APPENDIX G-WQ2
WATER QUALITY

G-WQ2.1 INTRODUCTION

Appendix G-WQ2 contains figures summarizing and comparing the California Department of Water Resources' (DWR) water temperature modeling results for the different project alternative scenarios. The appendix also gives descriptions of the methodologies used in DWR's relicensing studies for water quality and provides tables summarizing the results of these studies. The water quality studies include SP-W6, a water temperature monitoring study. The results of the water temperature modeling and the water quality studies provide the bases for the descriptions of existing conditions and project effects in the main text of the Preliminary Draft Environmental Assessment (PDEA). Finally, the appendix includes several tables that give numerical limits for concentrations of water quality parameters and tissue contaminants. These numerical limits serve as the Central Valley Regional Water Quality Control Board (RWQCB) Basin Plan objectives for water quality.

G-WQ2.2 LIST OF TABLES AND FIGURES INCLUDED

The following tables of output data are included in this appendix:

- Table G-WQ2.4-1. Monitoring Site Number System for Maps
- Table G-WQ2.4-2. Numerical Limits Used to Evaluate Compliance of Surface Waters with Basin Plan Objectives (expressed as mg/L unless otherwise noted)
- Table G-WQ2.4-3. Fish and Crayfish Collected from Project Waters for Analysis of Tissue Contaminants
- Table G-WQ2.4-4. Numerical Limits Used to Evaluate Compliance of Fish and Crayfish Tissue Metals Concentrations with Basin Plan Objectives for Toxicity
- Table G-WQ2.4-5. Numerical Limits Used to Evaluate Compliance of Fish and Crayfish Tissue Organic Concentrations with Basin Plan Objectives for Toxicity
- Table G-WQ2.4-6. Water Quality Limits for Feather River Basin Groundwater
- Table G-WQ2.5-1. Fish (and Crayfish) Tissue Concentrations of Metals
- Table G-WQ2.5-2. Fish (and Crayfish) Tissue Concentrations of Pesticides
- Table G-WQ2.5-3. Ranges of Bacteria Counts at SP-W1 Monitoring Stations and Numbers of Water Quality Standard Exceedances
- Table G-WQ2.5-4. Ranges of Bacteria Counts at Recreation Area Monitoring Stations and Number of Water Quality Standards Exceedances in 2002

- Table G-WQ2.5-5. Ranges of Bacteria Counts at Recreation Area Monitoring Stations and Number of Water Quality Standard Exceedances in 2003

- Table G-WQ2.5-6. Stormwater Sampling Results – Bacteria

- Table G-WQ2.5-7. Water Quality Ranges in Downgradient and Upgradient Wells and Surface Water Samples

- Table G-WQ2.5-8. Exceedances of Basin Plan Water Quality Objectives

- Table G-WQ2.5-9. Water Quality Ranges in Well A11 near Thermalito Forebay, Other Wells, and Surface Water Samples

The following figures representing output data are included in this appendix (or the Figures volume):

- Figure G-WQ2.3-1. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, at the Thermalito Diversion Dam

- Figure G-WQ2.3-2. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, in the Feather River at Robinson Riffle

- Figure G-WQ2.3-3. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, in the Feather River Upstream of the Thermalito Afterbay Outlet

- Figure G-WQ2.3-4. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, in the Thermalito Afterbay Outlet

- Figure G-WQ2.3-5. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, in the Feather River Downstream of the Thermalito Afterbay Outlet

- Figure G-WQ2.3-6. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, in the Feather River Upstream of Honcut Creek

- Figure G-WQ2.3-7. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, in the Feather River Upstream of the Yuba River

- Figure G-WQ2.3-8. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between

the Scenarios, at the California Water Company Diversion from the Thermalito Complex

- Figure G-WQ2.3-9. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between Scenarios, at the Thermalito Irrigation District Diversion from the Thermalito Complex

- Figure G-WQ2.3-10. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, at the Western Canal Main Diversion from Thermalito Afterbay

- Figure G-WQ2.3-11. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, at the Western Canal Lateral Diversion from Thermalito Afterbay

- Figure G-WQ2.3-12. Temperature Exceedances from Simulations for Existing Conditions, No-Action, and Alternative 2 Scenarios and for Differences between the Scenarios, at the Sutter Butte Canal Diversion from Thermalito Afterbay

- Figure G-WQ2.4-1. Temperature Monitoring Sites for Project Waters

- Figure G-WQ2.4-2. Temperature Monitoring Sites in the Lower Feather River

- Figure G-WQ2.4-3. Water Quality Monitoring Sites in the Project Area

- Figure G-WQ2.4-4. Water Quality Monitoring Sites in the Lower Feather River

- Figure G-WQ2.4-5. Fish and Crayfish Sampling Sites for Analysis of Tissue Contaminants

- Figure G-WQ2.4-6. Groundwater Quality Monitoring Wells

- Figure G-WQ2.5-1a. Metals at Water Quality Sampling Stations (North) – Frequency of Exceedance of Limits (March 2002 – April 2004).

- Figure G-WQ2.5-1b. Metals at Water Quality Sampling Stations (South) – Frequency of Exceedance of Limits (March 2002 – April 2004).

- Figure G-WQ2.5-2. Mercury Levels in Individual Fish (Spotted Bass, Largemouth Bass, and Pikeminnow) from Project Waters

G-WQ2.3 WATER TEMPERATURE MODELING RESULTS

This section provides exceedance plots summarizing water temperature modeling results for several locations in the Low Flow Channel and High Flow Channel of the Feather River and at agricultural diversions in the Thermalito Complex under “Existing Conditions,” which for the modeling is year 2001 level of development; “No-Action,”

which for the modeling is year 2020 level of development with no new project actions; and “Alternative 2,” which for the modeling is year 2020 level of development with the project actions included in Alternative 2. Figures giving results for the Proposed Action are not provided, because project operations under this alternative would be identical to those under the No-Action Alternative and, therefore, the water temperature results for the alternative are identical to those of No-Action.

The following provides 1 figure for each of 12 modeling locations, with 5 plots included per figure. Each plot gives information on water temperature exceedances for each day of the year, based on the 1922-through-1993 simulation period of record. The first 3 plots in each figure show the 50^{th} (median), 80^{th}, and 95^{th} percentile water temperatures for the Existing Conditions, No-Action, and Alternative 2 modeling scenarios, respectively. The last two charts show the differences in the three percentiles between No-Action and Existing Conditions and between Alternative 2 and No-Action. The two charts of differences are useful for evaluating effects of “Future Conditions” (including both No-Action and “Proposed Action”) and Alternative 2.

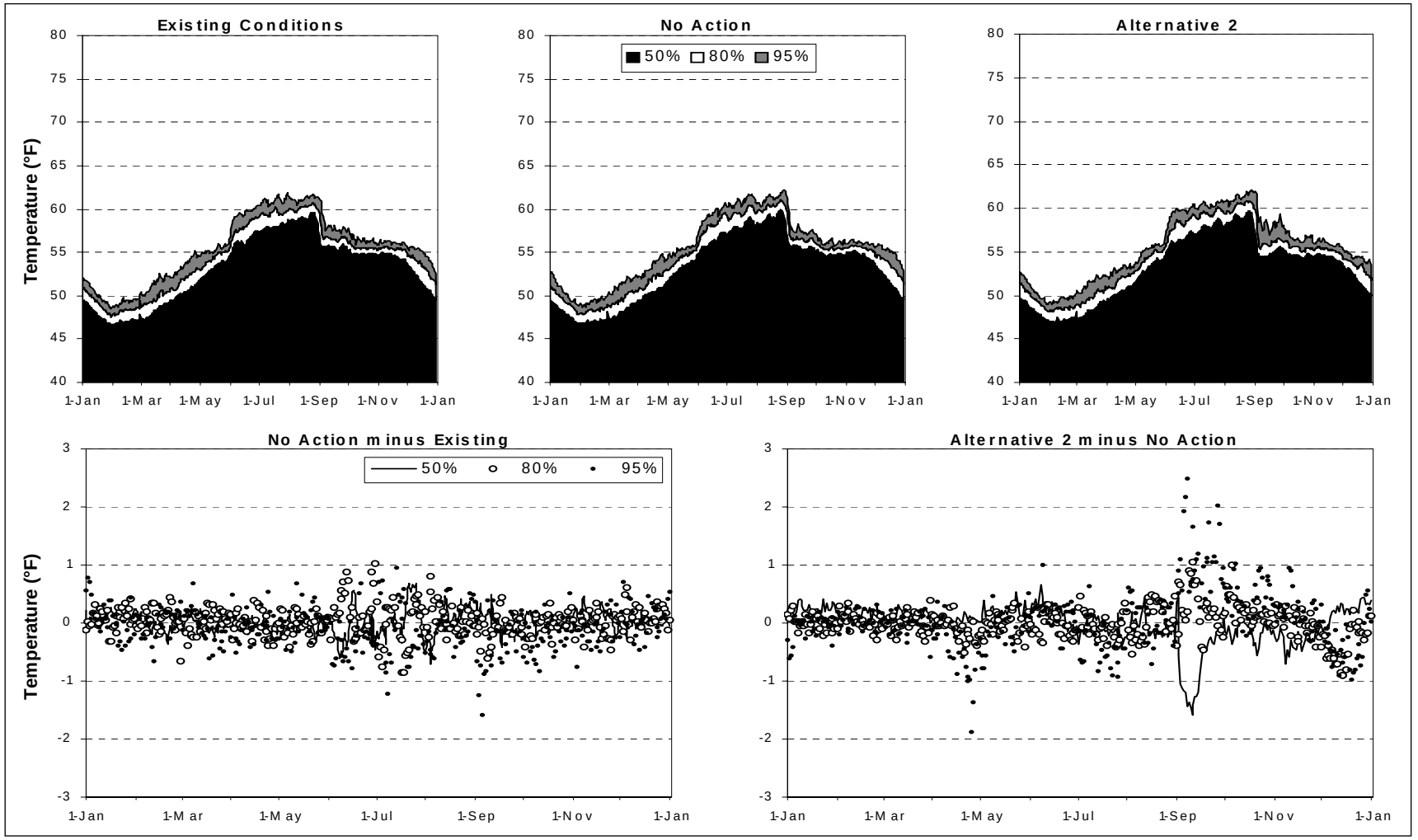


Figure G-WQ2.3-1. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, at the Thermalito Diversion Dam.

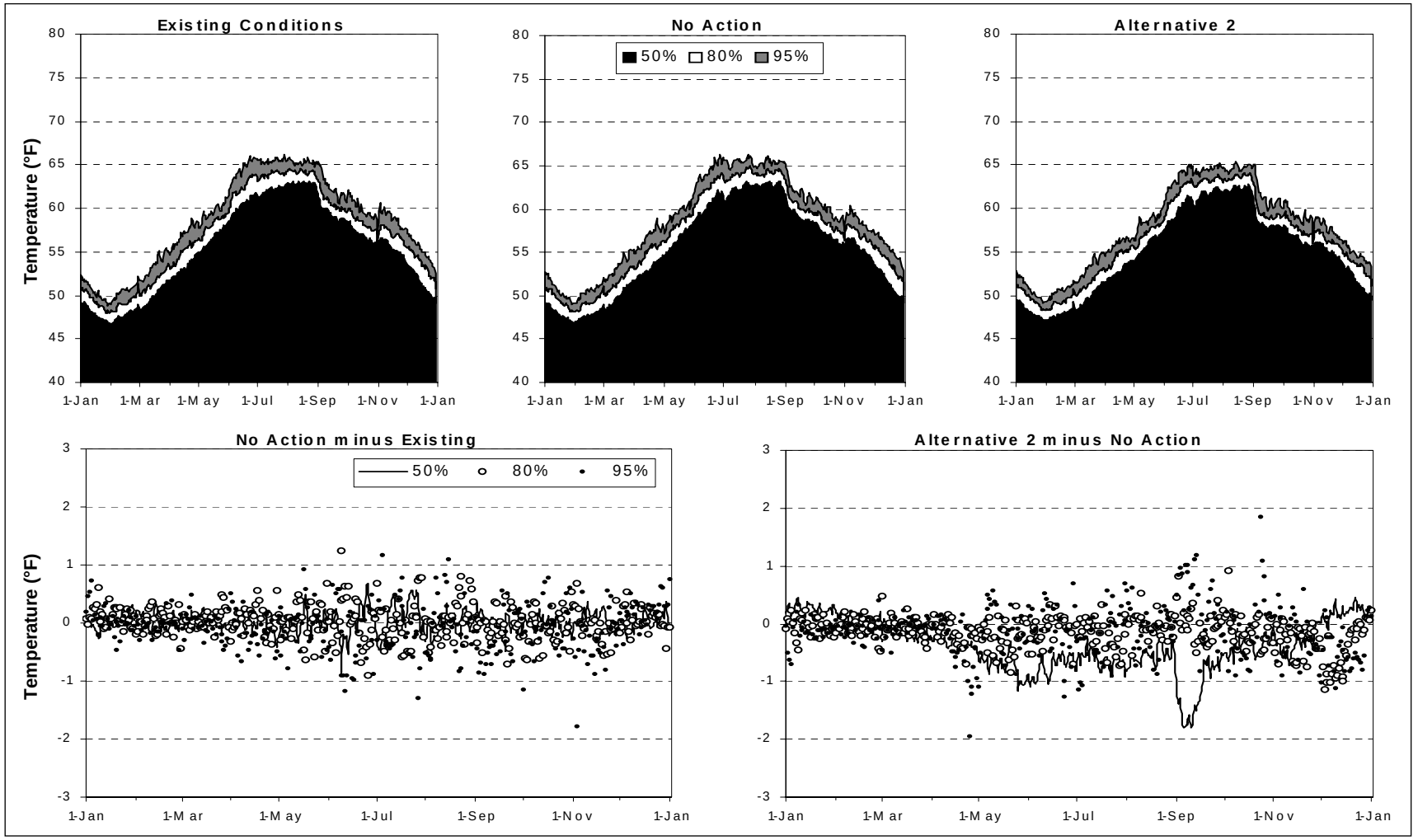


Figure G-WQ2.3-2. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, in the Feather River at Robinson Riffle.

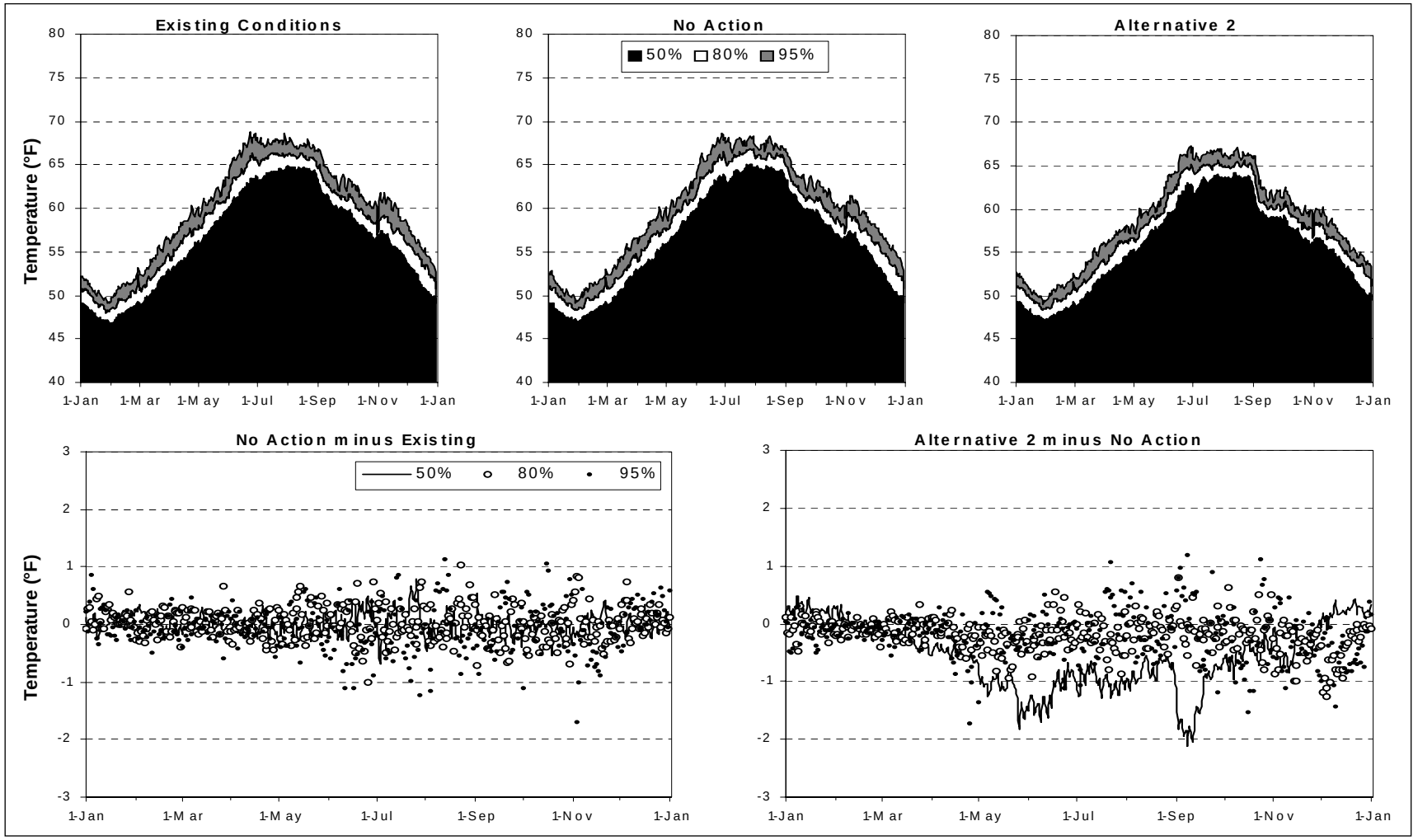


Figure G-WQ2.3-3. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, in the Feather River upstream of the Thermalito Afterbay Outlet.

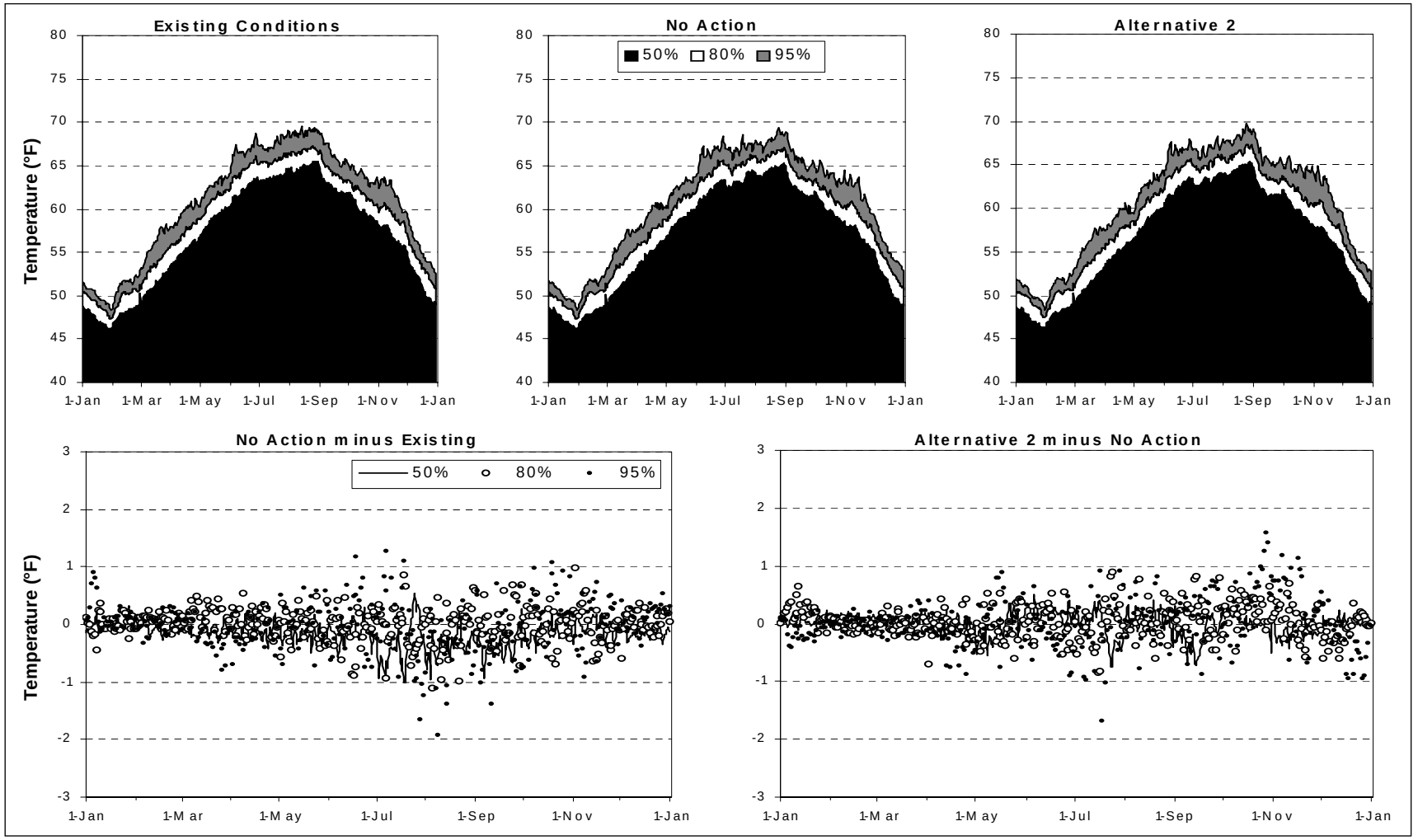


Figure G-WQ2.3-4. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, at the Thermalito Afterbay Outlet.

