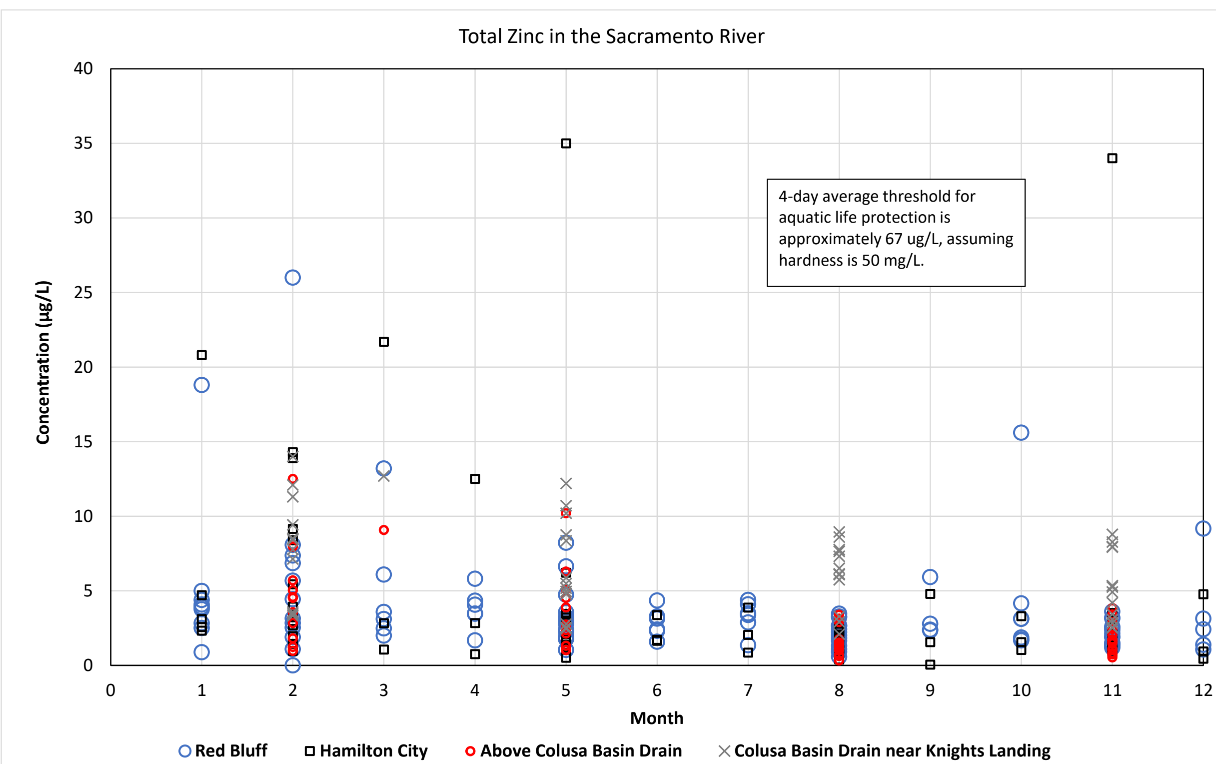

Figure 6E-9. Measured Total Zinc in the Sacramento River and Colusa Basin Drain

6E.3 Metals Data Tables

The following tables provide a summary of the total metal concentrations presented in the figures above along with a summary of the concentrations of dissolved metals (measurements of filtered samples). Tables are also provided for metal concentrations in Stone Corral Creek near Sites (WDL station A0043500) and in groundwater samples from wells in the Sites Reservoir inundation area (DWR 2007).

Table 6E-2. Metal Concentrations (µg/L) Reported in the DWR Water Data Library for the Sacramento River below Red Bluff (Stations A0275890 and A0275500)

Metal/Metalloid	Count	Minimum	Average	Maximum
Dissolved Aluminum	101	1.1	81.1	1459
Total Aluminum	103	11.9	283.6	3630
Dissolved Arsenic	101	0.41	1.23	1.96
Total Arsenic	103	0.70	1.34	2.06
Dissolved Cadmium	101	0.0025	0.0428	0.0500
Total Cadmium	103	0.0025	0.0443	0.0810
Dissolved Chromium	101	0.1	0.6	2.8
Total Chromium	103	0.2	1.1	10.3
Dissolved Copper	101	0.58	1.42	6.99
Total Copper	104	0.65	2.10	14.70
Dissolved Iron	101	0.8	52.1	878
Total Iron	103	22.3	297.0	4160
Dissolved Lead	101	0.002	0.032	0.575
Total Lead	103	0.014	0.166	3.14
Dissolved Manganese	101	0.1	1.3	13.5
Total Manganese	103	1.3	11.9	144
Dissolved Nickel	101	0.4	1.2	13.2
Total Nickel	103	0.5	1.8	15.7
Dissolved Selenium	101	0.05	1.71	160
Total Selenium	103	0.07	0.17	0.88
Dissolved Silver	101	0.0005	0.0133	0.04
Total Silver	103	0.0005	0.0178	0.1255
Dissolved Zinc	101	0.09	1.05	7.63
Total Zinc	103	0.58	3.66	26

Note:
Values less than detection limits were assumed to equal half the detection limit.
Data collected May 2003 through November 2017. Data search was for 2000 – 2020.

Table 6E-3. Metal Concentrations (µg/L) Reported in the DWR Water Data Library for the Sacramento River at Hamilton City (station A0263000)

Metal/Metalloid	Count	Minimum	Average	Maximum
Dissolved Aluminum	77	0.2	134.6	2887
Total Aluminum	80	6.0	438.5	6686
Dissolved Arsenic	77	0.86	1.66	2.70
Total Arsenic	80	1.15	1.87	4.07
Dissolved Cadmium	77	0.0025	0.0399	0.0500
Total Cadmium	80	0.0025	0.0426	0.0920
Dissolved Chromium	77	0.1	0.7	5.0
Total Chromium	80	0.2	1.7	18.9
Dissolved Copper	77	0.50	1.26	4.26
Total Copper	80	0.73	2.33	18.70
Dissolved Iron	77	0.1	90.0	1773
Total Iron	80	7.8	520.6	10052
Dissolved Lead	77	0.002	0.038	0.648
Total Lead	80	0.011	0.222	3.24
Dissolved Manganese	77	0.1	2.0	23.2
Total Manganese	80	1.6	17.6	272
Dissolved Nickel	77	0.4	1.1	4.69
Total Nickel	80	0.6	2.5	30.7
Dissolved Selenium	77	0.07	0.13	0.36
Total Selenium	80	0.03	0.17	0.49
Dissolved Silver	77	0.0005	0.0125	0.0385
Total Silver	80	0.0005	0.0419	2.11
Dissolved Zinc	77	0.05	0.80	5.79
Total Zinc	80	0.05	4.02	35

Note: Values less than detection limits were assumed to equal half the detection limit.
Data collected November 2003 through November 2017. Data search was for 2000 - 2020.

Table 6E-4. Metal Concentrations (µg/L) Reported in the DWR Water Data Library for the Sacramento River above Colusa Basin Drain (station A0223002)

Metal/Metalloid	Count	Minimum	Average	Maximum
Dissolved Aluminum	52	0.2	57.4	560
Total Aluminum	55	24.2	343.0	2750
Dissolved Arsenic	52	1.29	1.92	3.30
Total Arsenic	55	1.31	2.09	3.32
Dissolved Cadmium	52	0.0040	0.0463	0.0500
Total Cadmium	55	0.0035	0.0466	0.1080
Dissolved Chromium	52	0.0	0.5	1.8
Total Chromium	55	0.0	1.3	5.5
Dissolved Copper	52	0.79	1.37	2.64
Total Copper	55	1.04	2.42	7.47
Dissolved Iron	52	0.1	57.8	503
Total Iron	55	36.3	425.0	2776
Dissolved Lead	52	0.002	0.041	0.3
Total Lead	55	0.020	0.221	1.47
Dissolved Manganese	52	0.1	1.7	17.9
Total Manganese	55	4.6	19.4	83.8
Dissolved Nickel	52	0.3	1.0	2.84
Total Nickel	55	0.6	2.0	8.12
Dissolved Selenium	52	0.09	0.16	0.64
Total Selenium	55	0.09	0.19	0.95
Dissolved Silver	52	0.0005	0.0141	0.02
Total Silver	55	0.0005	0.0159	0.0725
Dissolved Zinc	52	0.05	0.46	1.93
Total Zinc	55	0.32	2.95	12.5

Note: Values less than detection limits were assumed to equal half the detection limit.
Data collected November 2003 through November 2017. Data search was for 2000 - 2020.

Table 6E-5. Metal Concentrations (µg/L) Reported in the DWR Water Data Library for Colusa Basin Drain near Knights Landing (station A0294710)

Metal/Metalloid	Count	Minimum	Average	Maximum
Dissolved Aluminum	48	0.3	66.2	743
Total Aluminum	51	125.0	1021.6	3444
Dissolved Arsenic	48	2.26	4.24	7.40
Total Arsenic	51	3.03	4.75	7.77
Dissolved Cadmium	48	0.0040	0.0585	0.6760
Total Cadmium	51	0.0035	0.0570	0.6870
Dissolved Chromium	48	0.0	0.7	4.1
Total Chromium	51	0.2	3.7	9.4
Dissolved Copper	48	1.60	2.94	4.33
Total Copper	51	2.61	5.72	10.30
Dissolved Iron	48	2.4	104.3	767
Total Iron	51	265.0	1544.8	3762
Dissolved Lead	48	0.002	0.061	0.356
Total Lead	51	0.184	0.775	1.41
Dissolved Manganese	48	0.2	14.1	269
Total Manganese	51	69.4	168.4	438
Dissolved Nickel	48	1.4	3.2	5.45
Total Nickel	51	3.4	7.6	14.5
Dissolved Selenium	48	0.10	0.43	0.92
Total Selenium	51	0.10	0.53	1.25
Dissolved Silver	48	0.0005	0.0164	0.092
Total Silver	51	0.0005	0.0190	0.111
Dissolved Zinc	48	0.16	0.80	2.82
Total Zinc	51	2.09	6.45	14

Note: Values less than detection limits were assumed to equal half the detection limit.
Data collected November 2003 through November 2017. Data search was for 2000 - 2020.

Table 6E-6. Metal Concentrations (µg/L) Reported in the DWR Water Data Library for Stone Corral Creek near Sites (WDL station A0043500)

Metal/Metalloid	Count	Minimum	Average	Maximum
Dissolved Aluminum	40	0.66	149.49	1991
Total Aluminum	40	1.46	562.07	6149
Dissolved Arsenic	40	0.682	2.76	8.84
Total Arsenic	40	0.774	3.10	9.96
Dissolved Cadmium	40	0.001	0.05	0.187
Total Cadmium	40	0.001	0.06	0.524
Dissolved Chromium	40	0.21	2.92	8.1
Total Chromium	40	0.47	4.05	11
Dissolved Copper	40	0.69	2.78	5.45
Total Copper	40	0.83	3.93	14.9
Dissolved Iron	40	0.7	122.52	1370
Total Iron	40	1.79	512.06	7420
Dissolved Lead	40	0.006	0.08	0.782
Total Lead	40	0.008	0.31	2.91
Dissolved Manganese	40	0.14	12.36	63.4
Total Manganese	40	1.34	36.60	203
Dissolved Nickel	40	1.2	2.83	8
Total Nickel	40	1.38	4.02	15.8
Dissolved Selenium	40	0.26	6.15	30
Total Selenium	40	0.38	6.74	30.4
Dissolved Silver	40	0.0005	0.03	0.131
Total Silver	40	0.0025	0.05	0.347
Dissolved Zinc	40	0.46	1.40	6.47
Total Zinc	40	0.64	3.70	24.9

Note: Values less than detection limits were assumed to equal half the detection limit.
Data collected May 2003 through January 2011. Searched for all data available.

Table 6E-7. Metal Concentrations (µg/L) Reported from Groundwater 15 Wells in the Sites Reservoir Inundation Area during 2005 (DWR 2007)

Metal/Metalloid	Count	Minimum	Average	Maximum
Dissolved Aluminum	15	0.5	3.02	15.2
Total Aluminum	15	0.57	12.04	89
Dissolved Arsenic	15	0.259	0.68	2.02
Total Arsenic	15	0.284	0.80	2.63
Dissolved Cadmium	15	0.0045	0.02	0.081
Total Cadmium	15	0.0045	0.05	0.165
Dissolved Chromium	15	0.06	2.61	5.6
Total Chromium	15	0.65	3.31	7.14
Dissolved Copper	15	0.14	2.70	11.1
Total Copper	15	0.21	3.37	16.2
Dissolved Iron	15	1.59	7.28	41
Total Iron	15	0.54	80.72	388
Dissolved Lead	15	0.0045	0.12	0.52
Total Lead	15	0.0135	0.27	1.85
Dissolved Manganese	15	0.06	17.77	107
Total Manganese	15	0.09	20.64	125
Dissolved Nickel	15	0.1	1.04	4.01
Total Nickel	15	0.13	1.26	4.02
Dissolved Selenium	15	1.01	4.55	25.3
Total Selenium	15	1.32	5.03	25.6
Dissolved Silver	15	0.001	0.00	0.014
Total Silver	15	0.0025	0.01	0.026
Dissolved Zinc	15	0.04	112.48	737
Total Zinc	15	0.129	115.19	748

Note: Values less than detection limits were assumed to equal half the detection limit.

6E.4 Metals Data Versus Flow

The following graphs were created to evaluate the relationship between flow and total metal concentrations. Flow in the Sacramento River at Keswick (USGS Station 11370500) was used to represent magnitude of flow and the ratio of flow in the Sacramento River at Keswick to flow in the Sacramento River at Bend Bridge (USGS station 11377100) was used to indicate the amount of runoff from local tributaries (with a lower number indicating more runoff from local tributaries). The first graph below shows the relationship between these two metrics.

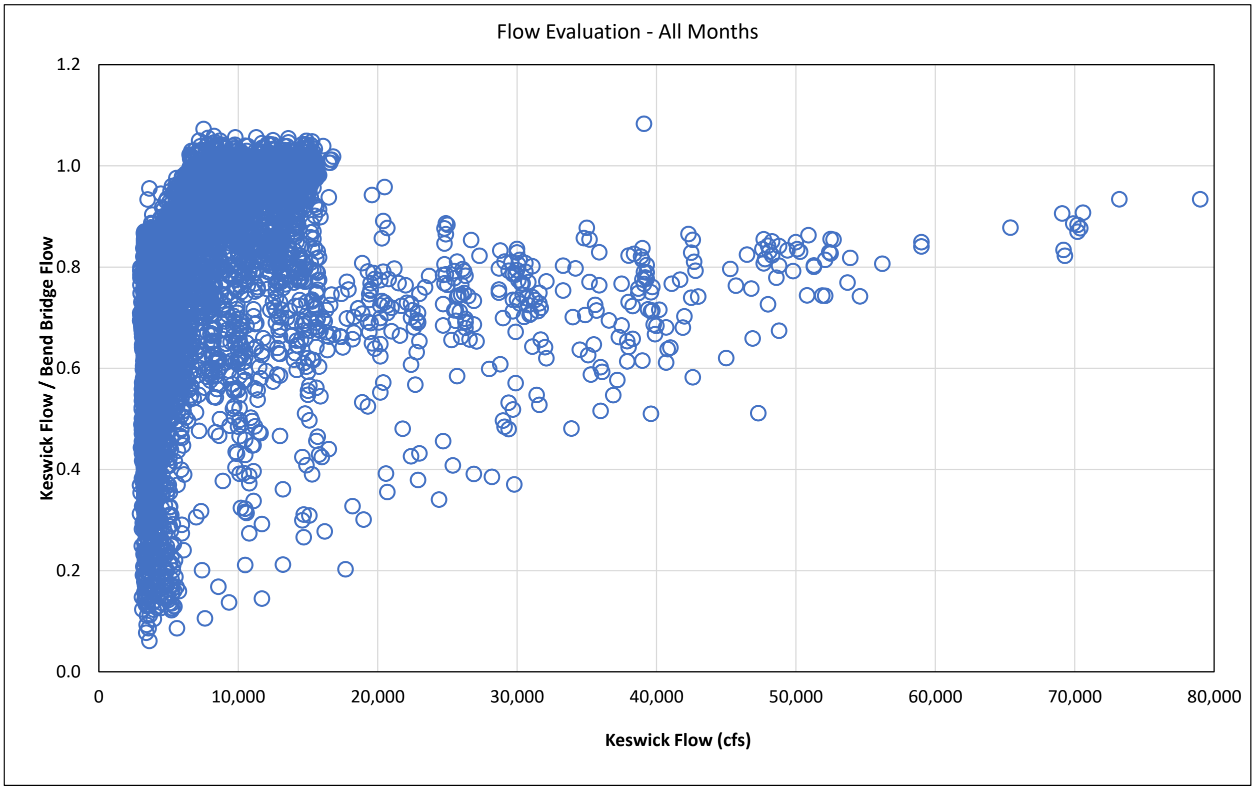

Figure 6E-10. Relationship between Measured Sacramento River Flow at Keswick and an Indicator of Local Runoff (Keswick Flow / Sacramento River flow at Bend Bridge)

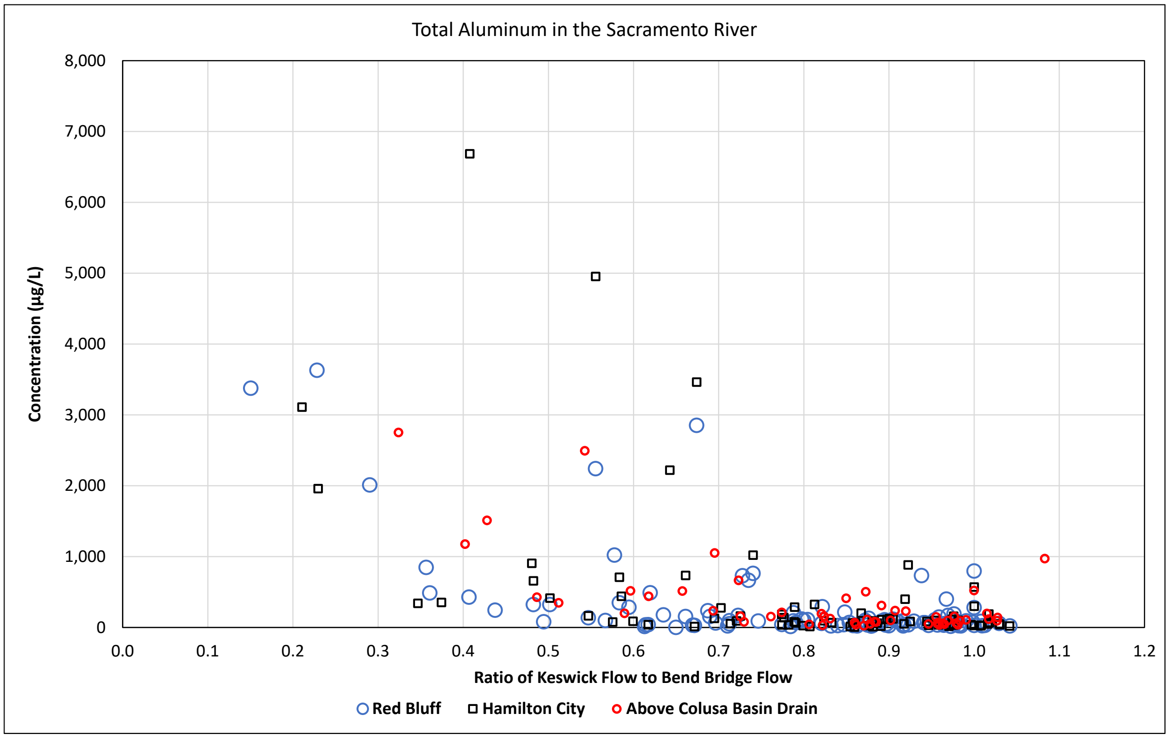

Figure 6E-11. Relationship between Indicator of Local Runoff and Concentration of Measured Total Aluminum in the Sacramento River

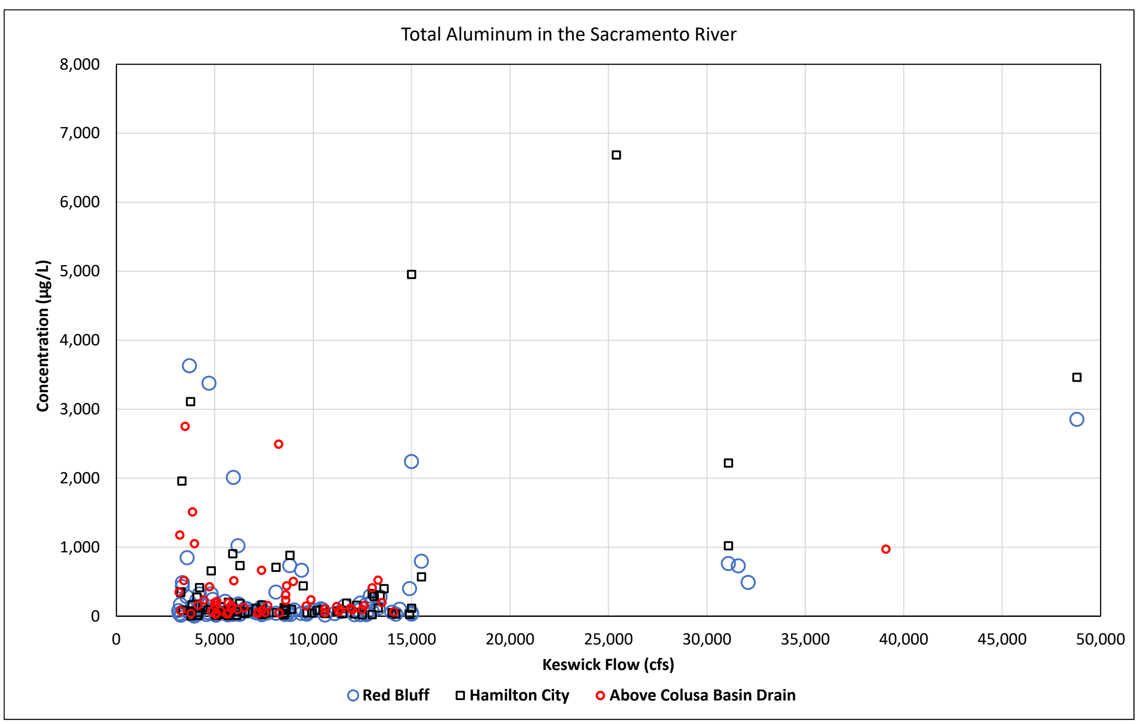

Figure 6E-12. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Aluminum in the Sacramento River

