

California Environmental Protection Agency
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

CLEAR LAKE MERCURY
TOTAL MAXIMUM DAILY LOAD UPDATE

FINAL
November 8, 2010

Summary

Clear Lake was added to the Clean Water Act Section 303(d) List of Impaired Waterbodies for mercury in 1988. The listing was based upon high levels of mercury in fish tissue and the existence of a fish consumption advisory issued in 1987 by the California Department of Health Services. The fish consumption advisory was issued based on mercury contamination in edible fish tissue collected from the lake (OEHHA, 2005). Accordingly, the Central Valley Water Board developed a Total Maximum Daily Load (TMDL) for mercury for Clear Lake to lower mercury levels to attain commercial and sport (non-commercial) fishing and wildlife habitat beneficial uses (CVWB, 2002b). This TMDL established site-specific numeric water quality objectives of 0.09 and 0.19 mg/kg mercury, wet weight, for fish in trophic levels 3 and 4, respectively, and assigned load allocations to land management agencies with jurisdiction in the Clear Lake Watershed and Sulphur Bank Mercury Mine (Sulphur Bank). On December 6, 2002, the Central Valley Water Board adopted Resolution No. R5-2002-0207, *Amending the Water Quality Control Plan for the Sacramento and San Joaquin Rivers Basins for the Control of Mercury in Clear Lake* (CVWB, 2002a). The Clear Lake Mercury TMDL became effective October 2, 2003 and put forth a management strategy to reduce the concentrations of methylmercury in fish by reducing the overall mercury loads to Clear Lake.

To date, implementation actions for the Clear Lake Mercury TMDL have focused on implementation plan development, coordination, and implementing best management practices to control erosion of sediments into the lake. Implementation of best management practices to control sediment erosion is essential since erosion control retains mercury-bound sediments from entering the lake. Sulphur Bank has contributed the majority of mercury to the lake. For this mine, implementation actions include sediment erosion control, reduction of mercury tainted groundwater flow into the lake and other measures that prevent or reduce evasion of mercury-bound sediments into the atmosphere.

The TMDL provides direction for Central Valley Water Board staff to review the progress toward meeting the fish tissue objectives for Clear Lake every five years (CVWB, 2002a). This document provides an opportunity to review the progress to date in meeting the TMDL objectives, in addition to providing information on the proposed efforts for the next five years. This update provides the status on TMDL implementation progress and does not revise or amend the *Water Quality Control Plan (Basin Plan) for the Sacramento and San Joaquin River Basins*.

Mercury Sources within the Clear Lake Watershed

The United States Environmental Protection Agency (USEPA) provides the following description of mercury, as it occurs in the environment:

Mercury is a naturally occurring element that can be found throughout the environment. Human activities, such as burning coal and using mercury to manufacture certain products, have increased the amount of mercury in many parts of the environment including the atmosphere, lakes and streams. People and animals are exposed to mercury by eating organisms that live in places where microbes have converted some of the natural and human mercury to a more toxic form, methylmercury (USEPA, 2001; USEPA, 2010a).

Clear Lake lies within the northern Coastal Range, which is naturally enriched with mercury. In this mercury rich region, mercury occurs as cinnabar (i.e., mercuric sulfide) and metacinnabarite in silica-carbonate deposits. Consistent with other Coastal Range locations, some deposits may contain native mercury.

Natural and anthropogenic mercury sources include, but are not limited to, mercury prospects, claims and mines including associated processing facilities to extract mercury or other commodities over time; geothermal springs; and erosion of mercury-bearing soils and rocks; atmospheric deposition from global contributors, such as industrial processes involving polyvinyl chloride pipe manufacturing, chlorine chemical and coal, natural gas or petroleum combustion, or natural processes, such as volcanoes or forest fires; evaporation of mercury containing water; animal excretions; refuse incineration, landfills and landfill gas; industrial processes, such as lime and cement manufacturing; and medical processes; and the application of legacy agricultural pesticides and fungicides that contained mercury (USBM, 1994; USEPA, 1997). In the Clear Lake Watershed, historical mercury mining is regarded as the major contributor of mercury discharges into the lake at this time.