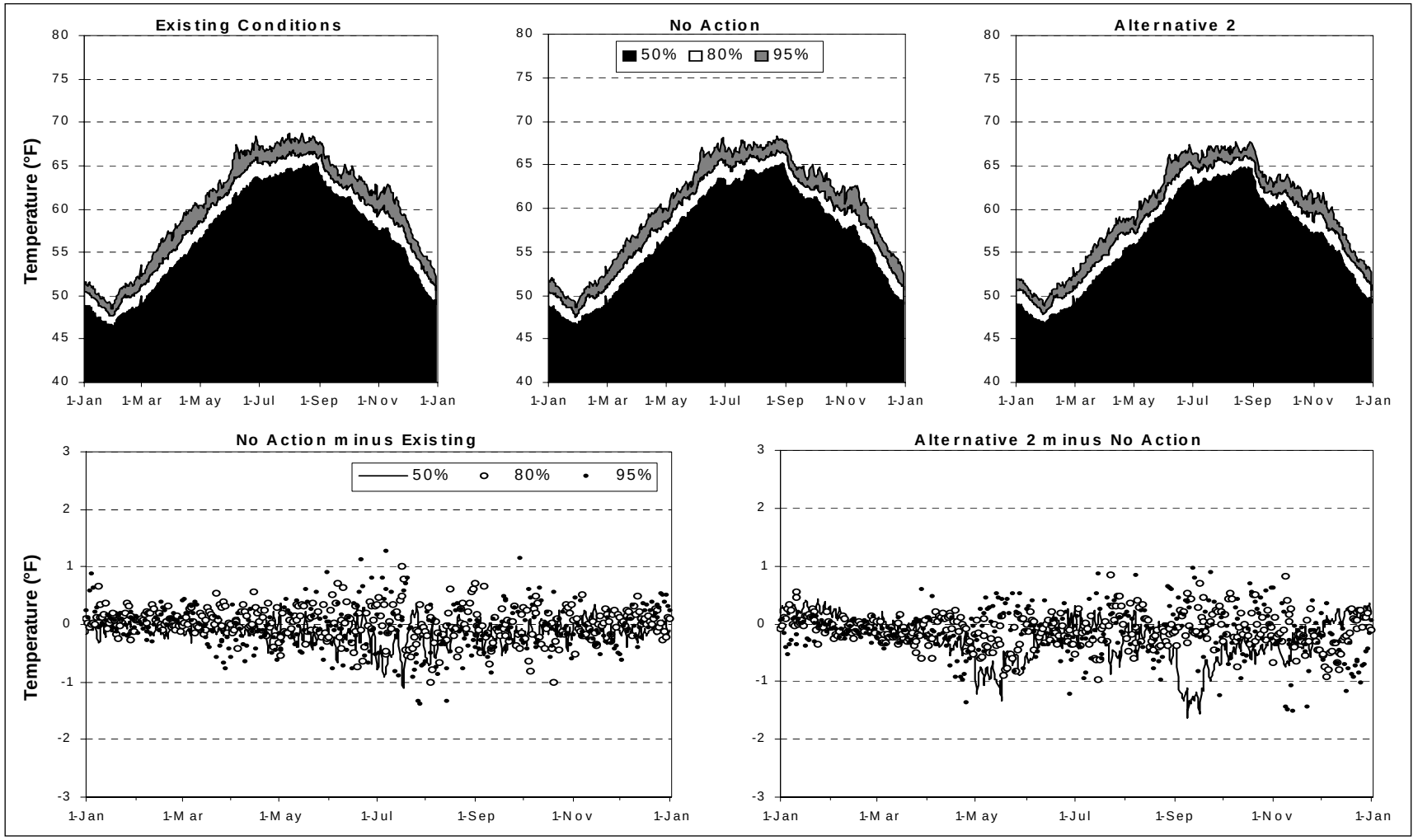


Figure G-WQ2.3-5. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, in the Feather River downstream of the Thermalito Afterbay Outlet.

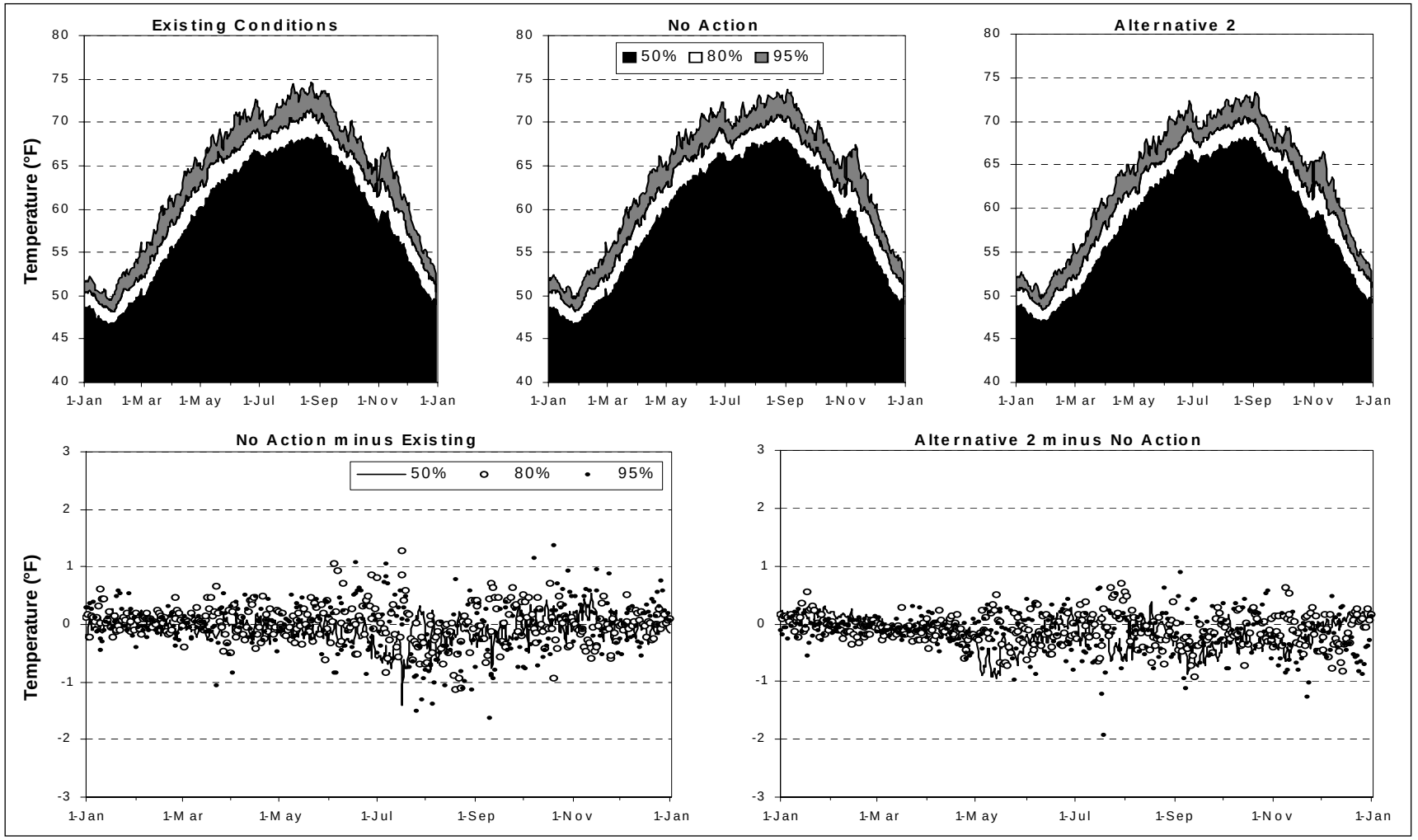


Figure G-WQ2.3-6. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, in the Feather River upstream of Honcut Creek.

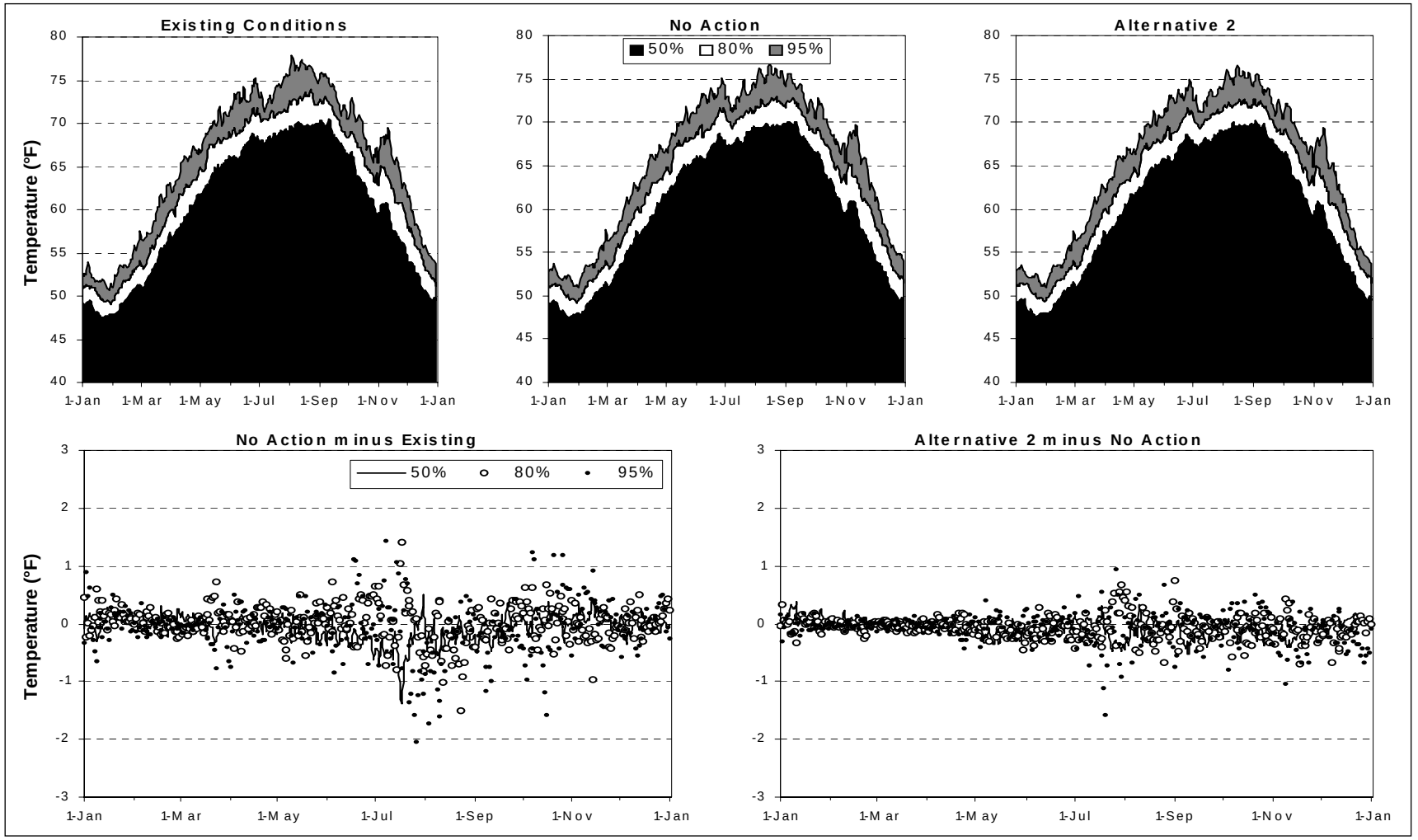


Figure G-WQ2.3-7. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, in the Feather River upstream of the Yuba River.

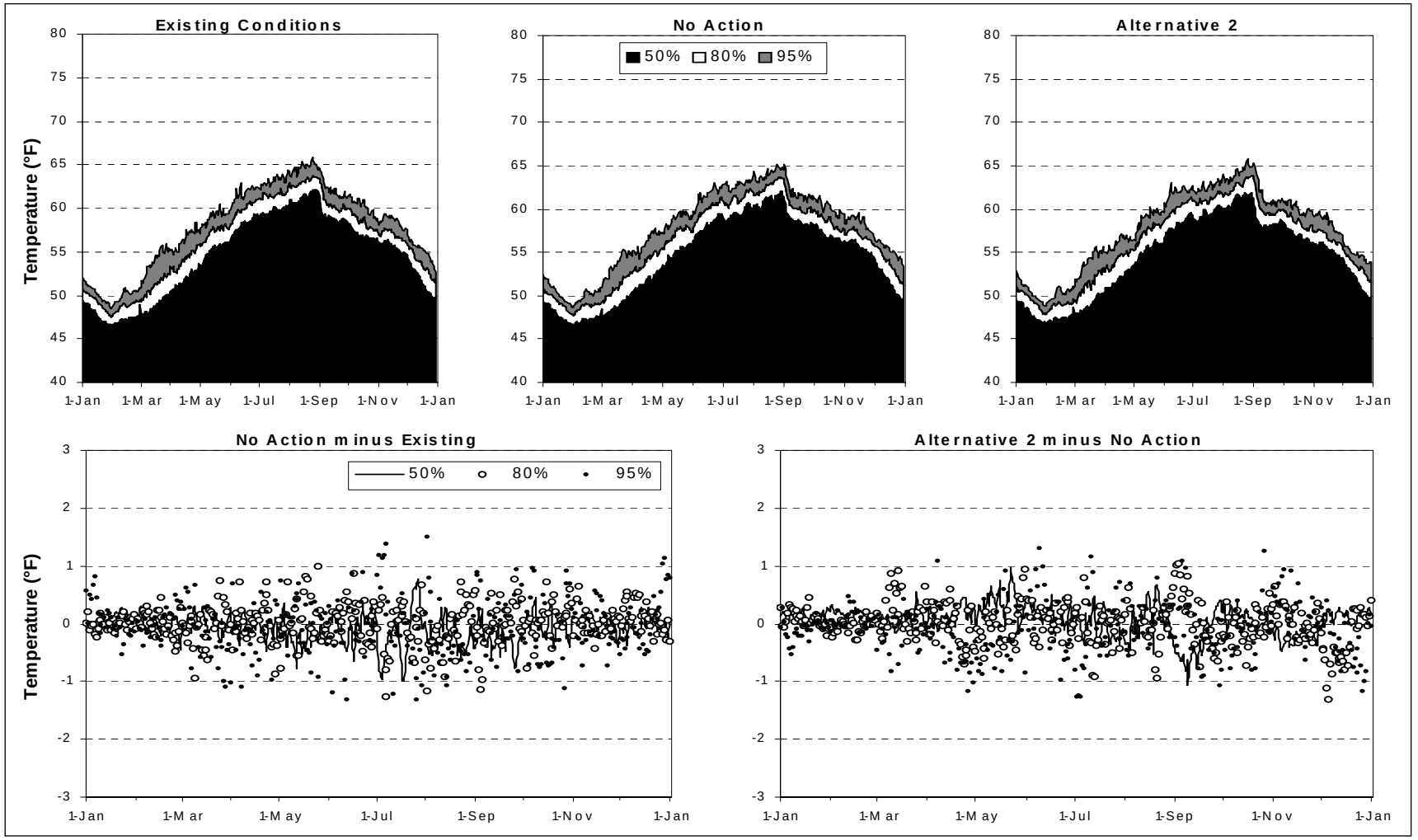


Figure G-WQ2.3-8. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, at the California Water Company Diversion from the Thermalito Complex.

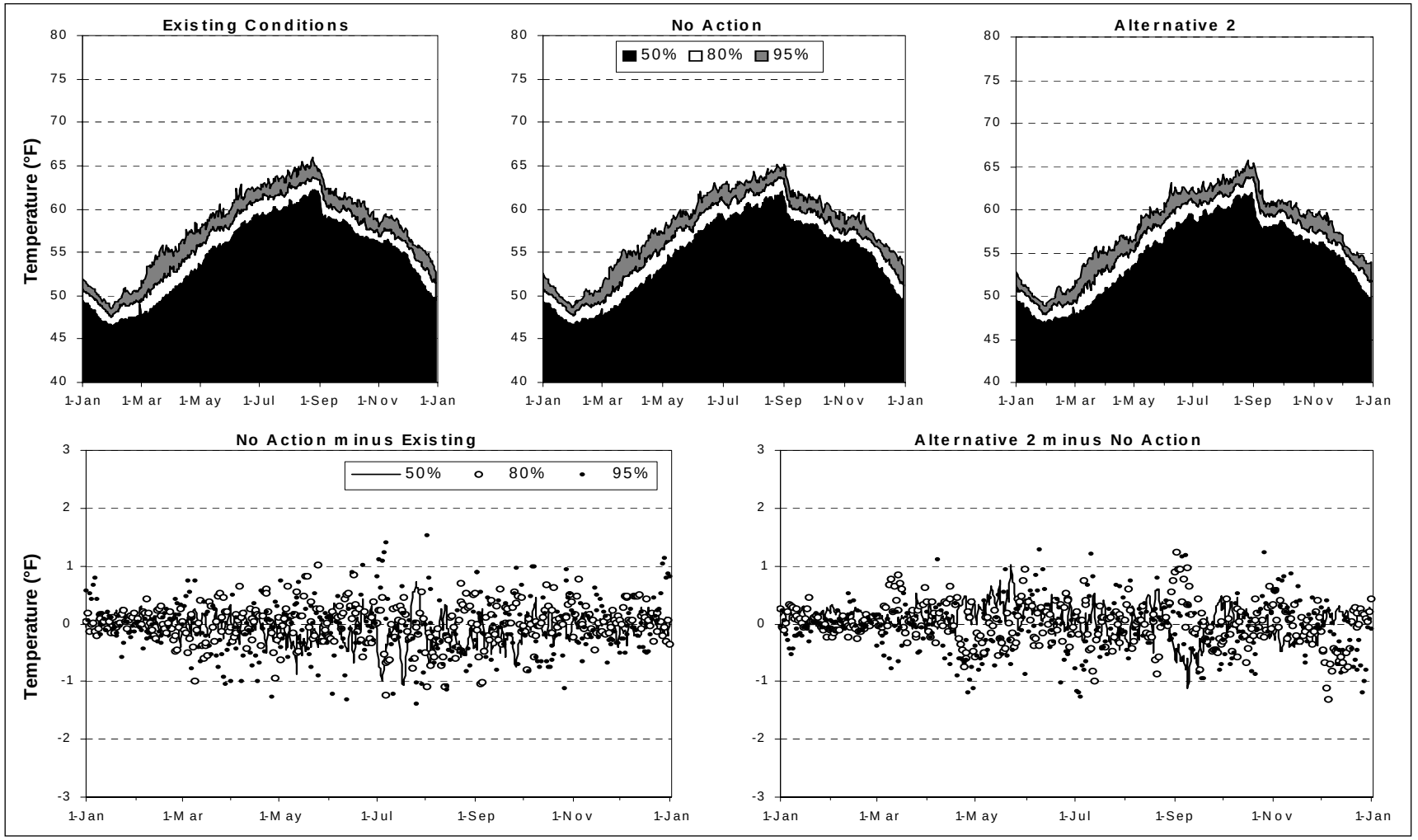


Figure G-WQ2.3-9. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between scenarios, at the Thermalito Irrigation District Diversion from the Thermalito Complex.

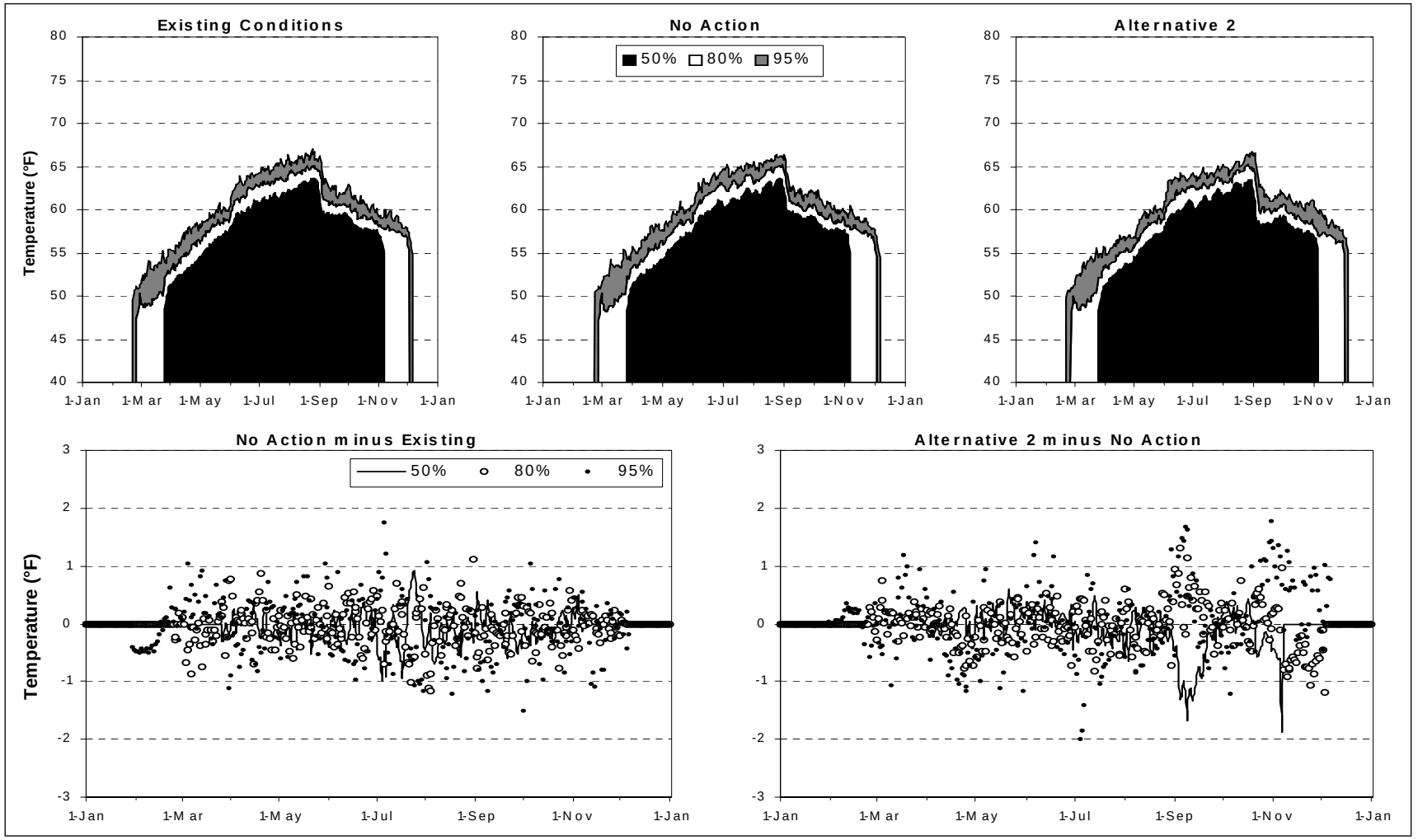


Figure G-WQ2.3-10. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, at the Western Canal Main Diversion from Thermalito Afterbay.

