

## SUMMARY

This summary provides a plain-language overview of the Statewide Mercury Control Program for Reservoirs.

The Water Boards recognize that reservoirs are vital to California and that reservoir operations face challenges from floods, droughts, and climate change. Especially in response to challenges posed by climate change, reservoir operators will likely need to nimbly manage water chemistry that could change from year-to-year. Therefore, this mercury program addresses controllable water quality factors and does not impose any restrictions on water supply.

In the first decade, reservoir owners and operators would test feasible reservoir management actions. The Water Boards encourage a coordinated approach for fewer, focused tests rather than tests in all mercury-impaired reservoirs. The test results will be evaluated by an independent, third-party Technical Review Committee before the Water Boards would develop long term requirements for all mercury-impaired reservoirs.

While the reservoir testing program is underway, the Water Boards will ensure that mercury sources are controlled to all mercury-impaired reservoirs.

### **S-1 Problem Statement, Goals, and Scope**

#### ***Problem statement***

Harmful levels of methylmercury in fish are a statewide and nationwide problem. Mercury is a bioaccumulative toxic pollutant that results in many reservoir fish having methylmercury levels that pose a risk for humans and wildlife that eat the fish. Mercury does not impair drinking water quality in California reservoirs. The number of reservoirs determined to be impaired by mercury is expected to increase substantially as new fish tissue monitoring data are collected and evaluated. The Statewide Mercury Control Program for Reservoirs applies to the mercury-impaired reservoirs listed on Table S-2. Elevated fish methylmercury levels impair the following beneficial uses: commercial and sport fishing (COMM), wildlife habitat (WILD), and preservation of rare and endangered species (RARE).

## **Goals**

To address the mercury problem in reservoirs, the State Water Resources Control Board (State Water Board) has undertaken a statewide program (“Statewide Mercury Control Program for Reservoirs”), which has the following main goals:

1. Reduce fish methylmercury concentrations in reservoirs that have already been determined to be mercury-impaired;
2. Have a control program in place that will apply to additional reservoirs when they are determined in the future to be mercury-impaired; and
3. Protect additional reservoirs from becoming mercury-impaired.

To achieve these goals, the State Water Board is proposing to establish a rule titled, “Amendment to the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California—Mercury TMDL and Implementation Program for Reservoirs” (hereinafter, Mercury Reservoir Provisions).

## **Scope**

The Mercury Reservoir Provisions include several key elements. The first element is a program of implementation for achieving and maintaining mercury water quality objectives (see below) in reservoirs. The program of implementation includes control actions for (1) point and nonpoint sources of mercury, and pilot tests for (2) reservoir water chemistry to reduce methylmercury production and (3) fisheries management to reduce methylmercury bioaccumulation.

The second element consists of recommendations (1) to protect people who eat mercury-contaminated reservoir fish while pilot tests are underway and inorganic mercury source reductions are occurring, (2) directed to the California Department of Fish and Wildlife for fisheries management, and (3) directed to other agencies to ensure reductions in atmospheric mercury.

The third element is a “total maximum daily load” for mercury-impaired reservoirs (Reservoir Mercury TMDL).

### **S-2 Reservoir Definition**

For this program, a reservoir is defined as a natural or artificial water impoundment that:

- Has constructed structures such as dams, levees, or berms to contain or otherwise manage water, and/or was excavated; and
- Provides year round habitat for fish other than those specifically introduced for vector control purposes.

Several types of impoundments are excluded, such as the following: potable water storage; industrial and mining supply water storage; wastewater treatment and storage; basins filled intermittently for flood control; and agricultural and ranching ponds.

### **S-3 Water Quality Objectives**

There is a related but separate mercury water quality objectives project (see [link](#)) that includes several objectives to protect human and wildlife health for consumption of fish. These objectives will apply to reservoirs addressed by the Statewide Mercury Control Program for Reservoirs. Mercury water quality objectives are proposed for sport fish, prey fish, and small prey fish where least tern habitat is supported. However, only one or two of these three mercury objectives apply to any particular water body, including to reservoirs (see Table S-1).

The “sport fish objective” protects humans and applies to all reservoirs to protect wildlife. Average methylmercury concentrations should not exceed 0.2 milligrams of methylmercury per kilogram of fish (mg/kg wet weight). This objective protects humans for consumption of one meal per week of fairly large fish (i.e., legal size catch).

One of two prey fish objectives may apply to each reservoir to protect wildlife that eats very small fish (see Table S-1). If a reservoir supports California least tern habitat, then the “CA least tern objective” applies; average methylmercury concentrations should not exceed 0.03 mg/kg. If a reservoir does not support California least tern habitat, then the “prey fish objective” would apply; average methylmercury concentrations should not exceed 0.05 mg/kg.