Historical Mercury Mining in the Clear Lake Watershed

One of the primary producing mercury mining districts in the late 1800s, the Clear Lake Mining District included mines and properties in the south central and southeast portion of Lake County. Although not one of the larger producing mercury mining districts in California¹, approximately 129,000 flasks² were reportedly produced for all mines in this particular district between 1870 and 1961 (USBM, 1965). Mercury deposits in Lake County were recognized as early as the mid-1830s, but were not actively mined until the mid-1840s and continued well into the 1960s at various claims, prospects and mines around the watershed. Mercury properties were typically located along the lake or tributaries

¹ California was the highest mercury producer in the United States between 1850 and 1961, generating a total output of 2,772,120 flasks of mercury. The top mercury producing mining districts in the state were (1) the New Almaden Mining District and Properties, which produced over 1,000,000 flasks of mercury since at least 1850; (2) the New Idria Mining District and Properties, which produced approximately 500,000 flasks of mercury since at least 1854; (3) the East Mayacmas Mining District and Properties, which produced approximately 390,000 flasks of mercury since at least 1870; and (4) the Knoxville District Mines and Properties, which produced over 160,000 flasks of mercury since at least 1862 (USBM, 1965).

² Production in 76-pound flasks

that fed into the lake. Mercury mine activity fluctuated in response to economic demands due to developments in gold mining and hydraulic mining technology, the discovery of the Comstock Lode in Nevada, medicine, explosives, gasoline additives, atomic energy research, and federal incentives (Pennington, 1959; USBM, 1965).

Sulphur Bank is located within the Clear Lake Mining District and contributed to the majority of the mining district's total output. Starting in 1865, the 800 acre property was mined for sulfur, until the economic demand during the 1870s spurred the development of this property for mercury. Underground workings continued until approximately 1906. In 1915, the Sulphur Bank Association began open pit mining at the property, which continued through 1919 and then again from 1927 through 1950. As of 1965, the Bradley Mining Company owned the mining property (USBM, 1965).

Mercury deposits were reportedly described as sporadic, so it was difficult to accurately estimate the reserve at Sulphur Bank. The majority of surface operations were widely distributed over the property and underground operations occurred along seven shafts. The mine included a 60-ton reduction plant. Records indicate a production rate of 60 tons daily and an ore grade of five pounds of mercury per ton. Labor records are variable but have been confirmed to include as few as fifteen men, while unconfirmed sources include one hundred or more (Pennington, 1959; USBM, 1965).

In 1990, the Sulphur Bank site, which lies along the lake shoreline, was listed on USEPA's National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act, more commonly known as Superfund. Accordingly, USEPA has responded with long term actions to remediate hazardous wastes at the site. The property includes extensive mining workings, mine tailings, waste rock, and an open pit referred to as the Herman Impoundment. The Elem Pomo Tribe, which lies directly adjacent to the mine property, is also part of the Superfund site. A wetland which has served as critical habitat for three endangered wildlife species is located in close proximity to the mine (USEPA, 2010b).

Other mercury prospects, claims and mines and associated workings or other commodities are known to be located in the Clear Lake Watershed, serving as potential sources of mercury. These properties are included in the Clear Lake Mining District and may include, but are not limited to, Anderson Mine, Baker Mine, Gordon Springs Mine, Lucitta (or Konokoti or Konocti) Mine, Utopia Mine, White Elephant (or King of All Group) Prospect, Baxter Prospect, and the Shamrock Prospect (USBM, 1965). Due to the geology of the area, undisturbed deposits rich in mercury may also contribute to the sediment load to Clear Lake, in terms of alluvial, geothermal and groundwater movement through such deposits.