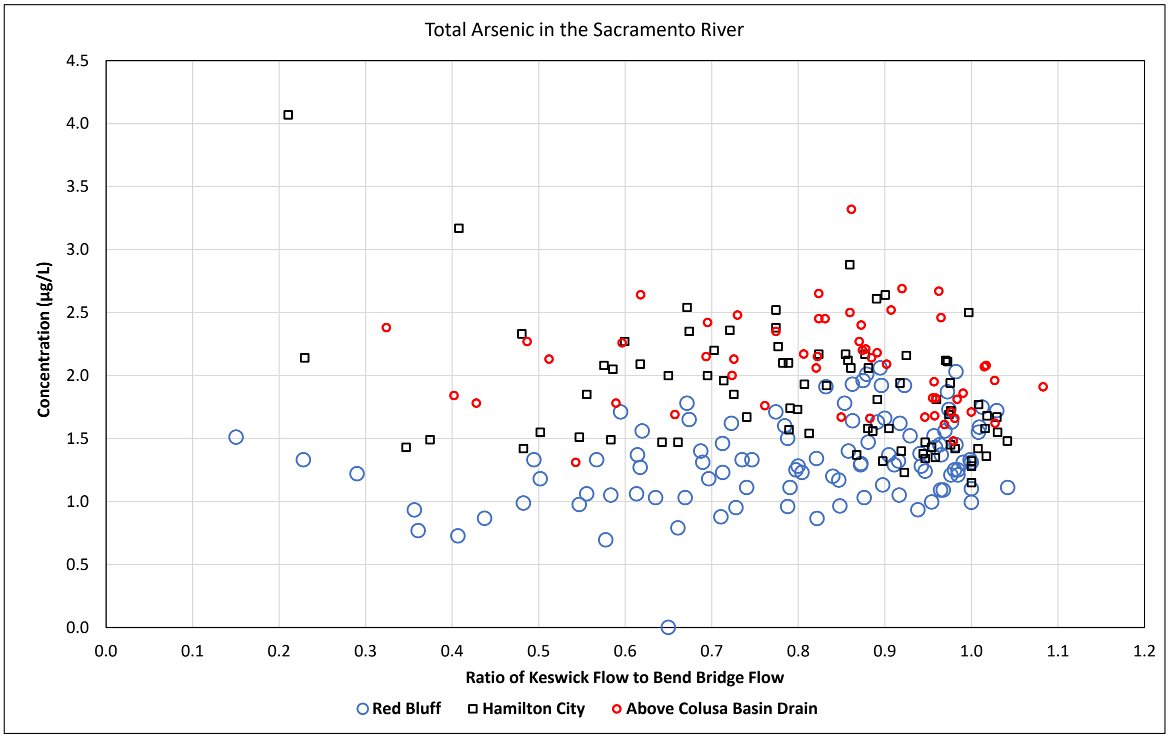

Figure 6E-13. Relationship between Indicator of Local Runoff and Concentration of Measured Total Arsenic in the Sacramento River

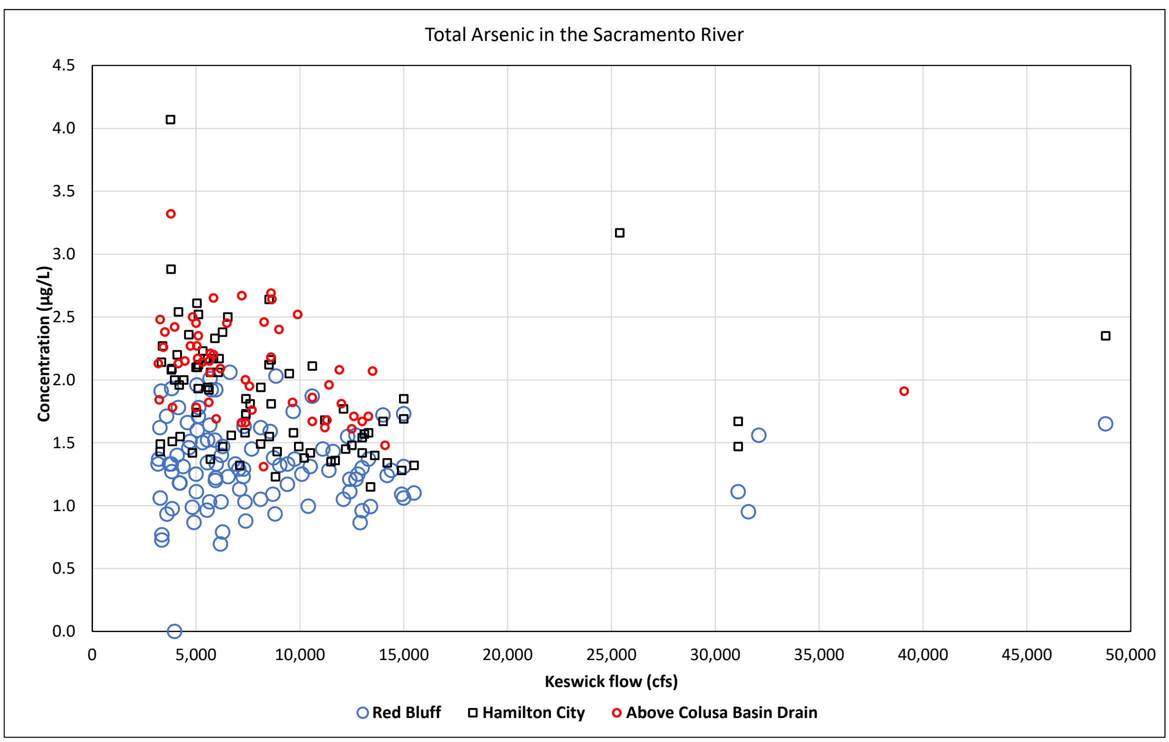

Figure 6E-14. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Arsenic in the Sacramento River

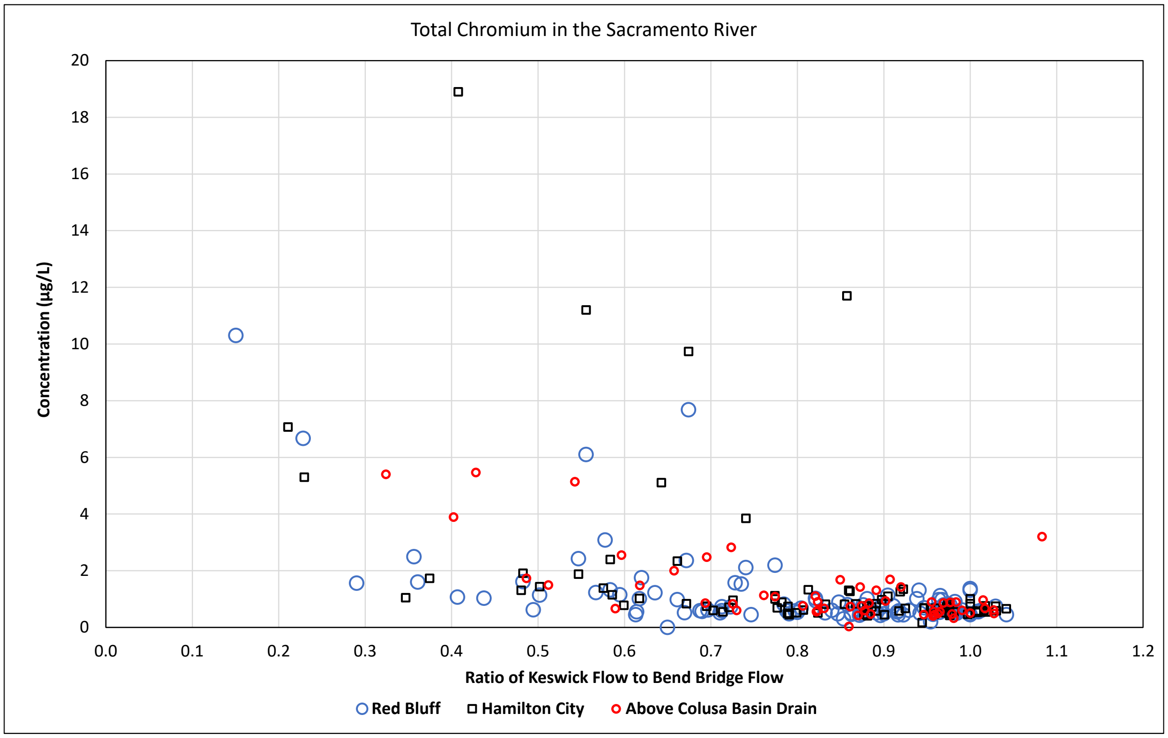

Figure 6E-15. Relationship between Indicator of Local Runoff and Concentration of Measured Total Aluminum in the Sacramento River

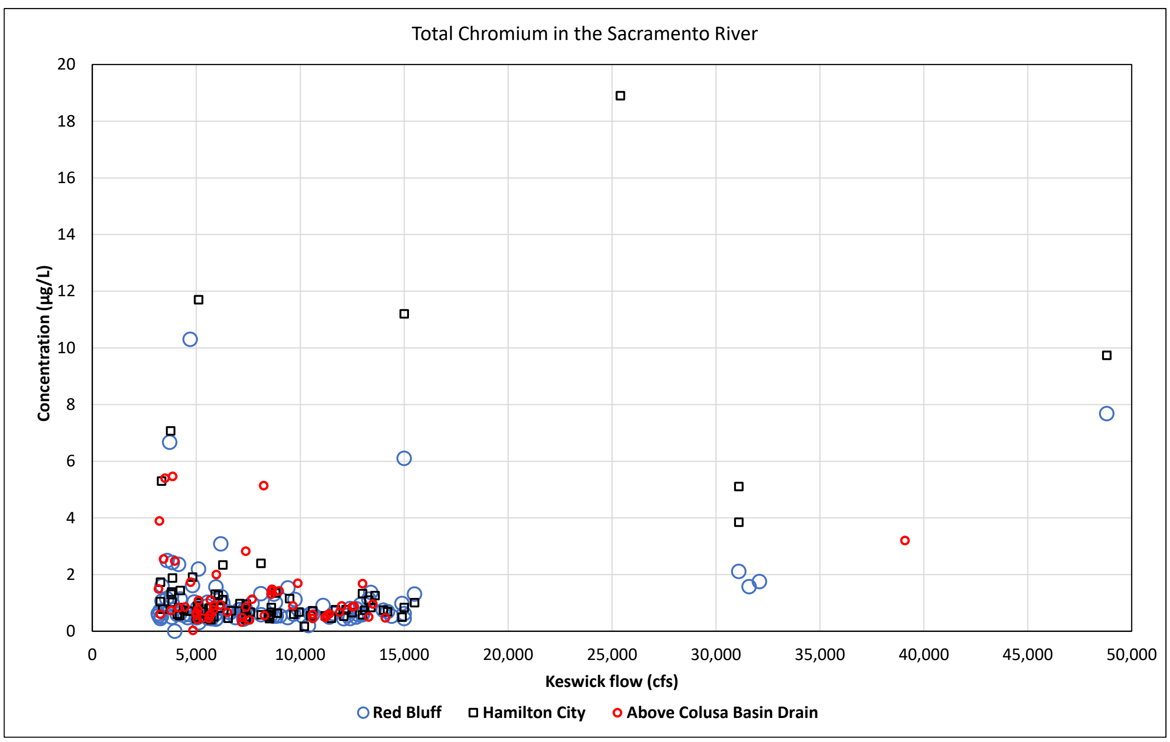

Figure 6E-16. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Chromium in the Sacramento River

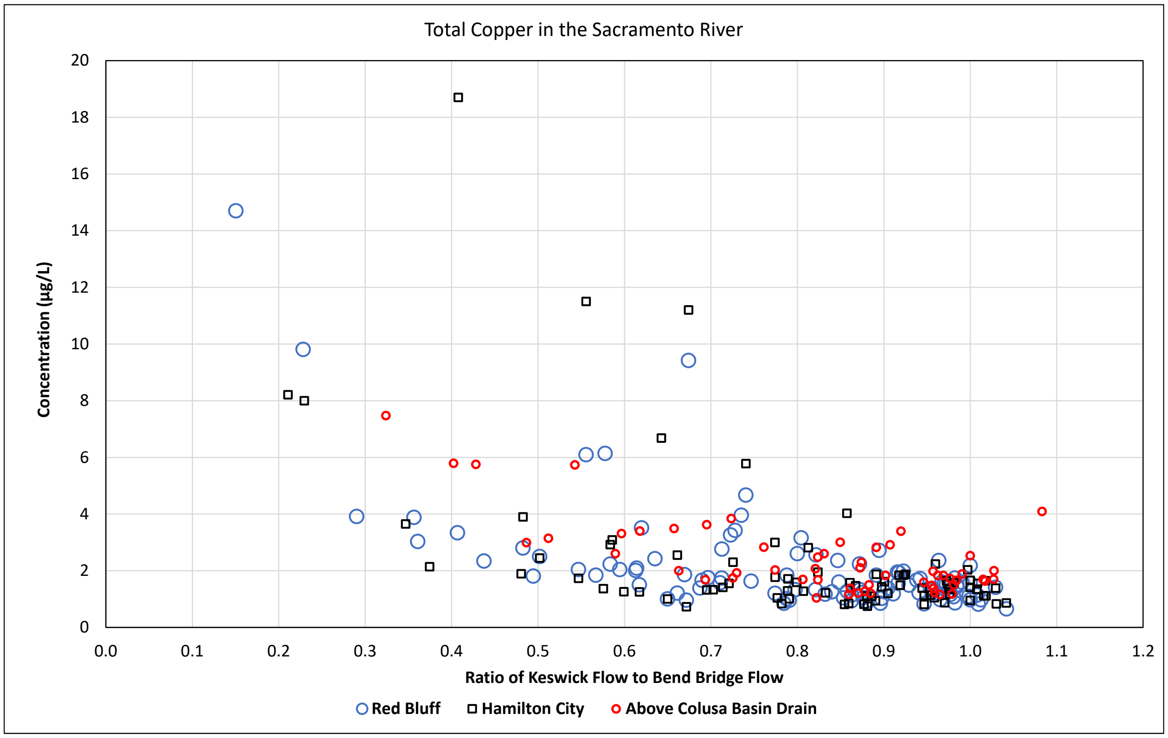

Figure 6E-17. Relationship between Indicator of Local Runoff and Concentration of Measured Total Copper in the Sacramento River

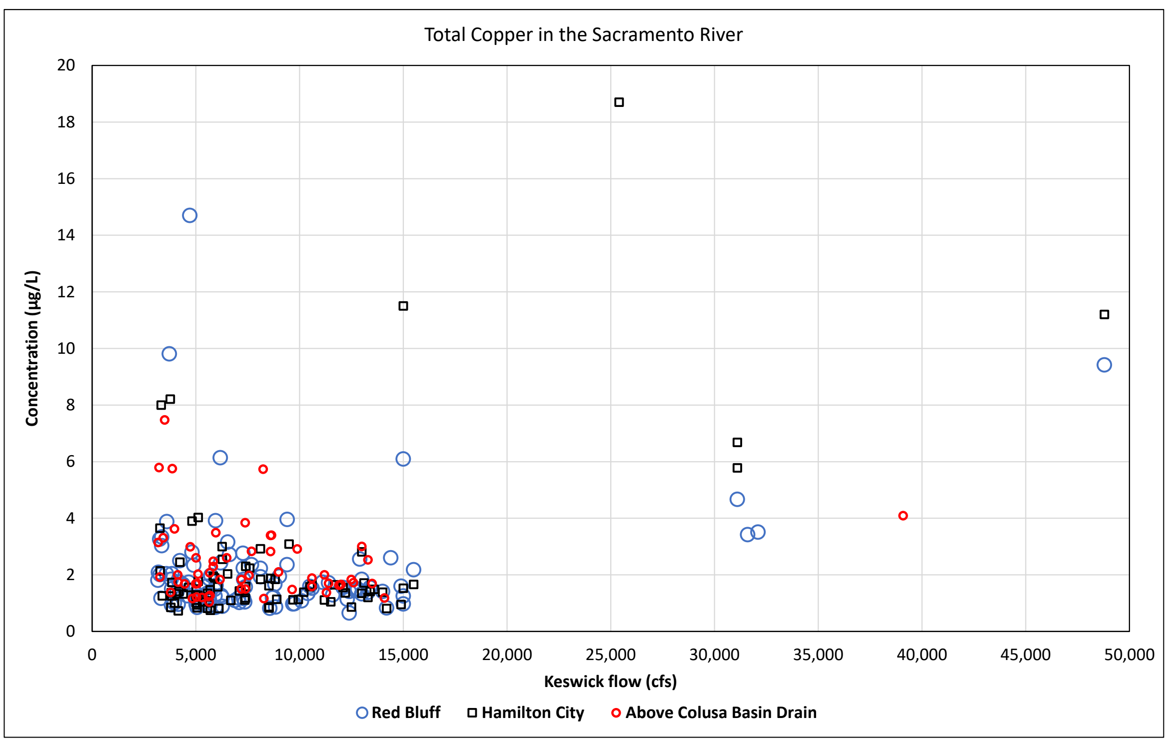

Figure 6E-18. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Copper in the Sacramento River

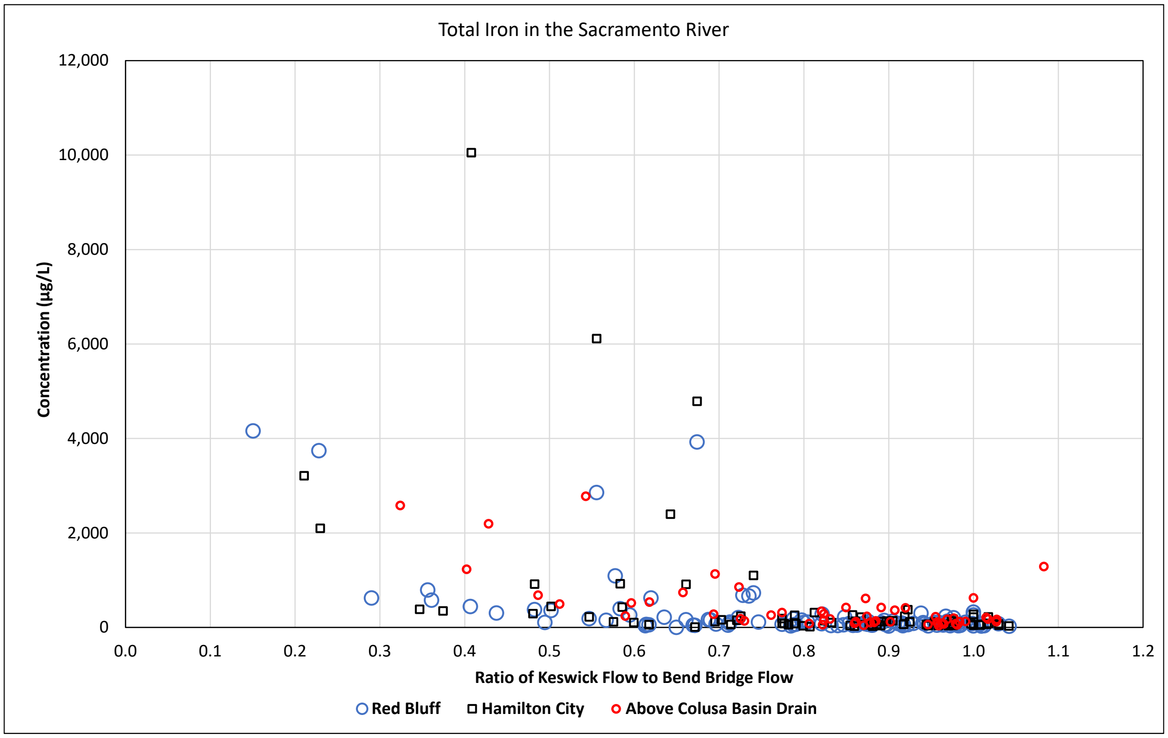

Figure 6E-19. Relationship between Indicator of Local Runoff and Concentration of Measured Total Iron in the Sacramento River

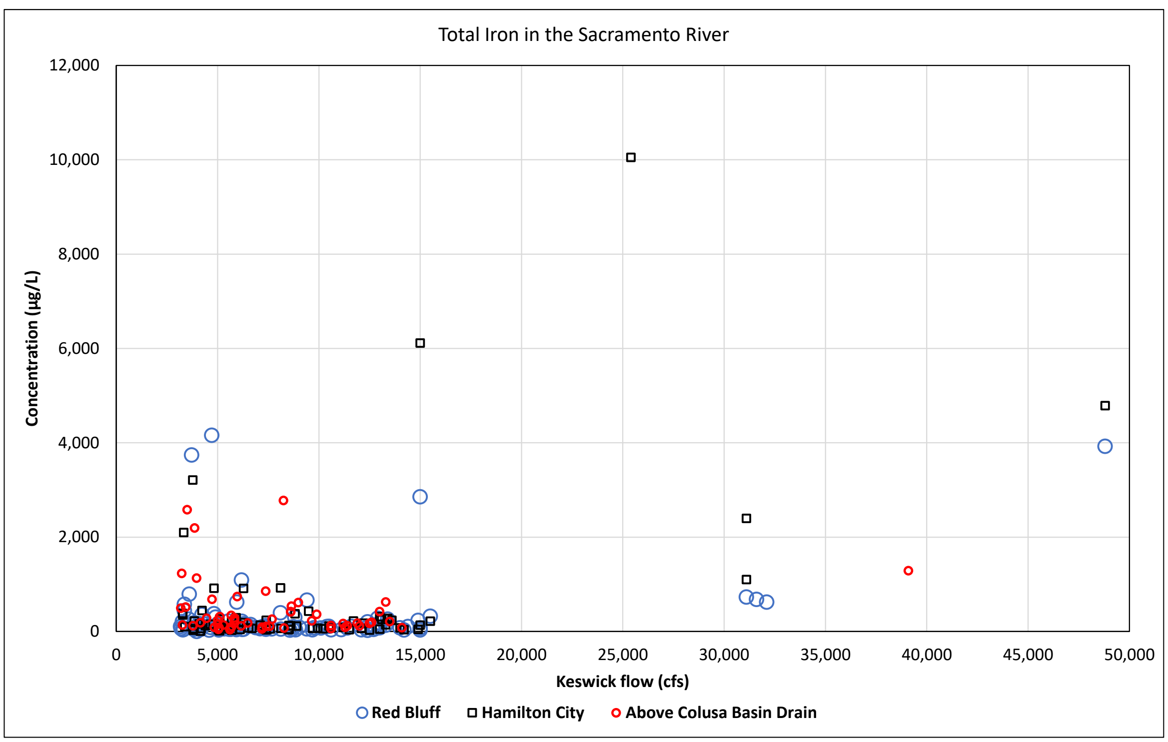

Figure 6E-20. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Iron in the Sacramento River