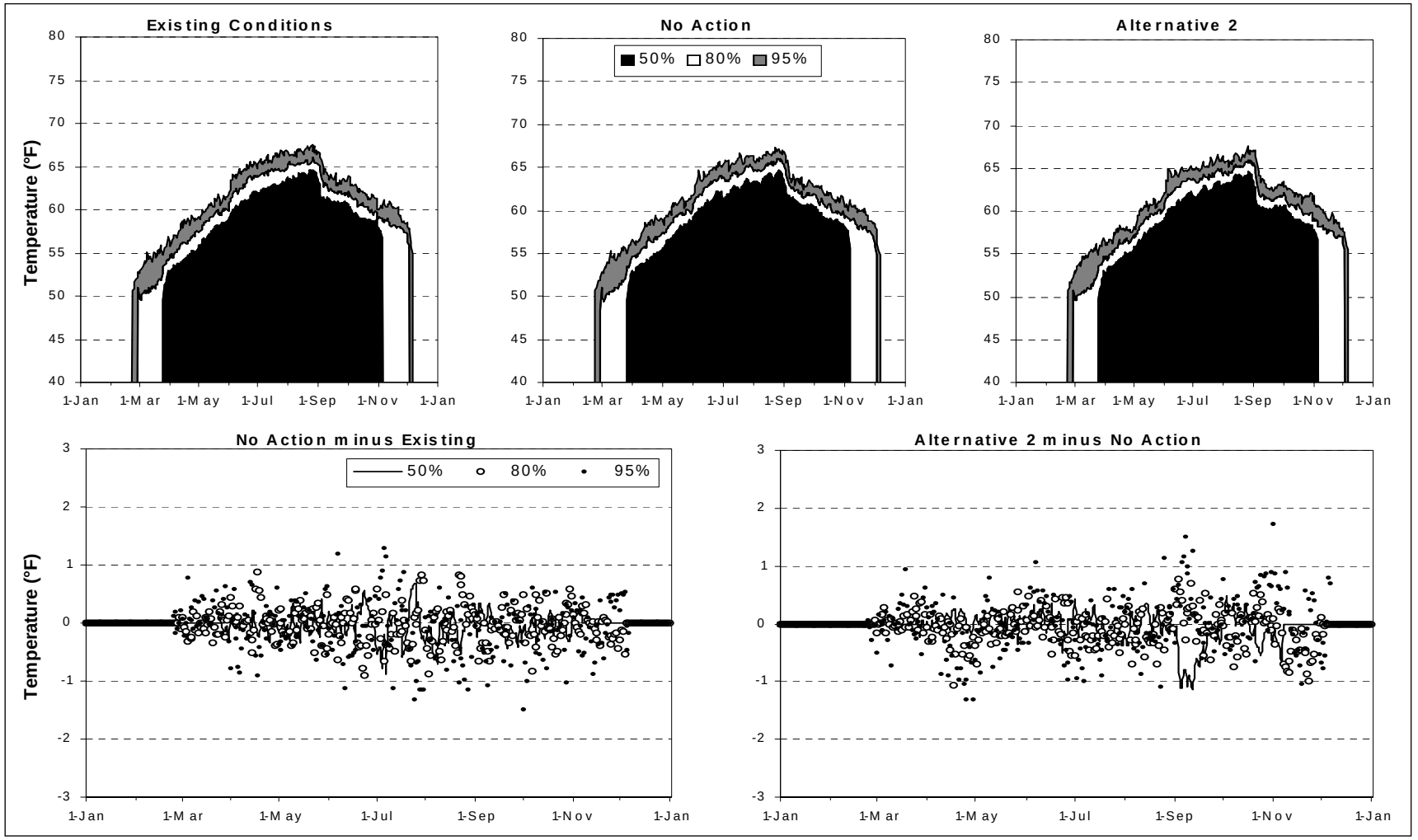


Figure G-WQ2.3-11. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, at the Western Canal Lateral Diversion from Thermalito Afterbay.

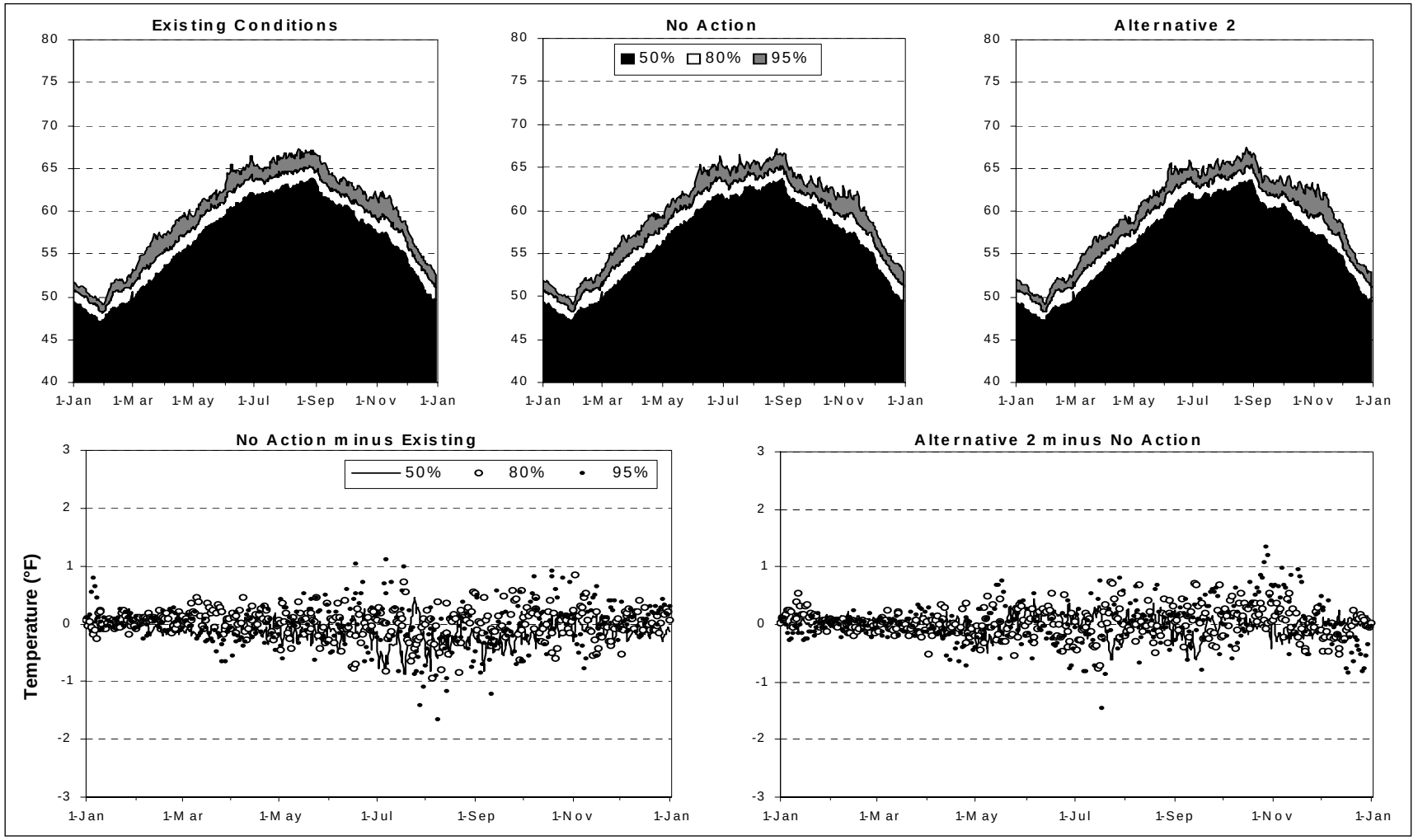


Figure G-WQ2.3-12. Temperature exceedances from simulations for Existing Conditions, No-Action, and Alternative 2 scenarios and for differences between the scenarios, at the Sutter Butte Canal Diversion from Thermalito Afterbay.

G-WQ2.4 WATER QUALITY STUDIES, METHODOLOGY

G-WQ2.4.1 Water Temperature Monitoring Program (SP-W6)

This study obtained water temperature data for empirical analyses of current conditions and to provide data for calibration of the temperature models developed in Engineering and Operations study plans.

Continuously recording loggers (Onset Optic Stowaway) were used to record temperatures at 15-minute intervals at river or discharge (e.g., Feather River Fish Hatchery, Thermalito Afterbay Outlet) monitoring locations (Figures G-WQ2.4-1 and G-WQ2.4-2). Temperature loggers were serviced and data downloaded to laptop computers at intervals not exceeding monthly.

Water temperatures were measured with a thermistor at half-meter intervals in deeper pools in the Feather River downstream of the dam to determine effects of project flows on thermal conditions including stratification. Temperatures were measured biweekly from late spring (May) to fall (October), and monthly from late fall (November) though early spring (April). Additional profiles were obtained at several sites upstream, within, and downstream of the pool formed in the Feather River by discharges from the Thermalito Afterbay Outlet. These additional measurements were obtained monthly from late spring to fall. Both temperature and dissolved oxygen were measured at intervals from the surface to the bottom at these sites.

Water temperatures were also measured at close intervals along the edge of the river upstream and downstream of the Feather River Fish Hatchery from spring through fall to help determine whether water leaches to the river from the hatchery and whether any hatchery leakage affects river temperatures.

Water temperatures were measured from the surface to the bottom at monthly intervals during the winter and biweekly from spring to fall in impounded waters (Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and the Fish Barrier Pool) and ponds in the Oroville Wildlife Area (OWA). Temperature profiles were measured in Lake Oroville with a thermistor at meter intervals when temperature differences are observed between successive depth measurements, and at 3- to 5- meter intervals when temperatures are uniform between depths. Temperature profiles were measured at 0.5- to 1-meter intervals in the other water bodies from the surface to the bottom using a thermistor. Cross section measurements were also conducted at Thermalito Forebay and Thermalito Afterbay to determine variation in temperatures in shallower and deeper areas, arms, and bays.

Existing and newly collected data were evaluated to determine thermal processes in Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the Fish Barrier Pool, and OWA ponds. Temperature data and the depth-capacity curve for the reservoir were used to evaluate the extent of the coldwater pool under existing project operations.

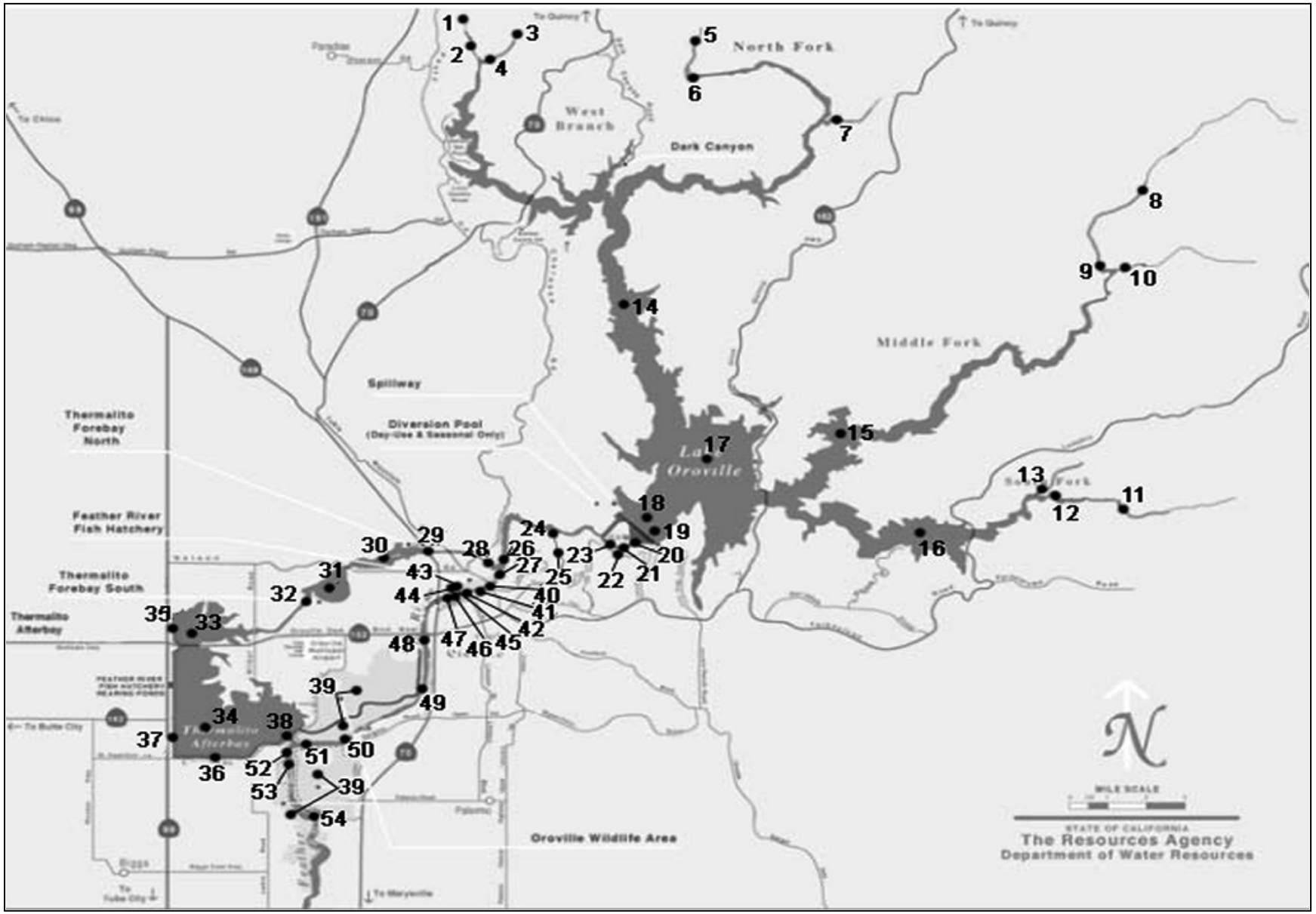


Figure G-WQ2.4-1. Temperature monitoring sites for project waters.

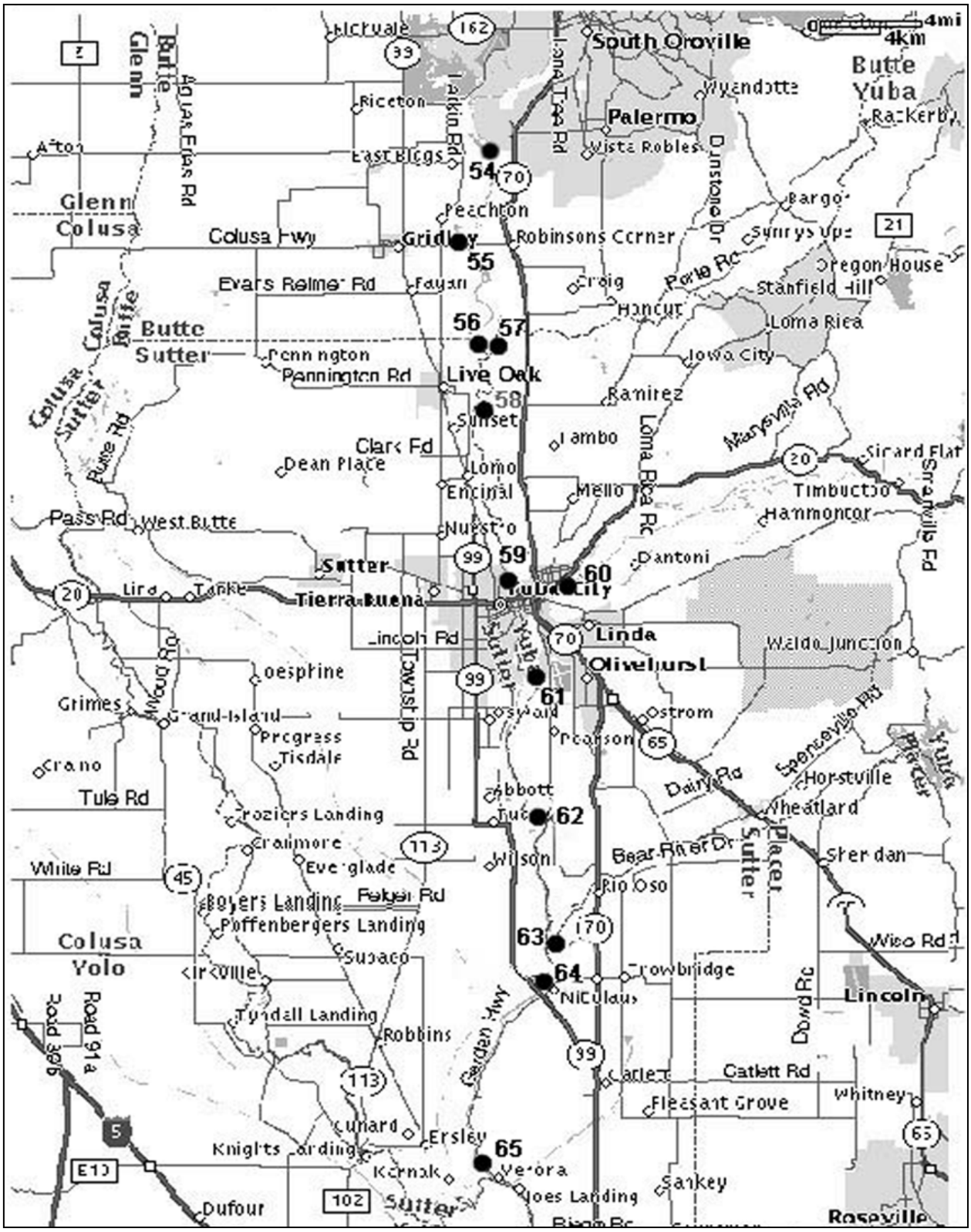
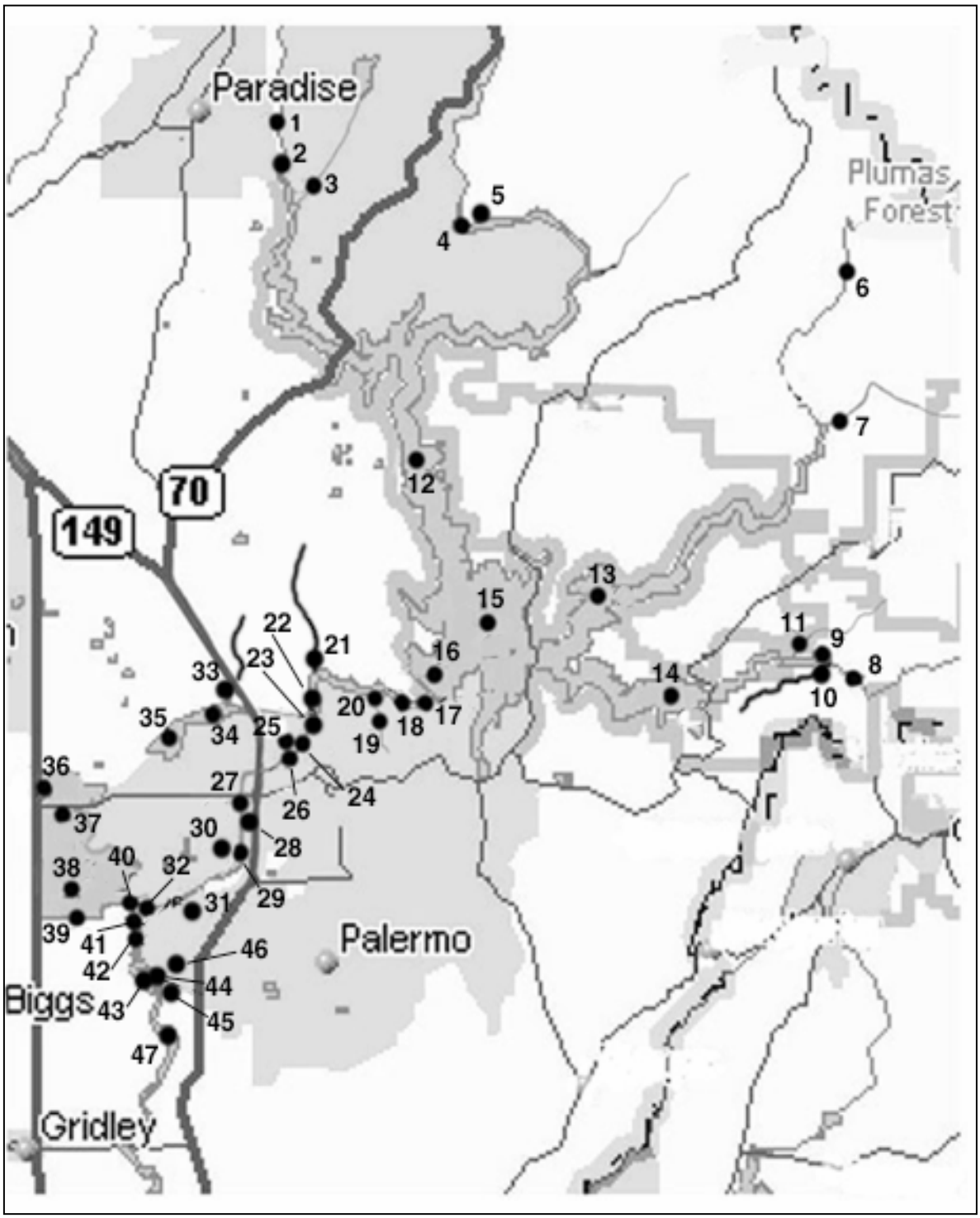


Figure G-WQ2.4-2. Temperature monitoring sites in the lower Feather River.