Tribes and Impacts of Mercury Mining

The following information was provided by the Clear Lake Tribes:

Based on anthropological research from the Native population, fish consumption rates are historically reported to exceed subsistence level rates at 680-1361 grams/day, which is equivalent to 1-1/2 to 3 lbs of fish/day. The high mercury levels in Clear Lake fish have all but eliminated fish consumption at historical consumption rates due to public concern posed by fish consumption advisories. However, despite fish consumption advisories, some families within some Tribes continue to eat large amounts of catfish, crappie, bluegill and bass. The tragedy of mercury contamination has affected both the health of the Native people and their cultural heritage. The current TMDL does not clean up the mercury contamination to safe consumption levels for the Native population.

Clear Lake Mercury TMDL

Clear Lake Mercury Management Strategy

The goal of the Clear Lake mercury management strategy is to reduce fish tissue methylmercury concentrations by 60% of 2000 levels by (a) reducing the concentrations of total mercury in the surficial layer of lakebed sediment by 70% of 2000 levels and (b) further investigation and reduction of other mercury sources believed to have a high potential for mercury methylation. In order to accomplish the 70% reduction in concentration of total mercury in the surficial layer of lakebed sediments, mercury loads must be reduced by 70% around the watershed. The following are mercury load allocations (i.e., 5% of 2002 total mercury load equals a reduction of 95%) (CVWB, 2002b):

- Clear Lake sediment: 30% of 1996-2000 concentrations³
- Sulphur Bank Mine: 5% of 2002 total mercury load⁴
- Tributaries: 80% of 2002 total mercury load
- Atmospheric Deposition: No change

The majority of load allocations were assigned to the Sulphur Bank.

Specifically, the following actions are identified in the Clear Lake Mercury TMDL (CVWB, 2002b):

- USEPA is requested to continue necessary remediation activities on the Sulphur Bank mine site and prepare an implementation plan or plan(s).

³ For this load allocation, a greater percent reduction is required in sediment at the eastern end of the Oaks Arm.

⁴ For this load allocation, there is a specific limit for mercury entering Clear Lake in groundwater of 0.5 kg/year.

- USEPA is requested to submit remediation plans for the Sulphur Bank site for Central Valley Water Board concurrence by 2011, and then implement those plans by 2013. USEPA should complete remediation activities at the mine site and active lakebed sediment remediation by 2023.
- Central Valley Water Board staff will coordinate the development of monitoring activities to investigate other sources of mercury loads to Clear Lake.
- The United States Bureau of Land Management (USBLM), United States Forest Service (USFS), other land management agencies in the Clear Lake Basin, and Lake County shall submit plans for monitoring and implementation of mercury load reduction projects by 2008.
- Central Valley Water Board staff will work with the Native American Tribes in the Clear Lake watershed on mercury reduction programs for the tributaries and surface water runoff.
- Central Valley Water Board staff, USBLM, USFS and other land management agencies in the Clear Lake Basin, and Lake County will assess the potential for production of methylmercury during the planning of any wetlands or floodplain restoration projects within the Clear Lake watershed.
- The Lake County Public Health Department will provide outreach and education to the community, emphasizing portions of the population that are at risk, such as pregnant women and children.
- The Central Valley Water Board will review the progress toward meeting the fish tissue objectives for Clear Lake every five years. This review is to coincide with the five year review to be conducted by USEPA for the Record of Decision for the Sulphur Bank Superfund Site.

Clear Lake Stakeholders

Land Management Agencies

The following land management agencies with jurisdiction in the Clear Lake Watershed have been identified in the Clear Lake Watershed: USBLM, USFS, California Department of Transportation (Caltrans), Lake County, City of Clearlake, and City of Lakeport. The USEPA, while not a land management agency, is the lead in the cleanup at the Sulphur Bank property. USEPA has identified some potentially responsible parties for this site. These parties have not participated in the TMDL implementation discussions to date. Due to this, USEPA's actions are included in this discussion for that property instead.

Tribes

The following seven federally recognized Tribes have jurisdiction in the Clear Lake Watershed: Big Valley Rancheria, Elem Pomo Tribe, Habematolel Pomo of Upper Lake, Lower Lake Rancheria Koi Nation, Middletown Rancheria, Robinson Rancheria, and Scotts Valley Band of Pomo Indians.