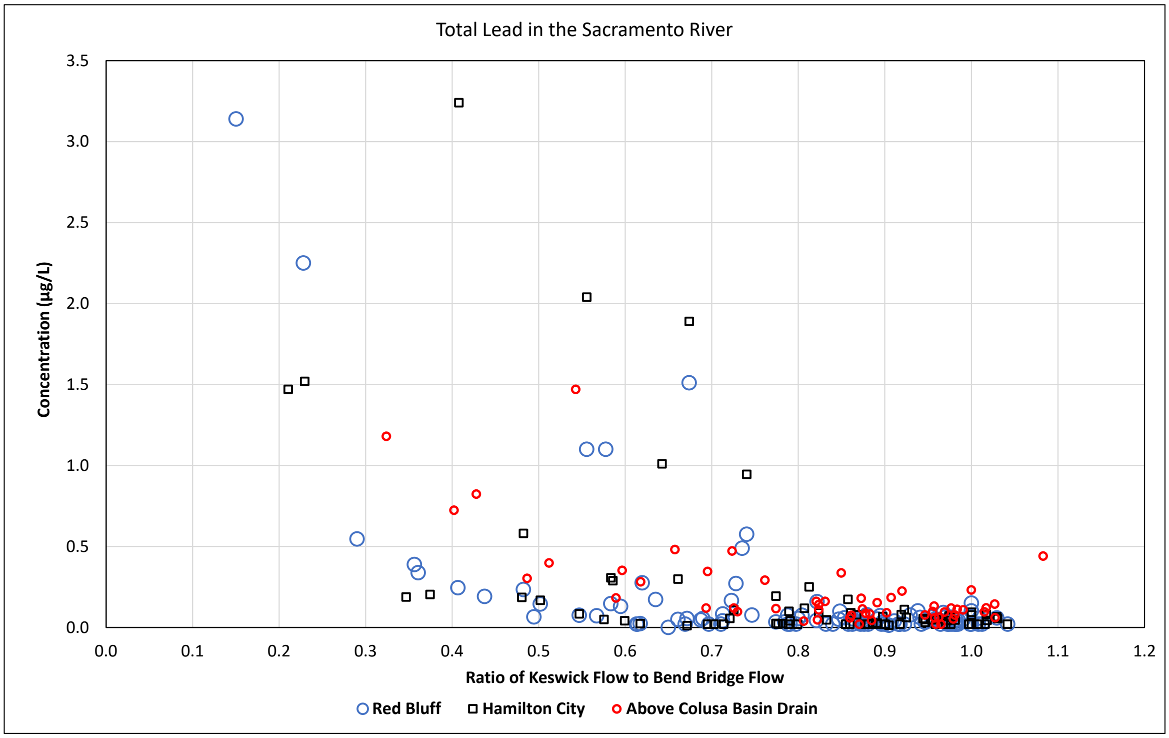

Figure 6E-21. Relationship between Indicator of Local Runoff and Concentration of Measured Total Lead in the Sacramento River

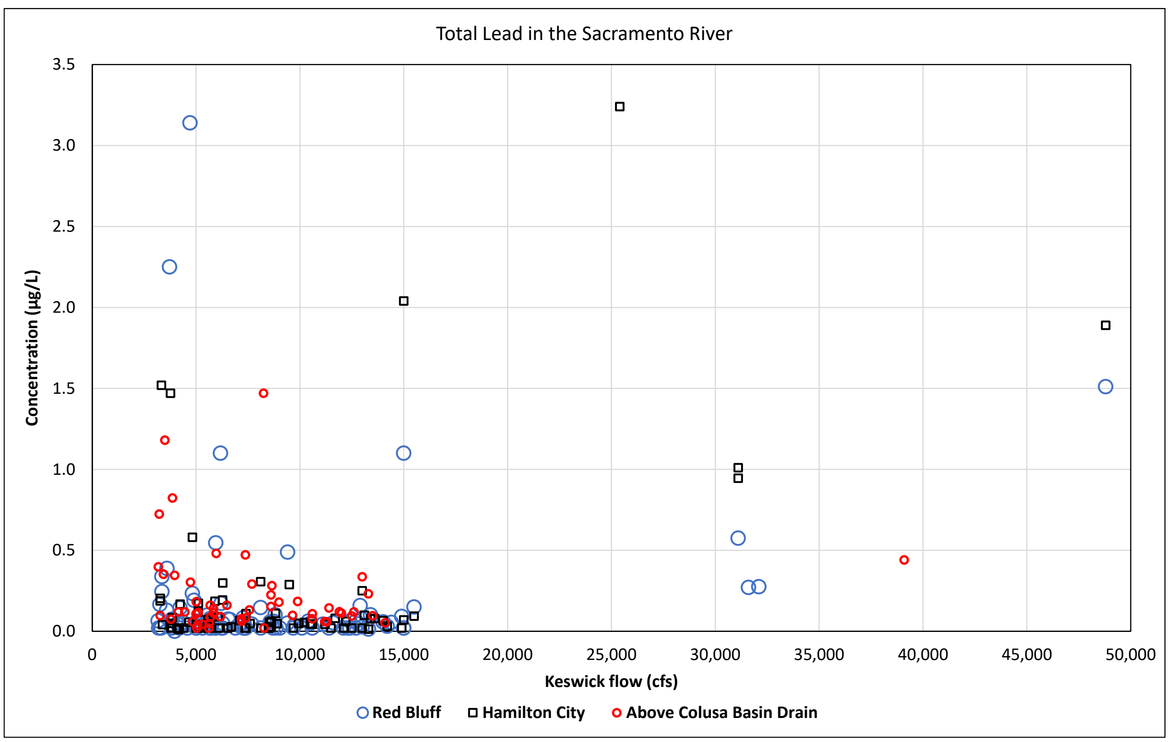

Figure 6E-22. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Lead in the Sacramento River

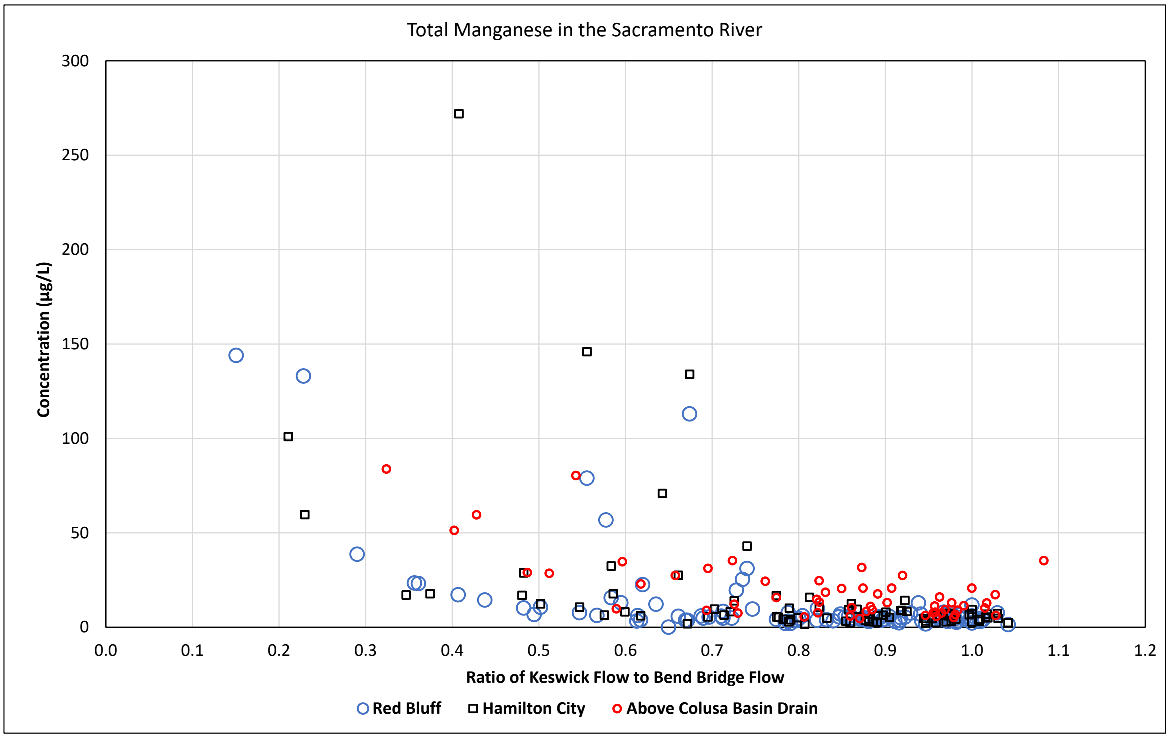

Figure 6E-23. Relationship between Indicator of Local Runoff and Concentration of Measured Total Manganese in the Sacramento River

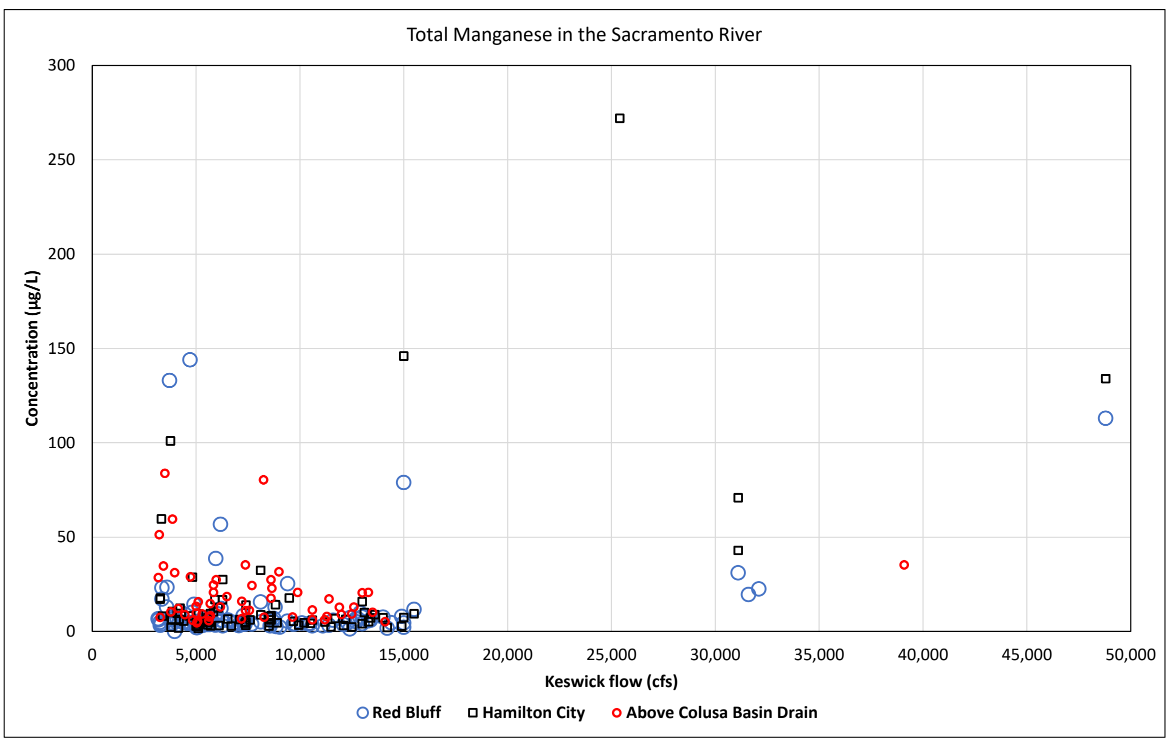

Figure 6E-24. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Manganese in the Sacramento River

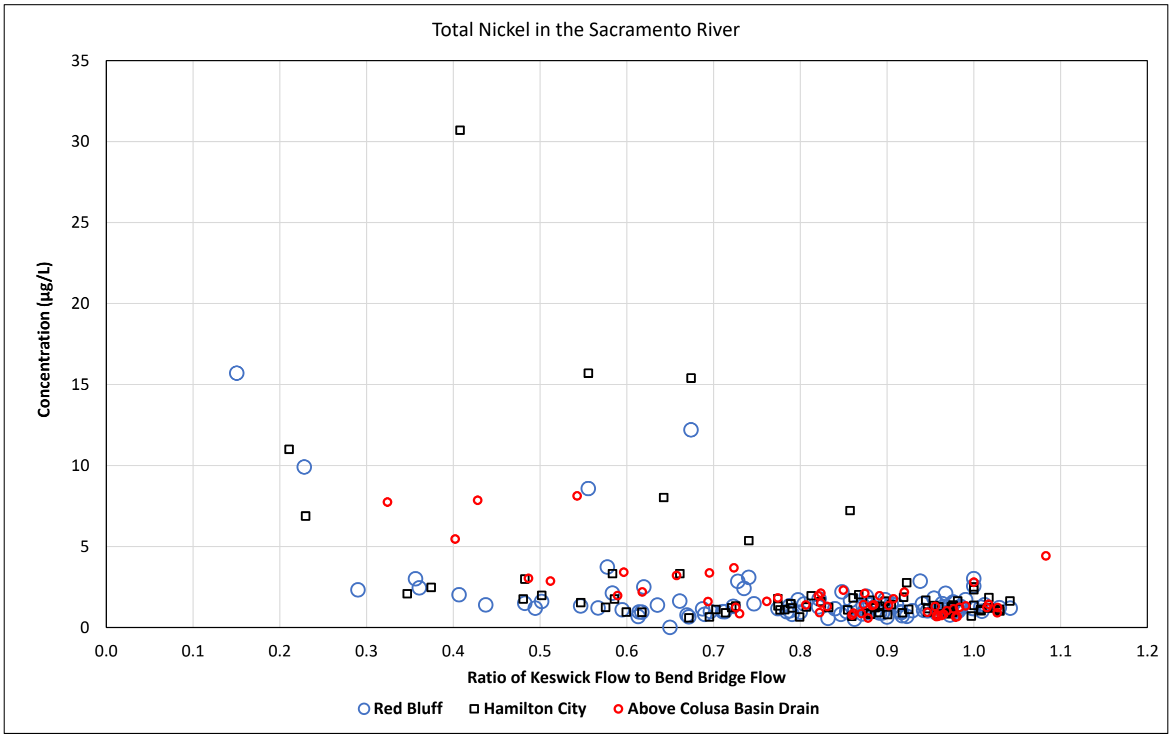

Figure 6E-25. Relationship between Indicator of Local Runoff and Concentration of Measured Total Nickel in the Sacramento River

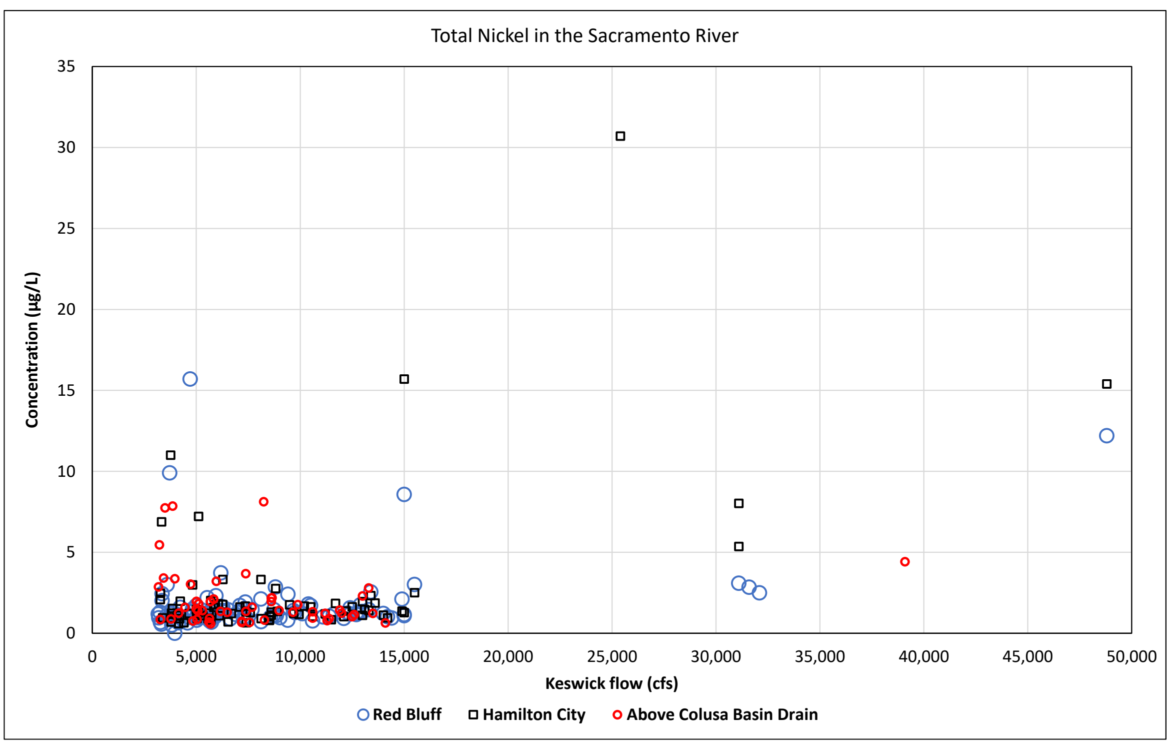

Figure 6E-26. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Nickel in the Sacramento River

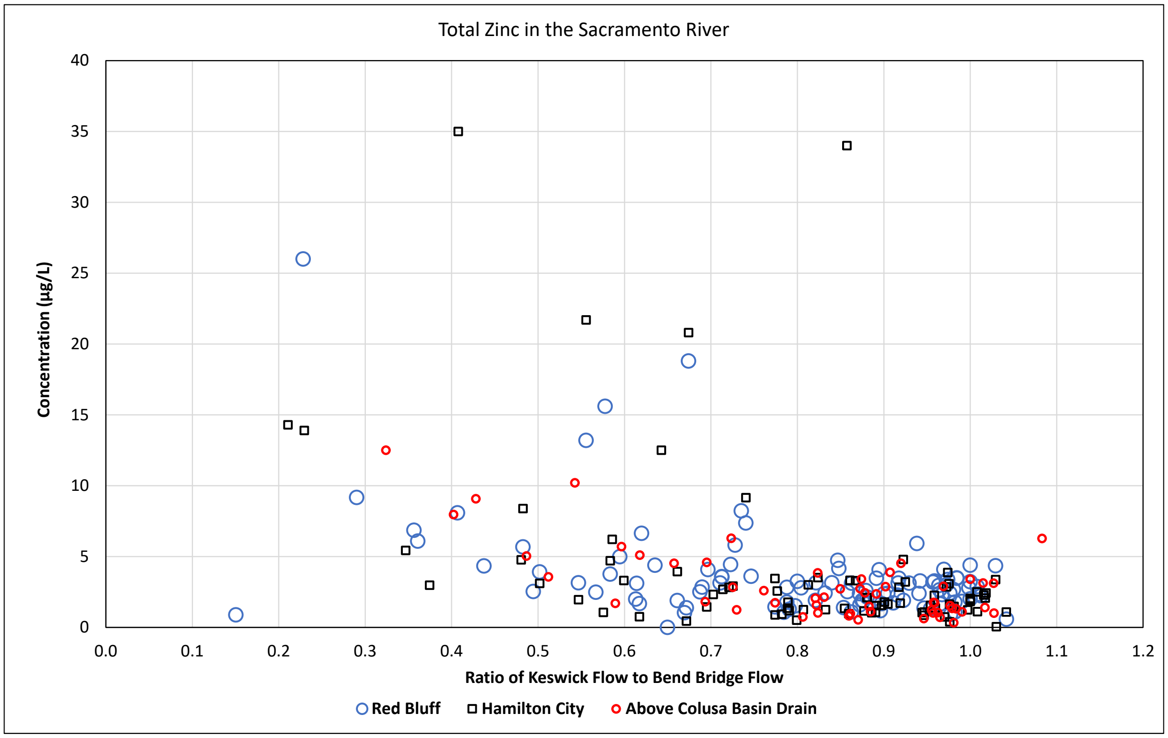

Figure 6E-27. Relationship between Indicator of Local Runoff and Concentration of Measured Total Zinc in the Sacramento River

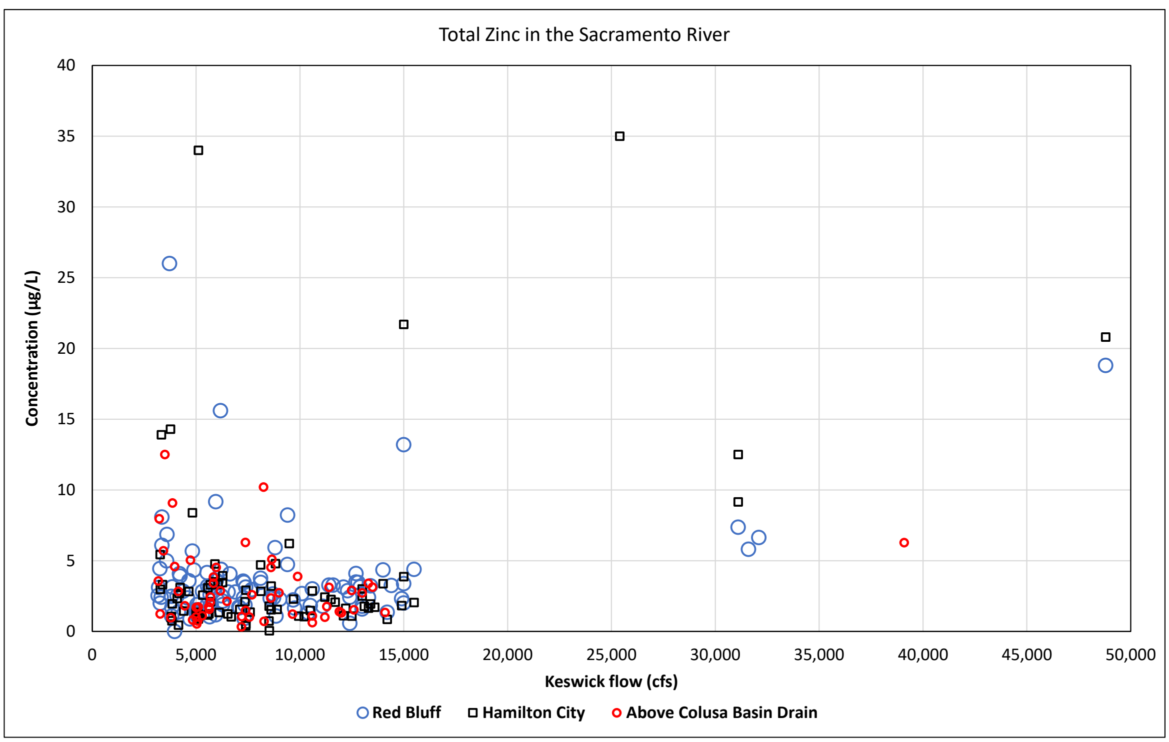

Figure 6E-28. Relationship between Flow in the Sacramento River at Keswick and Measured Concentration of Total Zinc in the Sacramento River

6E.5 Pesticide Data by Month

The graphs below show pesticide data from California Department of Pesticide Regulation's Surface Water Database (SURF), which combines data from multiple sources. Data were downloaded for the period of record from four stations:

- Sacramento River near Hamilton City – Station 04_2
- Sacramento River at Colusa – Station 06_4
- CBD above Knights Landing – Station 57_2, and
- Yolo Bypass Toe Drain near Babel Slough – Station 57_58

The measurements are shown by month in order to show seasonal trends.