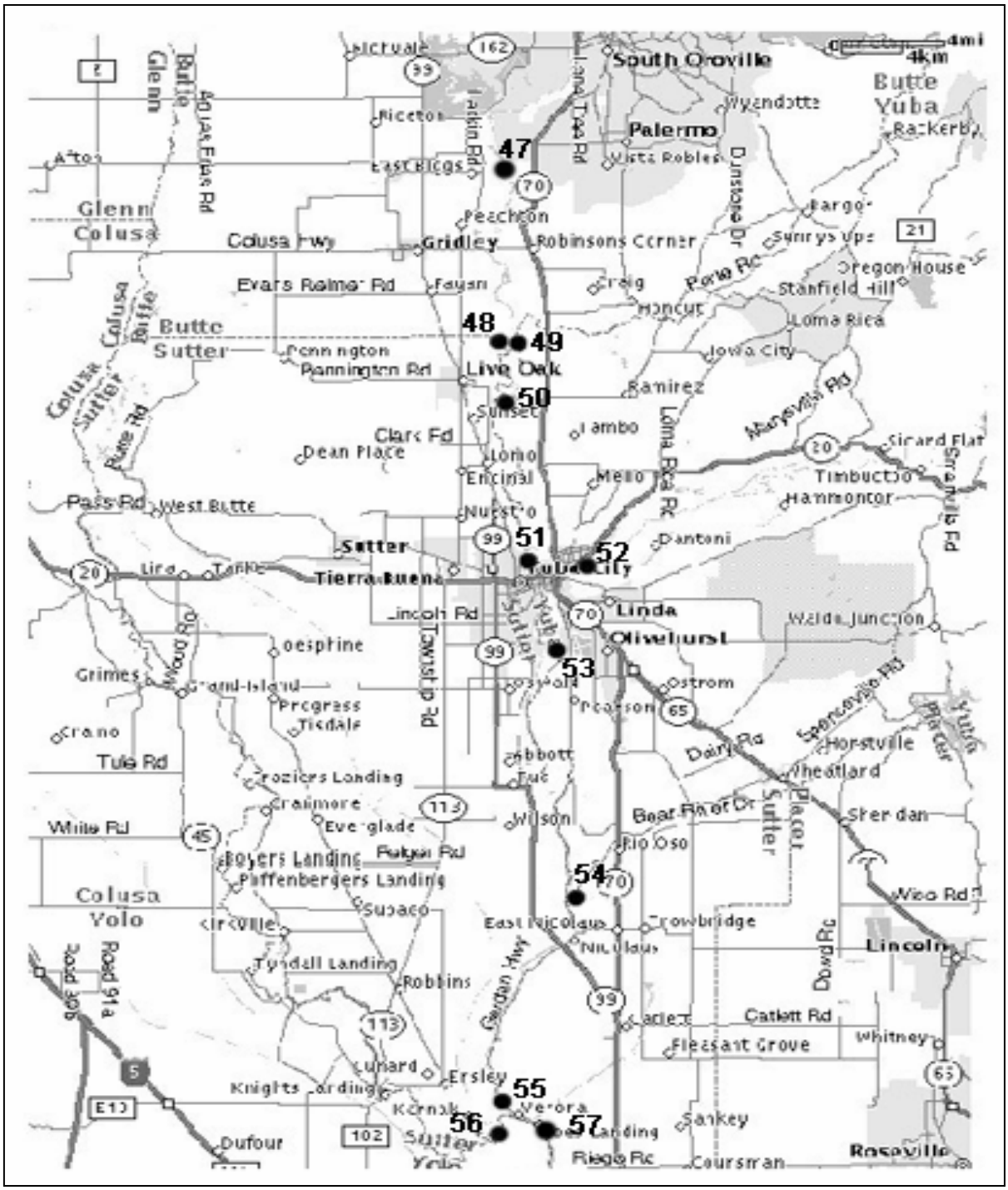
G-WQ2.4.2 General Water Quality Sampling Program (SP-W1)

This study characterized existing water quality conditions at different times of year throughout the project area to provide a basis for understanding effects of potential actions on water quality. The study generally relied on monthly collection of data from spring 2002 through spring 2004, although some parameters were targeted to specific times of the year because of parameter-specific factors. The study evaluated those parameters potentially affected by the project for which the Central Valley Regional Water Quality Control Board (RWQCB) has established water quality objectives in the Water Quality Control Plan (Basin Plan). Monitoring sites were identified in Environmental Work Group Task Force meetings, which included participation by federal and State agencies and other stakeholders. The monitoring sites were divided into three major regions: the Feather River and tributaries upstream of Lake Oroville, Lake Oroville and the Thermalito Complex impoundments, and the lower Feather River, including the OWA ponds (Figures G-WQ2.4-3 and G-WQ2.4-4, Table G-WQ2.4-1). The results of the study were compared to Basin Plan objectives and other water quality criteria for protection of beneficial uses in Table G-WQ2.4-2.



Note: See Table G-WQ2.4-1 for numbers legend.

Figure G-WQ2.4-3. Water quality monitoring sites in the project area.



Note: See Table G-WQ2.4-1 for numbers legend.

Figure G-WQ2.4-4. Water quality monitoring sites in the Lower Feather River.

Table G-WQ2.4-1. Monitoring site number system for maps.

1. West Branch Feather River near Paradise	30. Robinson Riffle Pond
2. West Branch Feather River upstream of Lake Oroville	31. Upper Pacific Heights Pond
3. Concow Creek at Jordan Hill Road	32. Feather River upstream of Thermalito Afterbay Outlet
4. North Fork Feather River upstream of Poe Powerhouse	33. North Thermalito Forebay Creek
5. Poe Powerhouse Discharge	34. Thermalito Forebay (north)
6. Middle Fork Feather River near Merrimac	35. Thermalito Forebay (south)
7. Fall River upstream of Feather Falls	36. Western Canal at Thermalito Afterbay Outlet
8. South Fork Feather River upstream of Ponderosa Reservoir	37. Thermalito Afterbay (north)
9. South Fork Feather River downstream of Ponderosa Reservoir	38. Thermalito Afterbay (south)
10. Miners Ranch Canal	39. Sutter Buttes Canal at Thermalito Afterbay Outlet
11. Sucker Run near Forbestown	40. Thermalito Afterbay Outlet Canal to Feather River
12. North Fork Arm Lake Oroville	41. Feather River downstream of Thermalito Afterbay Outlet
13. Middle Fork Arm Lake Oroville	42. Feather River downstream of SCOR Outlet
14. South Fork Arm Lake Oroville	43. Mile Long Pond
15. Lake Oroville Main Body	44. Feather River near Mile Long Pond
16. Lake Oroville near Dam	45. Lower Pacific Heights Pond
17. Diversion Pool upstream of Kelly Ridge Powerhouse (upstream of power plant)	46. See's Pond
18. Diversion Pool downstream of Kelly Ridge Powerhouse (downstream of power plant)	47. Feather River downstream of FERC project boundary
19. Glen Creek upstream of Glen Pond	48. Feather River at Singh AB Riviera Road
20. Glen Pond	49. Honcut Creek at Pacific Ranch near Palermo
21. Morris Ravine	50. Feather River at Archer Ave. (near Live Oak)
22. Diversion Pool upstream of Dam	51. Feather River upstream of Yuba River
23. Feather River at Oroville	52. Yuba River at Mouth
24. Feather River upstream of the Feather River Fish Hatchery	53. Feather River at Shanghai Bend
25. Feather River Fish Hatchery Settling Pond	54. Bear River near Mouth
26. Feather River downstream of the Feather River Fish Hatchery	55. Feather River near Verona
27. Feather River downstream of State Route (SR) 162	56. Sacramento River upstream of Feather River
28. Oroville Fishing Pond	57. Sacramento River at Verona
29. Feather River at Robinson Riffle	

Table G-WQ2.4-2. Numerical limits used to evaluate compliance of surface waters with Basin Plan objectives (expressed as mg/L unless otherwise noted).

Criteria	Sedimentation	Turbidity	Suspended Solids	Settleable Matter	Dissolved Oxygen	pH	Alkalinity	Conductivity
Primary MCL[1]	*no criteria*	1 / 5 NTU [8]	*no criteria*	*no criteria*				
Secondary MCL[1]		5 NTU						900 µmhos/cm
Agricultural Goal[2]						6.5 to 8.4		700 µmhos/cm
NAWQC Humans[3]								
NAWQC Aquatic Life[3]								
Chronic (4-day Average)					variable [9]		≥ 20	
Acute (1-hour Average)[4]						6.5 to 9		
Recommended Ecoregional Nutrient Criteria								
Central Valley Rivers and Streams[5]		4.38 NTU						
Sierra Nevada Rivers and Streams[6]		1.3 NTU						
Basin Plan[7]								150 µmhos/cm

[1] *California Department of Health Services (DHS), California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring.*
[2] *Food and Agriculture Organization of the United Nations. 1985. Water Quality for Agriculture.*
[3] *U.S. Environmental Protection Agency (USEPA), Quality Criteria for Water, 1986 (May 1986) [The Gold book] plus updates (various dates).*
[4] *Sometimes this is an Instantaneous Maximum.*
[5] *USEPA, Ambient Water Quality Criteria Recommendations for Rivers and Streams in Ecoregion I. 2001. EPA 822-B-01-012.*
[6] *USEPA, Ambient Water Quality Criteria Recommendations for Rivers and Streams in Ecoregion II. 2000. EPA 822-B-00-015.*
[7] *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region, Fourth edition. The Sacramento River Basin and the San Joaquin River Basin. Central Valley Regional Water Quality Control Board. Sacramento, California.*
[8] *Proposed; applies only to second value if two separate values are listed; applies to range if a range of values is listed.*
[9] *Central Valley Regional Water Quality Control Board (RWQCB). 2003. A Compilation of Water Quality Goals. See Page 26.*

Table G-WQ2.4-2 (Continued). Numerical limits used to evaluate compliance of surface waters with Basin Plan objectives (expressed as mg/L unless otherwise noted).

Criteria	Calcium	Magnesium	Sodium	Potassium	Sulfate	Chloride	Boron	Hardness
USEPA - Taste and Odor Thresholds[10]	*no criteria*	*no criteria*	30 to 60	*no criteria*	250			*no criteria*
Secondary MCL[11]					250/500 [17]	250		
Agricultural Goal[12]			69			106	0.7	
NAWQC Aquatic Life[13]								
Chronic (4-day Average)						230 [18]		
Acute (1-hour Average)						860 [18]		
USEPA IRIS Reference Dose[14]							0.63 [19]	
DHS Action Level for drinking water[15]							1	
USEPA draft Drinking Water Advisory[10]			20 [16]		500		0.6	
USEPA Proposed MCL Goal[10]					500			

[10] *USEPA, Office of Water, 2004 Edition of the Drinking Water Standards & Health Advisories. (Winter 2004). EPA 822-R-04-005.*
[11] *DHS, California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring.*
[12] *Food and Agriculture Organization of the United Nations, 1985. Water Quality for Agriculture.*
[13] *USEPA, Quality Criteria for Water, 1986 (May 1986) [The Gold book] plus updates (various dates).*
[14] *USEPA, Integrated Risk Information System [IRIS] database.*
[15] *DHS, Division of Drinking Water and Environmental Management, Drinking Water Action Levels (6 June 2003), http://www.dhs.cahwnet.gov/ps/ddwem.*
[16] *Guidance level to protect those individuals restricted to a total sodium intake of 500 mg/day; Reference 33.*
[17] *First value is ambient level, second is "upper" level.*
[18] *For dissolved chloride associated with sodium; criterion probably will not be adequately protective when chloride is associated with potassium, calcium, or magnesium, rather than sodium.*
[19] *Assumes 70 kilograms body weight, 2 liters per day drinking water consumption, and 20 percent relative source contribution. An additional uncertainty factor of 10 is used for Class C carcinogens.*

Table G-WQ2.4-2 (Continued). Numerical limits used to evaluate compliance of surface waters with Basin Plan objectives (expressed as mg/L unless otherwise noted).

Criteria	Ammonia		Nitrate	Nitrite (as N)	Nitrate + Nitrite (as N)	Ortho-phosphate (dissolved)	Total Phosphorus	Organic Carbon
	Total	Dissolved						
Tastes and Odors[20]	1.5	*no criteria*				*no criteria*		*no criteria*
Primary MCL[21]			45 [28]	1				
NAWQC Aquatic Life[22]								
Chronic (4-day Average)	see table 1							
Acute (1-hr Average)	see table 1							
Recommended Ecoregional Nutrient Criteria								
Central Valley Rivers and Streams[23]					0.15		0.047	
Sierra Nevada Rivers and Streams[24]					0.014		0.01	
Sierra Nevada Lakes and Reservoirs[25]					0.02		0.00875	
USEPA Draft Drinking Water Health Advisory[26]			10 [29]	1				
Public Health Goal[27]			10 [29]	1	10			

[20] *J. E. Amoore and E. Hautala. Odor as an aid to chemical safety: Odor thresholds compared with threshold limit values and volatitilities for 214 industrial chemicals in air and water dilution. Journal of Applied Toxicology, 3(6):272-290. 1983.*
[21] *DHS, California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring.*
[22] *USEPA, Quality Criteria for Water, 1986 (May 1986) [The Gold book] plus updates (various dates).*
[23] *USEPA, Ambient Water Quality Criteria Recommendations for both Rivers and Streams in Ecoregion 1. 2001. EPA 822-B-01-012.*
[24] *USEPA, Ambient Water Quality Criteria Recommendations for Rivers and Streams in Ecoregion II. 2000. EPA 822-B-00-015.*
[25] *USEPA, Ambient Water Quality Criteria Recommendations for Lakes and Reservoirs in Ecoregion II. 2000. EPA 822-B-00-007.*
[26] *USEPA, Office of Water, 2004 Edition of the Drinking Water Standards and Health Advisories. (Winter 2004). EPA 822-R-04-005.*
[27] *California Environmental Protection Agency (Cal/EPA), Office of Environmental Health Hazard Assessment, Public Health Goals for Chemicals in Drinking Water (various dates), http://www.oehha.org/water.phg/.*
[28] *As NO_3.*
[29] *As nitrogen (N).*

Table G-WQ2.4-2 (Continued). Numerical limits used to evaluate compliance of surface waters with Basin Plan objectives (expressed as mg/L unless otherwise noted).

Criteria	Aluminum		Arsenic		Cadmium	Chromium	Copper		Iron	Mercury	
	T	D	T	D	D	T	T	D	D	T	D
Public Health Goal[30]	-	0.6	-	-	-	-	-	0.17	-	-	-
Primary MCL[31]	-	1	-	0.05	0.005	0.05	-	1.3	-	-	-
Secondary MCL[31]	-	0.2	-	-	0.00007	-	-	1	0.3	-	-
Agricultural Goal[32]	-	5	-	-	0.01	-	-	200	5	-	-
Cal/EPA Cancer Potency Factor[33,34]	-	-	-	0.000023	0.000092	-	-	-	-	-	-
CTR Humans[35]	-	-	-	-	-	-	1.3	-	-	0.00005	-
CTR Aquatic Life[35]											
Chronic, 4-day Average	-	-	-	0.15	*variable* [41]	-	-	*variable* [43]	-	-	-
Acute, 1-hour Average	-	-	-	0.34	*variable* [41]	-	-	*Variable* [43]	-	-	-
NAWQC Humans[36]	-	-	.000018 [40]	-	-	-	-	1.3	-	-	-
NAWQC Aquatic Life[36]											
Chronic, 4-day Average	0.087 [39]	-	-	0.15	*variable* [42]	-	-	*variable* [43]	1	-	0.00077
Acute, 1-hour Average	0.75 [39]	-	-	0.34	*variable* [42]	-	-	*Variable* [43]	-	-	0.0014
USEPA IRIS Reference Dose[37,38]	-	-	-	.0021	0.0035	-	-	-	-	-	-

[30] *California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment Public Health Goals for Chemicals in Drinking Water.*
[31] *DHS, California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring.*
[32] *Food and Agriculture Organization of the United Nations, 1985. Water Quality for Agriculture.*
[33] *Cal/EPA, Office of Environmental Health Hazard Assessment, Cal/EPA Toxicity Criteria Database.*
[34] *Assumes 70 kg body weight and 2 liters/day water consumption.*
[35] *State Water Resources Control Board (SWRCB), Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (2 March 2003).*
[36] *USEPA, Quality Criteria for Water, 1986 (May 1986) [The Gold book] plus updates (various dates).*
[37] *USEPA, Integrated Risk Information System [IRIS] database.*
[38] *Assumes 70 kilograms body weight, 2 liters/day water consumption, and 20 percent relative source contribution from drinking water. An additional uncertainty factor of 10 is used for Class C carcinogens.*
[39] *For pH between 6.5 and 9.0. Use of Water-Effects Ratios might be appropriate because: (1) aluminum is less toxic at higher pH and hardness but relationship not well quantified; (2) aluminium associated with clay particles may be less toxic than that associated with aluminum hydroxide particles; (3) many high quality waters in U.S. exceed 87 µg/L as total or dissolved.*
[40] *Criterion refers to the inorganic form only.*
[41] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 19.*
[42] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 20.*
[43] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 23.*

Table G-WQ2.4-2 (Continued). Numerical limits used to evaluate compliance of surface waters with Basin Plan objectives (expressed as mg/L unless otherwise noted).

Criteria	Methyl Mercury	Manganese	Nickel		Lead	Selenium		Silver	Zinc	
	T	D	T	D	D	T	D	D	T	D
Public Health Goal[44]	-	-	-	0.012	0.002	-	-	-	-	-
Primary MCL[45]	-	-	-	0.1	0.015	-	0.05	-	-	-
Secondary MCL[45]	-	0.05	-		-	-	-	0.1	-	5
Agricultural Goal[46]	-	0.2	-	0.2	5	-	0.02	-	-	2
Cal/EPA Cancer Potency Factor[47,48]	-	-	-		0.0041	-	-	-	-	-
CTR Humans[49]	-	-	0.61	-	-	-	-	-	-	-
CTR Aquatic Life[49]										
Chronic, 4-day Average	-	-	-	*variable* [53]	*variable* [54]	0.005		-	-	*variable* [57]
Acute, 1-hour Average	-	-	-	*variable* [53]	*variable* [54]	0.02		*variable* [55]	-	*variable* [57]
NAWQC Humans[50]	-	-	0.61	-	-	0.170	-	-	7.4	-
NAWQC Aquatic Life[50]										
Chronic, 4-day Average	-	-	-	*variable* [53]	*variable* [54]	0.005		-	-	*variable* [57]
Acute, 1-hour Average	-	-	-	*variable* [53]	*variable* [54]	0.135		*variable* [56]	-	*variable* [57]
USEPA IRIS Reference Dose[51,52]	0.00007	0.98	-	0.14	-	-	0.035	0.035	-	2.1

[44] *Cal/EPA, Office of Environmental Health Hazard Assessment, Public Health Goals for Chemicals in Drinking Water.*
[45] *DHS, California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring.*
[46] *Food and Agriculture Organization of the United Nations, 1985. Water Quality for Agriculture.*
[47] *Cal/EPA, Office of Environmental Health Hazard Asssessment, Cal/EPA Toxicity Criteria Database.*
[48] *Assumes 70 kilograms body weight and 2 liters/day water consumption.*
[49] *SWRCB, Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (2 March 2003).*
[50] *USEPA, Quality Criteria for Water, 1986 (May 1986) [The Gold book] plus updates (various dates).*
[51] *USEPA, Integrated Risk Information System [IRIS] database.*
[52] *Assumes 70 kilograms body weight, 2 liters/day water consumption, and 20 percent relative source contribution from drinking water. An additional uncertainty factor of 10 is used for Class C carcinogens.*
[53] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 25.*
[54] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 24.*
[55] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 28.*
[56] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 29.*
[57] *Central Valley RWQCB. 2003. A Compilation of Water Quality Goals. See Page 30.*

Notes: CTR = California Toxics Rule; MCL = Maximum Contaminant Level; mg/L = milligrams per liter; µmhos/cm = micro-mhos per centimeter; NAWQC = National Ambient Water Quality Criteria; NTU = nephelometric turbidity units

G-WQ2.4.2.1 Field Parameters (Water Temperature, Dissolved Oxygen, pH, Electrical Conductivity, and Turbidity)

Basic water quality parameters, including water temperature, dissolved oxygen (DO), pH, electrical conductivity, and turbidity were measured with calibrated field instrumentation during each field visit. Stream samples or measurements were collected about 1 foot below the surface in flowing, well-mixed riffle or run areas. DO was measured in streams by titration (azide modification of the iodometric method). Basic water quality parameters collected in lentic waters (impoundments and ponds) were measured from the surface to the bottom at meter intervals when differences in individual parameters were observed between successive depths, and at 3- to 5- meter intervals when there were no differences in successive values. Conductivity and pH were measured with meters in samples collected at intervals with a van Dorn water bottle. Turbidity was measured with a nephelometer from samples collected using the van Dorn water bottle.

DO was also measured in pools near the sampling stations downstream of the Fish Barrier Dam to the mouth of the Feather River. DO (and temperature in conjunction with SP-W6) profiles were measured at half-meter intervals from the surface to the bottom of pools with meters and probes every other week from May through October, and monthly from November through April.