Other Clear Lake Stakeholders

In addition to the land management agencies and Tribes discussed in this document, other Clear Lake Watershed stakeholders, include, but are not limited to, United States Army Corps of Engineers (USACOE), USEPA, United States Fish and Wildlife Service, other federally and non-federally recognized Tribes with aboriginal lands in the Clear Lake Watershed, Department of Fish and Game, Department of Toxic Substances Control (DTSC), Department of Water Resources (DWR), East Lake and West Lake Resource Conservation Districts, University of California Cooperative Extension, Lake County Farm Bureau for irrigated agriculture, non-irrigated agriculture, private landowners, Lake County Special Districts, Sierra Club, Clear Lake Environmental Action Network, Friends of Clear Lake, watershed councils, and other individuals and organizations coordinating activities in, and adjacent to, the Clear Lake Watershed.

Status of TMDL Implementation Efforts (2003 to 2010)

Central Valley Water Board Staff Efforts to Coordinate TMDL Implementation

Central Valley Water Board staff has been working with each land management agency, tribe and other Clear Lake stakeholders to implement the TMDL. Staff efforts include, but are not limited to, providing technical guidance, reviewing plans, guidance and environmental documents to ensure consistency with TMDL objectives, enforcement coordination, and regular attendance to meetings, such as the Lake County Coordinating Resource Management Committee, Lake County Clean Water Program Advisory Council, Lake County Board of Supervisors meetings, and other interested stakeholder meetings as requested. Central Valley Water Board staff maintains a positive working relationship with Clear Lake Watershed stakeholders and are routinely contacted about local issues.

Six federally recognized Tribes have been active in the notification of Clear Lake Mercury TMDL activities, plans and projects. Central Valley Water Board staff continues to coordinate with each Tribe to ensure information transfer, participation, and that Clear Lake Mercury TMDL actions are inclusive. Central Valley Water Board staff continues outreach to non-federally recognized Tribes that may be interested in TMDL implementation in the Clear Lake Watershed.

Central Valley Water Board staff coordinates and consults with project proponents planning or constructing any wetlands or floodplain restoration projects in the Clear Lake Watershed, to assess the potential for production of methylmercury. Specific examples are coordination with the USACOE and Lake County for the Middle Creek Ecosystem Restoration and Flood Damage Reduction Project and Highlander Ranch Reservoir Project. Staff also coordinates with all Clear Lake stakeholders regarding best management practices that incorporate the use of wetlands, among others.

Central Valley Water Board staff work with Clear Lake Watershed stakeholders to ensure activities across the watershed are not counter productive to actions and efforts implementing the Clear Lake Mercury TMDL objectives. These types of actions may include, but are not limited to, the implementation of unproven technologies to remove mercury or methylmercury from sediments or waters, or ineffective best management practices. Of particular interest is the incorporation of best management practices (i.e., water pollution controls) to control erosion in proposed projects and actions located within the Clear Lake Watershed, which are subject to the California Environmental Protection Act (CEQA) and National Environmental Policy Act (NEPA), respectively. For all local and state proposed projects subject to CEQA, environmental documents should address water quality issues, as applicable. During the CEQA review process, mitigation measures should incorporate best management practices pertaining to erosion control to reduce proposed local and state project impacts to less than significant, as applicable and feasible. Similarly, for all federal proposed actions subject to NEPA, environmental documents should address water quality issues, as applicable. During the NEPA review process, environmental commitments should suggest best management practices pertaining to erosion control be incorporated to reduce proposed action impacts, as applicable and feasible.

Specific Highlighted Actions

Over the past seven years, USEPA, USBLM, USFS, Caltrans, Lake County, City of Clearlake, and City of Lakeport and other Clear Lake Watershed stakeholders, including Big Valley Rancheria Band of Pomo Indians, Elem Pomo Tribe, Habematolel of Pomo of Upper Lake, Middletown Rancheria, Robinson Rancheria Band of Pomo Indians, and Scotts Valley Band of Pomo Indians, have coordinated and collaborated in their TMDL implementation efforts. These efforts include, but are not limited to, water quality monitoring, load allocation refinements, implementation plan development, pursuing project implementation funding, and leveraging resources across the watershed. Each of these federal, Tribal, state and local agencies has attended coordination meetings to discuss TMDL implementation.