Pesticides selected for graphing are those that have been detected in the Central Valley and that have a moderate number of measurements. These include azinphos-methyl, bifenthrin, carbofuran, chlorpyrifos, diazinon, malathion, proponil, and thiobencarb. Additional pesticides considered in the evaluation included chlordane, DDT, dichlorvos, dieldrin, and pyrethroids other than bifenthrin. The SURF database either had no data for these pesticides in the Sacramento River between Knights Landing and Red Bluff (stations at Colusa and near Hamilton City) or all values at these stations were less than detection limits.

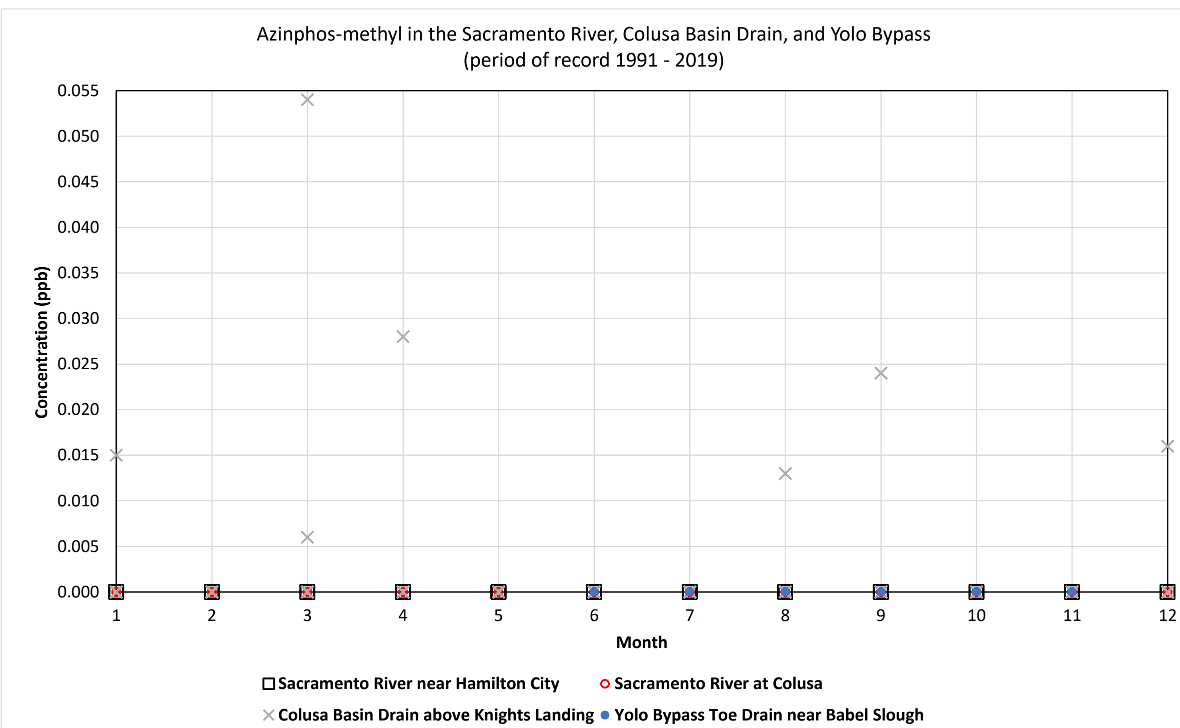

Figure 6E-29. Measured Azinphos-methyl in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

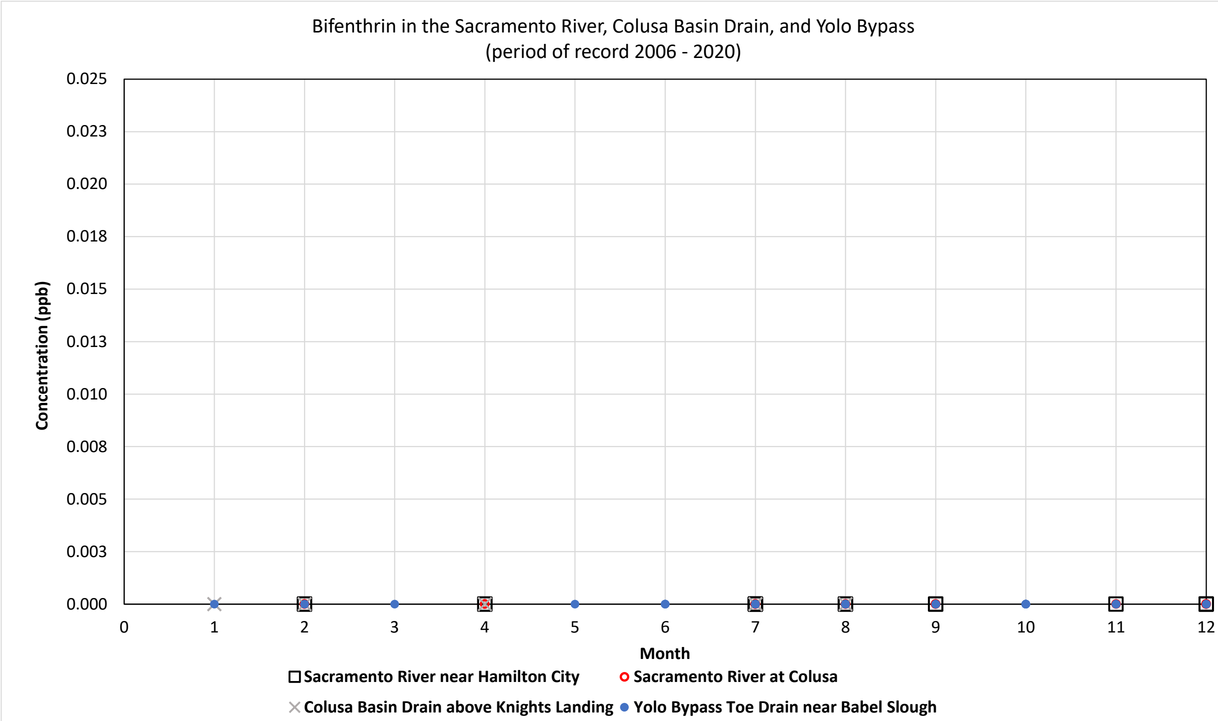

Figure 6E-5-30. Measured Bifenthrin in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

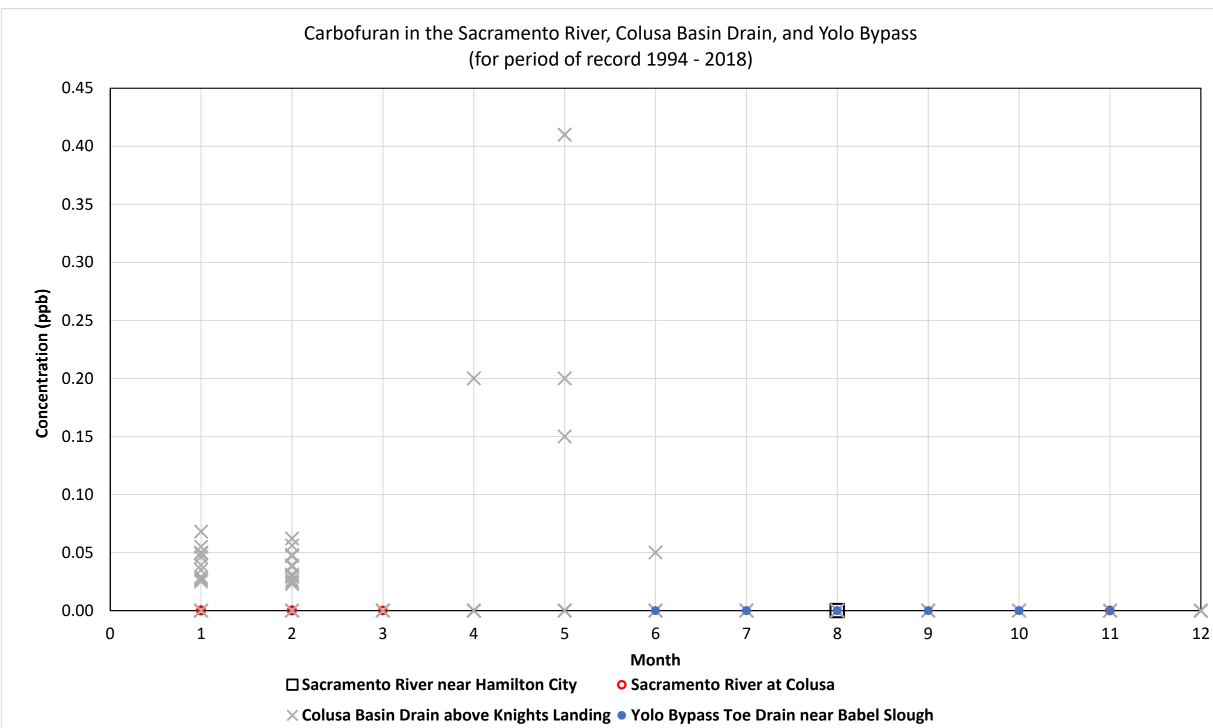

Figure 6E-31. Measured Carbofuran in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

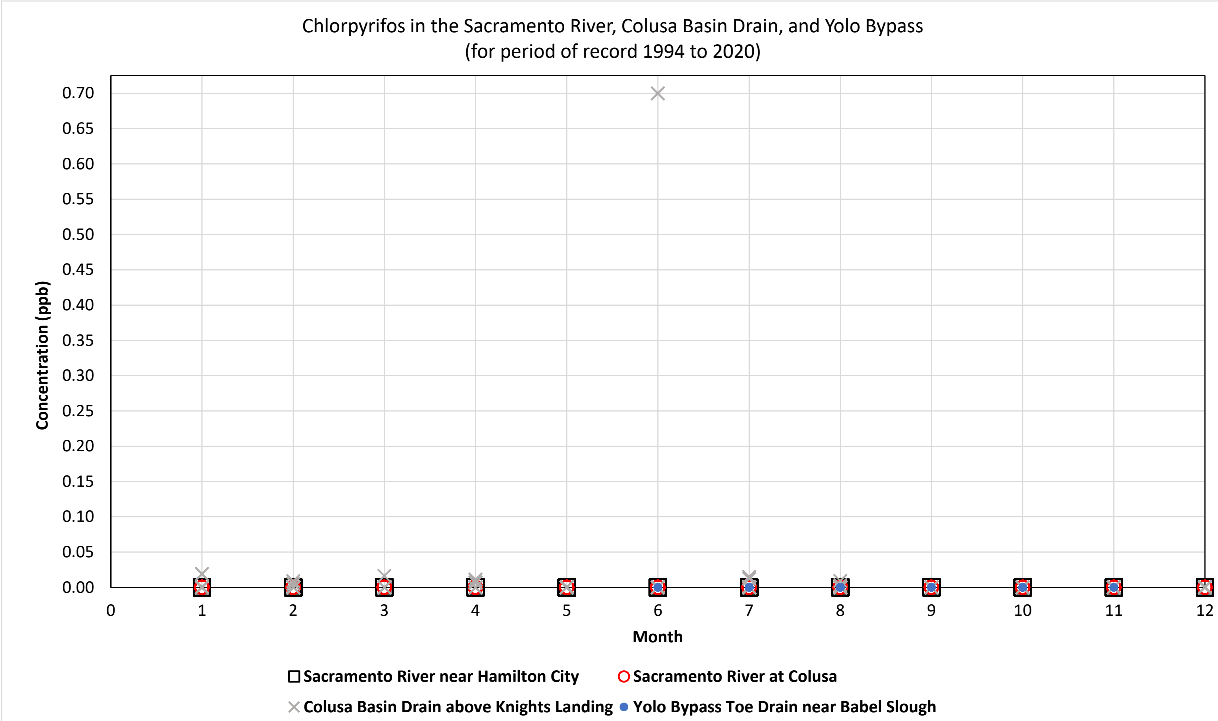

Figure 6E-32. Measured Chlorpyrifos in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

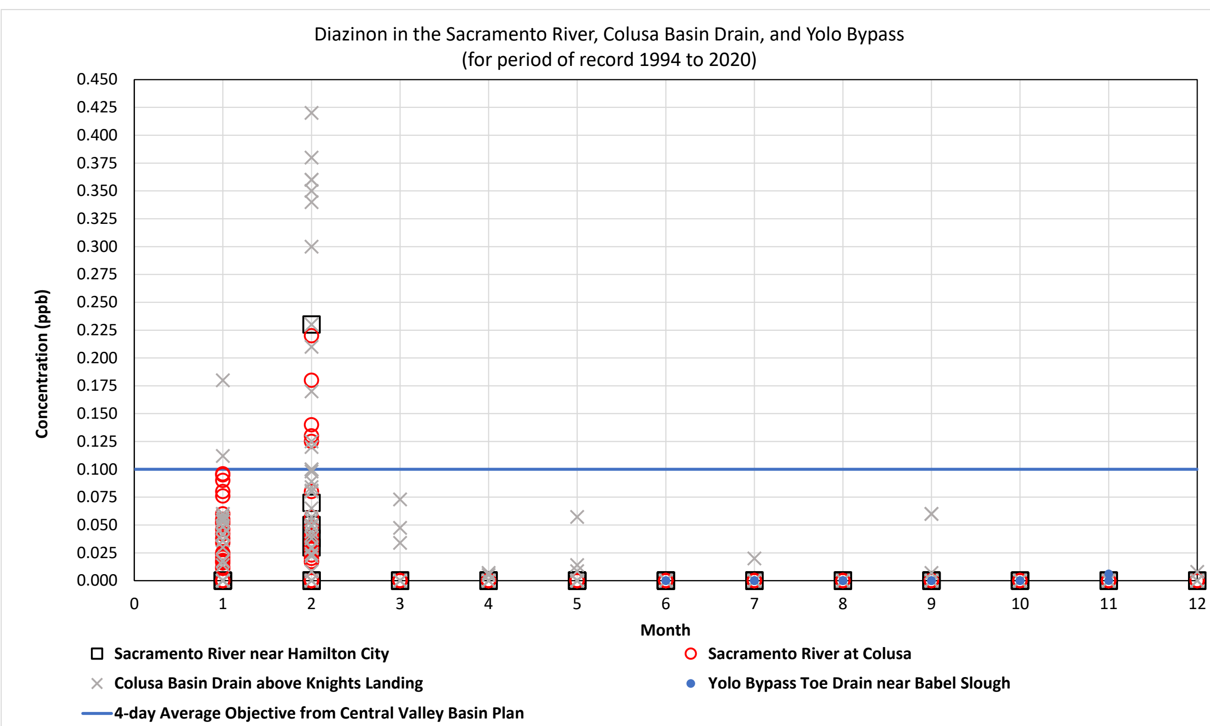

Figure 6E-33. Measured Diazinon in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

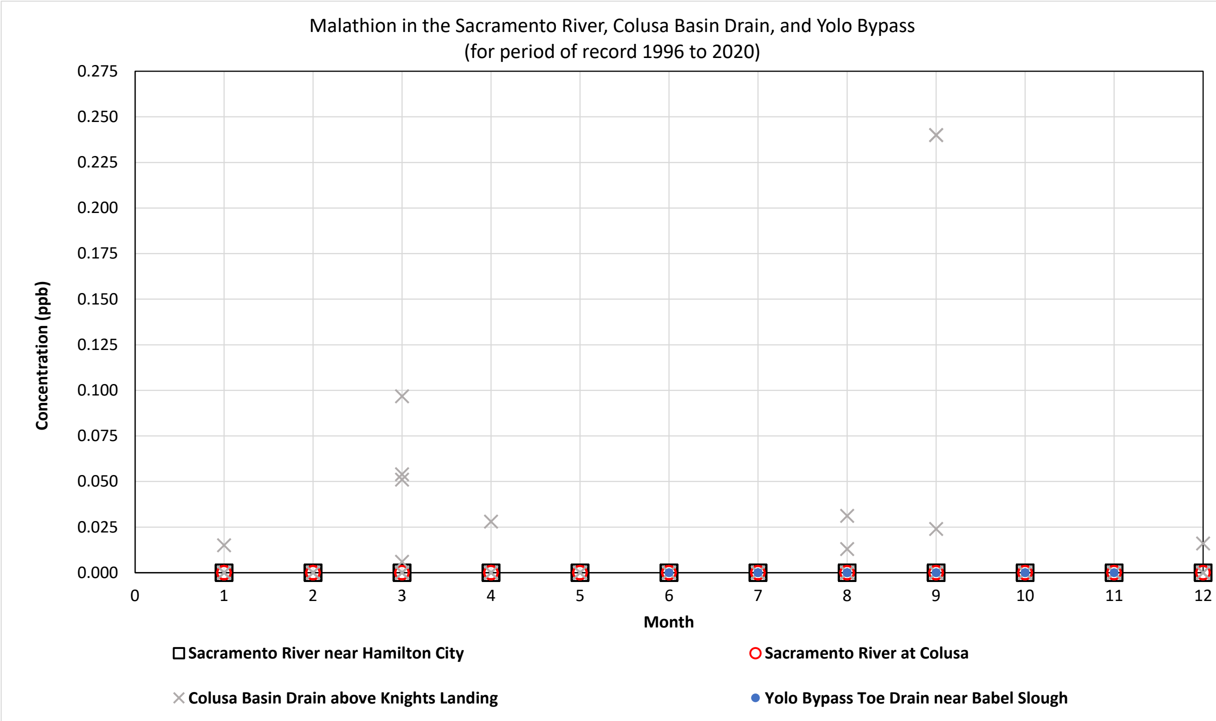

Figure 6E-34. Measured Malathion in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

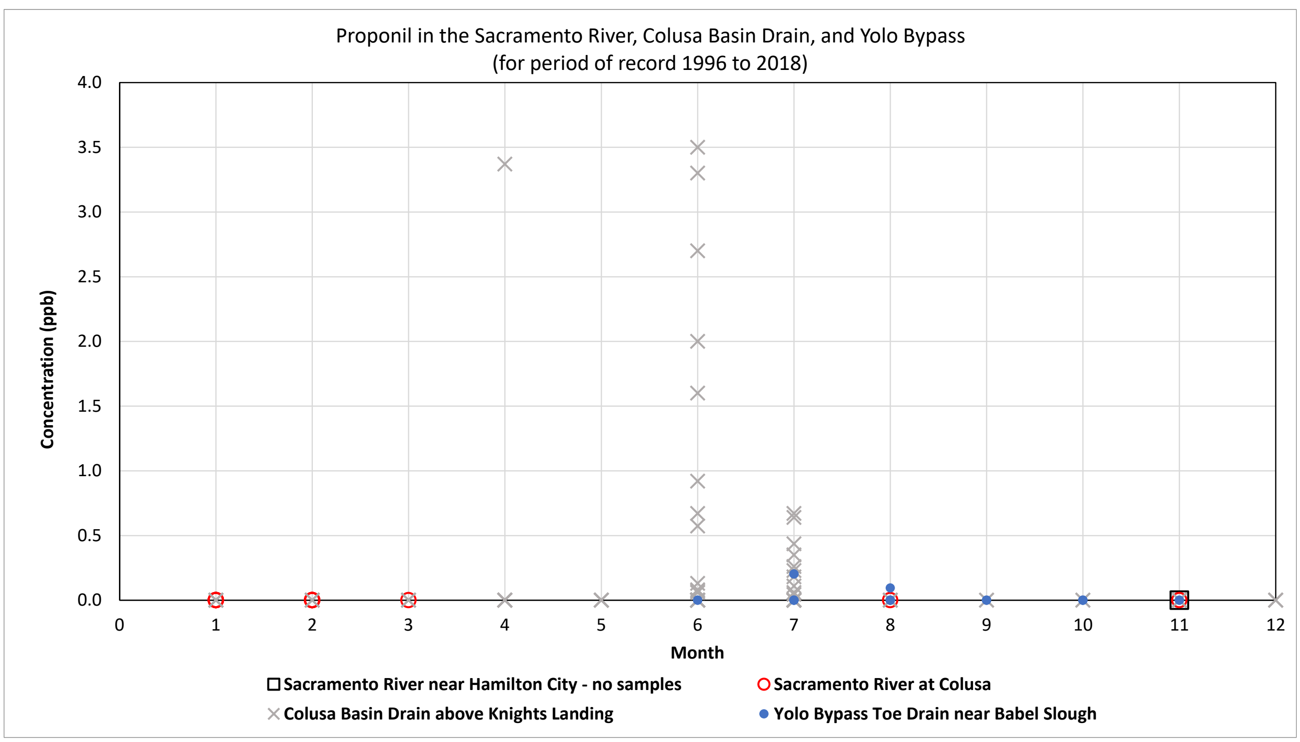

Figure 6E-35. Measured Proponil in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