G-WQ2.4.2.2 Inorganic Chemistry (Minerals, Alkalinity, Metals, Hardness, Nutrients, and Organic Carbon)

Inorganic chemical analyses included minerals (calcium, sodium, potassium, magnesium, sulfate, chloride, boron, and alkalinity); metals (aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, and zinc); nutrients (nitrate plus nitrite, ammonia, dissolved orthophosphate, and total phosphorus); and total and dissolved organic carbon. For all metals except mercury, samples were collected for both total recoverable and dissolved metals. Mercury analyses were conducted by using U.S. Environmental Protection Agency (USEPA) Method 1631, and include both total recoverable and total methyl fractions. Hardness was also analyzed from samples collected at each site.

Samples for chemical analyses from streams were collected by wading into the channel and dipping sample containers to a depth of approximately 1 foot into the well-mixed channel flow. Mineral and nutrient samples were collected into clean polyethylene containers. Samples for trace metals analyses at water quality criteria levels were collected into polyethylene or glass bottles according to USEPA Method 1669 (USEPA 1996). Samples for mineral, nutrient, and metal analyses from lakes and ponds were collected from the surface by dipping an inverted container to approximately 0.5 meter below the surface. Water samples at greater depths were collected with a van Dorn water bottle for minerals and nutrients and Teflon bomb or Kemmerer style bottles for trace metals. Samples were collected from near the surface and bottom of lakes and ponds during periods of stratification or when differences in field parameters occurred between the surface and bottom, but only at mid-depth during those portions of the year

when field parameters indicated uniform conditions throughout the water column in the shallower water bodies, such as OWA ponds.

Chemical analyses of minerals, nutrients, and metals were performed at the DWR Bryte Chemical Laboratory in West Sacramento using USEPA approved techniques, equipment, and methods.

G-WQ2.4.2.3 Sedimentation

Stream gravels from riffle areas were analyzed for laboratory determination of particle size distribution in Study Plan SP-G2, Task 2.

G-WQ2.4.2.4 Suspended and Settleable Solids

Water samples were collected for suspended and settleable materials analyses during monthly visits to the sites designated for inorganic chemistry analyses. Settleable materials were determined by settling the water sample in an Imhoff cone, while suspended material was determined by filtration.

G-WQ2.4.2.5 Pesticides

Water samples for determining concentrations of pesticides were collected from the monitoring stations in the fall after rains produced the first significant runoff and again during February or March. Samples were analyzed at the Bryte Chemical Laboratory for chlorinated organic pesticides, organic phosphorus pesticides, chlorinated phenoxy acid herbicides, volatile organic pesticides, carbamate pesticides, and glyphosate.

G-WQ2.4.2.6 Color

Color is defined as either true or apparent color. Water samples were collected for color analyses during monthly visits to the sites designated for inorganic chemistry analyses. Color was determined by first filtering samples to remove apparent color and then comparing the filtered samples against calibrated glass disks (colorimetry). The analyses were conducted by using Standard Method 2120 B.

G-WQ2.4.2.7 Floating Material and Oil and Grease

Floating materials and oil and grease were determined through visual observation during each visit to each monitoring site. Floating materials, if present, were estimated as a percent cover of the water. If oil, grease, or related compounds were sighted, water samples were collected for laboratory determination of the type of compound. The oil and grease analyses were conducted using Standard Method 5520.

G-WQ2.4.2.8 Tastes and Odors

Sampling water for taste requires that a sample be taken into the mouth for sensory analysis. However, raw water is not safe for taste testing because of the potential

presence of bacteria, viruses, hazardous chemicals, and other factors. Therefore, water from the project area was not subjected to taste tests.

Water can be analyzed for odor simply by smelling a sample. At least two individuals smelled water samples from each site visit to determine the presence of odors. The samplers described the type of any odor detected to attempt determination of the causative agent.

G-WQ2.4.2.9 Pathogens (Bacteria)

Fecal coliform bacteria in aquatic ecosystems are indicative of fecal contamination. Though these bacteria generally do not pose adverse risks, their presence indicates the possible presence of far more serious microorganisms that may affect human health and potential nutrient loading that may adversely affect the aquatic environment.

Bacteria levels were screened monthly at the monitoring stations using membrane filter procedures for both fecal and total coliform bacteria. In addition, a focused coliform bacteria sampling program was conducted by monitoring selected stations at intensively used recreation areas, such as the North Forebay Recreation Area, during a major holiday event, according to requirements in the Basin Plan (i.e., no fewer than 5 samples for any 30-day period). This list of coliform sampling stations was developed in consultation with State Water Resources Control Board (SWRCB) staff and other members of the Environmental Work Group.

G-WQ2.4.2.10 Aquatic Toxicity

Toxicity tests measured survival and growth for the fathead minnow, and reproduction and survival of *Ceriodaphnia* over a 7-day test period (USEPA 1994). The tests were conducted by using USEPA Method 600-4-91-002. Water samples were analyzed during the high-temperature months of July and September, following the first flush in the fall, following winter dormant spraying in February, and again during the high runoff period in April or May in tributaries to Lake Oroville. Samples were analyzed monthly for toxicity analyses from the monitoring sites downstream from the Fish Barrier Dam to Honcut Creek. Identification of the causative agent for toxicity was attempted through toxicity identification evaluation (TIE) procedures for some sites displaying frequent toxicity. Several OWA ponds were sampled in the spring and again in mid-summer. Toxicity tests were conducted at the Pacific EcoRisk Laboratory.

G-WQ2.4.2.11 Periphyton

Periphyton is attached algae. Taxa and density of periphyton are used as indices of nutrient status of the water. Periphyton was sampled monthly from riffle substrates in the Feather River and upstream tributaries. A cylindrical sampler was used to enclose the periphyton, which was then brushed from the substrate and aspirated into collection jars. Ten samples from each site were composited. Analyses of the periphyton included species identification and counts.

G-WQ2.4.3 Fish Tissues Contaminants Sampling Program (SP-W2)

This study investigated concentrations of metal and pesticide contaminants in fish and crayfish from the Thermalito Complex impoundments and the lower Feather River. Fish tissues were collected from 16 locations and crayfish were collected from four sites. Site selections were based on water quality data from Study Plan SP-W1. The study area included Lake Oroville, the Diversion Pool, Thermalito Forebay, Thermalito Afterbay, the Low Flow Channel of the Feather River, the Feather River immediately downstream of the Thermalito Afterbay Outlet, and two OWA ponds (Table G-WQ2.4-3 and Figure G-WQ2.4-5).

Table G-WQ2.4-3. Fish and crayfish collected from project waters for analysis of tissue contaminants.

Sampling Location	Bass	Pikeminnow	Catfish	Carp	Crayfish
SF Lake Oroville (McCabe Cove)	9 SB		3 CHC		
SF Lake Oroville (Lower)	7 SB		5 CHC		
MF Lake Oroville (Upper)	7 SB		3 CHC		
MF Lake Oroville (Lower)	5 SB		3 CHC		
NF Lake Oroville (Bloomer Canyon)	10 SB		4 CHC	2	
NF Lake Oroville (Foreman Creek)	10 SB		5 CHC, 3WHC		
Lime Saddle Marina (West Branch Arm)	10 SB		4 CHC		
Lake Oroville (Spillway Arm)	7 SB		4 CHC		
Lake Oroville (Bidwell Arm)	7 SB		5 CHC		
Diversion Pool					10
North Thermalito Forebay (Swim Area)		10		5	
North Thermalito Afterbay					10
North Thermalito Afterbay (Potter's Pond)	8 LM			3	
South Thermalito Afterbay	8 LM			5	10
Feather River US of Thermalito Afterbay Outlet	5 LM				
Feather River DS of Thermalito Afterbay Outlet	10 LM				
Feather River DS of SR 70					10
Mile Long Pond	8 LM		4 BRB		
Lower Pacific Heights Pond			5 CHC		

Note: BRB = brown bullhead, CHC = channel catfish, DS = downstream, LM = largemouth bass, MF = Middle Fork, NF = North fork, SB = spotted bass, SF = South Fork, SR = State Route, US = upstream, WHC = white catfish

The fish species selected for sampling were those resident in the water body being investigated. Collection of newly planted fish (i.e., less than 1 year residency) was avoided. Fish were collected beginning in the late spring of 2002 with electroshockers, gill nets, hooks and lines, and seines. Fish were weighed and measured, wrapped in aluminum foil, and immediately frozen for transport to the laboratory. Crayfish were also collected from several sites within the project area at approximately the same time that the fish were collected. Larger (older) crayfish were targeted. Ten crayfish of similar size from each sampled site were composited. Crayfish were collected by hand, nets, and baited traps. Crayfish were wrapped in aluminum foil and frozen for transport to the laboratory.

Analytical procedures generally followed those used in the Toxic Substances Monitoring Program conducted by the SWRCB and California Department of Fish and Game (DFG) (SWRCB 1996). Metals, pesticides, polychlorinated biphenyls, and polynuclear aromatic hydrocarbons were analyzed from fish or crayfish tissues for this study. Methyl mercury is assumed to be the form of mercury available for bioaccumulation in the food web. Most mercury in fish tissues is in the methyl mercury fraction. Total mercury, however, is typically analyzed from fish tissue and is assumed to represent the methyl mercury content of tissues. Fish muscle tissue (filet) is typically analyzed for arsenic, cadmium, nickel, mercury, and selenium, while fish liver is analyzed for copper, zinc, chromium, lead, and silver. The laboratory performed these typical analyses, as well as analyses of all the metals from most filet samples. All organic chemicals in the fish were analyzed from filets. Whole body analyses of metals and organic chemicals were performed on the crayfish. Crayfish were shelled at the laboratory before analysis for methyl mercury. All analyses for organic contaminants were performed at the DFG Water Pollution Control Laboratory in Rancho Cordova, while metals analyses were performed at the DFG Moss Landing Marine Laboratories in Monterey.

Bass obtained from each sampling site were individually analyzed for total mercury contamination. Subsequently, up to five fish from each site were composited following guidelines of the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (OEHHA). The bass and catfish composites were analyzed for organic and metal contaminants. The composites of bass and catfish collected near the Lime Saddle Marina were analyzed for polynuclear aromatic hydrocarbons. The composited crayfish samples were analyzed for organic and metal contaminants.

Criteria and guidance values for protection of human health and wildlife from contaminant accumulation or ingestion were researched and reviewed for those contaminants identified in the fish from this study. Criteria and guidance values reviewed include numerical criteria and guidance values of USEPA, OEHHA, SWRCB, the U.S. Food and Drug Administration, the Food and Agriculture Organization of the United Nations, the U.S. Fish and Wildlife Service (USFWS), Environment Canada, the National Academies of Sciences and Engineering, and the New York Department of Environmental Conservation (see SP-W2). Unfortunately, few criteria or guidelines have been developed for protection of predatory wildlife species from ingestion of prey containing metal or organic contaminants, although USFWS and USEPA are beginning efforts to evaluate toxicity data that may eventually lead to development of protective criteria. The numerical limits used to evaluate compliance with the Basin Plan objective for toxicity are listed in Tables G-WQ2.4-4 and G-WQ2.4-5.

Table G-WQ2.4-4. Numerical limits used to evaluate compliance of fish and crayfish tissue metal concentrations with Basin Plan objectives for toxicity (expressed as ppm [mg/kg] fresh weight).

			Arsenic	Cadmium	Chromium	Copper		Lead	Mercury	Nickel	Selenium	Silver	Zinc
Maximum Tissue Residue Levels (MTRLs) (for Filets or Edible Tissues) [a]	For Carcinogens in Inland Surface Waters		0.2										
	For Non-carcinogens in Inland Surface Waters			0.64					1				
NAS Recommended Guideline for Freshwater Fish [b]	(Whole Fish)								0.5				
FDA Action Level for Freshwater and Marine Fish [c]	(Edible Portion)								1.0 [d]				
OEHHA Screening values and action levels in fish tissues [e]	USEPA Value		3 [f]	10					0.6 [g]		50		
	OEHHA Value		1 [f]	3					0.3 [g,j]		20		
Elevated Data Levels [a]	Fish Type [h]		All	All	All	Non	Salmo	All	All	All	All	All	All
	Fish Livers	EDL 85	0.21	0.36	0.03	12	170	0.1	ID [i]	<0.10 [h]	3.32	0.26	28
		EDL 95	0.68	0.99	0.07	33	230	0.2	ID	0.2	4.74	0.76	38
	Whole Fish	EDL 85	0.41	0.12	0.23	3.3		0.2	0.11	0.21	1.4	0.02	42
		EDL 95	0.88	0.19	0.54	4.3		0.46	0.22	0.56	1.9	0.04	49
	Fish Filets	EDL 85	0.14	<0.01 [h]	<0.02 [h]	0.69		<0.10 [h]	0.8	<0.10 [h]	1	<0.02 [h]	21.4
		EDL 95	0.43	0.01	<0.02 [h]	0.99		<0.10	1.7	<0.10 [h]	1.8	<0.02 [h]	30.2
Median International Standards [a]	(Excludes Liver)		1.5	0.3	1	20		2	0.5		2		45
Canadian Tissue Residue Guidelines									0.033 [k]				
USFWS Contaminant Hazard Reviews			NA [l] (USFWS 1988b)	0.1 (USFWS 1985a)	NA [l] (USFWS 1986b)	NA [l] (USFWS 1998a)		NA [l] (USFWS 1988c)	wildlife: 1.1, avian: 0.1 (USFWS 1987)	wildlife: 500; avian: 200 (USFWS 1998b)	NA [l] (USFWS 1985b)	6 (USFWS 1996)	300 [l] (USFWS 1993)
USFWS Protection of Threatened and Endangered Wildlife									0.3 [m]				

Table G-WQ2.4-4. Numerical limits used to evaluate compliance of fish and crayfish tissue metal concentrations with Basin Plan objectives for toxicity (expressed as ppm [mg/kg] fresh weight).

	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Zinc

[a] *From SWRCB 1995. Toxic Substances Monitoring Program, 1994-95 Data Report. State Water Resources Control Board, Sacramento, California.*
[b] *National Academy of Sciences-National Academy of Engineering. 1973. Water Quality Criteria, 1972 (Blue Book). U.S. Environmental Protection Agency, Ecological Research Series.*
[c] *U.S. Food and Drug Administration (FDA) 2000. Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed. U.S. Food and Drug Administration. Industry Activities Staff Booklet. Washington, D.C.*
[d] *As methyl mercury.*
[e] *OEHHA 1999. Prevalence of Selected Target Chemical Contaminants in Sport Fish from Two California Lakes: Public Health Designed Screening Study. Office of Environmental Health Hazard Assessment, Sacramento, California.*
[f] *Measured as total arsenic.*
[g] *Measured as total mercury.*
[h] *< = elevated data level (EDL) lies below the indicated detection limit.*
[i] *ID = Insufficient data to calculate the EDL.*
[j] *As methyl mercury; from USEPA 2001. Water Quality Criterion for the Protection of Human Health: Methylmercury. EPA-823-R-01-001.*
[k] *As methyl mercury.*
[l] *No criteria proposed.*
[m] *USFWS 2003. Evaluation of the Clean Water Act Section 304(a) Human Health Criterion for Methylmercury: Protectiveness for Threatened and Endangered Wildlife in California. U.S. Fish and Wildlife Service. Sacramento, California.*

Table G-WQ2.4-5. Numerical limits used to evaluate compliance of fish and crayfish tissue organic concentrations with Basin Plan objectives for toxicity (expressed as ppb [ng/g] fresh weight).

			Chlordane, cis	Chlordane, trans	Nonachlor, cis	Nonachlor, trans	Chlordane (total) [e]	Chlorpyrifos	DDD, o,p'	DDD, p,p'	DDE, p,p'	DDMU, p,p'	DDT (total) [f]	Dieldrin	HCB	aroclor 1254	aroclor 1260	PCB [g]	PCB (total) [h]
Maximum Tissue Residue Levels (MTRLs) (for Filets or Edible Tissues) [a]	For Carcinogens in Inland Surface Waters						1.1						32	0.65	6			2.2	
NAS Recommended Guideline for Freshwater Fish [b]	(whole fish)						100						1,000	100				500	
FDA Action Level for Freshwater and Marine Fish [c]	(edible portion)						300						5,000	300				2,000 (i)	
OEHHA Screening values and action levels in fish tissues [d]	USEPA value						80	30,000					300	7	70			10	
	OEHHA value						30	10,000					100	2	20			20	
Elevated Data Levels [a]	Fish type [h]																		
	Whole freshwater fish calculated using 1978-1995 data (ppb, wet weight)	EDL 85	30.7	20	16.7	44	128.8	25.4	44	254	1,570	46.4	2,393.4	46.4	3.6	120	77.1	219.6	
		EDL 95	57.9	36	27	65.7	195.1	61.9	140	893	3,490	120	5,037.7	379	9.1	358.5	160	472.5	

Table G-WQ2.4-5. Numerical limits used to evaluate compliance of fish and crayfish tissue organic concentrations with Basin Plan objectives for toxicity (expressed as ppb [ng/g] fresh weight).

			Chlor-dane, cis	Chlor-dane, trans	Non-achlor, cis	Non-achlor, trans	Chlor-dane (total) [e]	Chlor-pyrifos	DDD, o,p'	DDD, p,p'	DDE, p,p'	DDMU, p,p'	DDT (total) [f]	Diel-drin	HCB	aroc-lor 1254	aro-clor 1260	PCB [g]	PCB (total) [h]
	Fresh-water fish filets calcula-ted using 1978-1995 data (ppb, wet weight)	EDL 85	12	7.4	5.4	17.2	38.8	<10.0	11	77.6	540	<5.0	667.9	9.4	<2.0	<50.0	54.2	120	
		EDL 95	36.4	21	18	44	117.8	25.7	33.6	232	1,955	36	2,424.4	32.5	5	140.5	180	350	
Median International Standards [a]	(excludes liver)																		
New York DEC Fish Flesh Criteria for fish-eating wildlife							500						200	120	330			110	110
Canadian Tissue Residue Guidelines													14						
USFWS Contaminant Hazard Reviews recommendation							300 (USF-WS 1990)	2,000 (USF-WS 1988a)										Wildlife <100, avian <3,000 (USF-WS 1986a)	Wildlife <100, avian <3,000 (USF-WS 1986a)

Note: HCB = hexachlorobenzene; PCB = polychlorinated biphenyl; ppb = parts per billion

[a] *From SWRCB 1995. Toxic Substances Monitoring Program, 1994-95 Data Report. State Water Resouces Control Board, Sacramento, California.*

[b] *National Academy of Sciences-National Academy of Engineering. 1973. Water Quality Criteria, 1972 (Blue Book). U.S. Environmental Protection Agency, Ecological Research Series.*

[c] *FDA 2000. Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed. U.S. Food and Drug Administration. Industry Activities Staff Booklet. Washington, D.C.*

[d] *OEHHA 1999. Prevalence of selected target chemical contaminants in sport fish from two California Lakes: Public Health Designed Screening Study. Office of Environmental Health Hazard Assessment, Sacramento, California.*

[e] *Sum of alpha and gamma chlordane, cis- and trans-nonachlor and oxychlordane.*

[f] *Sum of ortho and para DDTs, DDDs, and DDEs.*

[g] *Expressed as the sum of Aroclors.*

[h] *Expressed as sum of congeners.*

G-WQ2.4.4 Recreational Facilities Water Quality Sampling Program (SP-W3)

This study focused on evaluating the potential for recreation facilities, operations, and activities to affect water quality. Water quality monitoring was performed to determine the extent of contamination. Data obtained from the study were compared to water quality goals and criteria for protection of beneficial uses (Table G-WQ2.4-4). Several different water quality–sampling programs were implemented to evaluate the effects of different recreational facilities and activities on natural water quality through Resource Area Managers (RAMs). Sampling sites were chosen to reflect the specific type of contaminant from each facility or activity that could potentially affect project waters.

The current Lake Oroville State Recreation Area map was reviewed for completeness and updated to ensure that all recreational facilities and activities have been identified. The potential types of contamination associated with each type of recreational facility and activity were identified. Field surveys were conducted to determine potential sources of contamination from recreation facilities and activities. Operators of recreation facilities were contacted, recreation facilities visited, and recreational activities reviewed to determine potential for contamination of project waters. The interviews and field visits were conducted to identify potential sources of contamination, potential contaminants, source pathways, and operations and management that may contribute to contamination.

Specific monitoring was developed following determination of the potential for each type of recreational facility and activity to contaminate project waters. The contribution of contaminants from wildlife was also investigated where appropriate, such as waterfowl contribution to bacterial levels at swim areas. The monitoring programs were designed to target specific recreational facilities and activities with potential to introduce contaminants into project waters.

Monitoring for effects on water quality from recreational facilities and activities was dependent upon the type of recreational facility or activity and the period of effect. Parameters monitored include bacteria, metals, nutrients, pesticides, petroleum byproducts, and special substances of concern (polybrominated diphenyl ether [PBDE], tetrabutyl titanate [TBT]). Weekly and event-based (e.g., holiday weekends, recreation or fishing tournaments, spills) water quality data collection was performed during the recreation season or event.

G-WQ2.4.5 Stormwater Drainage Sampling Program (SP-W7)

Stormwater runoff water quality within urbanized areas around the Oroville Facilities was monitored at three stormwater discharge outfalls from the City of Oroville to the Feather River and one discharge outfall from Kelly Ridge to Lake Oroville during the first three storm events of the 2003–2004 winter season, November 7 and 14, and December 1. Samples bottles were filled directly from the ends of culverts or pipes and preserved with ice. Discharges were analyzed for bacteria, metals, minerals, nutrients, pesticides, petroleum byproducts, physical parameters, and toxicity through use of

toxicity bioassays. Results of the analyses were compared to the numerical limits for the Basin Plan water quality objectives in Table G-WQ2.4-4.