Land management agencies have collaborated and coordinated in the development and preparation of implementation plans. For example, in October

2008, Central Valley Water Board staff approved the *Monitoring and Implementation Plan* that was developed by Lake County, in coordination and collaboration with land management agencies and other Clear Lake Watershed stakeholders, for both the Clear Lake Mercury TMDL and Clear Lake Nutrient TMDL⁵ (Lake County, 2008a). The *Monitoring and Implementation Plan* describes the Nutrient and Mercury TMDLs and stakeholder efforts or plans to monitor and implement nutrients and mercury and will be periodically updated. A Memorandum of Understanding formalizing the stakeholder's intent and willingness to leverage resources, share information and cooperate in the development of the implementation plan was submitted as part of this approved package.

Tribes and other Clear Lake stakeholders routinely collaborate and coordinate with the land management agencies to improve the water quality of the Clear Lake Watershed. Efforts include, but are not limited to, watershed coordination, water quality and sediment sampling, best management practice implementation, annual creek cleanup events, streambank restoration or stabilization projects, off-highway vehicle trail maintenance, public education and outreach, and collaborations to pursue plan or project funding.

Hereon, specific actions are listed in federal, state, and local order.

Federal Agencies and Actions

Sulphur Bank Mercury Mine

To date, USEPA has performed the following actions at the Sulphur Bank Superfund site:

- USEPA has performed three removal actions since September 2003, the Elem Pomo Tribe Mine Waste Removal Action, the Sulphur Bank Road Mine Waste Removal Action, and the Bureau of Indian Affairs (BIA) Road 120 Waste Removal Action.
- USEPA has two ongoing Feasibility Studies, Operable Unit 1 (The Mine Property), and Operable Unit 2 (Clear Lake Sediment and North Wetland).

During the Elem Pomo Tribe Mine Waste Removal Action in 2006-2007, USEPA performed a mine waste removal action at the Elem Pomo Tribe residential area. Mining waste had been used to maintain gravel roads

⁵ The Central Valley Water Board adopted Resolution No. R5-2006-0060, Amendment to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins for the Control of Nutrients in Clear Lake, on June 23, 2006. The Clear Lake Nutrient TMDL became effective in September 2007.

and construct the paved roadway system at the Elem Pomo Tribe, which was removed. Mining wastes were also removed from residential yards.

In 2008, USEPA removed mine wastes at a residential area located along the Sulphur Bank Mine Road. Recently, under the BIA Road 120 Waste Removal Action, USEPA has initiated a mine removal action to remediate mine waste used in the construction of the primary access road to the Elem Pomo Tribe.

For Operable Unit 2, USEPA has performed numerous studies in order to gather sufficient data to characterize and evaluate mercury contamination sources in the Clear Lake sediments and the North Wetland, in particular. Specifically, the USEPA performed several characterizations, including, but not limited to, those relating to mine waste, sediment and pore water, sentinel species baseline, Oak Arm current, suspended matter, and tributary storm water input.

Several technical reports detailing these actions have been developed and finalized.

- In 2008, USEPA developed a Final Community Involvement Plan, for the Sulphur Bank Mercury Mine Site, in an effort to describe USEPA's community involvement activities being conducted as part of the Superfund site cleanup at Operable Unit 1 (USEPA, 2008).
- USEPA has estimated the ongoing discharge of mercury from the Herman Impoundment to Clear Lake in numerous engineering studies for Operable Unit 1. The most recent estimate is published in the *2007-2008 Annual Groundwater Monitoring Report, Sulphur Bank Mercury Mine Superfund Site, Clearlake Oaks, California* (CH2M Hill, 2009).
- USEPA developed and evaluated several treated waste discharge alternatives for Operable Unit 1, including, (1) use of the Southeast Geysers Effluent Pipeline to convey treated waste to the Geysers for re-injection, (2) construction of a new treated water discharge pipeline to the Geysers for re-injection, (3) construction of an on-site geothermal injection well to dispose of the treated water, and (4) construction of an outfall for direct discharge of treated water to the lake.