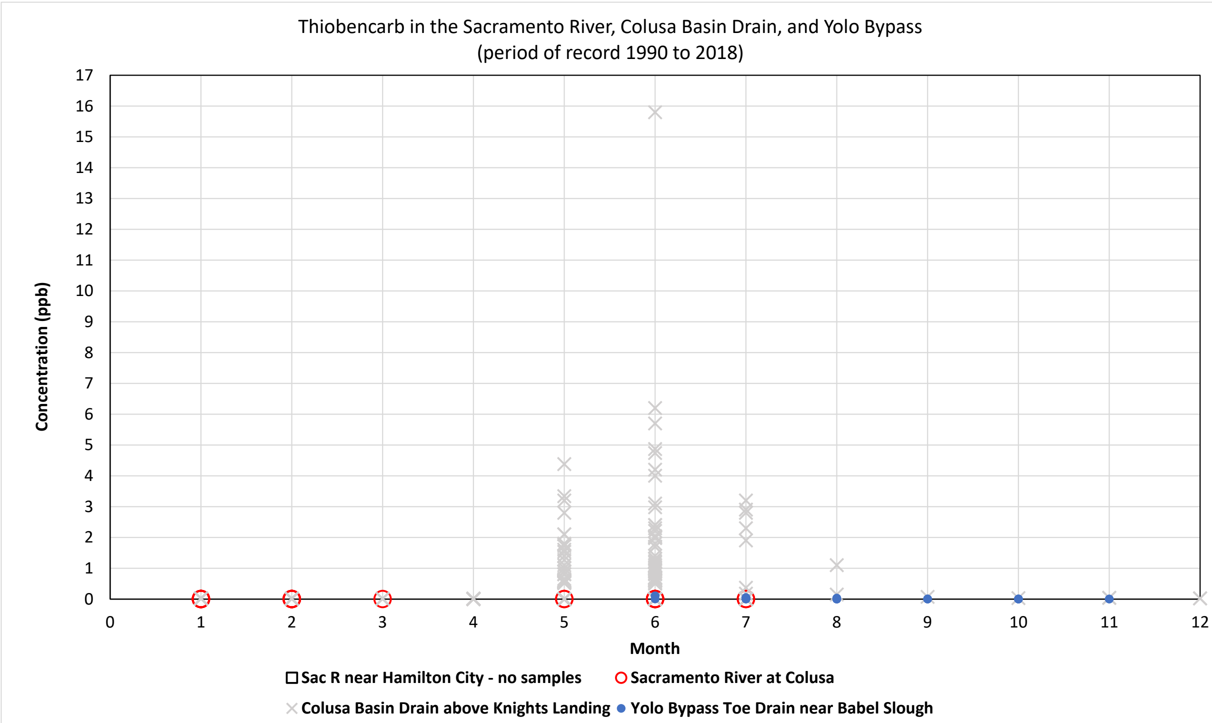

Figure 6E-36. Measured Thiobencarb in the Sacramento River, Colusa Basin Drain, and the Yolo Bypass

6E.6 Nutrients Data by Month

The graphs below show nutrient data from the California Department of Water Resources Water Data Library for measurements of total concentration (i.e., not filtered) taken during 2000 through 2020 at four stations:

- Sacramento River below Red Bluff - Station A0275890
- Sacramento River at Hamilton City - Station A0263000
- Sacramento River above Colusa Basin Drain - Station A0223002, and
- Colusa Basin Drain near Knights Landing - Station A0294710

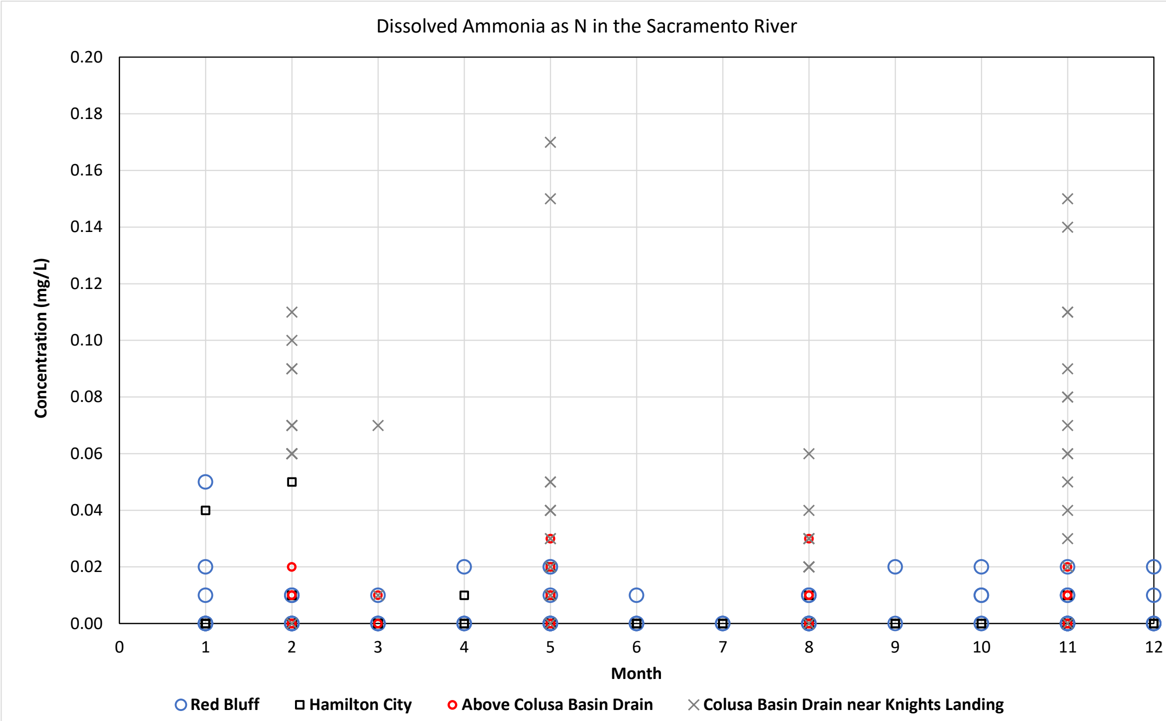

Figure 6E-37. Measured Dissolved Ammonia as Nitrogen in the Sacramento River and Colusa Basin Drain

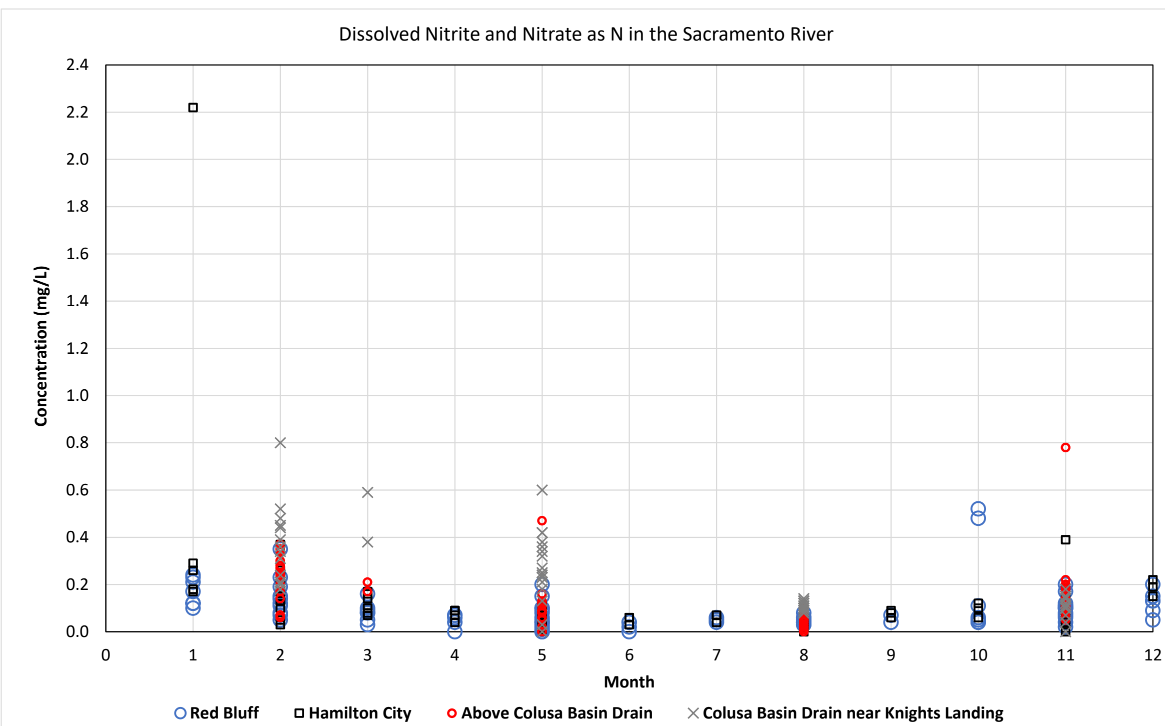

Figure 6E-38. Measured Dissolved Nitrite and Nitrate as Nitrogen in the Sacramento River and Colusa Basin Drain

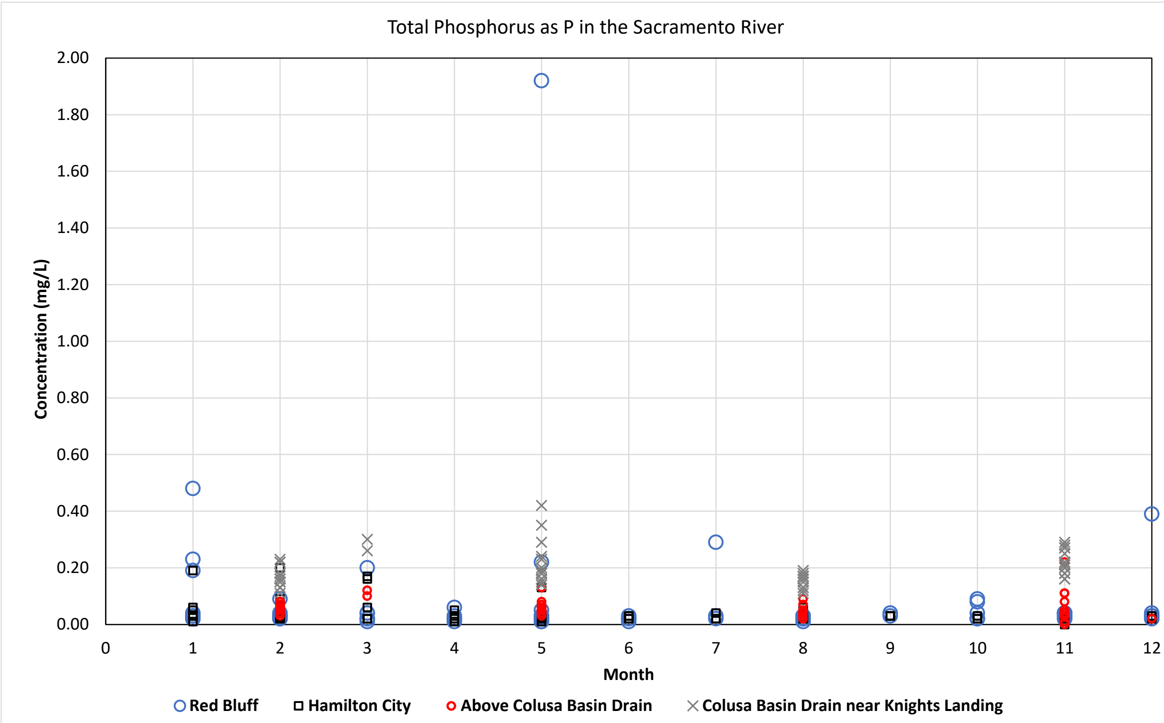

Figure 6E-39. Measured Total Phosphorus as Phosphorus in the Sacramento River and Colusa Basin Drain

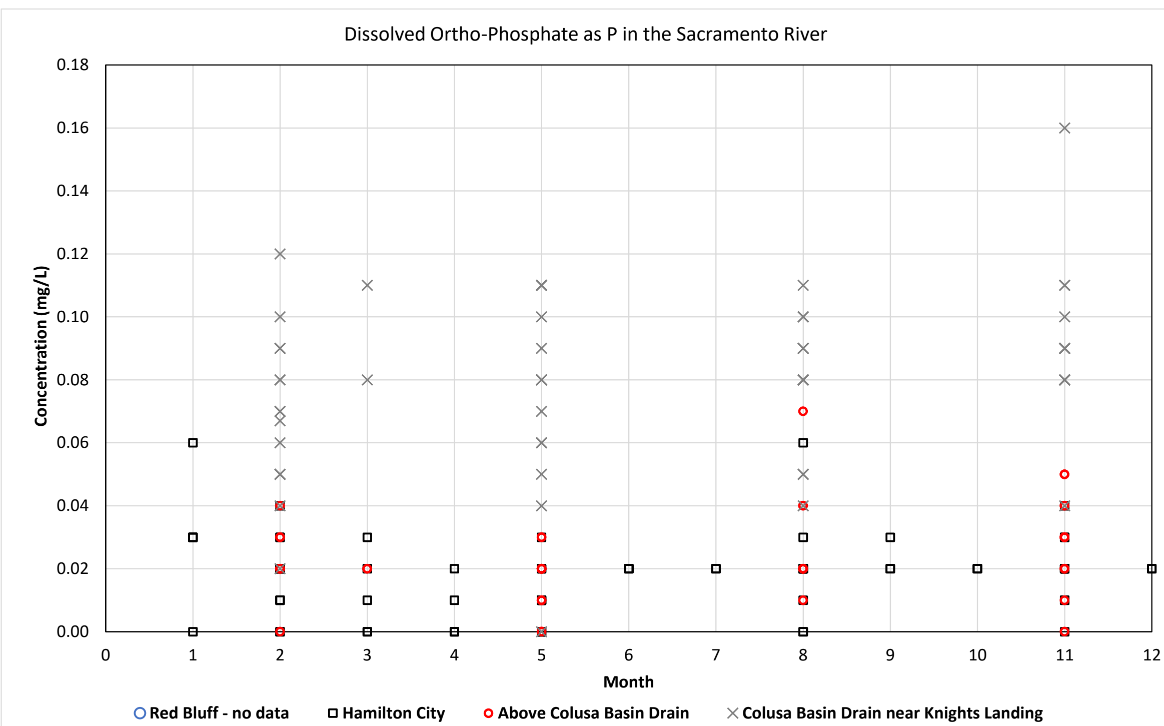

Figure 6E-40. Measured Dissolved Ortho Phosphate as Phosphorus in the Sacramento River and Colusa Basin Drain

6E.7 Metals Analysis for Aluminum, Copper, Iron, and Lead

Quantitative assessment was performed for total concentrations of four metals: aluminum, copper, iron, and lead. These four metals are of greatest concern based on what the measured data show for seasonal changes in concentration and concentrations above standards (graphs in Section 6E.2).

6E.7.1. Equations for Estimating Inflow Concentrations Assuming No Settling of Suspended Sediment

Total concentrations measured in the Sacramento River at Red Bluff and Hamilton City (Sections 6E.2 and 6E.3) were used to develop equations for estimating total metal concentration entering Sites Reservoir assuming no settling of suspended sediment. These data were paired with the daily average flow measured in the Sacramento River at Keswick and Bend Bridge. The data used in the evaluation were restricted to the November – May period of higher flows and concentrations to better focus on the range of flows that may occur when Sacramento River water would be diverted to Sites Reservoir.

A metric of the following form was developed to combine the indicators of flow and local runoff:

Metric = A*max(0,1-KWK/BND-B) + KWK

Where:

KWK = Sacramento River flow at Keswick in cfs

BND = Sacramento River flow at Bend Bridge in cfs

A and B were selected to balance the ratio metric (KWK/BND) with the flow metric and to optimize ability to estimate concentration.

An exponential trendline was fitted to the metric data to estimate concentration as a function of the metric. In some cases, the fitted equation was modified to estimate the higher concentrations more conservatively by slightly increasing the estimated values. The resulting equation has this form:

[Inflow] = C*e^(D*Metric)

Where:

[Inflow] = Estimated total metal concentration entering Sites Reservoir assuming no settling of suspended sediment

C and D are determined by fitting the equation to the data, and

e = Euler’s number ≈ 2.718282

And, the maximum value was limited to double the highest measured concentration

Table 6E-8 Parameters for Estimating Total Concentrations of Aluminum, Copper, Iron, and Lead in Water Diverted to Sites Reservoir Storage

Metal	A	B	C	D	Value of R-Squared Prior to Equation Adjustments
Aluminum	70,000	0.1	17.44	0.000095	0.71
Copper	70,000	0.3	1.06	0.000053	0.69
Iron	70,000	0.1	28	0.000090	0.71
Lead	80,000	0	0.009	0.000077	0.67

6E.7.2. Graphs Showing Performance of Equations for Estimating Inflow Concentration Assuming No Settling of Suspended Sediment

There is much scatter in the values at the higher concentrations. The calculations capture the range of values that may occur, which is the purpose of these calculations.

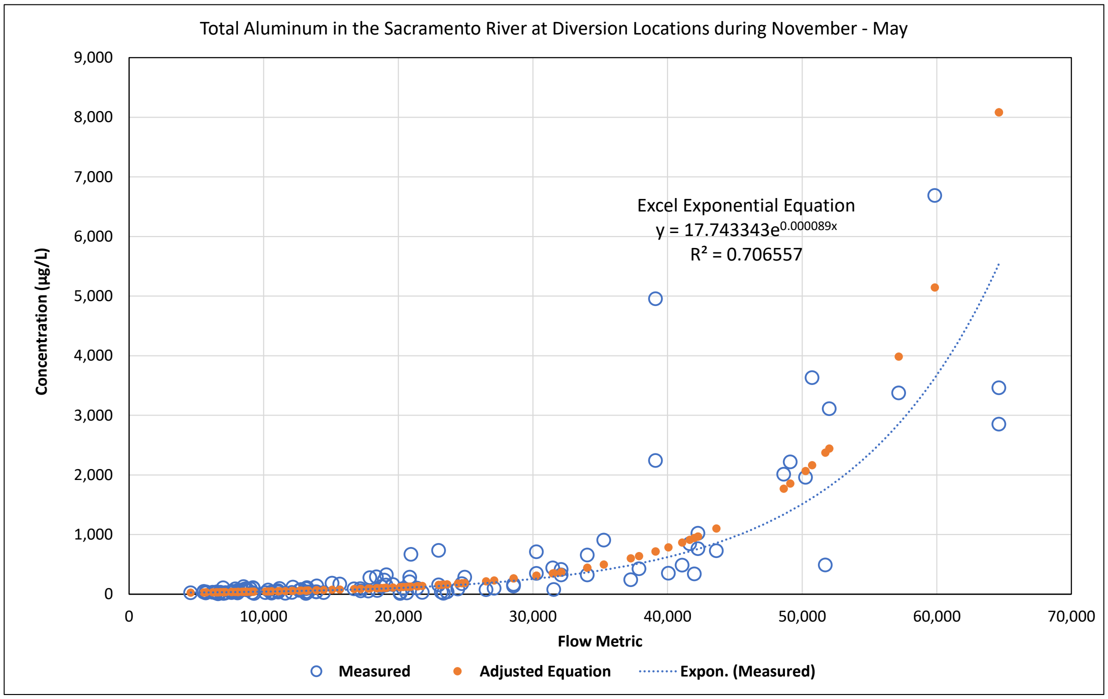

Figure 6E-41. Regression for Estimating Total Aluminum Concentration in Water diverted to Sites Reservoir Storage as a function of the flow metric

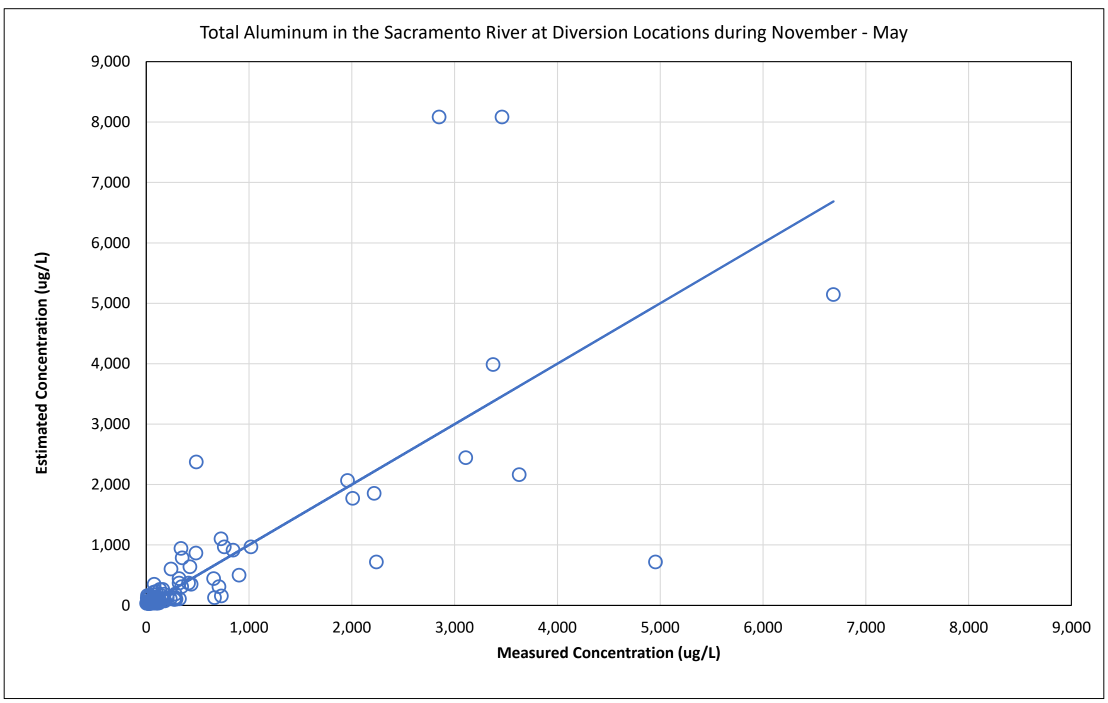

Figure 6E-42. Evaluation of the performance of the equation for estimating total aluminum concentration in the water diverted to Sites Reservoir Storage as a function of the flow metric, Measured versus estimated values