### **S-4 Implementation Plan**

#### ***Achieve all applicable targets***

One or two TMDL targets (see S-7) are applicable to each mercury-impaired reservoir. (These TMDL targets correspond to the one or two mercury water quality objectives applicable to each reservoir.) This implementation plan is designed to achieve all applicable targets in mercury-impaired reservoirs.

#### ***Phases and program review***

Implementation would occur over two phases. Table S-2 lists the mercury-impaired reservoirs that would be included in Phase 1 and mercury-impaired reservoirs with Federal Energy Regulatory Commission hydropower licenses that would be addressed in the future. Phase 1 is expected to last for 10 years, after which the State Water Board will conduct a program review.

This program review will determine effective and feasible reservoir management actions based on results of the reservoir pilot tests (described below) and will develop Phase 2 implementation requirements. In Phase 2, requirements would be applied to additional reservoirs and corresponding mercury sources as the reservoirs are determined to be mercury-impaired by the Water Boards<sup>1</sup>. Initiating Phase 2 would require a future amendment to the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California.

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<sup>1</sup> “Water Boards” refers collectively to the State Water Board and nine Regional Water Quality Control Boards.

### **Reservoirs and mercury control actions**

The mercury control actions apply to different sets of reservoirs as follows:

- Mercury source control actions for dredging and studies needed for atmospheric deposition apply statewide;
- Recommendations for exposure reduction apply to all reservoirs and are particularly needed for impaired reservoirs;
- Control actions apply to many mercury sources upstream of impaired reservoirs; sources such as mines, urban runoff (storm water), and municipal and industrial facility discharges (non-stormwater).
- In Phase 1, reservoir water chemistry and fisheries management pilot tests apply to mercury-impaired reservoirs that do not have a Federal Energy Regulatory Commission hydropower license; and
- Mercury source and methylation control actions for new reservoirs.

### **Effective date**

After the State Water Board adopts the Mercury Reservoir Provisions, the Mercury Reservoir Provisions are effective upon approval by the California Office of Administrative Law. The effective date is the beginning of Phase 1.

### **Applicability to existing mercury TMDLs**

The Reservoir Mercury TMDL will not apply to Clear Lake (Lake County), Soulajule Reservoir (Marin County), and Guadalupe River Watershed (Santa Clara County) reservoirs downstream of Vasona Dam or downstream of New Almaden mining district because mercury TMDLs were previously adopted by the Regional Water Boards for these reservoirs.

In contrast, the Reservoir Mercury TMDL will supersede the mercury TMDL for Hernandez Reservoir previously adopted by the Central Coast Regional Water Board. Additionally, both the Reservoir Mercury TMDL and USEPA-established mercury TMDLs (in the Los Angeles Area Lakes TMDL for nitrogen, phosphorus, mercury, trash, organochlorine pesticides, and PCBs) will apply to the El Dorado Park Lakes, Puddingstone Reservoir, and Lake Sherwood.

## **S-5 Key Actions in Phase 1**

### **Reservoirs: Pilot tests**

Owners and operators of mercury-impaired reservoirs (see Table S-2) would conduct pilot tests of methods to reduce methylmercury concentrations in reservoir fish. Hydroelectric power reservoirs (i.e., licensed by Federal Energy Regulatory Commission) would be excluded from mercury pilot test requirements in Phase 1. Coordinated pilot tests could be conducted in fewer, targeted reservoirs rather than in all impaired reservoirs. Reservoir owners and operators would convene a third-party independent Technical Review Committee to advise on pilot tests.

Reservoir owners and operators would use lessons learned from pilot tests to develop long-term reservoir and fisheries management plans. In program review after Phase 1, the Technical Review Committee and the State Water Board would evaluate results of pilot tests and long-term reservoir and fisheries management plans.

### ***Potential pilot tests***

Manage reservoir water chemistry to reduce methylmercury production:

- Oxidant addition to reservoir bottom waters (near the sediment-water interface) to reduce anoxia or adjust redox potential when reservoirs are stratified to suppress methylation of mercury. Evaluate various oxidants (e.g., dissolved oxygen, ozone, nitrate, others) for (a) efficacy for methylmercury reduction, (b) multiple benefits (e.g., drinking water quality, algal controls), and (c) avoidance of adverse consequences;
- In-reservoir sediment removal or encapsulation to address inorganic mercury hotspots such as submerged or near-shore mine sites and mining waste; and
- Other management practices to reduce methylation, including enhancing demethylation.

Manage fisheries to reduce fish bioaccumulation of methylmercury:

- Nutrient management such as minimal additions of nitrogen or phosphorus (including from natural sources such as restoring historical salmon runs) to slightly increase chlorophyll-a concentrations in oligotrophic reservoirs;
- Intensive fishing to increase the growth rate of remaining fish;
- New or changes to fish stocking practices to increase the abundance of fish with lower methylmercury levels, such as (a) stock low-methylmercury prey fish for reservoir predator fish to consume, (b) stock more or different sport fish species, such as lower trophic level sport fish, and/or (c) stock large, old predator fish from hatcheries that supply low methylmercury fish; and
- Assess potential changes to make to fish assemblage that result in top predator fish with lower methylmercury levels.