In consideration of the impacts of each alternative for Operable Unit 1, USEPA has consulted with Lake County, Elem Pomo Tribe, DTSC and Central Valley Water Board staff. Meetings have focused on technical issues and compliance with applicable and appropriate federal, state, and local laws, regulations, ordinances and guidance.

USEPA expects that the alternatives being considered for the Record of Decision on Operable Unit 1 serves as compliance with (a) meeting the overall mercury load allocation of 5% of the 2002 loads and (b) the specific allocation of 0.5kg/year for mercury loads entering the lake through groundwater from the mine.

In order to comply with the requirements assigned to the Sulphur Bank in the Clear Lake Mercury TMDL, a reduction in mercury concentrations of lakebed surficial sediments is necessary. USEPA's remedial investigation to characterize the contaminated sediments in Clear Lake is ongoing.

- USEPA continues to develop the Sulphur Bank Remedial Investigation and Feasibility Studies for both Operable Units 1 and 2. Specifically, the USEPA has performed geochemical and hydrological modeling investigations for Operable Unit 1 to determine the discharge rates of contaminated water from the Herman Impoundment to Clear Lake. USEPA continues to perform stormwater and groundwater monitoring and conduct other engineering studies related to the Superfund site.
- USEPA has provided a revised timeline for when the Record of Decision(s) will be produced for the entire Superfund site. Currently, USEPA plans to sign a Record of Decision for Operable Unit 1 by July 31, 2011 and Operable Unit 2 by March 31, 2013. The issuance of a Record of Decision for Operable Unit 1 is dependent on the alternative's compliance with applicable and appropriate federal, state, and local laws, regulations, ordinances and standards.

United States Bureau of Land Management

The following actions have contributed to or will contribute to the reduction of sediment loading to Clear Lake:

- Earlier this year, USBLM, in coordination and collaboration with other Clear Lake Watershed stakeholders, applied for an USEPA 319(h) grant for the Eight Mile Valley Sediment Reduction and Habitat Enhancement project. One component of this project is monitoring sediment loads from this area, which are expected to be lessened considerably with project implementation. This project is recognized by Clear Lake Watershed stakeholders as central to controlling sediment entering the lake. Unfortunately, the project did not continue through the 2009 Clean Water Act 319h grant solicitation process.

However, USBLM, in coordination and collaboration with other Clear Lake Watershed stakeholders, is seeking other funding sources to complete the design phase of this project, including, but not limited to, submitting a

proposal for a Supplemental Environmental Project with the Central Valley Water Board.

USBLM is recognized for working to increase the public's awareness on this project and how it would improve the sediment loading into Clear Lake, as well as collaboratively pursuing funding with the West Lake Resource Conservation District.

- The USBLM has developed an *Off-Highway Vehicle (OHV) Wet Weather Closure Policy for the South Cow Mountain OHV Area*, a popular OHV recreational area in the state. The policy provides a temporary closure to all motorized vehicles during specific conditions.
- The USBLM conducts annual trail maintenance in the Cow Mountain Recreation Area, with a goal of minimizing soil loss, which ultimately reduces soil loss and sediment production.
- USBLM is initiating a soil monitoring program for the South Cow Mountain OHV Area, which will include a plan for revegetation.
- USBLM maintains a program or plan for fire suppression.
- USBLM does not authorize grazing allotments or grazing leases around Clear Lake.
- In 2006, USBLM issued the *Ukiah Resource Management Plan*, which presents the decisions and visions for management areas in the Ukiah Field Office, including Cow Mountain. For water resources, USBLM has listed several objectives, including "achieve and maintain the beneficial uses of water bodies as outlined by the Regional Water Quality Control Board Basin Plans." This document also notes mitigation measures for sediment erosion control under soil resources (USBLM, 2006).
- USBLM, in coordination with other state and federal agencies, is working on completing site characterizations, investigations and remediations of historical mercury mines which are contributing to discharges to the Cache Creek Watershed.