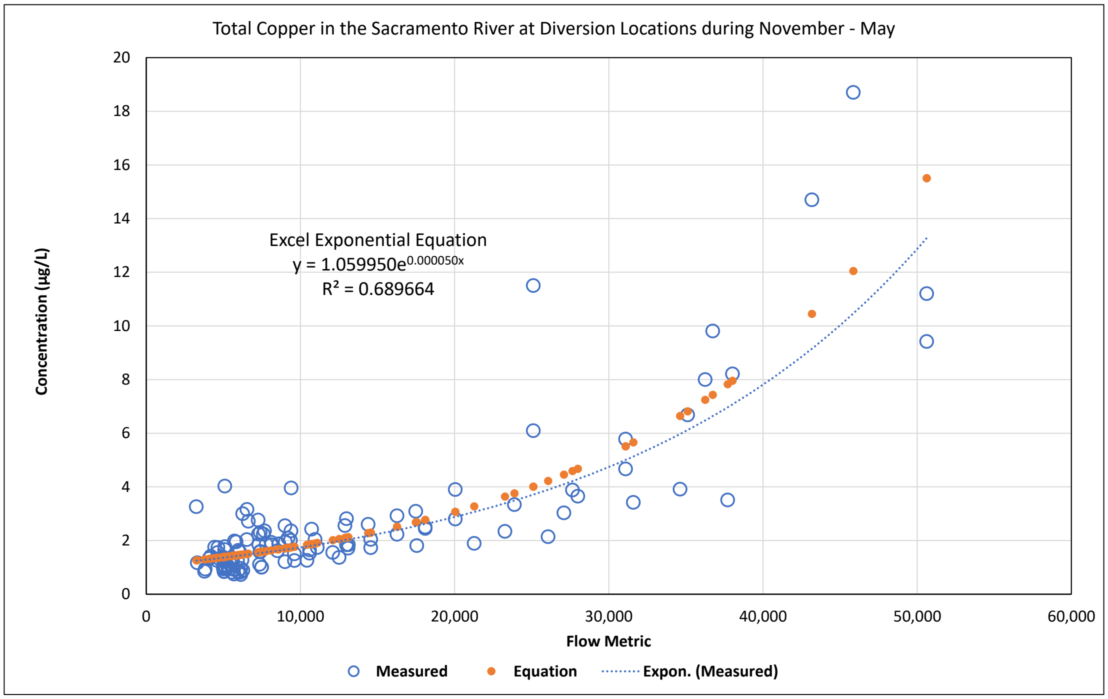

Figure 6E-43. Regression for Estimating Total Copper Concentration in Water diverted to Sites Reservoir Storage as a function of the flow metric

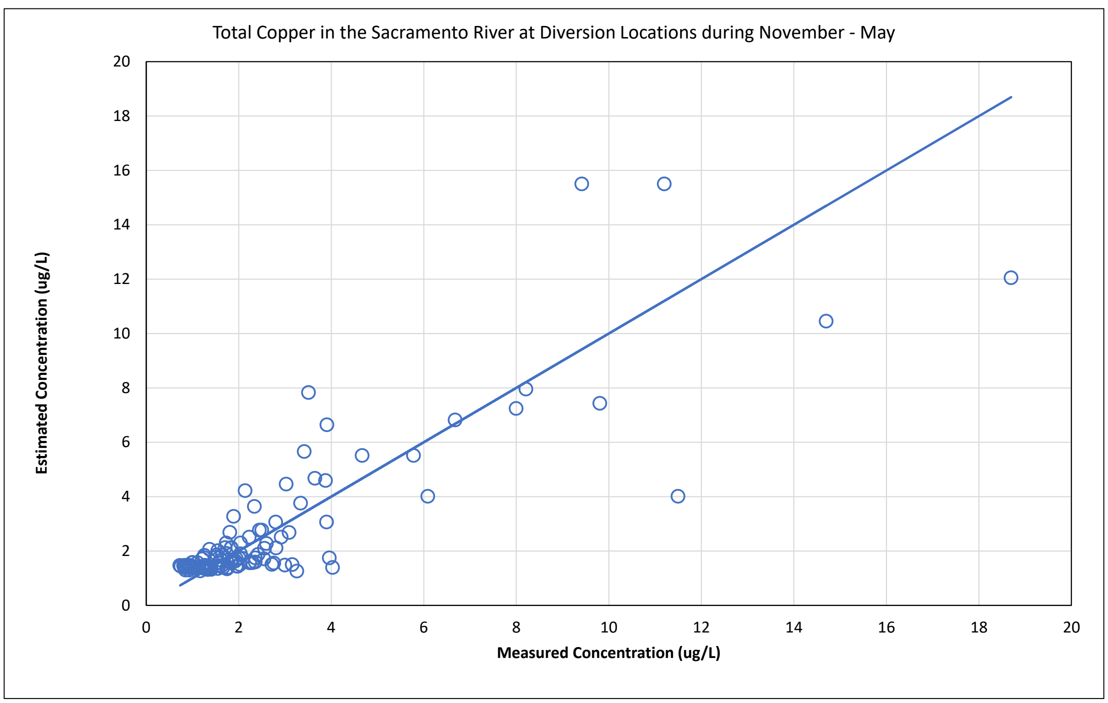

Figure 6E-44. Evaluation of the performance of the equation for estimating total copper concentration in the water diverted to Sites Reservoir Storage as a function of the flow metric, Measured versus estimated values

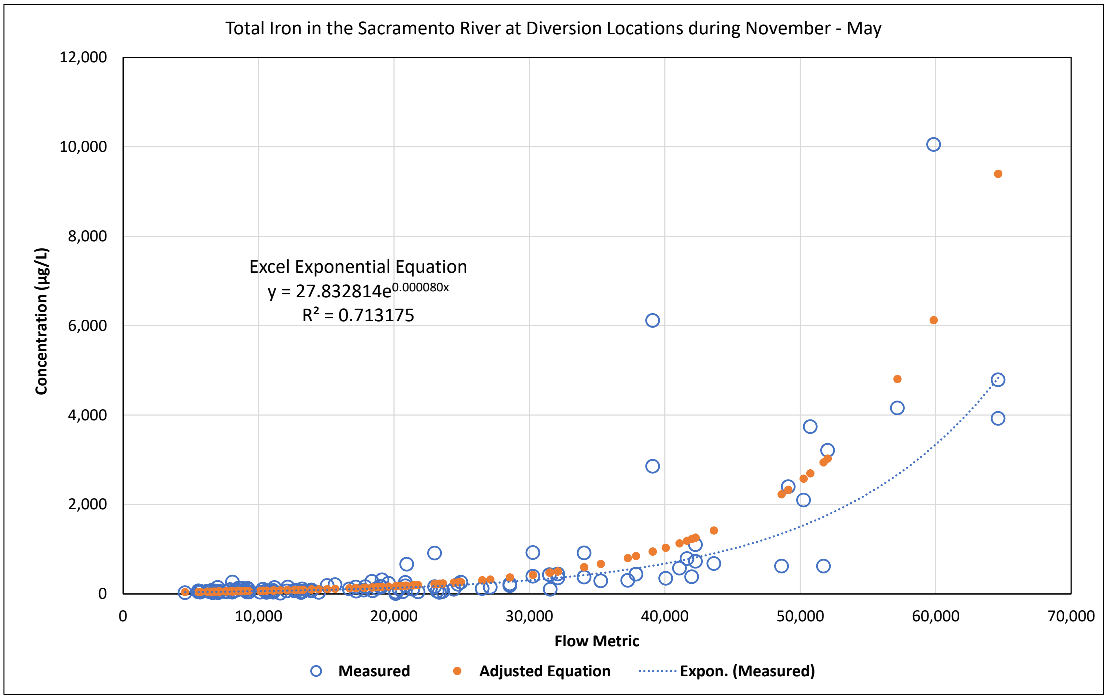

Figure 6E-45. Regression for Estimating Total Iron Concentration in Water diverted to Sites Reservoir Storage as a function of the flow metric

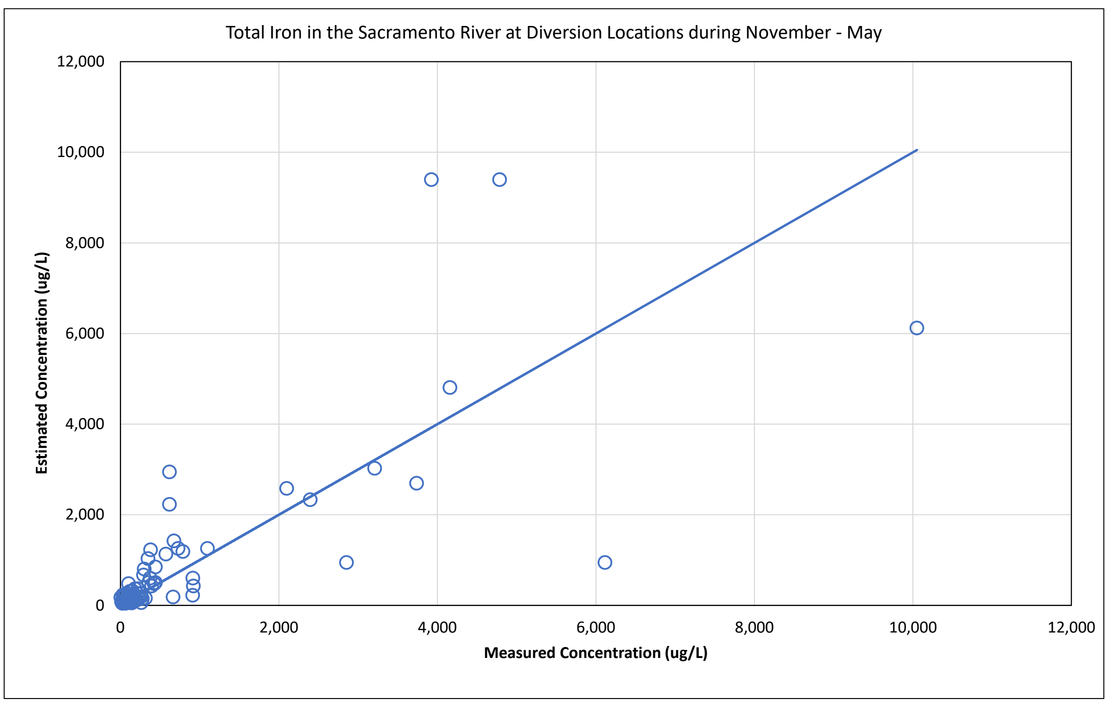

Figure 6E-46. Evaluation of the performance of the equation for estimating total iron concentration in the water diverted to Sites Reservoir Storage as a function of the flow metric, Measured versus estimated values

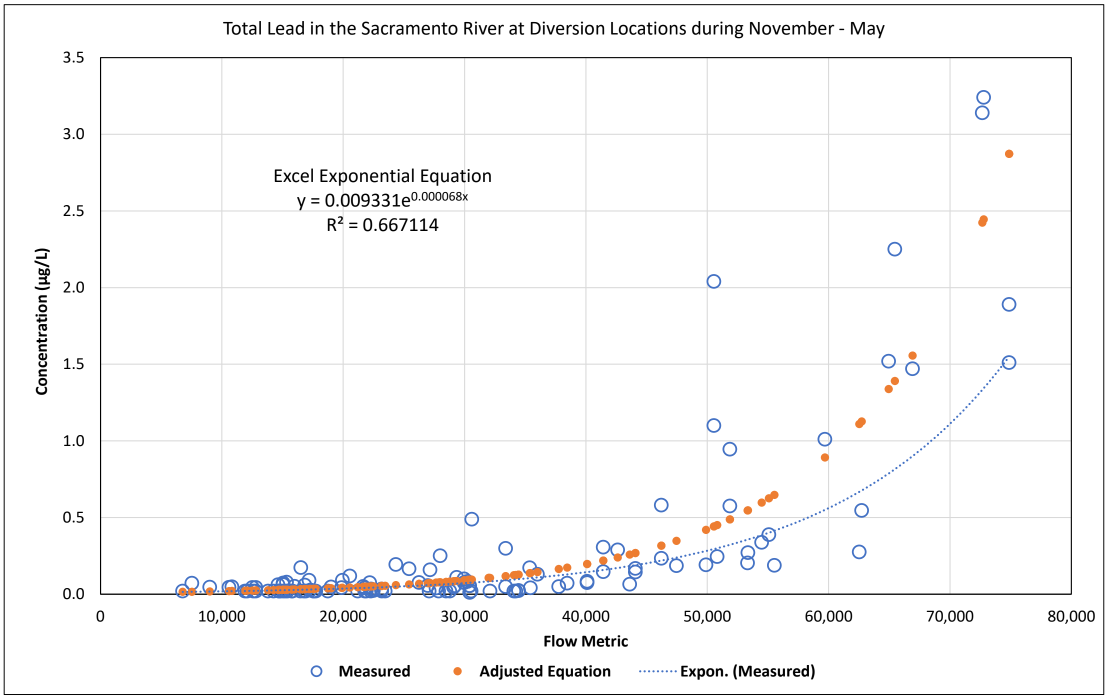

Figure 6E-47. Regression for Estimating Total Lead Concentration in Water diverted to Sites Reservoir Storage as a function of the flow metric

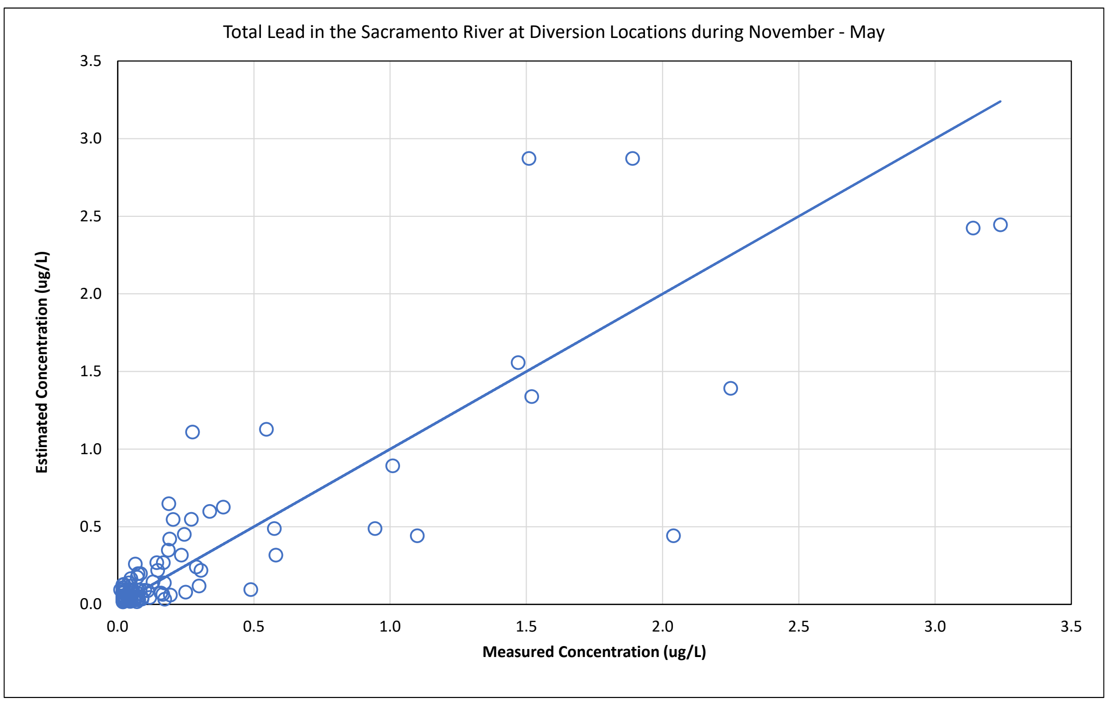

Figure 6E-48. Evaluation of the performance of the equation for estimating total lead concentration in the water diverted to Sites Reservoir Storage as a function of the flow metric, Measured versus estimated values

6E.7.3. Procedure for Evaluating Effect of Settling of Suspended Sediment

To approximate potential concentration of total metal in Sites Reservoir after settling of sediment, additional calculations were made based on the assumption that once total concentrations are high (above the 80th percentile of measured values). Most of the difference between the measured total and dissolved concentrations is due to sediment that would settle in the canals, regulating reservoirs, or Sites Reservoir. This approximated value could be an underestimate but serves to illustrate the substantial effect that sediment settling can have on metal concentrations. To implement this conservative estimate of settling, a second set of inflow concentrations to estimate inflow concentration after settling was created. If the estimated total concentration was less than the 80th percentile value, it was unmodified; if it was greater, the new inflow concentration was estimated as:

(total concentration – 80th percentile value) * ratio + 80th percentile value

Where:

> 80th percentile value = 80th percentile of measurements collected from the Sacramento River at Red Bluff and Hamilton City during November – May (i.e., the same measured values used to create the equations for estimating Sites Reservoir inflow concentrations).
>
> ratio = 80th percentile of dissolved concentrations / 80th percentile of total concentrations.

The figure below shows how this estimation process affects estimated metals concentrations using aluminum as an example. All of the concentrations below the 80th percentile are unaffected. Concentrations above the 80th percentile increase as a fraction of the total concentration. Most of the concentrations are below the 80th percentile, but the spread of the higher concentrations, some of which are outside of the graph, dominates what is seen on the graph.

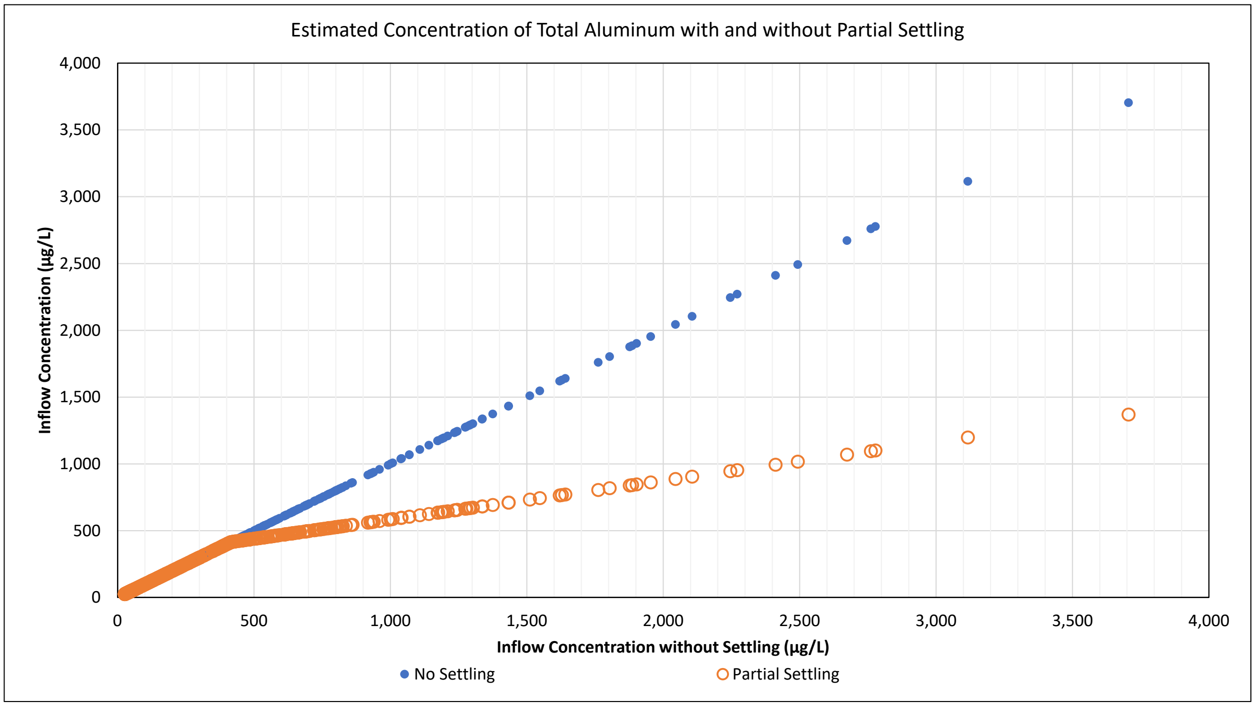

Figure 6E-49. Comparison of Inflow Concentration with No Settling of Suspended Sediment compared to inflow concentration with partial settling of suspended sediment.

6E.7.4. Estimated Metals Concentration in Sites Reservoir and the Sacramento River downstream of the Sites Discharge with and without Settling of Suspended Sediment

Estimated concentrations in the Sacramento River upstream of the Sites discharge location were based on measured values for the Sacramento River above CBD and the Sacramento River at Hamilton City during May – September. To demonstrate a range of results, these graphs show two types of results for concentrations in the Sacramento River downstream of the Sites discharge:

- Concentrations assuming median river concentrations mixed with Sites Reservoir concentrations that assume no settling of suspended sediment. This represents typical river concentrations mixed with Sites concentrations and are conservatively high and likely would not occur.
- Concentrations assuming 95th percentile river concentrations mixed with Sites Reservoir concentrations that assume some settling of suspended sediment. This represents high river concentrations mixed with Sites concentrations that are more realistic and likely would occur.