### ***Mine sites upstream of reservoirs***

The Water Boards would compel, using existing authorities, cleanup of the highest priority mine sites upstream of mercury-impaired reservoirs. Cleanup of highest priority mine sites is expected to reasonably quickly decrease reservoir mercury concentrations.

### ***Exposure reduction***

Human health should be protected while pilot tests are underway and inorganic mercury source reductions are occurring. This would involve reservoir owners and operators, the State Department of Public Health, Office of Environmental Health Hazard Assessment, and other stakeholders, for actions such as the following:

- Post fish consumption warning signs;

- Recommend fish catch restrictions to reduce human consumption of larger, older fish with high methylmercury levels, e.g., “slot limits” that specify a safe size range of fish for consumption; and
- Conduct public outreach and educational activities to discourage people from consuming fish with highly elevated methylmercury.

### ***Atmospheric deposition***

The California Air Resources Board and USEPA should evaluate atmospheric deposition of mercury to California. California already reduced anthropogenic emissions of mercury by more than half since 2001 and is expected to achieve the load allocation (see “Reservoir Mercury TMDL” section) by the end of Phase 1. The Water Boards would encourage USEPA to increase its efforts to address mercury emissions from foreign countries (particularly artisanal gold mining on several continents and power plant emissions in Asia).

## **S-6 Other Actions in Phase 1**

### ***Urban runoff to Mercury-Impaired Reservoirs (Storm water NPDES Dischargers)***

“MS4 permittees” are responsible for urban runoff from municipal separate storm sewer systems (MS4s) regulated by National Pollutant Discharge Elimination System (NPDES) permits. Large MS4 permittees in highly urbanized areas would monitor methylmercury in their discharges upstream of or directly to mercury-impaired reservoirs. In program review after Phase 1, the State Water Board would evaluate these data as a first step toward determining whether methylmercury controls from MS4 permittees are needed.

MS4 permittees located upstream of mercury-impaired reservoirs that contain historical mercury mine sites, or gold or silver mine sites where mercury was used, would ensure that earth-moving projects will employ erosion and sediment control best management practices to prevent discharge of mercury.

### ***Municipal and Industrial Wastewater Facility Discharges to Mercury-Impaired Reservoirs (Non-Stormwater NPDES Dischargers)***

The Water Boards would include the following in the next permit cycle for NPDES-permitted municipal and industrial wastewater facilities that discharge upstream of or directly to impaired reservoirs:

- Mercury numeric effluent limitations based on waste load allocations (see “Reservoir Mercury TMDL” section);
- Require dischargers to monitor total mercury in effluent; and
- Require dischargers with treatment pond systems to monitor methylmercury in effluent for up to two years.

In program review after Phase 1, the State Water Board will evaluate these data as a first step toward determining whether methylmercury controls are needed for discharges from treatment pond systems.

### ***Dredging and earth-moving***

The Water Boards issue certifications or permits for projects such as dredging in reservoirs and creek channels downstream of mine sites, and earth-moving projects such as construction of roads and watercourse crossings near mines. Future certifications and permits would include requirements for erosion and sediment control best management practices to prevent discharge of mercury.

## **S-7 Reservoir Mercury Total Maximum Daily Load**

This Statewide Mercury Control Program for Reservoirs would establish a total maximum daily load for mercury-impaired reservoirs (Reservoir Mercury TMDL) that would include the following elements.

### ***Numeric targets***

Three targets, one set equal to the sport fish objective, one set equal to the CA least tern objective, and one set equal to the prey fish objective. The targets apply to the impaired reservoirs corresponding to the mercury objectives. One or two of these three mercury targets apply to each mercury-impaired reservoir (see Table S-1).

### ***Source assessment***

Mercury sources are not evenly distributed across the State and no one source type is responsible for all reservoir impairments. The most important anthropogenic sources to impaired reservoirs are historical mine sites and atmospheric deposition from global and California industrial emissions.

Mercury is naturally-occurring in many geologic formations. Natural background (pre-industrial) concentrations in soils and sediments reflect naturally-occurring mercury from native geologic formations and volcanoes. California's Coast Ranges have some of the world's most productive mercury mines, and much of this mercury was used in gold mines in the Sierra Nevada and elsewhere.

Modern background soil mercury levels are elevated above natural background because mercury emissions and associated atmospheric deposition have increased greatly since the dawn of the industrial era. "Atmospheric deposition" is the term for this source after emissions settle onto the landscape or water surface. National and global emission inventories indicate that California anthropogenic emissions have decreased substantially in recent years while emissions from Asia have increased.