United States Forest Service

The following actions have contributed to or will contribute to the reduction of sediment loading to Clear Lake:

- As a result of a 1996 fire that burned approximately 30% of the Middle Creek subwatershed, the USFS has implemented fuel reduction projects

- to reduce the potential of a wildfire that could increase sediment inputs to the lake. Specifically, the USFS continues to implement fuel reduction projects within the watershed, which include prescribed fires, mastication of fuels, and fuel breaks in the Mendocino National Forest. These projects are designed to reduce the size and impact of future unintentional fires, which can lead to large areas susceptible to sediment production.
- The USFS continues to implement watershed improvement projects and to update their Watershed Improvement Needs Inventory. Projects include rerouting problem OHV trail segments and installing a sediment buffer strip along the Middle Creek open riding area. The USFS has inventoried unsurfaced roads in the Middle Creek Watershed, landslide mapping was completed and the agency is pursuing funding sources to implement road improvements to alleviate identified road based problems. USFS efforts implementing best management practices to control erosion in an effort to maintain roads and trails of the Mendocino National Forest lands is notable in the Clear Lake Watershed.
 - There are several active grazing allotments on USFS lands within the watershed. Livestock grazing is allowed to occur in the Mendocino National Forest under permit. Herds are small in size and the permittees are required to follow best management practices as a condition of their permit.
 - The USFS uses the GYR (green-yellow-red) trail monitoring protocol developed in conjunction with Roger Poff and the State OHV commission. The results of the monitoring are reported annually to the Off-Highway Motor Vehicle Recreation Commission, California Department of State Parks.
 - The USFS Pacific Southwest Region (Region 5), which includes the Mendocino National Forest, is party to the 1981 Management Agency Agreement with the State Water Resources Control Board (State Water Board) pertaining to water quality in the State. As part of this agreement, the USFS uses the *Best Management Practices Evaluation Program User's Guide, Investigating Water Quality in the Pacific Southwest Region*, June 2002 (USFS, 2002). This guide directs the evaluation of best management practices for all of the forests actions from fuel reduction projects, to foot trail, OHV trail and road maintenance. All of the monitoring performed to comply with the agreement is housed in a regional database.
 - In 2009, the USFS, Pacific Southwest Region (Region 5), published the *Water Quality Protection on National Forests in the Pacific Southwest Region: Best Management Practices Evaluation Program, 2003-2007* (USFS, 2009a). This document summarized the randomly selected onsite

evaluations of best management practice implementation and effectiveness over a five-year period. Results are region wide, and include those implemented in the Mendocino National Forest.

- The USFS annually developed a *Soil Conservation Plan* for the Mendocino National Forest OHV Motor Vehicle Recreation Program (USFS, 2009b). This plan outlines protocols for assessment, maintenance and monitoring of trails used for authorized OHV use, and implementation of best management practices. USFS OHV monitoring is reported annually to the OHV Commission as part of the Soil Conservation Strategy submitted each grant cycle.
- Pursuant to State Water Resources Control Board Resolution No. 2009-0064, *Directing Staff to Develop A Statewide Approach Addressing Forest Activities on National Forest System Lands, including Timber Harvesting, Grazing, Off-Road Vehicle Recreation and Fire Suppression*, the State Water Board, in collaboration with USFS Region 5, is developing a new Water Quality Management Plan (SWRCB, 2009a). This plan will address control of nonpoint source pollution generated by various activities on National Forest System lands in California including the Mendocino National Forest. More effective best management practices have been developed for several forest management activities, including roads, OHV trails, and range management. This new plan will replace the existing plan which was originally certified by the State Water Board in 1981 and is intended to be the basis for a State Water Board regulatory action. This process is underway and expected to be completed by February 2011 (SWRCB, 2010).
- Currently, the USFS, in coordination with other Clear Lake stakeholders, is pursuing funding to implement sediment erosion controls along roads of the Mendocino Forest that lie within the Clear Lake Watershed. One component of this project will be monitoring sediment loads, which are expected to be lessened considerably.