Additionally, three river stations (the Feather River upstream of the Feather River Fish Hatchery, the Feather River downstream of the Feather River Fish Hatchery, and the Feather River downstream of the State Route [SR] 162 bridge) were sampled for toxicity analysis only. Grab samples for toxicity analyses were collected by first rinsing pre-cleaned, 5-gallon polyethylene bottles three times in ambient water at the sampling site. The bottles were then held approximately 6 inches below the water's surface at the river locations and filled with approximately 5 gallons of sample water. The sample bottles were placed into ice chests, and preserved with ice at a temperature of approximately 39 degrees Fahrenheit (ºF). Samples were delivered to the Pacific EcoRisk Laboratory in Martinez, California, within 24 hours of collection. Laboratory staff removed an aliquot from each water sample for analysis of initial water quality characteristics, including temperature, pH, dissolved oxygen, alkalinity, hardness, electrical conductivity, and total ammonia. The remaining sample water was stored at 39ºF until used for the toxicity tests. Toxicity tests measured survival and growth for the fathead minnow, and reproduction and survival of *Ceriodaphnia* over a 7-day test period using USEPA Method 600-4-91-002 (USEPA 1994).

G-WQ2.4.6 Pesticides Treatment Sampling Program (SP-W7)

The Butte County Mosquito and Vector Control District (MVCD) treats the open-water ponds in the OWA with methoprene and malathion for mosquito control. Both chemicals are approved by USEPA for this use.

Water samples were collected monthly for analyses of methoprene and malathion from May 2003 to November 2003 from six persistent ponds that are treated with methoprene or are in the vicinity of malathion treatments, as well as along the bank of the Feather River adjacent to the treated area to determine any leaching to the river. In addition, water temperatures were measured along the bank and compared to pond temperatures to determine if any significant leaching to the river could be occurring. The ponds were also sampled for zooplankton and aquatic invertebrates. Two control ponds in untreated areas were sampled for comparison.

G-WQ2.4.7 Groundwater Sampling Program (SP-W5)

Potential effects of Thermalito Forebay and Thermalito Afterbay on local groundwater water quality were investigated by measuring water quality in 18 wells in the vicinity of these reservoirs (Figure G-WQ2.4-6). Most of the sampled wells were downgradient from Thermalito Afterbay, but two upgradient wells were also sampled to assess water quality of local groundwater unaffected by the Thermalito Complex. One well downgradient from Thermalito Forebay was also sampled. Depth of the groundwater sampled from the wells ranged from 24 to 463 feet below the surface. Water from 4 of the wells was at least 100 feet below ground. These 4 wells were considered deep wells and the remaining 14 wells were considered shallow wells. All of the wells were sampled once in the late spring or early summer and once in fall 2003.

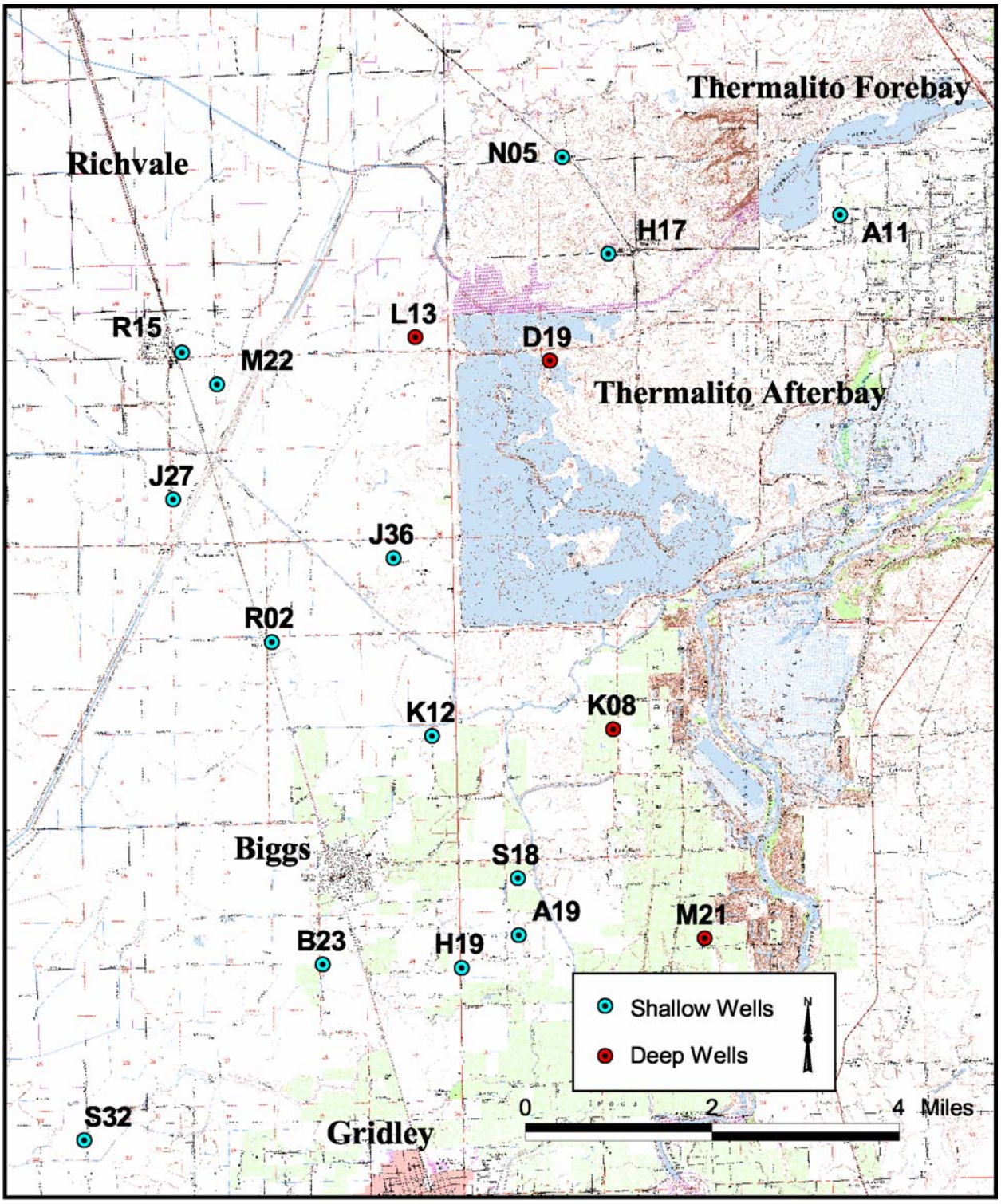


Figure G-WQ2.4-6. Groundwater quality monitoring wells.

The water quality parameters measured in the groundwater were a subset of those measured in surface waters. Temperature, pH, and specific conductance were measured at the time of sampling. Groundwater samples were analyzed for general mineral composition, aluminum, and mercury. Mineral composition and specific conductance measurements are particularly useful for evaluating effects of surface waters on groundwater quality. Aluminum was measured because all surface-water-sampling stations in the project area had aluminum concentrations that at least occasionally exceeded Basin Plan objectives. Mercury was analyzed because of its toxicity and its prevalence in many Central Valley surface waters. No pesticides or petroleum byproducts were detected in surface water samples, so these constituents were assumed to be below detection limits in the groundwater samples.

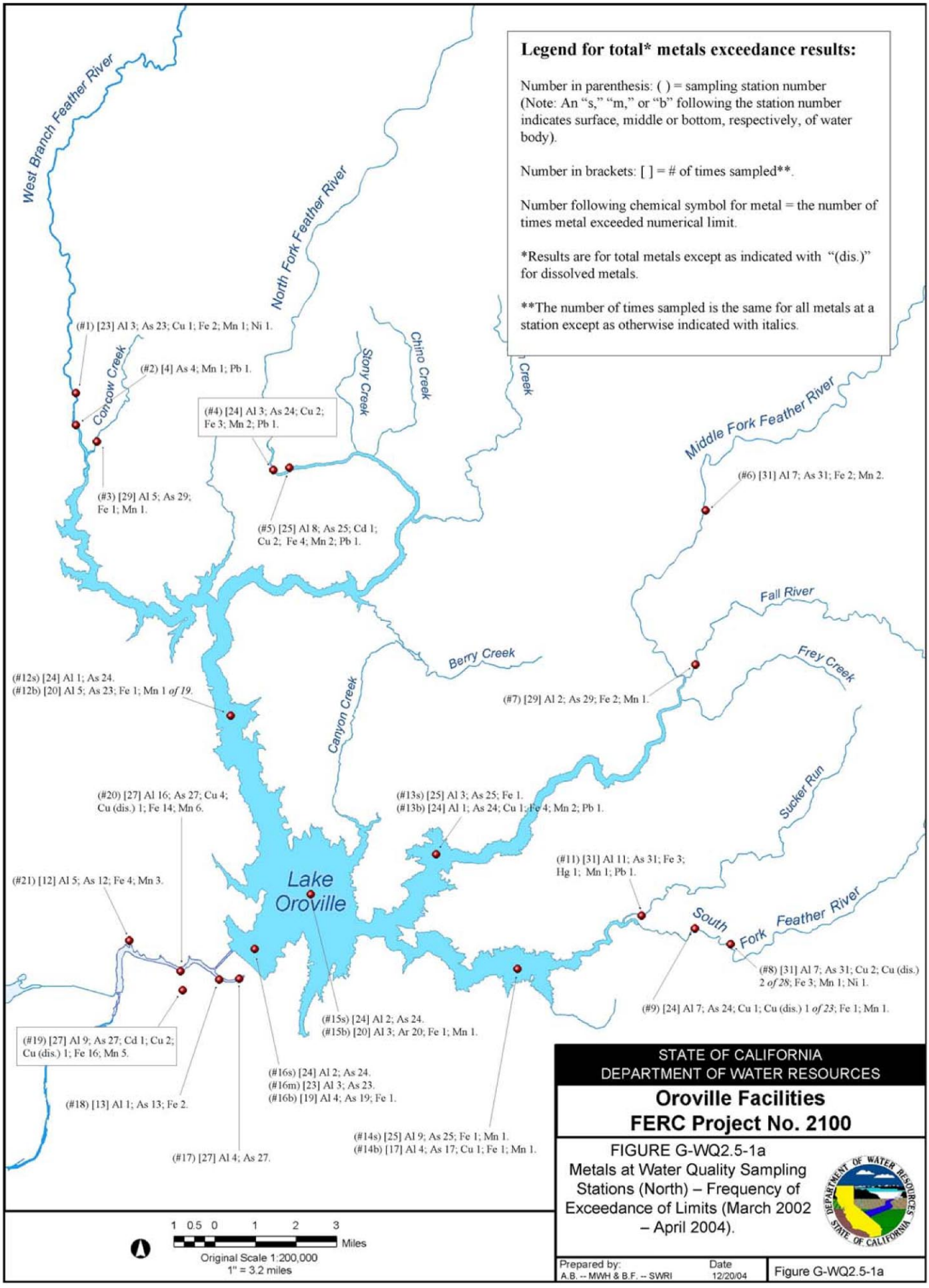
Results of groundwater water quality measurements were compared to Basin Plan objectives. Many of the beneficial uses for surface waters in the Feather River Basin, including recreation, freshwater habitat, and fish migration and spawning, do not apply to groundwater. Therefore, the water quality objectives for groundwater differ somewhat from those for surface waters. The numerical limits for the Basin Plan groundwater quality objectives are given in Table G-WQ2.4-6.

G-WQ2.5 SUPPLEMENTARY TABLES AND FIGURES FOR THE AFFECTED ENVIRONMENT SECTION

This section contains a number of tables and figures that were referenced in the Affected Environment section of Section 5.4, Water Quality, of the Preliminary Draft Environmental Assessment (PDEA).

G-WQ2.5.1 Results of Metals Analyses from Surface Waters

Figures G-WQ2.5-1a and G-WQ2.5-1b give the maximum number of times that each metal exceeded one of the numerical limits listed in Table G-WQ2.4-2 during the March 2002 through April 2004 study period at each of the sampling stations.



Legend for total* metals exceedance results:

Number in parenthesis: ( ) = sampling station number (Note: An "s," "m," or "b" following the station number indicates surface, middle or bottom, respectively, of water body).

Number in brackets: [ ] = # of times sampled**.

Number following chemical symbol for metal = the number of times metal exceeded numerical limit.

*Results are for total metals except as indicated with "(dis.)" for dissolved metals.

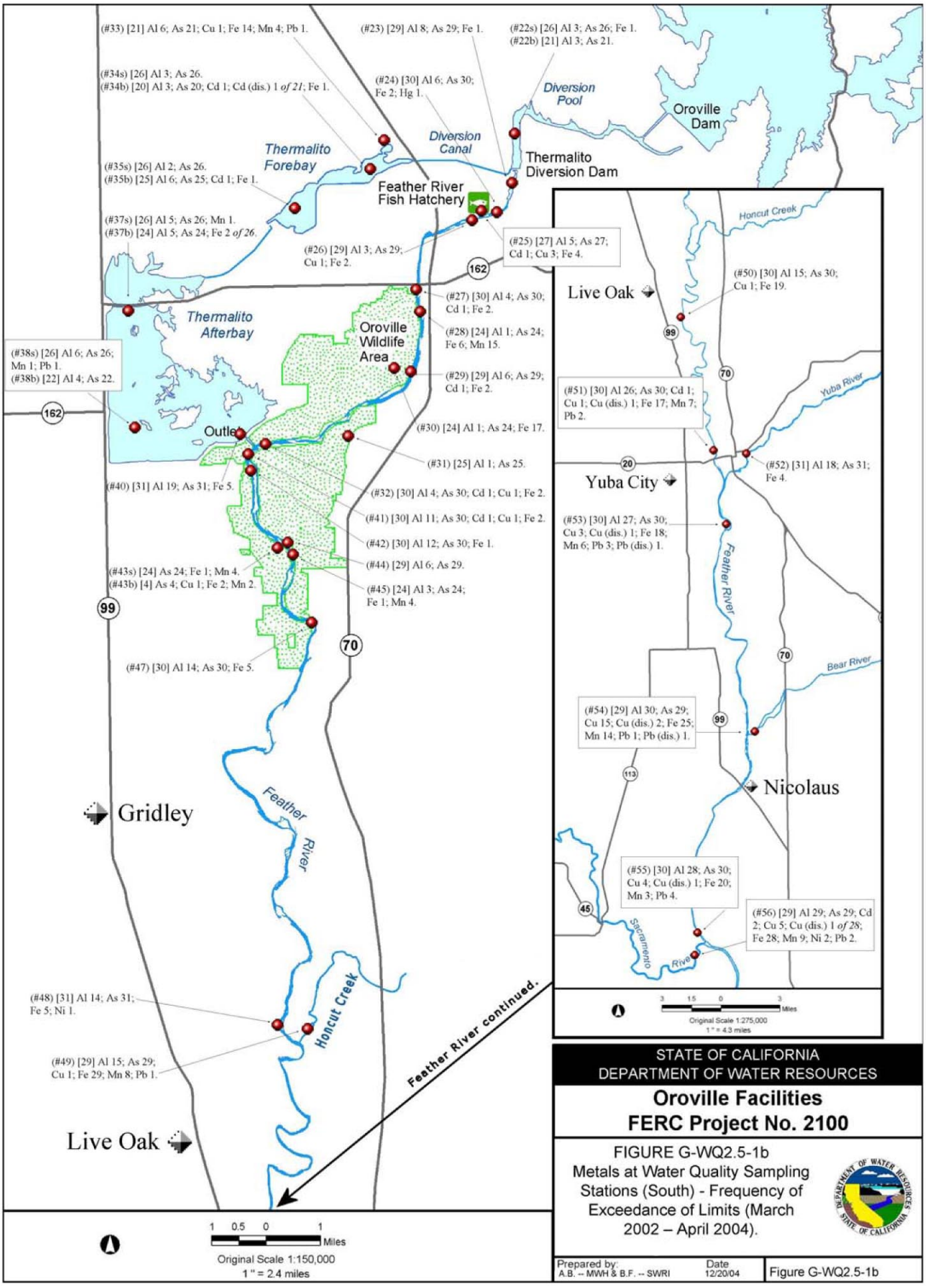
**The number of times sampled is the same for all metals at a station except as otherwise indicated with italics.

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE G-WQ2.5-1a
Metals at Water Quality Sampling Stations (North) – Frequency of Exceedance of Limits (March 2002 – April 2004).

Prepared by:	Date	
A.B. -- MWH & B.F. -- SWRI	12/20/04	Figure G-WQ2.5-1a



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Oroville Facilities
FERC Project No. 2100

FIGURE G-WQ2.5-1b
Metals at Water Quality Sampling Stations (South) - Frequency of Exceedance of Limits (March 2002 – April 2004).

Prepared by:	Date	
A.B. -- MWH & B.F. -- SWRI	12/20/04	Figure G-WQ2.5-1b

Table G-WQ2.4-6. Water quality limits for Feather River Basin groundwater.

Agency	pH	EC	TDS (mg/L)	Na* (mg/L)	B* (mg/L)	Cl* (mg/L)	SO^4* (mg/L)	Total Al (µg/L)	Total Hg (µg/L)
California Primary MCL [1]								1,000	2
California Secondary MCL [1]		900	500			500	250	200	
USEPA Primary MCL [2]							500	1,000	2
USEPA Secondary MCL [2]	6.5-8.5		500			250	250	50-200	
Agriculture Goal [3]	6.5-8.4	700	450	69	0.7	106		5,000	
California Public Health Goal [4]								600	1.2
DHS Action Level for Drinking Water [5]					1				
USEPA Drinking Water Taste and Odor Advisory [6]				30-60					
USEPA Drinking Water Health Advisory [6]				20	0.6		500		
NAWQC Humans [7]	5-9		250				250		

Note: DHS = California Department of Health Services; MCL = Maximum Contaminant Level, mg/L = milligrams per liter; NAWQC = National Ambient Water Quality Criteria; SC = Specific Conductance (micro-mhos per centimeter); USEPA = U.S. Environmental Protection Agency.

[1] DHS, California Code of Regulations, Title 22, Division 4, Chapter 15, Domestic Water Quality and Monitoring.

[2] USEPA, Title 40, Code of Federal Regulations, Parts 141 and 143.

[3] Food and Agriculture Organization of the United Nations. 1985. Water Quality for Agriculture.

[4] Cal/EPA, Office of Environmental Health Hazard Assessment, Public Health Goals for Chemicals in Drinking Water (various dates), http://www.oehha.org/water.phg/.

[5] DHS, Division of Drinking Water and Environmental Management, Drinking Water Action Levels (6 June 2003), http://www.dhs.cahwnet.gov/ps/ddwem.

[6] USEPA, Office of Water, 2004 Edition of the Drinking Water Standards & Health Advisories. (Winter 2004). EPA 822-R-04-005.

[7] USEPA, Quality Criteria for Water, 1986 (May 1986) [The Gold book] plus updates (various dates).

G-WQ2.5.2 Results of the Analysis of Fish and Crayfish Tissue Contaminants

Tables G-WQ2.5-1 and G-WQ2.5-2 below provide results of tissue concentrations of metals and pesticides, respectively, in fish and crayfish collected from the Thermalito Complex and the Feather River, as reported in SP-W2. The guidelines used to evaluate compliance of these concentrations with Basin Plan objectives for toxicity are listed in Tables G-WQ2.4-4 and G-WQ2.4-5 above.

Table G-WQ2.5-1. Fish (and crayfish) tissue concentrations of metals (expressed as ppm (mg/kg) fresh weight).

Station Name	Species [a]	Type	Arsenic	Cad-mium	Chromium	Copper	Lead	Mercury	Nickel	Sele-nium	Silver	Zinc
SF Arm Lake Oroville (McCabe Cove)	CHC	flesh	<0.025	<0.002	0.134 [i]	0.29	<0.002	0.876 [f,g,i,k,l,m,n]	<0.002	0.11	<0.002	6.78
SF Arm Lake Oroville (McCabe Cove)	CHC	liver	0.115	0.061	0.477 [h]	4.07	0.038	0.022	0.047	1.72	0.006	18.6
SF Arm Lake Oroville (McCabe Cove)	SPB	flesh	0.188 [i]	<0.002	0.123 [i]	0.24	<0.002	0.722 [f,g,k,l,m,n]	<0.002	0.27	<0.002	5.00
SF Arm Lake Oroville (McCabe Cove)	SPB	liver	0.378 [h]	0.775 [t,l]	0.125 [h]	6.33	0.005	0.556	<0.002	0.77	0.005	22.1
SF Arm Lake Oroville (Lower)	CHC	liver			0.3 [h]	2.13	0.943 [h]				0.003	19.2
SF Arm Lake Oroville (Lower)	CHC	flesh	<0.025	<0.002				1.059 [d,e,f,g,i,k,l,m,n]	0.006	0.16		
SF Arm Lake Oroville (Lower)	SPB	liver			0.27 [h]	2.82	0.070				<0.002	19.0
SF Arm Lake Oroville (Lower)	SPB	flesh	0.21 [c,i]	<0.002				0.677 [r,g,k,l,m,n]	0.007	0.28		
Upper MF Lake Oroville	CHC	liver			0.48 [h]	2.87	2.581 [h]				<0.002	18.4
Upper MF Lake Oroville	CHC	flesh	<0.025	<0.002				0.476 [g,l,m,n]	<0.002	0.12		
Upper MF Lake Oroville	SPB	liver			0.3 [h]	1.91	0.004				<0.002	18.3

Table G-WQ2.5-1. Fish (and crayfish) tissue concentrations of metals (expressed as ppm (mg/kg) fresh weight).