Historical gold, silver, and mercury mining activities were widespread in many of California's watersheds, and most mining activities occurred upstream of reservoirs. Yet, many mercury-impaired reservoirs downstream of mines do not have elevated sediment mercury concentrations.

In contrast to mines upstream of reservoirs, the majority of California's urban areas are downstream of reservoirs. NPDES-permitted urban runoff and treated wastewater facility discharges are generally insignificant sources of mercury.

### ***Linkage analysis***

There is a relationship between fish methylmercury concentrations and the environmental factors that control methylmercury production, bioaccumulation, and biomagnification in California reservoirs. More than 70 environmental factors have been assessed using statistical analyses and model development based on data collected from California reservoirs.

The linkage analysis indicates that no single factor explains fish methylmercury concentrations in California reservoirs. Multiple factors drive reservoir fish methylmercury levels: amount of mercury, methylmercury production, and bioaccumulation. The ratio of aqueous methylmercury to chlorophyll-a, aqueous total mercury, and annual reservoir water level fluctuations explain greater than 85% of the variability in reservoir fish methylmercury concentrations.

### ***TMDL and loading capacity***

The Reservoir Mercury TMDL and loading capacity for reservoirs is the sum of:

- Inorganic mercury waste load allocations for large and small NPDES-permitted discharges from municipal and industrial facilities;
- Inorganic mercury load allocations for mining waste, soils, and atmospheric deposition; and
- Methylmercury load allocation for in-reservoir methylmercury production.

The load allocations for soils and atmospheric deposition include natural background.

### ***Waste Load Allocations (WLAs) for point sources***

Facilities with individual NPDES permits are categorized as large, small, or negligible dischargers based on a comparison of their design flows to reservoir inflows. The WLAs are based on current performance and expressed as concentrations (nanograms of total mercury per liter [ng/L], calendar year average), as follows:

- Large municipal waste water treatment plants (WWTPs): 10 ng/L
- Other large facilities: 30 ng/L
- Small WWTPs: 20 ng/L
- Other small facilities: 60 ng/L

No WLAs are proposed for NPDES-permitted facilities with negligible discharges.

No WLAs are assigned to urban runoff discharged by MS4 entities and stormwater discharged by construction and industrial activities because mercury in these discharges is accounted for in the load allocations for atmospheric deposition.

### ***Load allocations for nonpoint sources***

Total mercury load allocations for mining waste and soils are based on mercury regions in California and expressed as concentrations (milligrams of mercury per kilogram of soil [mg/kg, dry weight, annual median]), as follows:



- 0.1 mg/kg for trace mercury areas;
- 0.3 mg/kg for mercury-enriched areas; and
- 400 mg/kg or a site-specific cleanup standard for mercury mineralized zone. (This mercury concentration is characteristic of background levels observed at mercury mine sites in the Coast Ranges.)

The statewide total mercury load allocations for atmospheric deposition are expressed as loads (kilograms of mercury per year [kg/yr]), as follows:

- 1,400 kg/yr for deposition from natural sources;
- 230 kg/yr for deposition from anthropogenic sources within California; and
- 1,600 kg/yr for deposition from anthropogenic sources outside of California.

The load allocation for in-reservoir methylmercury production is no detectable methylmercury in unfiltered reservoir water (calendar year median for the entire water column, including the epilimnion and hypolimnion) with a detection limit of 0.009 ng/L.

**Tables**

**Table S-1. Applicability of Numeric Targets**

	<b>Highest Trophic Level in Reservoir (TL4 Fish)</b>	<b>Highest Trophic Level in Reservoir (TL3 Fish)</b>
<b>Not habitat for California least tern</b>	sport fish target applies	sport fish and prey fish targets apply
<b>Habitat for California least tern</b>	sport fish and CA least tern targets apply	sport fish and CA least tern targets apply

*Table S-2 is provided on the following pages.*

**Table S-2 List of Mercury-Impaired Reservoirs to be Included in Phase 1**

See notes at bottom of table, especially note 2 regarding mercury-impaired reservoirs with Federal Energy Regulatory Commission (FERC) hydropower licenses.