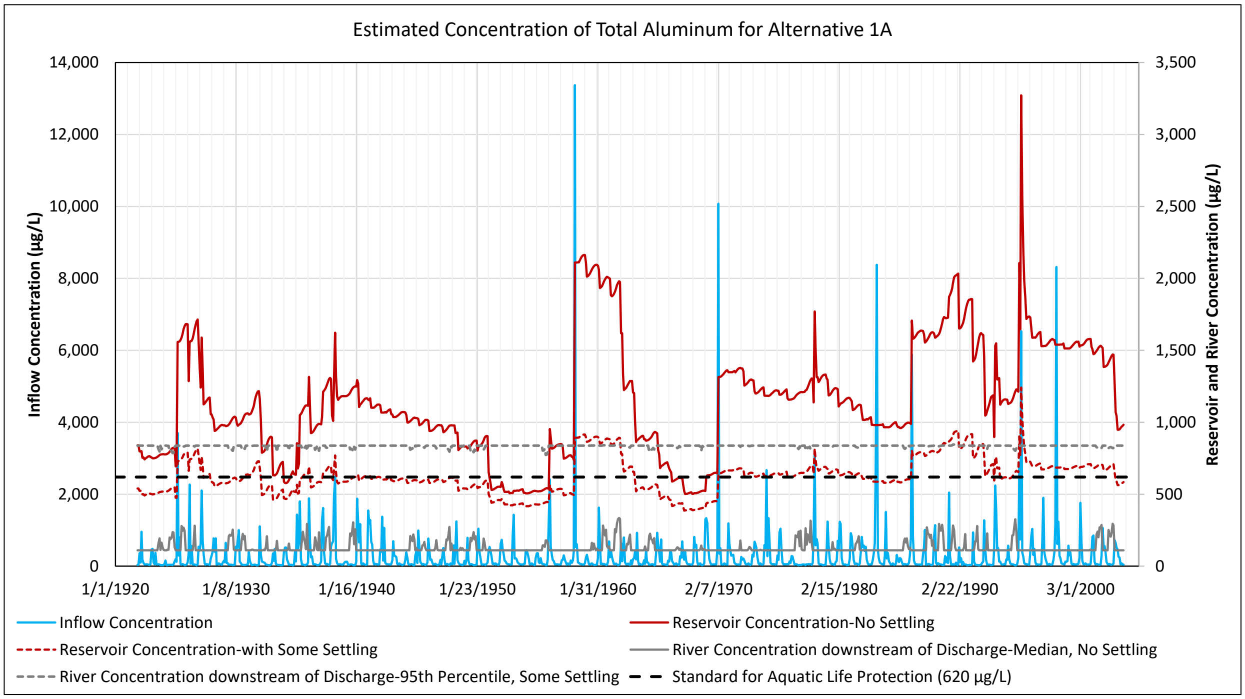

Figure 6E-50. Estimated Total Aluminum Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1A.

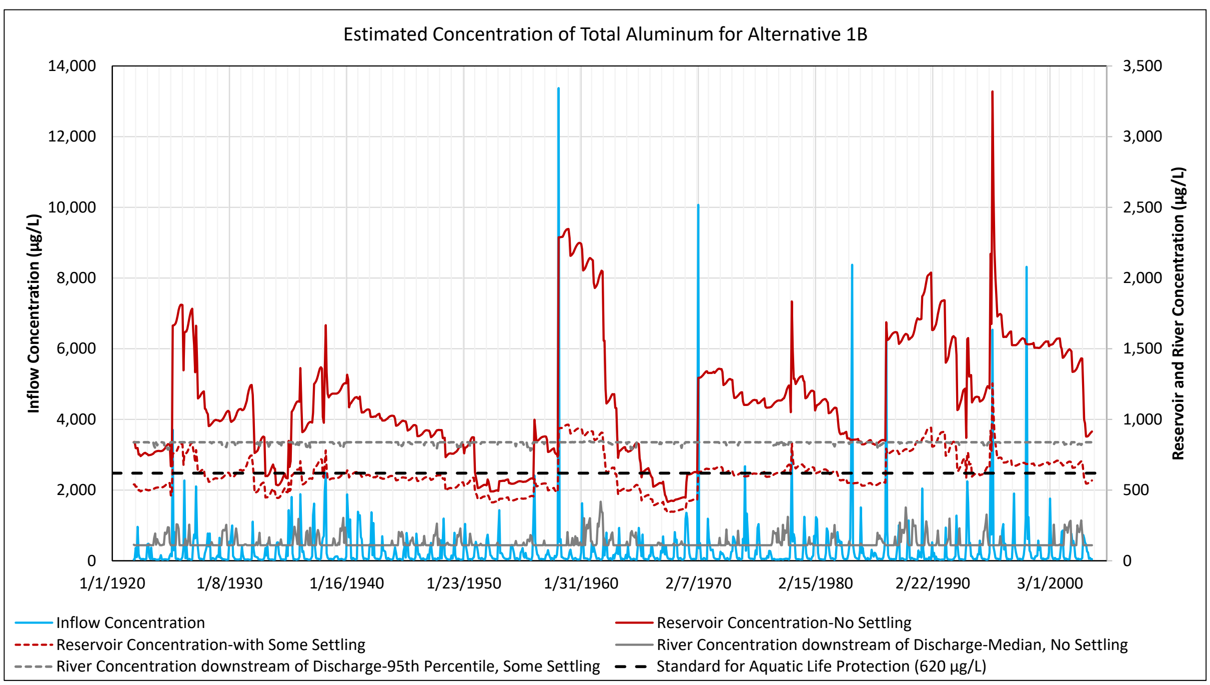

Figure 6E-51. Estimated Total Aluminum Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1B

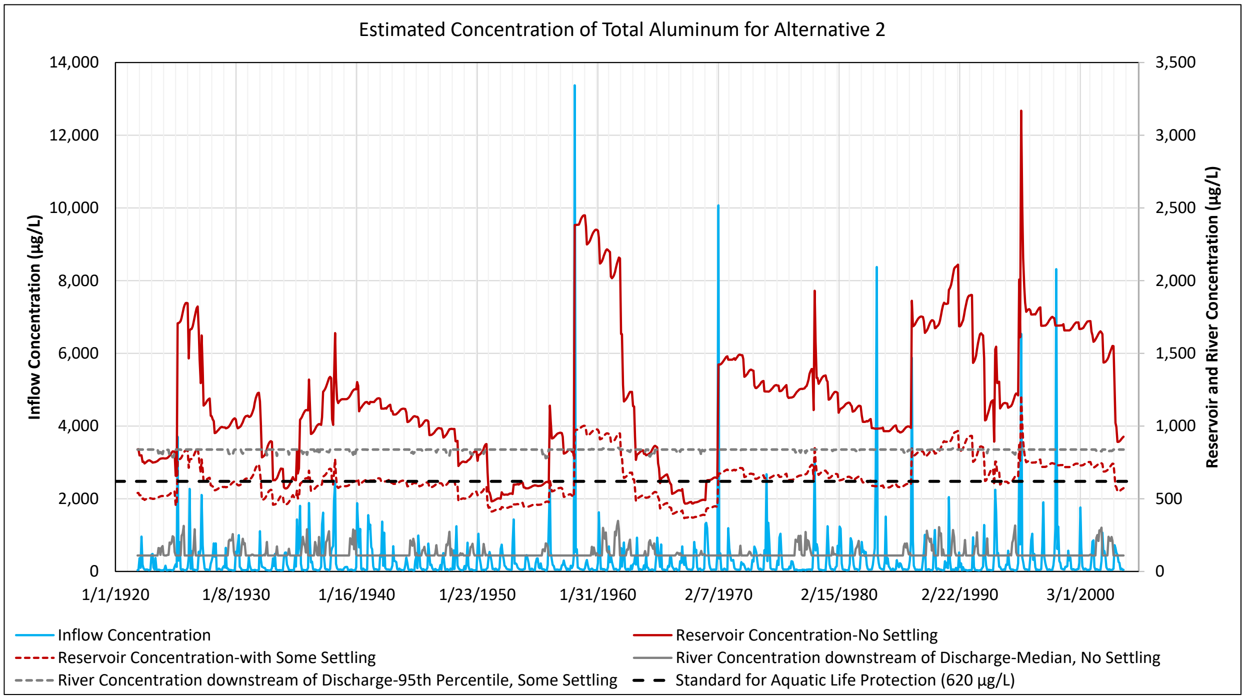

Figure 6E-52. Estimated Total Aluminum Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 2.

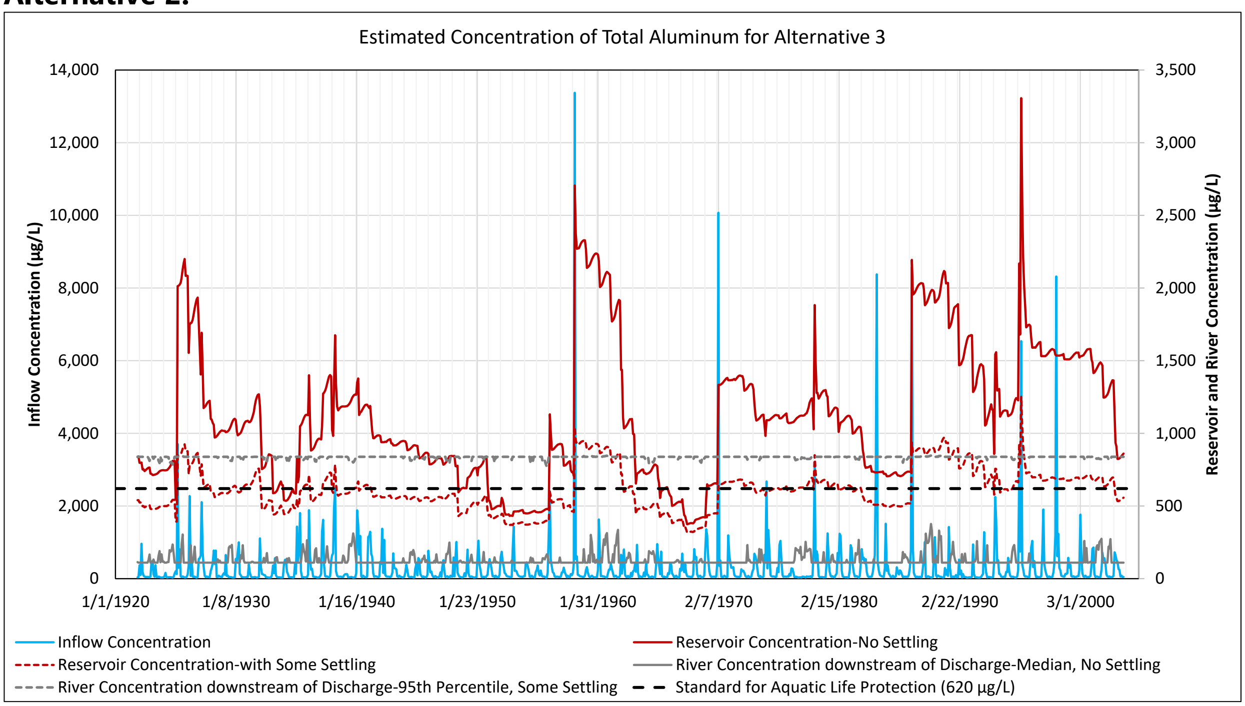

Figure 6E-53. Estimated Total Aluminum Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 3.

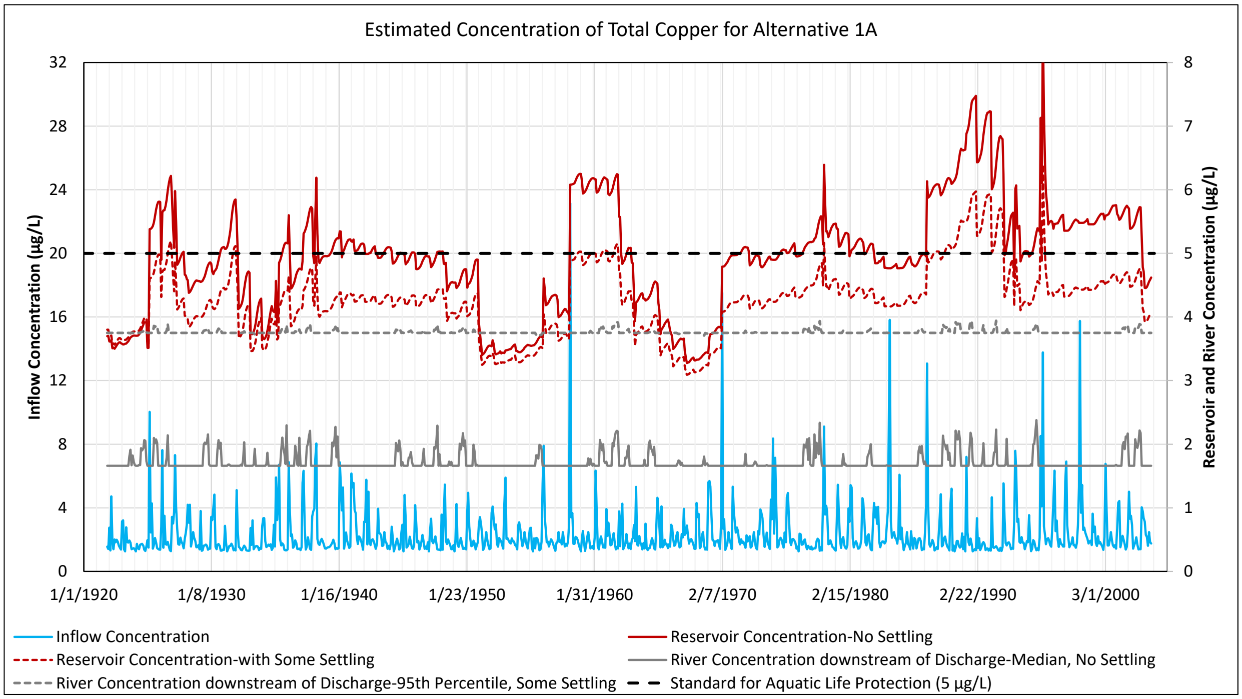

Figure 6E-54. Estimated Total Copper Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1A.

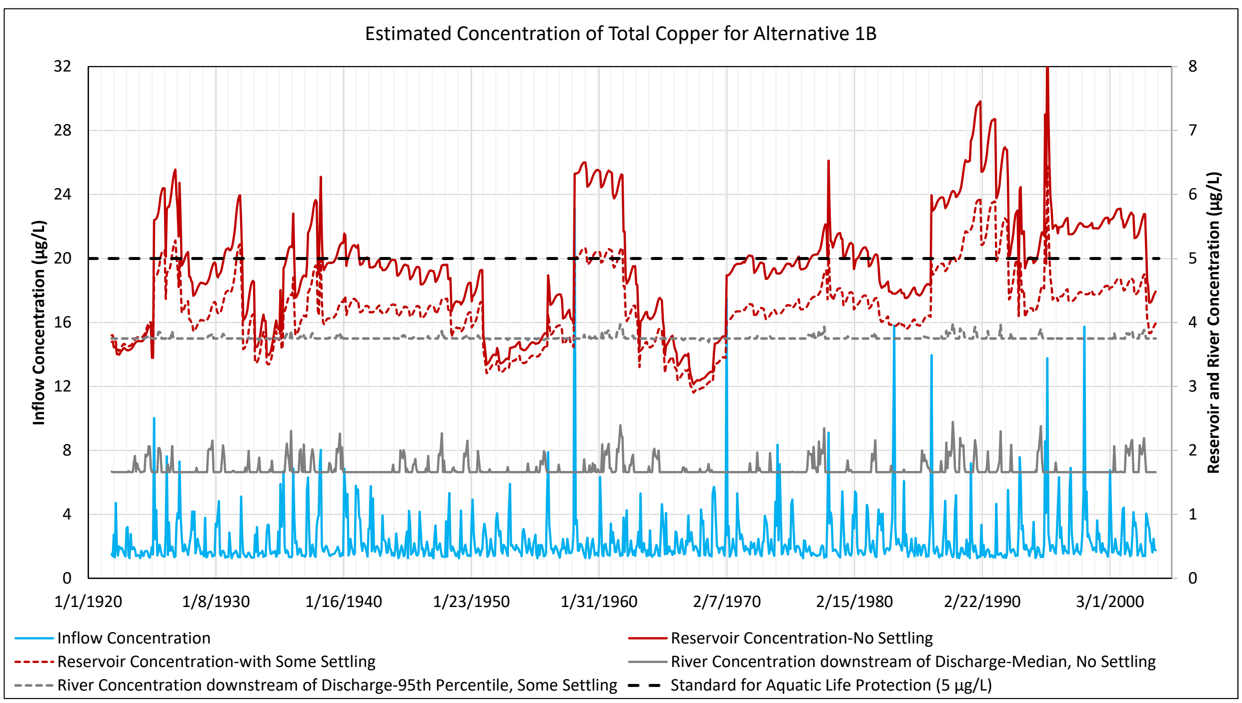

Figure 6E-55. Estimated Total Copper Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1B.

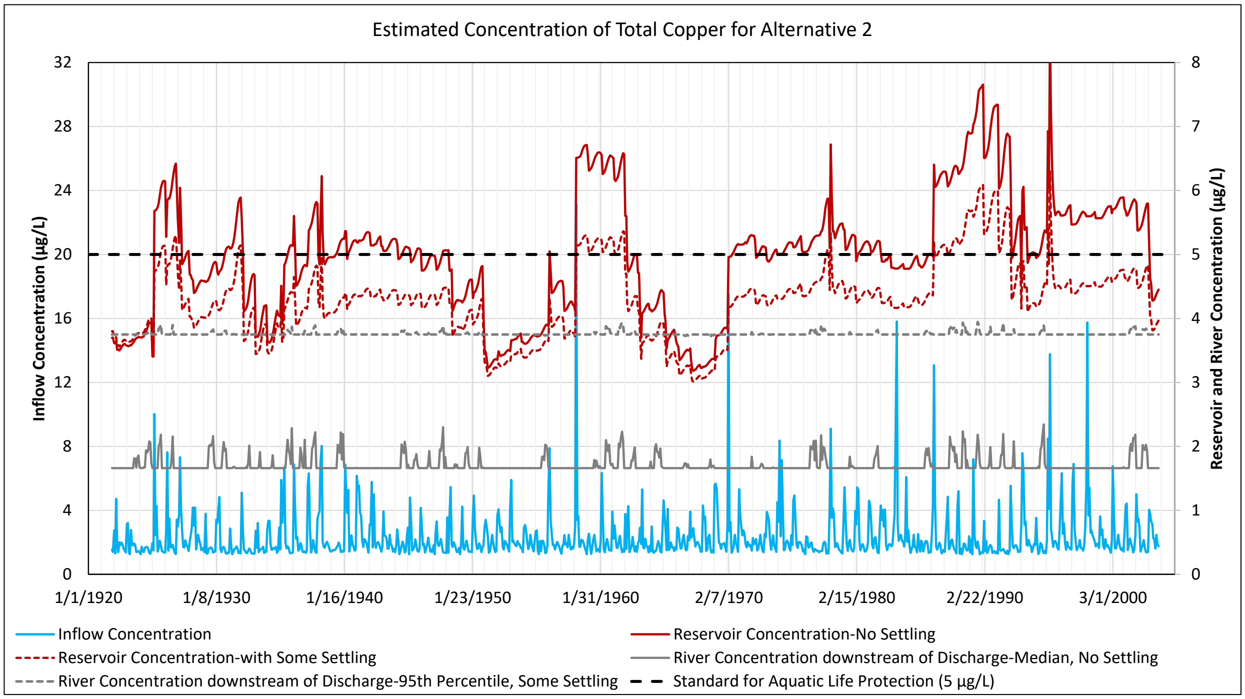

Figure 6E-56. Estimated Total Copper Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 2.

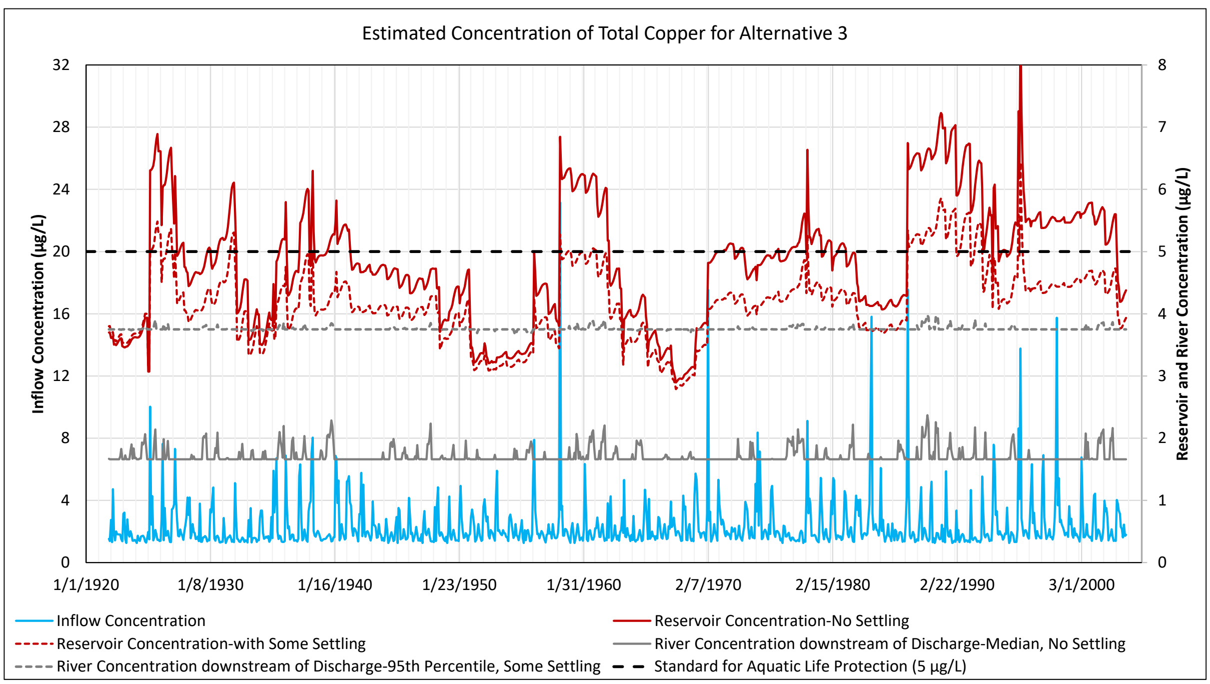

Figure 6E-57. Estimated Total Copper Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 3.