Station Name	Species [a]	Type	Arsenic	Cad-mium	Chromium	Copper	Lead	Mercury	Nickel	Sele-nium	Silver	Zinc
Upper MF Lake Oroville	SPB	flesh	0.17 [i]	<0.002				0.535 [g,k,l,m,n]	0.024	0.3		
Lower MF Lake Oroville	CHC	flesh	<0.025	<0.002	0.076 [i]	0.38	<0.002	1.614 [d,e,f,g,i,k,l,m,n]	<0.002	0.13	0.004	6.43
Lower MF Lake Oroville	CHC	liver	0.164	0.182 [l]	0.449 [h]	3.28	0.048	6.513	0.021	2.23	0.006	18.8
Lower MF Lake Oroville	SPB	flesh	0.189 [i]	<0.002	0.124 [i]	0.24	<0.002	0.587 [g,k,l,m,n]	0.018	0.27	<0.002	4.50
Lower MF Lake Oroville	SPB	liver	0.482 [h]	0.066	0.057 [h]	6.11	0.009	0.591	<0.002	0.94	0.009	22.9
NF Arm Lake Oroville (Bloomer Canyon)	CHC	liver			0.56 [h]	2.87	0.089				<0.002	18.3
NF Arm Lake Oroville (Bloomer Canyon)	CHC	flesh	0.020	0.003				0.402 [g,l,m,n]	0.135 [i]	0.16		
NF Arm Lake Oroville (Bloomer Canyon)	CP	flesh	0.050	0.006				0.231 [l,n]	0.007	0.27		
NF Arm Lake Oroville (Bloomer Canyon)	SPB	flesh	0.242 [c,i]	<0.002	0.096 [i]	0.21	<0.002	0.394 [g,l,m,n]	<0.002	0.27	<0.002	4.36
NF Arm Lake Oroville (Foreman Creek)	CHC	liver			0.48 [h]	2.73	0.015				<0.002	20.7
NF Arm Lake Oroville (Foreman Creek)	CHC	flesh	0.030	<0.002				0.343 [g,l,m,n]	<0.002	0.18		

Table G-WQ2.5-1. Fish (and crayfish) tissue concentrations of metals (expressed as ppm (mg/kg) fresh weight).

Station Name	Species [a]	Type	Arsenic	Cad-mium	Chromium	Copper	Lead	Mercury	Nickel	Sele-nium	Silver	Zinc
NF Arm Lake Oroville (Foreman Creek)	CP	flesh	0.110	0.005				0.721 [f,g,k,l,m,n]	0.007	0.45		
NF Arm Lake Oroville (Foreman Creek)	SPB	liver			0.26 [h]	1.91	<0.002				<0.002	18.4
NF Arm Lake Oroville (Foreman Creek)	SPB	flesh	0.100	<0.002				0.143 [l,n]	<0.002	0.13		
NF Arm Lake Oroville (Foreman Creek)	WHC	liver			0.63 [h]	1.85	0.005				<0.002	19.3
NF Arm Lake Oroville (Foreman Creek)	WHC	flesh	0.030	<0.002				0.38 [g,l,m,n]	<0.002	0.15		
Lake Oroville Spillway arm	CHC	flesh	0.029	<0.002	0.175 [i]	0.10	<0.002	0.154 [l,n]	<0.002	0.06	<0.002	4.14
Lake Oroville Spillway arm	SPB	flesh	0.228 [o,i]	<0.002	0.073 [i]	0.24	<0.002	0.469 [g,l,m,n]	<0.002	0.26	<0.002	4.68
Lake Oroville Spillway arm	SPB	liver	0.772 [h]	0.087	0.169 [h]	4.39	0.006	0.299	<0.002	1.10	<0.002	22.3
Lake Oroville Bidwell Arm	CHC	flesh	<0.025	<0.002	0.094 [i]	0.23	<0.002	0.973 [f,g,i,k,l,m,n]	<0.002	0.13	<0.002	6.28
Lake Oroville Bidwell Arm	CHC	liver	0.108	0.096	0.296 [h]	3.99	0.219 [h]	2.025	<0.002	1.45	0.002	20.4
Lake Oroville Bidwell Arm	SPB	flesh	0.159 [i]	<0.002	0.141 [i]	0.21	<0.002	0.432 [g,l,m,n]	<0.002	0.27	<0.002	4.85
Lake Oroville Bidwell Arm	SPB	liver	0.673 [h]	0.19 [l]	0.024	8.36	0.012	0.845	<0.002	1.03	0.013	25.9

Table G-WQ2.5-1. Fish (and crayfish) tissue concentrations of metals (expressed as ppm (mg/kg) fresh weight).

Station Name	Species [a]	Type	Arsenic	Cad-mium	Chromium	Copper	Lead	Mercury	Nickel	Sele-nium	Silver	Zinc
North Forebay (Swim Area)	CP	flesh	0.060	<0.002				0.146 [l,n]	<0.002	0.27		
North Forebay (Swim Area)	PM	flesh	0.25 [c,i]	<0.002				0.543 [g,k,l,m,n]	<0.002	0.17		
South Thermalito Afterbay (Ski Cove)	LMB	flesh	0.080	<0.002	0.077 [i]	0.19	<0.002	0.475 [g,l,m,n]	0.031	0.23	<0.002	4.78
South Thermalito Afterbay (Ski Cove)	LMB	liver	0.291 [h]	0.293 [l]	0.074 [h]	29.5 [h]	<0.002	0.399	0.025	0.90	0.018	29.6 [h]
South Thermalito Afterbay (Ski Cove)	CP	flesh	0.126	0.007				0.234 [l,n]	0.014	0.18		
Feather River US of Thermalito Afterbay Outlet	LMB	flesh	0.039	<0.002	0.09 [i]	0.26	<0.002	0.475 [g,l,m,n]	0.016	0.16	<0.002	4.45
Feather River US of Thermalito Afterbay Outlet	LMB	liver	0.113	0.058	0.109 [h]	1.68	0.003	0.215	0.022	0.63	<0.002	17.4
Feather River DS of Thermalito Afterbay Outlet	LMB	liver			0.22 [h]	9.23	<0.002				<0.002	18.0

Table G-WQ2.5-1. Fish (and crayfish) tissue concentrations of metals (expressed as ppm (mg/kg) fresh weight).

Station Name	Species [a]	Type	Arsenic	Cad-mium	Chromium	Copper	Lead	Mercury	Nickel	Sele-nium	Silver	Zinc
Feather River DS of Thermalito Afterbay Outlet	LMB	flesh	0.050	<0.002				0.542 [g,k,l,m,n]	<0.002	0.20		
Mile Long Pond	BRB	flesh	<0.025	<0.002	0.126 [i]	0.32	<0.002	0.062	0.004	0.04	<0.002	3.85
Mile Long Pond	BRB	liver	<0.025	<0.002	0.111 [h]	2.08	0.008	0.005	0.14 [h]	0.16	0.005	9.23
Potters Pond	CP	flesh	0.060	0.004				0.133 [l,n]	0.009	0.18		
Potters Pond	LMB	liver			0.19 [h]	3.53	0.008				<0.002	19.0
Potters Pond	LMB	liver			0.23 [h]	3.47	0.004				<0.002	18.2
Potters Pond	LMB	flesh	<0.025	<0.002				0.26 [l,n]	0.123 [i]	0.12		
Lower Pacific Heights Pond	CHC	liver			0.06 [h]	2.05	0.034				0.003	21.0
Lower Pacific Heights Pond	CHC	flesh	<0.025	<0.002				0.355 [g,l,m,n]	0.006	0.10		
Diversion Pool	crayfish [b]	cray-fish			0.25 [j]	20.3 [j,k]	0.012	0.0325 [n]			0.006	19.7
North Afterbay	crayfish [b]	cray-fish			0.25 [j]	34.3 [j,k]	0.023	0.022/0.0249			0.011	19.8
South Afterbay	crayfish [b]	cray-fish			0.32 [j]	27.6 [j,k]	0.035	0.0263			0.010	23.0
Feather River DS of SR 70	crayfish [b]	cray-fish			0.26 [j]	22.2 [j,k]	0.025	0.0416 [n]			0.016	22.5

Table G-WQ2.5-1. Fish (and crayfish) tissue concentrations of metals (expressed as ppm (mg/kg) fresh weight).

Station Name	Species [a]	Type	Arsenic	Cad-mium	Chromium	Copper	Lead	Mercury	Nickel	Sele-nium	Silver	Zinc

Note: DS = downstream; MF = Middle Fork; NF = North Fork; SF = South Fork; US = upstream.

[a] *BRB = brown bullhead; CHC = channel catfish; CP = carp; LMB = large mouth bass; PM = pikeminnow; SPB = spotted bass; WHC = white catfish.*

[b] *Analyzed as composites.*

[c] *Exceeds maximum tissue residue level (MTRL) for carcinogens.*

[d] *Exceeds MTRL for non-carcinogens.*

[e] *Exceeds FDA action level.*

[f] *Exceeds USEPA screening level.*

[g] *Exceeds OEHHA screening level.*

[h] *Exceeds EDL for fish livers.*

[I] *Exceeds EDL for fish filets.*

[j] *Exceeds EDL for whole fish.*

[k] *Exceeds Median International Standards (MIS).*

[l] *Exceeds recommended limit in USFWS Contaminant Hazard Review.*

[m] *Exceeds recommendation of USFWS Evaluation of CWA Section 304(a) for methyl mercury.*

[n] *Exceeds Canadian Tissue Guideline.*

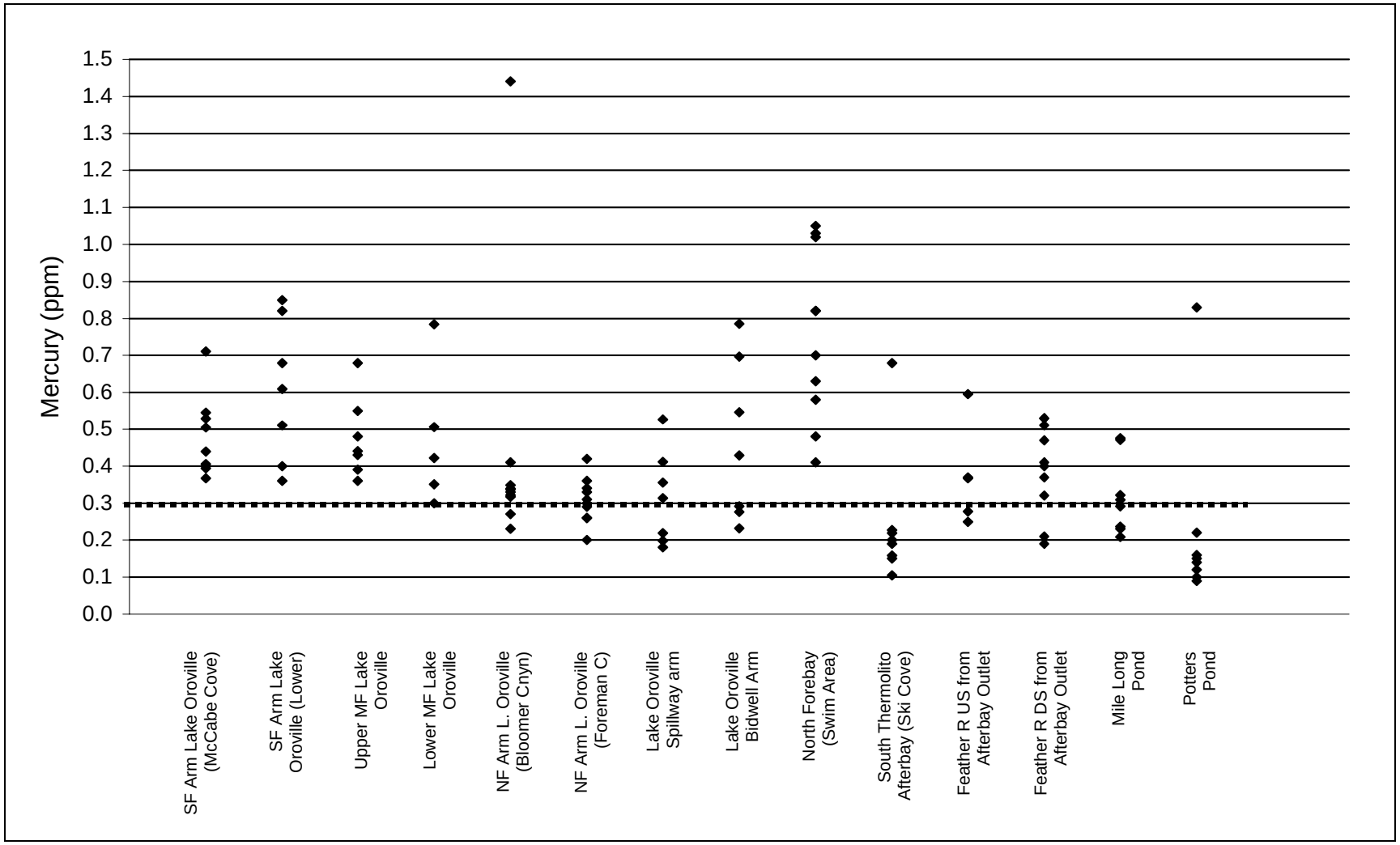


Figure G-WQ2.5-2. Mercury levels in individual fish (spotted bass, largemouth bass, and pikeminnow) from project waters.

Table G-WQ2.5-2. Fish (and crayfish) tissue concentrations of pesticides (expressed as ppb (ng/g) fresh weight).

	Species	chlordane, cis	chlordane, trans	nonachlor, cis	nonachlor, trans	chlordane (total) [a]	chlorpyrifos	DDD, o,p'	DDD, p,p'	DDE, p,p'	DDMU, p,p'	DDT (total) [b]	dieldrin	HCB	Aroclor 1254	Aroclor 1260	PCB [c]	PCB (total) [d]
SF Arm Lake Oroville (McCabe Cove)	SPB	ND	<RL	<RL	<RL		ND	ND	1.10	6.40	ND	7.50	<RL	<RL	16	31	47 [e,g,h]	34.991
SF Arm Lake Oroville (McCabe Cove)	CHC	<RL	<RL	<RL	2.26	2.26 [e]	ND	ND	2.59	27.8	<RL	30.39 [i]	ND	0.312	37	97 [f]	134 [e,f,g,h,j,k]	88.777
Lower SF Lake Oroville	CHC	<RL	<RL	<RL	2.31	2.31 [e]	ND	<RL	3.57	24.7	<RL	28.27 [i]	<RL	<RL	37	94 [f]	131 [e,f,g,h,j,k]	85.137
Lower SF Lake Oroville	SPB	<RL	<RL	<RL	<RL		ND	ND	<RL	5.21	ND	5.21	<RL	<RL	18	24	42 [e,g,h]	29.33
Upper MF Lake Oroville	CHC	<RL	<RL	<RL	1.79	1.79 [e]	ND	ND	1.37	15.9	<RL	17.27 [l]	0.522	<RL	20	27	47 [e,g,h]	29.093
Upper MF Lake Oroville	SPB	ND	ND	ND	<RL		ND	ND	<RL	2.16	ND	2.16	<RL	<RL	<RL	<RL		4.664
Lower MF Lake Oroville	SPB	ND	<RL	ND	<RL		ND	ND	<RL	2.05	ND	2.05	<RL	<RL	10	<RL	10 [e,h]	8.655
Lower MF Lake Oroville	CHC	<RL	<RL	<RL	3.43	3.43 [e]	ND	ND	2.21	21.0	<RL	23.21 [i]	<RL	<RL	37	66 [f]	103 [e,g,h,k]	66.772
NF Lake Oroville (Bloomer Canyon)	SPB	ND	ND	ND	<RL		ND	ND	<RL	2.24	ND	2.24	<RL	ND	<RL	<RL		7.078
NF Lake Oroville (Bloomer Canyon)	CHC	<RL	<RL	<RL	1.72	1.72 [e]	ND	ND	1.38	15.3	ND	16.68 [i]	0.732 [e]	<RL	27	24	51 [e,g,h]	30.398
NF Lake Oroville (Bloomer Canyon)	CP	<RL	<RL	<RL	1.51	1.51 [e]	ND	ND	1.16	12.9	<RL	14.06 [i]	0.525	<RL	18	12	30 [e,g,h]	20.327
NF Lake Oroville (Foreman Creek)	CHC	<RL	<RL	<RL	1.88	1.88 [e]	ND	ND	1.76	16.6	<RL	18.36 [i]	0.598	<RL	31	20	51 [e,g,h]	31.332
NF Lake Oroville (Foreman Creek)	SPB	<RL	<RL	ND	<RL		ND	ND	<RL	2.29	ND	2.29	<RL	ND	<RL	<RL		7.299
NF Lake Oroville (Foreman Creek)	WHC	<RL	<RL	ND	<RL		ND	ND	ND	3.3	ND	3.30	<RL	ND	<RL	<RL		7.473
NF Lake Oroville (Foreman Creek)	CP	<RL	<RL	<RL	1.58	1.58 [e]	ND	<RL	1.37	15.2	ND	16.57 [i]	<RL	<RL	16	15	31 [e,g,h]	22.023
Lake Oroville Spillway arm	CHC	<RL	<RL	<RL	2.46	2.46 [e]	<RL	ND	2.72	33.7	<RL	36.42 [e]	0.775 [e]	0.710	34	32	66 [e,g,h]	42.282

Table G-WQ2.5-2. Fish (and crayfish) tissue concentrations of pesticides (expressed as ppb (ng/g) fresh weight).

	Species	chlordane, cis	chlordane, trans	nonachlor, cis	nonachlor, trans	chlordane (total) [a]	chlorpyrifos	DDD, o,p'	DDD, p,p'	DDE, p,p'	DDMU, p,p'	DDT (total) [b]	dieldrin	HCB	Aroclor 1254	Aroclor 1260	PCB [c]	PCB (total) [d]
Lake Oroville Spillway arm	SPB	ND	ND	ND	<RL		ND	ND	<RL	2.43	ND	2.43	ND	<RL	<RL	<RL		8.406
Lake Oroville Bidwell arm	CHC	<RL	<RL	<RL	2.37	2.37 [e]	ND	ND	2.23	20.5	<RL	22.73 [i]	0.591	0.355	31	49	80 [e,g,h]	50.938
Lake Oroville Bidwell arm	SPB	ND	<RL	ND	<RL		ND	ND	ND	<RL	ND		<RL	ND	<RL	<RL		5.596
Diversion Pool	SS	<RL	<RL	<RL	2.69	2.69 [e]	ND	<RL	2.13	19.2	<RL	21.33 [i]	<RL	0.832	55 [f]	34	89 [e,g,h]	66.365
Diversion Pool	crayfish	ND	ND	ND	<RL		ND	ND	ND	<RL	ND		<RL	ND	<RL	<RL		3.894
North Thermalito Forebay (swim area)	PM	2.27	1.09	2.61	7.04	13.01 [e]	<RL	<RL	13	86.9	4.71	104.61 [e,g,i]	1.64	1.05	180 [f]	104 [f]	284 [e,f,g,h,j,k]	186.81 [j,k]
North Thermalito Forebay (swim area)	CP	2.86	1.17	2.40	6.64	13.07 [e]	<RL	1.57	11.1	121	3.48	137.15 [e,g,i]	0.738 [e]	0.956	166 [f]	215 [f]	381 [e,f,g,h,j,k]	281.386 [j,k]
North Afterbay	crayfish	ND	ND	ND	<RL		ND	ND	<RL	5.66	ND	5.66	ND	ND	<RL	<RL		7.272
South Thermalito Afterbay (Ski Cove)	LMB	ND	ND	ND	<RL		ND	ND	<RL	4.99	ND	4.99	<RL	ND	<RL	<RL		112.397 [j,k]
South Thermalito Afterbay (Ski Cove)	CP	1.01	<RL	1.26	4.31	6.58 [e]	<RL	1.22	6.31	214	7.82 (f)	229.35 [e,g,i]	0.751 [e]	0.457	81 [f]	68 [f]	149 [e,f,g,h,j,k]	5.59
South Thermalito Afterbay (Ski Cove)	crayfish	ND	ND	ND	ND		ND	ND	ND	2.11	ND	2.11	ND	ND	<RL	<RL		5.933
Potters Pond	LMB	ND	<RL	ND	<RL		ND	ND	ND	<RL	ND		<RL	ND	<RL	ND		3.365
Potters Pond	CP	<RL	<RL	<RL	<RL		ND	ND	<RL	23.7	ND	23.7 [i]	<RL	ND	19	17	36 [e,g,h]	22.537
Potters Pond	LMB	ND	<RL	ND	<RL		ND	ND	ND	<RL	ND		<RL	ND	<RL	<RL		1.937
Feather River DS of SR 70 #2	crayfish	ND	ND	ND	<RL		ND	ND	ND	3.01	ND	3.01	ND	ND	76 [f]	<RL	76 [e,g,h]	55.978
Feather River US of Thermalito Afterbay Outlet	LMB	<RL	<RL	ND	<RL		ND	ND	<RL	4.98	ND	4.98	<RL	ND	22	<RL	22 [e,g,h]	15.629

Table G-WQ2.5-2. Fish (and crayfish) tissue concentrations of pesticides (expressed as ppb (ng/g) fresh weight).