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator (if different from owner)</b>	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
Almanor, Lake	5	Plumas	Pacific Gas and Electric Co.		2010	FERC 2105	10/31/2004	
Alondra Park Lake	4	Los Angeles	Los Angeles Co. Dept of Parks and Recreation		Future			
Amador, Lake	5	Amador	Jackson Valley ID		Future	FERC5388	FERC Exempt	
Anderson Lake	2	Santa Clara	Santa Clara Valley Water District		2010			
Arrowhead, Lake	6	San Bernardino	Arrowhead Lake Association		2012			
Bass Lake	5	Madera	Pacific Gas and Electric Co.		Future	FERC1354	8/31/2043	
Beach Lake	5	Sacramento	Sacramento Regional County Sanitation District		2010			
Berryessa, Lake	5	Napa, Yolo	U.S. Bureau of Reclamation	Solano County Water Agency	2010	FERC 2780	12/31/2030	
Big Bear Lake	8	San Bernardino	Big Bear Municipal Water District		2010			
Black Butte Lake	5	Glenn, Tehama	U.S. Army Corps of Engineers	Santa Clara, City of	2010	FERC 3190	4/30/2033	
BLM Reservoir/Buena Vista Mine	3	San Luis Obispo	U.S. Bureau of Land Management		Future			
Bon Tempe Lake	2	Marin	Marin Municipal Water District		2010			
Bowman Lake	5	Nevada	Nevada Irrigation District		Future	FERC 2266	4/30/2013	
Briones Reservoir	2	Contra Costa	East Bay Municipal Utility District		Future			

**Table S-2** continued

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator</b> (if different from owner)	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
Brite Valley Lake	5	Kern	Tehachapi-Cummings Co WD		Future			
Britton, Lake	5	Shasta	Pacific Gas and Electric Co.		2010	FERC 233	6/30/2043	1/25/2007
Butt Valley Reservoir	5	Plumas	Pacific Gas and Electric Co.		Future	FERC 2105	10/31/2004	
Cachuma, Lake	3	Santa Barbara	U.S. Bureau of Reclamation		Future			
Calaveras Reservoir	2	Alameda, Santa Clara	San Francisco, City & Co. of		2010			
California, Lake	5	Tehama	Lake California Property Owners Association		Future			
Camanche Reservoir	5	Amador, Calaveras, San Joaquin	East Bay Municipal Utility District		2010	FERC 2916	3/31/2031	
Camden Percolation Pond	2	Santa Clara	Santa Clara Valley Water District		Future			
Camp Far West Reservoir	5	Nevada, Placer, Yuba	South Sutter Water District		2010	FERC 2997	6/30/2021	
Casitas, Lake	4	Ventura	U.S. Bureau of Reclamation	Casitas Municipal Water District	2010			
Castac Lake	5	Kern	Tejon Ranch Co		Future			
Castaic Lagoon	4	Los Angeles	Los Angeles County Department of Parks and Recreation		Future			
Castaic Lake	4	Los Angeles	CA Department of Water Resources		2010			
Cave Lake	5	Modoc	U.S. Forest Service		Future			

**Table S-2** continued

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator (if different from owner)</b>	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
Cerritos Park Lake	4	Los Angeles	Los Angeles County Department of Parks and Recreation		Future			
Chabot, Lake (Alameda Co.)	2	Alameda	East Bay Municipal Utility District		2010			
Chabot, Lake (Solano Co.)	2	Solano	Vallejo, City of		Future			
Chesbro Reservoir	3	Santa Clara	Santa Clara Valley Water District		2010			
Collins Lake	5	Yuba	Browns Valley ID		Future			
Combie, Lake	5	Nevada, Placer	Nevada Irrigation District		2010	FERC 2981	Exempt	
Contra Loma Reservoir	5	Contra Costa	U.S. Bureau of Reclamation		Future			
Copco Lake	1	Siskiyou	Pacific Power and Light Co.		2012	FERC 2082	3/1/2006	
Coyote Lake	2	Santa Clara	Santa Clara Valley Water District		Future			
Crowley Lake	6	Mono	Los Angeles, City of		Future			
Davis Creek Reservoir	5	Yolo	Homestake Mining Co.		2010			
Dead Lake	1	Del Norte	CA Department of Parks and Recreation		2012			
Del Valle Reservoir	2	Alameda	CA Department of Water Resources		2010			
Don Pedro Lake	5	Tuolumne	Turlock & Modesto Irrigation District		2010	FERC 2299	4/30/2016	
Donner Lake	6	Nevada	Truckee Meadows Water Authority		Future			

**Table S-2** continued

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator (if different from owner)</b>	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
East Park Reservoir	5	Colusa	U.S. Bureau of Reclamation	Orland Unit Water Users` Association	2010			
El Capitan Reservoir	9	San Diego	San Diego, City of		Future			
El Dorado Park Lakes	4	Los Angeles	Long Beach, City of		2010			
Elderberry Forebay	4	Los Angeles	Los Angeles, City of		Future	FERC 2426	1/31/2022	
Englebright Lake	5	Nevada, Yuba	U.S. Army Corps of Engineers	Yuba County Water Agency/Pacific Gas and Electric Company	2010	FERC 2246, 1403	03/31/2016, 01/31/2023	
Fallen Leaf Lake	6	El Dorado	U.S. Forest Service		Future			
Faucherie Lake	5	Nevada	Nevada Irrigation District		Future	FERC 2266	4/30/2013	
Finger Lake	5	Tehama	Endicott Bert		Future			
Folsom Lake	5	El Dorado, Placer, Sacramento	U.S. Bureau of Reclamation		2010			
French Meadows Reservoir	5	Placer	Placer Co. Water Agency		Future	FERC 2079	2/28/2013	
Frenchman Lake	5	Plumas	California Water Resources Dept		Future			
Grass Valley Lake	6	San Bernardino	Arrowhead Lake Association		Future			
Gregory, Lake	6	San Bernardino	San Bernardino, County of. Reg Parks		2012			
Hansen Dam Lake	4	Los Angeles	U.S. Army Corps of Engineers		Future			
Hell Hole Reservoir	5	Placer	Placer County Water Agency		2010	FERC 2079	2/28/2013	