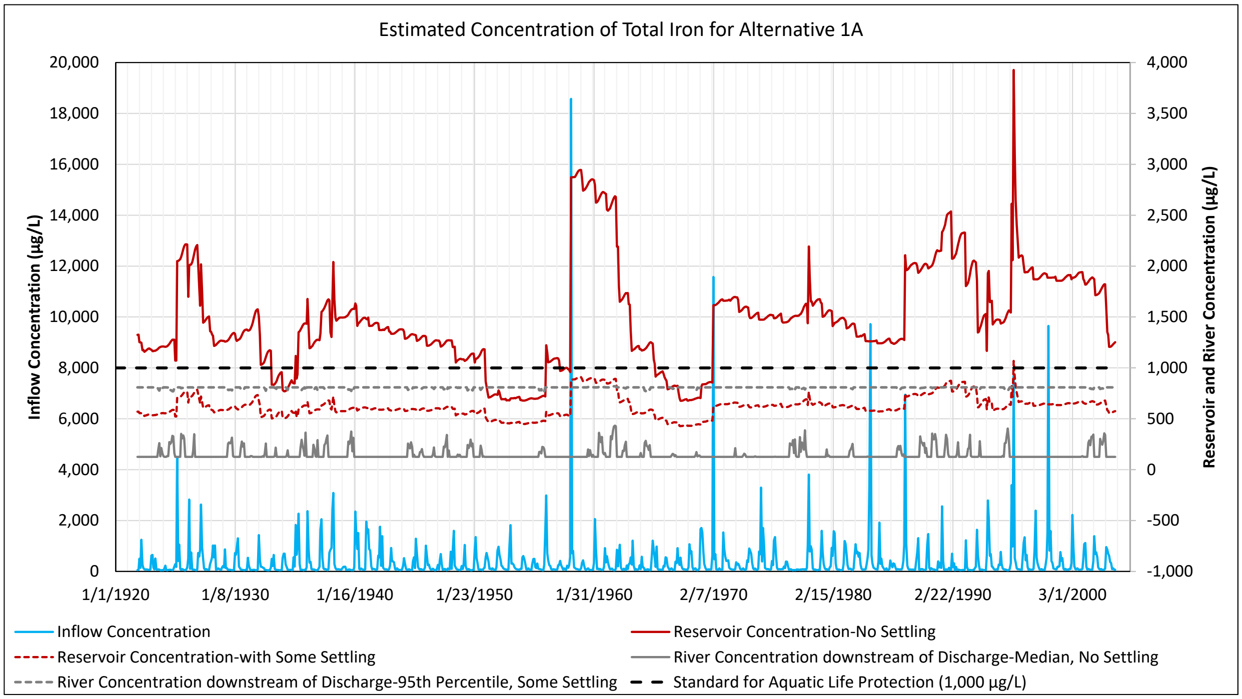

Figure 6E-58. Estimated Total Iron Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1A.

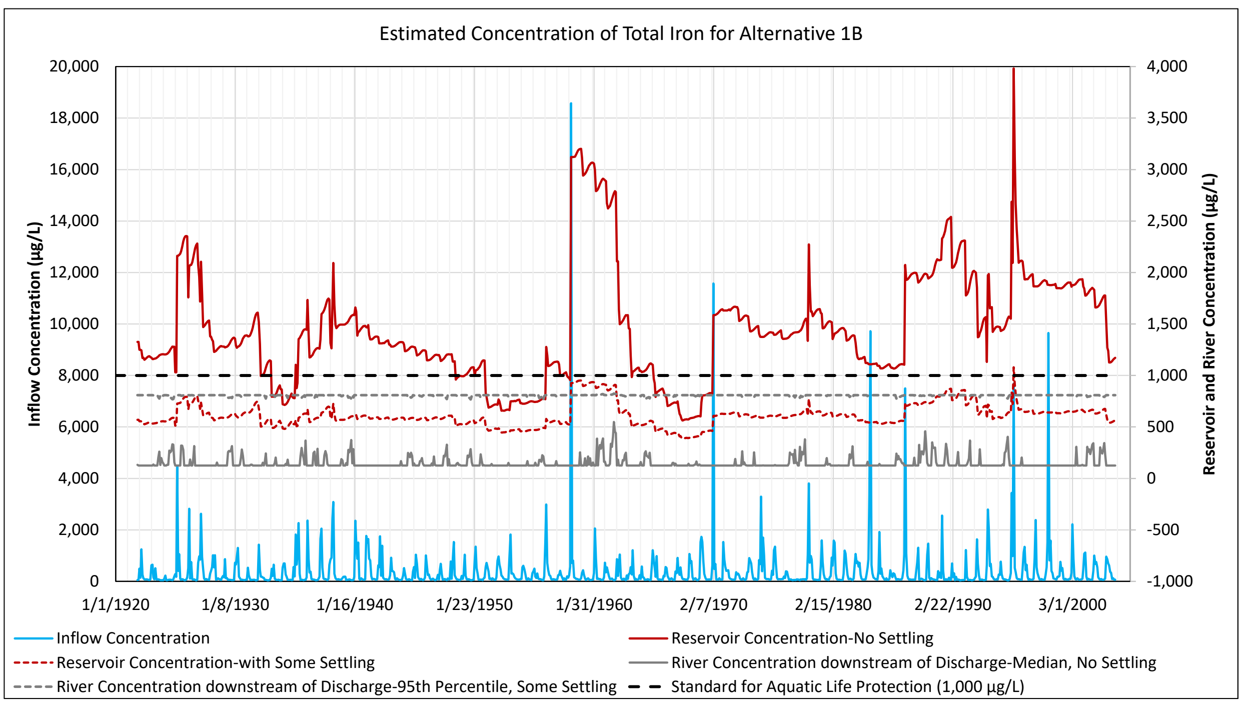

Figure 6E-59. Estimated Total Iron Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1B.

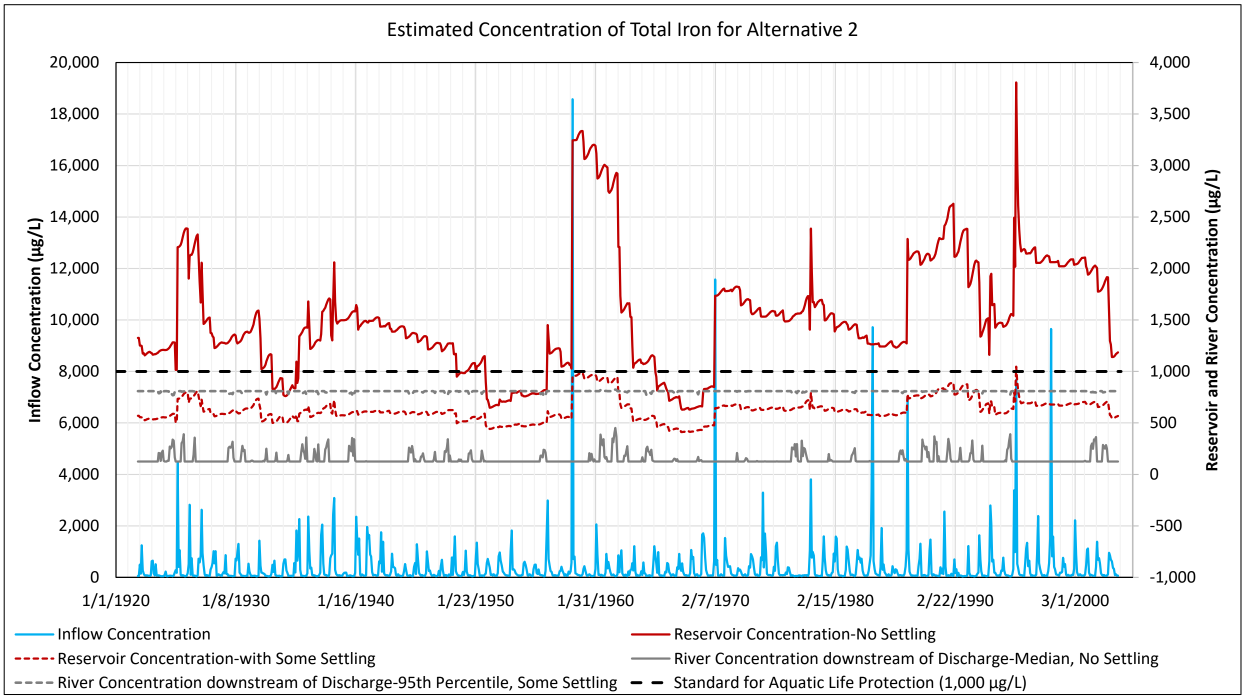

Figure 6E-60. Estimated Total Iron Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 2.

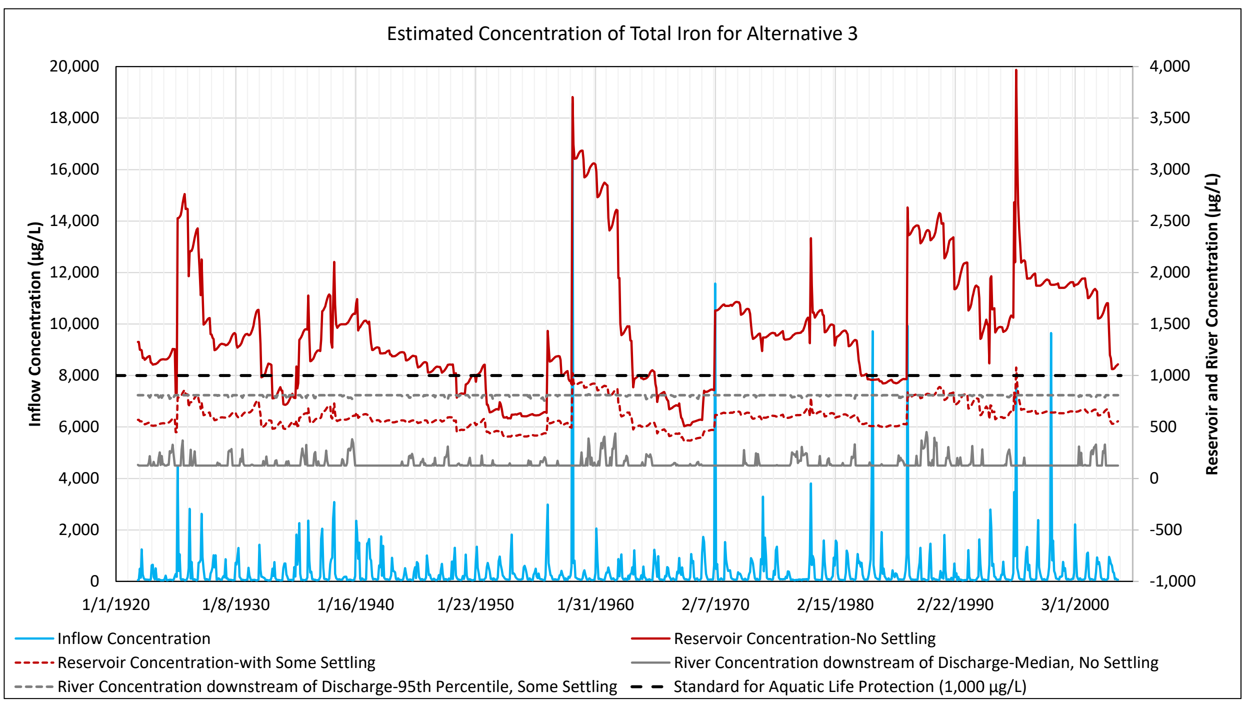

Figure 6E-61. Estimated Total Iron Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 3.

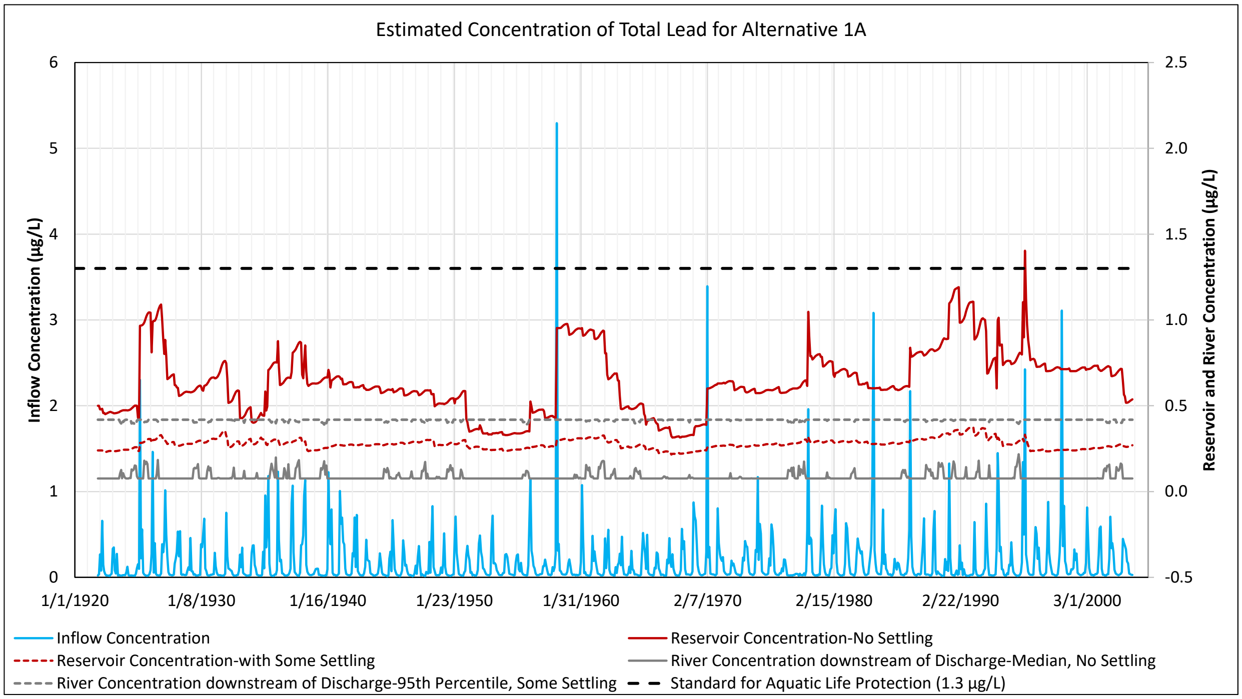

Figure 6E-62. Estimated Total Lead Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1A.

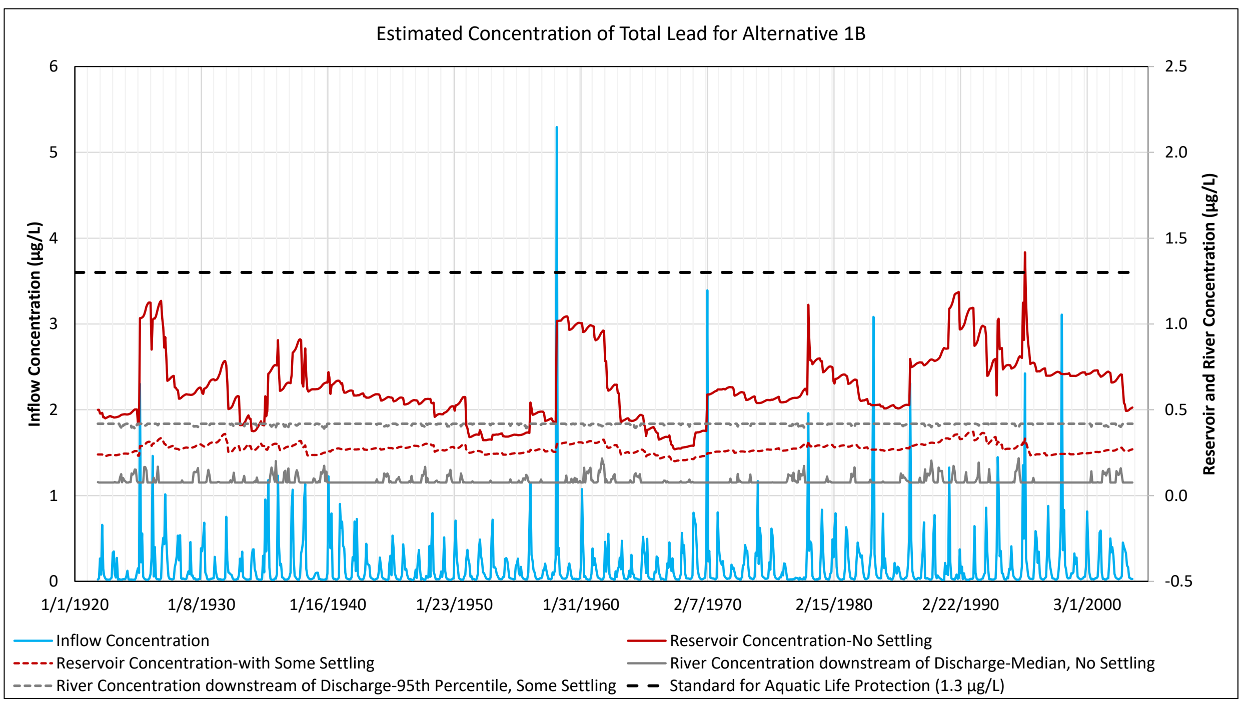

Figure 6E-63. Estimated Total Lead Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 1B.

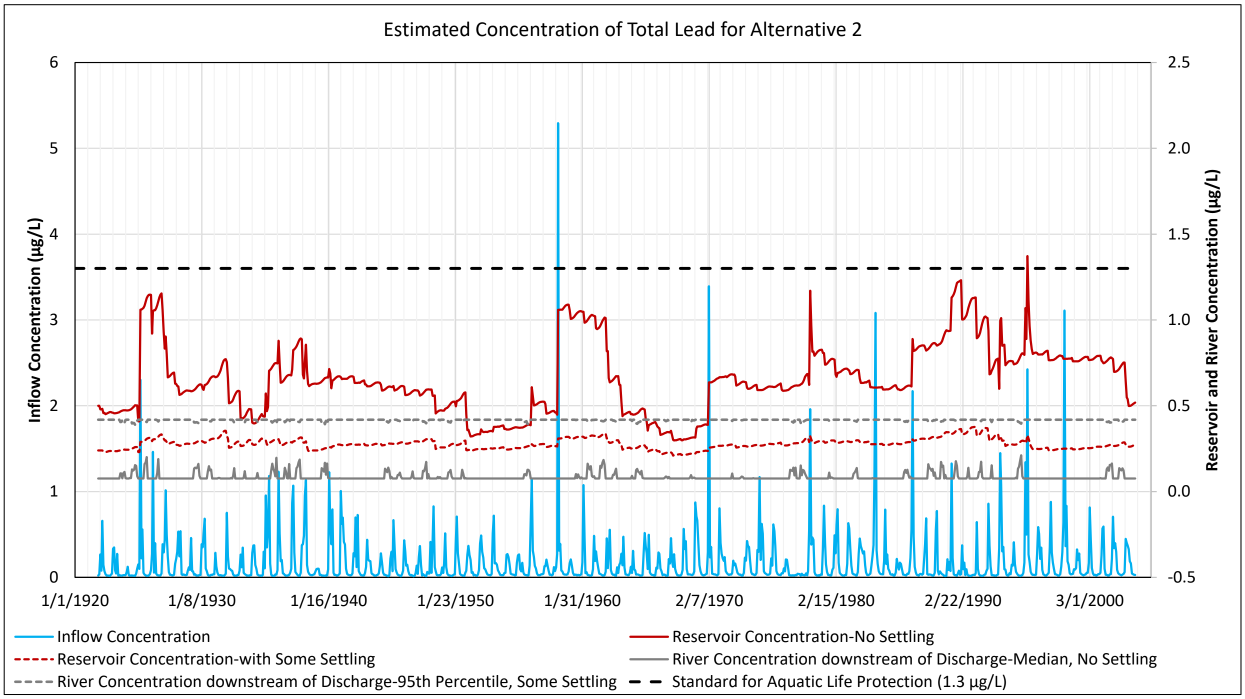

Figure 6E-64. Estimated Total Lead Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 2.

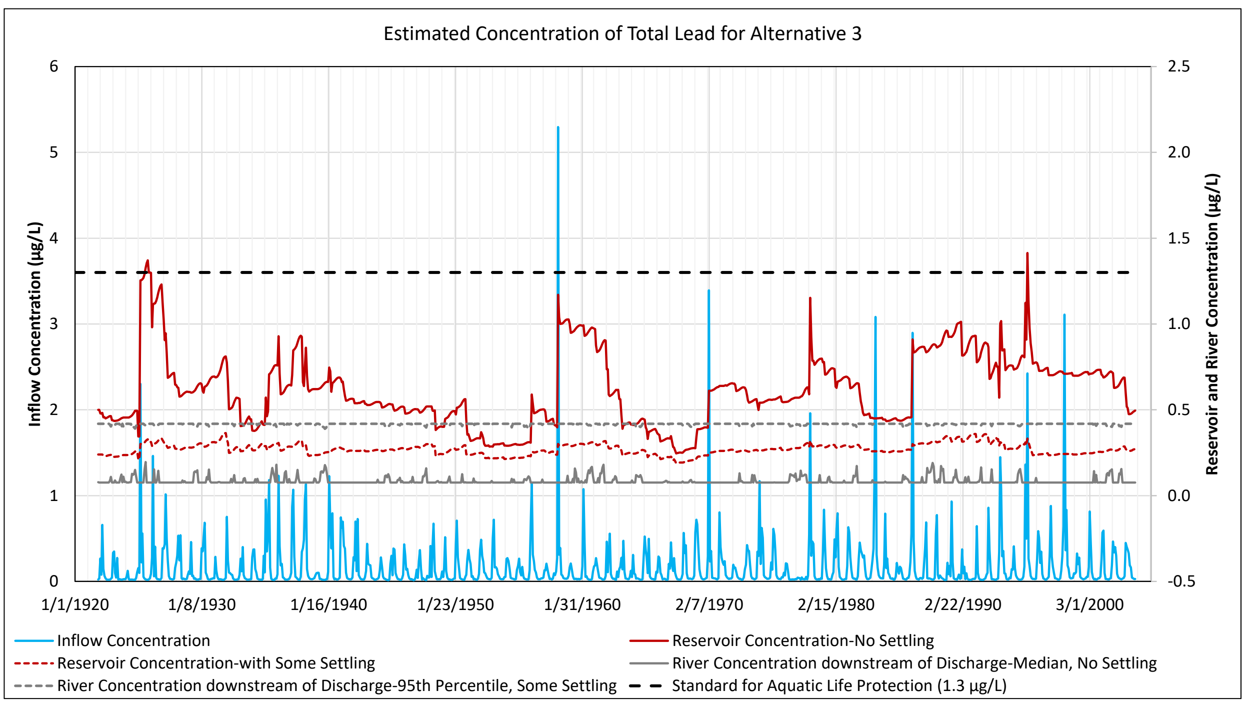

Figure 6E-65. Estimated Total Lead Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location for Alternative 3.

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