	Species	chlordane, cis	chlordane, trans	nonachlor, cis	nonachlor, trans	chlordane (total) [a]	chlorpyrifos	DDD, o,p'	DDD, p,p'	DDE, p,p'	DDMU, p,p'	DDT (total) [b]	dieldrin	HCB	Aroclor 1254	aroclor 1260	PCB [c]	PCB (total) [d]
Feather River DS of Thermalito Afterbay Outlet	LMB	ND	ND	ND	<RL		ND	ND	<RL	6.41	ND	6.41	<RL	<RL	24	<RL	24 [e,g,h]	15.008
Feather River DS of Thermalito Afterbay Outlet	LMB	ND	ND	ND	<RL		ND	ND	<RL	5.38	ND	5.38	<RL	<RL	21	<RL	21 [e,g,h]	11.228
Mile Long Pond	LMB	ND	ND	ND	ND		ND	ND	ND	<RL	ND		<RL	ND	<RL	ND		2.379
Mile Long Pond	BRB	ND	<RL	ND	<RL		ND	ND	ND	<RL	ND		1.67 [e]	ND	<RL	<RL		2.366
Lower Pacific Heights Pond	CHC	1.04	<RL	1.02	3.12	5.17 [e]	4.18	ND	2.25	56.2	<RL	58.45 [e,i]	0.836 [e]	<RL	54 [f]	27	81 [e,g,h]	48.893
Lower Pacific Heights Pond	CHC	1.03	<RL	1.01	2.94	4.98 [e]	3.97	ND	2.25	53.2	<RL	55.45 [e,i]	0.627	<RL	52 [f]	27	79 [e,g,h]	46.66

Notes: BRB = brown bullhead; DS = downstream; HCB = hexachlorobenzene; LMB = largemouth bass; MF = Middle Fork; NF = North Fork; PM = pikeminnow; SF = South Fork; SS = Sacramento sucker; US = upstream

[a] *Sum of alpha and gamma chlordane, cis- and trans-nonachlor and oxychlordane.*
[b] *Sum of ortho and para DDTs, DDDs, and DDEs.*
[c] *Expressed as the sum of Aroclors.*
[d] *Expressed as sum of congeners.*
[e] *Exceeds MTRL.*
[f] *Exceeds EDL for fish filets.*
[g] *Exceeds OEHHA screening level.*
[h] *Exceeds USEPA screening level.*
[i] *Exceeds Canadian Tissue Residue guideline.*
[j] *Exceeds New York DEC fish flesh criteria for fish-eating wildlife.*
[k] *Exceeds USFWS Contaminant Hazard Review proposed criteria in diet of wildlife (based on susceptibility of mink).*

G-WQ2.5.3 Results of Bacterial Monitoring

This section provides tables giving results of the relicensing studies' monitoring of bacteria that are used as indicators of the potential presence of pathogens. Table G-WQ2.5-3 gives results from the general water quality monitoring study (SP-W1), while Tables G-WQ2.5-4 and G-WQ2.5-5 show results from monitoring in recreation areas (SP-W1 and SP-W3). Table G-WQ2.5-6 gives the results of stormwater sampling conducted in 2003. Tables G-WQ2.5-3, G-WQ2.5-4, and G-WQ2.5-5 summarize results that are contained in extensive tables in the appendix of SP-W1, while Table G-WQ2.5-6 is taken directly from SP-W7. Table G-WQ2.5-3 gives the ranges of total and fecal coliform bacteria counts for monitoring conducted in 2002, 2003, and 2004 at each of the SP-W1 stations. The table also gives the number of dates on which a water quality standard, the California Department of Health Services' (DHS) draft guidance for bacteria counts at freshwater beaches, was exceeded. Tables G-WQ2.5-4 gives the ranges of total and fecal coliform bacteria counts and numbers of exceedances of the DHS guidelines and Basin Plan objectives for monitoring conducted in 2002 at a number of stations in recreation areas. Table G-WQ2.5-5 provides similar information for 2003, but also includes specific counts for enterococcus and fecal streptococcus.

Table G-WQ2.5-3. Ranges of bacteria counts at SP-W1 monitoring stations and numbers of water quality standard exceedances.

Station	Range				Exceedance	
	Total Coliform		Fecal Coliform		Total Coliform	Fecal Coliform
	Min	Max	Min	Max	DHS[1] Single Sample[2]	
West Branch near Paradise	0	588	0	30	0	0
West Branch US of Lake Oroville	0	252	0	3	0	0
Concow Creek at Jordan Hill Road	0	448	0	24	0	0
NF Feather River US of Poe Powerhouse	0	2,288	0	13	0	0
Poe Powerhouse Outflow	0	TNTC	0	41	1	0
NF Feather River DS of Poe Powerhouse	88	228	0	6	0	0
MF Feather River near Merrimac	0	TNTC	0	40	1	0
Fall River US of Feather Falls	0	TNTC	0	866	1	1
SF Feather River US of Ponderosa Reservoir	0	TNTC	0	30	1	0
Sucker Run near Forbestown	0	TNTC	0	42	3	0
SF Feather River DS of Ponderosa Reservoir	5	TNTC	0	8	1	0
Miner's Ranch Canal	0	111	0	4	0	0
NF arm of Lake Oroville	0	2,252	0	3	0	0
MF arm of Lake Oroville	0	212	0	2	0	0
SF arm of Lake Oroville	0	180	0	4	0	0
Lake Oroville Main Body	0	247	0	0	0	0
Lake Oroville near Dam	0	198	0	1	0	0
Diversion Pool US of Kelly Ridge Powerhouse	0	586	0	1	0	0
Diversion Pool DS of Kelly Ridge Powerhouse	4	TNTC	0	2	1	0
Glen Pond	0	TNTC	0	TNTC	6	3
Glen Creek US of Glen Pond	0	144	0	251	0	0
Glen Creek US of Glen Pond	13	TNTC	0	TNTC	7	1
Morris Ravine	28	TNTC	6	1,190	1	3
Diversion Pool US of Thermalito Diversion Dam	0	TNTC	0	105	1	0
Feather River at Oroville	0	TNTC	0	174	1	0
Feather River US of Feather River Fish Hatchery	0	990	0	46	0	0
Feather River Fish Hatchery Settling Pond	0	TNTC	0	55	2	0
Feather River DS of Feather River FishHatchery	1	TNTC	0	203	4	0
Feather River DS of SR 162	0	TNTC	0	123	4	0
Feather River at Robinson Riffle	0	TNTC	0	111	4	0
Feather River US of Thermalito Afterbay Outlet	0	TNTC	0	66	4	0
Feather River DS of Thermalito Afterbay Outlet	0	TNTC	0	32	2	0
Feather River DS of SCOR Outlet	0	TNTC	0	207	3	0

Table G-WQ2.5-3. Ranges of bacteria counts at SP-W1 monitoring stations and numbers of water quality standard exceedances.

Station	Range				Exceedance	
	Total Coliform		Fecal Coliform		Total Coliform	Fecal Coliform
	Min	Max	Min	Max	DHS[1] Single Sample[2]	
Feather River near Mile Long Pond	0	TNTC	0	39	1	0
Feather River DS of FERC Project Boundary	0	TNTC	0	95	3	0
Oroville Fish Pond	0	TNTC	0	15	2	0
Robinson Riffle Pond	0	TNTC	0	336	2	0
Mile Long Pond	0	TNTC	0	14	1	0
Upper Pacific Heights Pond	0	TNTC	0	TNTC	1	1
Lower Pacific Heights Pond	0	TNTC	0	3	1	0
Thermalito Afterbay at Feather River Outlet	0	TNTC	0	182	2	0
South Afterbay	0	272	0	21	0	0
North Afterbay	1	382	0	61	0	0
South Forebay	0	363	0	86	0	0
North Forebay Creek	19	TNTC	0	TNTC	5	3
North Forebay	0	613	0	146	0	0
Feather River at Singh AB Riviera Road	0	TNTC	0	50	3	0
Honcut Creek at Pacific Ranch near Palermo	0	TNTC	0	1,280	3	2
Feather River at Archer Ave.	0	TNTC	0	297	2	0
Feather River US of Yuba River	0	TNTC	0	TNTC	2	1
Yuba River at Mouth	0	TNTC	0	TNTC	3	1
Feather River at Shanghai Bend	0	TNTC	0	167	2	0
Bear River near Mouth	0	TNTC	0	TNTC	4	1
Feather River near Verona	2	TNTC	0	TNTC	4	2
Sacramento River US of Feather River	0	TNTC	0	TNTC	2	1

Notes: DS = downstream; MF = Middle Fork; NF = North Fork; SF = South Fork; TNTC = Too Numerous to Count; US = upstream.

[1] *DHS. Draft Guidance for Fresh Water Beaches. July 24, 2001.*

[2] *DHS recommends the bacteria in a single sample not to exceed 10,000 per 100 mL for total coliform and 400 per 100 mL for fecal coliform.*

Table G-WQ2.5-4. Ranges of bacteria counts at recreation area monitoring stations and number of water quality standards exceedances in 2002.

Station	Range				Exceedance			
	Total Coliform		Fecal Coliform		Total Coliform	Fecal Coliform	Fecal Coliform	
					CDHS[1]		CVRWQCB[3]	
	Min	Max	Min	Max	Single Sample[2]		5/30[4]	10% in 30[5]
Afterbay Outlet	6	88	0	5	0	0	0	0
Bedrock Park (Upstream)	40	368	0	21	0	0	0	0
Bedrock Park (Downstream)	16	432	0	332	0	0	0	0
Bidwell Marina Houseboats at E-36	0	124	0	3	0	0	0	0
Bidwell Marina Houseboats at L-4	0	72	0	2	0	0	0	0
Foreman Creek Boat Access	0	336	0	4	0	0	0	0
Mile Long Pond	26	TNTC	2	71	2	0	0	0
Monument Hill Recreation Area	0	304	0	TNTC	0	1	0	1
North Forebay Recreation Area at Beach	0	TNTC	6	416	1	1	0	1
North Forebay Recreation Area at Footbridge	0	12	0	148	0	0	0	0
North Forebay Recreation Area at Mouth	0	156	0	40	0	0	0	0
Potter Ravine Floating Campsite	0	36	0	10	0	0	0	0
South Forebay Boat Launch	0	334	1	96	0	0	0	0
South Forebay Recreation Area	0	TNTC	1	213	1	0	0	0
Stringtown Cove	0	164	0	0	0	0	0	0
Stringtown Main Body	0	44	0	1	0	0	0	0

Note: TNTC = Too Numerous To Count.

[1] *DHS. Draft Guidance for Fresh Water Beaches. July 24, 2001.*

[2] *DHS recommends the bacteria in a single sample not exceed 10,000 per 100 mL for total coliform and 400 per 100 mL for fecal coliform.*

[3] *Central Valley RWQCB. Water Quality Control Plan (Basin Plan), Fourth Edition, 1998.*

[4] *Geometric Mean of 200 bacteria per 100 mL of water sample from not less than 5 samples collected over a 30 days period.*

[5] *No more than 10 percent of the total samples taken during any 30-day period shall have fecal bacteria in excess of 400 organism per 100 mL.*

Table G-WQ2.5-5. Ranges of bacteria counts at recreation area monitoring stations and number of water quality standards exceedances in 2003.

Station	Range								Exceedance						
	Total Coliform		Fecal Coliform		Enterococcus		Fecal Streptococcus		Total Coliform	Fecal Coliform	Enterococcus	Fecal Coliform		Enterococcus	
	Min	Max	Min	Max	Min	Max	Min	Max	DHS[1]			Central Valley RWQCB[3]		USEPA[6]	
									Single Sample[2]			5/30[4]	10% in 30[5]	Single Sample[7]	5/30[8]
Bedrock Park US	23	>1,600	4	300	2	170	7	280	1	0	1	0	0	1	0
Bedrock Park DS	80	900	8	300	4	300	11	500	0	0	1	0	0	1	0
Foreman Creek Boat Access	17	>1,600	<2	>1,600	<2	500	<2	900	2	1	2	0	1	2	0
Loafer Creek Swim Area	14	>1,600	2	1,600	<2	>1,600	2	>1,600	2	2	2	0	2	2	1
Monument Hill Swim Area	60	>1,600	4	500	4	280	7	900	1	1	3	0	1	3	3
North Forebay Swim Area (Beach)	170	50,000	23	5,000	22	>1,600	50	>1,600	4	7	8	6	7	8	6
North Forebay Swim Area (Cove)	80	**>160,000**	22	22,000	2	>1,600	4	>1,600	3	3	9	3	3	9	6
North Forebay Swim Area (Mouth)	140	>1,600	14	>1,600	11	1,600	11	>1,600	3	2	4	0	2	4	3
South Forebay Boat Ramp	17	>1,600	4	>1,600	4	900	4	900	2	3	6	1	3	6	5
South Forebay Swim Area	17	>1,600	7	>1,600	2	>1,600	6	>1,600	2	2	3	0	2	3	3
Stringtown Boat Ramp	2	1,600	<2	1,600	<2	>1,600	2	>1,600	0	1	3	0	1	3	2

Table G-WQ2.5-5. Ranges of bacteria counts at recreation area monitoring stations and number of water quality standards exceedances in 2003.

Station	Range								Exceedance						
	Total Coliform		Fecal Coliform		Enterococcus		Fecal Streptococcus		Total Coliform	Fecal Coliform	Enterococcus	Fecal Coliform		Enterococcus	
	Min	Max	Min	Max	Min	Max	Min	Max	DHS[1]			Central Valley RWQCB[3]		USEPA[6]	
									Single Sample[2]			5/30[4]	10% in 30[5]	Single Sample[7]	5/30[8]

[1] *DHS. Draft Guidance for Fresh Water Beaches. July 24, 2001.*
[2] *DHS recommends the bacteria in a single water sample not to exceed 10,000 per 100 mL for total coliform and 400 per 100 mL for fecal coliform, and 61 per 100 mL for enterococcus.*
[3] *Central Valley RWQCB. Water Quality Control Plan (Basin Plan), Fourth Edition, 1998.*
[4] *Geometric Mean of 200 bacteria per 100 mL of water sample from not less than 5 samples collected over a 30 days period.*
[5] *No more than 10 percent of the total samples taken during any 30-day period shall have fecal bacteria in excess of 400 organism per 100 mL.*
[6] *USEPA. Ambient Water Quality Criteria for Bacteria - 1986. EPA 440/5-84-002.*
[7] *USEPA guideline, the enterococcus in a single sample per 100 mL of water sample shall not exceed 61 organism.*
[8] *Geometric Mean of 33 bacteria per 100 mL of water sample from not less than 5 samples collected over a 30-day period.*

Table G-WQ2.5-6. Stormwater sampling results—bacteria.

Station	Date	Total Coliform #/100 mL	Fecal Coliform #/100 mL	Entero-Coccus [1] #/100 mL	Fecal Strepto-coccus #/100 mL
Kelly Ridge	11/7/03	>1600	**>1600**	**>1600**	>1600
	12/1/03	>1600	**>1600**	**500**	500
Oliver Street	12/1/03	>1600	**>1600**	**>1600**	>1600
Pine Street	11/7/03	>1600	**>1600**	**>1600**	>1600
	12/1/03	>1600	**>1600**	**>1600**	>1600
Robinson Street	11/7/03	>1600	**>1600**	**>1600**	>1600
	12/1/03	>1600	**>1600**	**>1600**	>1600

Note: Bold indicates that values exceed water quality criteria.

[1] *USEPA criteria – freshwater designated bathing beach area: Enterococci 61 per 100 mL. DHS recommended freshwater public beach criteria: Total coliform 10,000/100 ml; Fecal coliform 400/100 mL; Enterococcus 33/100 mL.*

G-WQ2.5.4 Results of Groundwater Sampling

This section provides tables that contain results for chemical constituents in groundwater from monitoring of wells near Thermalito Afterbay and Thermalito Forebay, as well as results for surface water from Thermalito Afterbay. These results are directly referenced in the groundwater discussion of Section 5.4.1.2, Affected Environment for Water Quality. Table G-WQ2.5-7 compares ranges of water quality parameters in wells downgradient and upgradient from Thermalito Forebay and Thermalito Afterbay with ranges in the surface waters of these impoundments. Table G-WQ2.5-8 provides a record of exceedances of the numerical water quality limits that were provided in Table G-WQ2.4-6 of this appendix. Table G-WQ2.5-9 compares water quality in well A11, which is immediately downgradient of Thermalito Forebay, with the water quality of other groundwater and surface water samples.

Table G-WQ2.5-7. Water quality ranges in downgradient and upgradient wells and surface water samples.

Water Quality Parameter	Downgradient Wells			Upgradient Wells			Surface Water		
	Samples	Maximum	Minimum	Samples	Maximum	Minimum	Samples	Maximum	Minimum
pH	32	8.2	6.9	4	7.3	7.2	81	7.9	7.0
Total Alkalinity (mg/L $CaCO_3$)	32	437	44	4	93	64	76	52	35
Specific Conductance (mmhos/cm)	32	1,220	124	4	261	153	81	94	59
Total Hardness (mg/L $CaCO_3$)	32	609	36	4	93	60	72	41	30
Dissolved Hardness (mg/L $CaCO_3$)	32	610	34	4	93	58	72	41	30
Total Dissolved Solids (mg/L)	32	801	75	4	200	101	79	61	35
Total Calcium (mg/L)	32	125	6	4	14	11	72	10	7
Dissolved Calcium (mg/L)	32	127	7	4	14	10	72	10	7
Dissolved Potassium (mg/L)	32	2.8	<0.5	4	1.7	0.8	72	1.0	0.6
Total Magnesium (mg/L)	32	72	4	4	14	8	72	4	3
Dissolved Magnesium (mg/L)	32	71	4	4	14	8	72	4	3
Dissolved Sodium (mg/L)	32	48	5	4	16	11	72	4	3
Dissolved Boron (mg/L)	32	<0.01	<0.01	4	<0.01	<0.01	72	<0.01	<0.01
Dissolved Chloride (mg/L)	32	29	2	4	9	7	72	1	<1
Dissolved Sulfate (mg/L)	32	195	<1	4	9	2	72	2	2
Total Aluminum (mg/L)	32	54.8	1.32	4	2.14	1.35	80	**479**	11
Dissolved Aluminum (mg/L)	32	54.9*	0.52	4	1.62	0.79	80	38.4	<1.5
Dissolved Mercury (mg/L)	32	0.00156	<0.00015	4	0.00038	<0.00015	80	0.0366	0.00024

** This result may be erroneous. Next highest result for dissolved aluminum was 9.97 µg/L.*

Table G-WQ2.5-8. Exceedances of Basin Plan water quality objectives.

Specific Conductance						
Well ID	**Date**	**Value (µmhos/cm)**	**Water Quality Limit Exceeded***			
B23	10/14/2003	714	Agricultural Goal			
R15	6/11/2003	755				
M22	7/2/2003	783				
R15	10/15/2003	849				
M22	10/14/2003	1,220	California Secondary MCL			
Total Dissolved Solids						
Well ID	**Date**	**Value (mg/L)**	**Water Quality Limit Exceeded***			
J36	10/29/2003	268	NAWQC Humans			
K12	7/1/2003	273				
K12	10/15/2003	294				
H19	7/7/2003	299				
J27	7/7/2003	300				
S32	7/7/2003	303				
H19	10/14/2003	305				
J36	7/2/2003	309				
S32	10/29/2003	330				
B23	7/7/2003	416				
B23	10/14/2003	417				
R15	10/15/2003	479	Agricultural Goal			
M22	7/2/2003	490				
R15	6/11/2003	491				
M22	10/14/2003	801	California and USEPA Secondary MCLs			
Dissolved Sodium						
Well ID	**Date**	**Value (mg/L)**	**Water Quality Limit Exceeded***			
B23	7/7/2003	22	USEPA Drinking Water Health Advisories			
B23	10/14/2003	24				
J36	7/2/2003	21				
M22	7/2/2003	28				
M22	10/14/2003	30	USEPA Drinking Water Taste and Odor Advisory			
R15	6/11/2003	48				
R15	10/15/2003	44				
Total Aluminium						
Well ID	**Date**	**Value (µg/L)**	**Water Quality Limit Exceeded***			
A11	7/1/2003	54.8	USEPA Primary MCL			

** For each parameter, the indicated water quality limit was exceeded for the sample in the same row and all samples listed below it.*

Table G-WQ2.5-9. Water quality ranges in Well A11 near Thermalito Forebay, other wells, and surface water samples.

Water Quality Parameter	Other Wells			A11 Well			Surface Water		
	Samples	Maximum	Minimum	Samples	Maximum	Minimum	Samples	Maximum	Minimum
pH	34	8.2	6.9	2	7.5	7.3	81	7.9	7.0
Total Alkalinity (mg/L $CaCO_3$)	34	437	64	2	76	44	76	52	35
Specific Conductance (μmhos/cm)	34	1,220	137	2	153	124	81	94	59
Total Hardness (mg/L $CaCO_3$)	34	609	55	2	52	36	72	41	30
Dissolved Hardness (mg/L $CaCO_3$)	34	610	58	2	55	34	72	41	30
Total Dissolved Solids (mg/L)	34	801	101	2	109	75	79	61	35
Total Calcium (mg/L)	34	125	9	2	8	6	72	10	7
Dissolved Calcium (mg/L)	34	127	10	2	7	7	72	10	7
Dissolved Potassium (mg/L)	34	2.8	<0.5	2	0.6	<0.5	72	1.0	0.6
Total Magnesium (mg/L)	34	72	8	2	9	4	72	4	3
Dissolved Magnesium (mg/L)	34	71	8	2	9	4	72	4	3
Dissolved Sodium (mg/L)	34	48	11	2	11	5	72	4	3
Dissolved Boron (mg/L)	34	<0.01	<0.01	2	<0.01	<0.01	72	<0.01	<0.01
Dissolved Chloride (mg/L)	34	29	2	2	2	2	72	1	<1
Dissolved Sulfate (mg/L)	34	195	<1	2	6	1	72	2	2
Total Aluminum (μg/L)	34	33.3	1.32	2	54.8	1.93	80	479	11
Dissolved Aluminum (μg/L)	34	9.97	0.52	2	54.9*	1.31	80	38.4	<1.5
Dissolved Mercury (μg/L)	34	0.00156	<0.00015	2	0.00063	0.00033	80	0.0366	0.00024

G-WQ2.5.5 References

USEPA (U.S. Environmental Protection Agency). 1994. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water for Freshwater Organisms. Third edition. EPA-600-4-91-002. U.S. Environmental Protection Agency. Washington, D.C.

USEPA (U.S. Environmental Protection Agency). 1996. Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. EPA-821-R-96-008. U.S. Environmental Protection Agency. Washington, D.C.

This page intentionally left blank.