**Table S-2** continued

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator (if different from owner)</b>	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
Henne, Lake	2	Napa	Howell Mtn Mutual Water Co		Future			
Henshaw, Lake	9	San Diego	Vista Irrigation District/ City of Escandido		Future	FERC176	FERC Exempt	
Hensley Lake	5	Madera	U.S. Army Corps of Engineers		2010			
Herman, Lake	2	Solano	Benicia, City of		2010			
Hernandez Reservoir	3	San Benito	Can Benito County Water District		1998			
Hetch Hetchy Reservoir	5	Tuolumne	San Francisco, City & Co. of	San Francisco Public Utilities Commission	2010			
Hodges, Lake	9	San Diego	San Diego, City of		2010			
Hughes, Lake	4	Los Angeles	U.S. Forest Service		Future			
Indian Creek Reservoir	6	Alpine	So Tahoe Public Utility Dist		Future			
Indian Valley Reservoir	5	Lake	Yolo County Flood Control & Water Conservation District		2010			
Iron Gate Reservoir	1	Siskiyou	Pacific Power and Light Co.		2012	FERC 2082	3/1/2006	
Irvine Lake	8	Orange	Serrano Wd & Irvine Ranch WD		Future			
Isabella Lake	5	Kern	U.S. Army Corps of Engineers	Isabella Partners	Future	FERC8377	5/31/2038	
Jackson Meadow Reservoir	5	Nevada, Sierra	Nevada Irrigation District		Future	FERC 2266	4/30/2013	
Jameson Lake	3	Santa Barbara	Montecito Water District		Future			

**Table S-2** continued

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Jenkinson Lake	5	El Dorado	El Dorado ID		Future			
Jennings, Lake	9	San Diego	Helix WD		Future			
Kaweah, Lake	5	Tulare	U.S. Army Corps of Engineers	Kaweah River and Power Authority	2010	FERC 3947	7/31/2036	
Ken Hahn Park Lake	4	Los Angeles	California Dept. of Parks and Rec.		Future			
La Mirada Park Lake	4	Los Angeles	Los Angeles Co. Dept of Parks and Recreation		Future			
Lafayette Reservoir	2	Contra Costa	East Bay Municipal Utility District		2010			
Lee Lake/Corona Lake	8	Riverside	Elsinore Valley MWD		Future			
Legg Lake	4	Los Angeles	Los Angeles Co. Dept of Parks and Recreation		Future			
Lexington Reservoir	2	Santa Clara	Santa Clara Valley Water District		Future			
Little Rock Reservoir	6	Los Angeles	Little Rock Creek ID		2012			
Loch Lomond Reservoir	3	Santa Cruz	Santa Cruz, City of		Future			
Loon Lake	5	El Dorado	Sacramento Municipal Utility District		Future	FERC 2101	6/30/2064	10/4/2013
Lopez Lake	3	San Luis Obispo	San Luis Obispo Co FCWCD		Future			
Los Banos Reservoir	5	Merced	U.S. Bureau of Reclamation		Future			
Los Vaqueros Reservoir	5	Contra Costa	Contra Costa Co WD		Future			

**Table S-2** continued

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Loveland Res	9	San Diego	Sweetwater Authority, South Bay ID		Future			
Lower Crystal Springs Reservoir	2	San Mateo	San Francisco, City & Co. of		Future			
Lower Otay Reservoir	9	San Diego	San Diego, City of		Future			
Malibou Lake	4	Los Angeles	Malibu Lake Mtn Club Inc		Future			
Mammoth Pool Reservoir	5	Fresno, Madera	Southern California Edison Co.		Future	FERC2085	11/30/2007	
Marsh Creek Reservoir	5	Contra Costa	Contra Costa County Flood Control & Water Conservation District		2010			
Marsh in Fresno Slough	5	Fresno	Fresno Slough WD		Future			
Mathews, Lake	8	Riverside	Metropolitan WD of Southern California		Future			
McClure, Lake	5	Mariposa	Merced Irrigation District		2010	FERC 2179	2/28/2014	
McSwain, Lake	5	Mariposa	Merced Irrigation District		Future	FERC 2179	2/28/2014	
Mendocino, Lake	1	Mendocino	U.S. Army Corps of Engineers	Sonoma County Water Agency	2010	FERC 2841	3/31/2032	
Mile Long Pond	5	Butte	CA Department of Water Resources		2010			
Millerton Lake	5	Fresno, Madera	U.S. Bureau of Reclamation	Friant Power Authority	2010	FERC 2892	8/31/2032	
Modesto Reservoir	5	Stanislaus	Modesto Irrigation District		2010			



**Table S-2** continued

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator (if different from owner)</b>	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
Moon Lake	5	Lassen	John Hancock Mutual Ins Co		Future			
Morena Reservoir	9	San Diego	San Diego, City of		Future			
Nacimiento, Lake	3	San Luis Obispo	Monterey County Water Resources Agency		2010	FERC6378	FERC Exempt	
Natoma, Lake	5	Sacramento	U.S. Bureau of Reclamation		2010			
New Bullards Bar Reservoir	5	Yuba	Yuba County Water Agency		2010	FERC 2246	3/31/2016	
New Hogan Lake	5	Calaveras	U.S. Army Corps of Engineers	Modesto Irrigation District	2010	FERC 2903	10/31/2032	
New Melones Lake	5	Calaveras, Tuolumne	U.S. Bureau of Reclamation		2010			
Nicasio Reservoir	2	Marin	Marin Municipal Water District		2010			
Ogier Quarry Ponds	2	Santa Clara	Santa Clara, County of		Future			
O'Neill Forebay	5	Merced	U.S. Bureau of Reclamation	CA Department of Water Resources	2010			
Oroville, Lake	5	Butte	CA Department of Water Resources		2010	FERC 2100	1/31/2007	8/31/2010
Oxbow Reservoir	5	El Dorado, Placer	Placer County Water Agency		2010	FERC 2079	2/28/2013	
Palmdale Lake	6	Los Angeles	Palmdale Water District		Future			
Paradise Lake	5	Butte	Paradise Irrigation District		Future			
Pardee Reservoir	5	Amador, Calaveras	East Bay Municipal Utility District		2010	FERC 2916	3/31/2031	

**Table S-2** continued

Reservoir	Water Board Region	County(ies)	Owner	Operator (if different from owner)	303(d) List	FERC License No.	FERC Expiration Date	FERC with CWA 401 Certification
Peck Road Park Lake	4	Los Angeles	Los Angeles Co. Dept of Parks and Recreation		Future			
Perris Reservoir	8	Riverside	California Water Resources Dept		Future			
Pilarcitos Lake	2	San Mateo	San Francisco, City & Co. of		Future			
Pillsbury, Lake	1	Lake	Pacific Gas and Electric Co.		2010	FERC 77	4/14/2022	
Pine Flat Lake	5	Fresno	U.S. Army Corps of Engineers	Pacific Gas and Electric Company and Kings River Conservation District	2010	FERC 175, 1988, 2741	08/31/2029, 04/30/2026, 02/28/2041	
Pinto Lake	3	Santa Cruz	Santa Cruz, County of. Dept. of Public Works		Future			
Piru, Lake	4	Ventura	United Water Control District		Future	FERC2153	8/31/2048	
Puddingstone Reservoir	4	Los Angeles	Los Angeles County Department of Public Works		2010			
Pyramid Lake	4	Los Angeles	CA Department of Water Resources		2010	FERC 2426	1/31/2022	
Robinson's Pond	5	Butte	CA Department of Fish and Wildlife		2010			
Rollins Reservoir	5	Nevada, Placer	Nevada Irrigation District		2010	FERC 2266	4/30/2013	
Ruth Lake	1	Trinity	Humboldt Bay MWD	Humboldt Bay Municipal Water District	2012	FERC 1993	FERC Exempt	
San Antonio Reservoir	3	Monterey, San Luis Obispo	Monterey County Water Resources Agency		2010			
San Luis Reservoir	5	Merced	U.S. Bureau of Reclamation	CA Department of Water Resources	2010			

**Table S-2** continued

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator (if different from owner)</b>	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
San Pablo Reservoir	2	Contra Costa	East Bay Municipal Utility District		2010			
San Vicente Reservoir	9	San Diego	San Diego, City of		Future	FERC14642		
Santa Fe Dam Park Lake	4	Los Angeles	U.S. Army Corps of Engineers		Future			
Santa Margarita Lake	3	San Luis Obispo	U.S. Army Corps of Engineers		Future			
Scotts Flat Reservoir	5	Nevada	Nevada Irrigation District		2010			
Shadow Cliffs Reservoir	2	Alameda	East Bay Regional Park District		2010			
Shasta Lake	5	Shasta	U.S. Bureau of Reclamation		2010			
Shastina, Lake	1	Siskiyou	Montague Water Conservation District		2010			
Sherwood, Lake	4	Ventura	Westlake Lake Management Association		2010			
Silverwood Lake	6	San Bernardino	California Water Resources Dept		2012	FERC14797	1/31/2022	
Siskiyou Lake	5	Siskiyou	Siskiyou Co. FCWCD		Future			
Slab Creek Reservoir	5	El Dorado	Sacramento Municipal Utility District		2010	FERC 2101	6/30/2064	7/12/2016
Solano, Lake	5	Yolo	U.S. Bureau of Reclamation	Solano County Water Agency	2010	FERC 2780	12/31/2030	
Sonoma, Lake	1	Sonoma	U.S. Army Corps of Engineers		2010	FERC 3351	11/30/2034	
Spicer Meadow Reservoir	5	Tuolumne, Alpine	Calaveras Co. WD	Northern California Power Authority	Future	FERC 2409	1/31/2032	

**Table S-2** continued

<b>Reservoir</b>	<b>Water Board Region</b>	<b>County(ies)</b>	<b>Owner</b>	<b>Operator (if different from owner)</b>	<b>303(d) List</b>	<b>FERC License No.</b>	<b>FERC Expiration Date</b>	<b>FERC with CWA 401 Certification</b>
Spring Lake	1	Sonoma	Sonoma Co. Water Agency		Future			
Stevens Creek Reservoir	2	Santa Clara	Santa Clara Valley Water District		2010			
Stony Gorge Reservoir	5	Glenn	U.S. Bureau of Reclamation	Orland Unit Water Users` Association	2010	FERC 3193	7/31/2032	
Sutherland, Lake	9	San Diego	San Diego, City of		Future			
Sweetwater Reservoir	9	San Diego	Sweetwater Authority		Future			
Thermalito Afterbay	5	Butte	CA Department of Water Resources		2010	FERC 2100	1/31/2007	12/15/2010
Topaz Lake	6	Mono	Walker River Irrigation District		2012			
Trinity Lake	1	Trinity	U.S. Bureau of Reclamation		2010			
Tulloch Reservoir	5	Calaveras, Tuolumne	South San Joaquin and Oakdale Irrigation Districts		2010	FERC 2067	12/31/2046	9/15/2005
Tunnel Reservoir	5	Shasta	Pacific Gas and Electric Co.		Future	FERC 233	6/30/2043	
Turlock Lake	5	Stanislaus	Turlock Irrigation District		2010			
Upper San Leandro Reservoir	2	Alameda, Contra Costa	East Bay Municipal Utility District		Future			
Upper Twin Lake	6	Mono	Centennial Livestock		2012			
Uvas Reservoir	3	Santa Clara	Santa Clara Valley Water District		2010			
Vasona Reservoir	2	Santa Clara	Santa Clara Valley Water District		Future			

**Table S-2** continued

Reservoir	Water Board Region	County(ies)	Owner	Operator (if different from owner)	303(d) List	FERC License No.	FERC Expiration Date	FERC with CWA 401 Certification
Webb, Lake	5	Kern	Kern Co Dept of Parks & Rec		Future			
West Valley Reservoir	5	Modoc, Lassen	South Fork Irrigation District		Future			
Westlake Lake	4	Los Angeles, Ventura	Westlake Lake Management Association		Future			
Whiskeytown Lake	5	Shasta	U.S. Bureau of Reclamation		2010			
Wildwood, Lake	5	Nevada	Lake Wildwood Association		2010			
Woodward Reservoir	5	Stanislaus	South San Joaquin Irrigation District		2010			
Zayak/Swan Lake	5	Nevada	Lakewood Association		Future			

Notes

- 1 FERC: Federal Energy Regulatory Commission hydropower license
- 2 Table S-1 lists the mercury-impaired reservoirs that would be included in Phase 1 and mercury-impaired reservoirs with FERC licenses that would be addressed in the future. In Phase 2, requirements would be applied to additional reservoirs and corresponding mercury sources as the reservoirs are determined to be mercury-impaired by the Water Boards.
- 3 303(d) List: "1998," "2010," or "2012" indicates the year that reservoirs impaired by mercury were included on the Clean Water Act section 303(d) List. These lists are available at: [http://www.waterboards.ca.gov/water\\_issues/programs/water\\_quality\\_assessment/#impaired](http://www.waterboards.ca.gov/water_issues/programs/water_quality_assessment/#impaired)
- 4 "Future" indicates that fish have elevated methylmercury levels; data analysis is planned to be reported in a future staff report for public review.
- 5 "FERC with CWA 401 Certification with Mercury Re-opener" indicates that the previous FERC license renewal included in the Clean Water Act section 401 Water Quality Certification a provision to re-open the 401 certification for water quality reasons including mercury.