Tribes

Big Valley Rancheria Band of Pomo Indians

The Big Valley Rancheria Band of Pomo Indians implements projects that improve the Clear Lake shoreline, including storm water runoff control, pesticide and water quality monitoring, GIS mapping of invasive species control projects, shoreline revegetation and stabilization, and Clear Lake tule monitoring.

Elem Pomo Tribe

The Elem Pomo Tribe continues to work on SBMM remediation and water quality monitoring, and collaboration with partners, such as Lake County, Bureau of Indians Affairs, and USEPA.

Habematolel Pomo of Upper Lake

The Habematolel Pomo of Upper Lake Tribe implements water quality monitoring projects along county-wide tributaries, including stream and habitat restoration, stormwater runoff sampling, sediment sampling, and collaboration with partners, such as Lake County and other federal agencies.

Robinson Rancheria Band of Pomo Indians

The Robinson Rancheria Band of Pomo Indians Tribe has completed a Quality Assurance Project Plan for implementing water quality program and monitoring. The Tribe has also implemented other projects, including riparian restoration projects at Tribal ponds within Clear Lake watershed for sediment runoff control, the development of natural resource conservation codes for off-road vehicle restrictions, pesticide use on Tribal lands, solid waste disposal, and water pollution discharge, and works collaboratively on Caltran projects for erosion control and best management practices.

Scotts Valley Band of Pomo Indians

The Scotts Valley Band of Pomo Indians Tribe has developed a partnership in implementing the USBLM Eight Mile project stream and habitat enhancement project, and collaborates with Lake County Water Resources Department Works and West Lake and East Lake Resource Conservation Districts on watershed-related sediment erosion projects and support on Tribal water quality projects.

Collectively, the Tribes have been instrumental in conveying and collaborating on Lake County water quality projects. The Tribal Environmental Departments are actively participating on the following committees:

- California Environmental Protection Agency Tribal Advisory Board Member
- California Indian Environmental Alliance
- Chi Council
- Clarks Island Restoration Workgroup
- Clear Lake Advisory Committee
- Clear Lake Planning Taskforce
- Hinthil Environmental Resource Consortium (HERC)
- Integrated Regional Water Management Program
- Invasive Species Council
- Lake County Coordinating Resource Management Committee
- Lake County Coordinated Resource Management and Planning groups

- Nice Mutual Water Board Member
- Sacramento River Watershed Program Trustee
- State Water Board - Biological Objectives Stakeholders
- TMDL Stakeholder Committee
- Tribal Regulatory Environmental Taskforce
- USEPA Regional Tribal Operations Committee

Tribal outreach and education includes, but not limiting to the following events, workshops, and presentations and resource protection activities:

- Alternative Energy research and implementation outreach to Tribal communities
- Annual Tule Boat Festival held at Big Valley Rancheria
- Earth Day events
- Environmental Campouts
- Kids-In-The Creek Day held at Middle Creek and Field Days are held in Middletown
- Lake County Fair HERC booth
- Present current environmental trends and conditions at regional USEPA Tribal Conferences and meetings
- Supplemental environmental inserts into monthly Tribal newsletters
- Tribal watershed outreach presentation at public schools

State Agencies and Actions

California Department of Transportation

The following actions have contributed or will contribute to the reduction of sediment loading to Clear Lake:

- In September 2008, Central Valley Water Board staff approved an implementation plan to install four (4) monitoring stations at sites along the northern portion of Clear Lake where Caltrans facilities lie in close proximity to the lake (Caltrans, 2008). Flow weighted composite samples will be collected from these stations in order to estimate the concentration of total phosphorus in the runoff. Data will need to be collected for at least two years before current loads can be assessed. Once current loads have been established, a compliance plan will be developed that will include best management practices that are feasible and effective in controlling phosphorus loading.

Caltrans has made significant progress developing this plan and secured necessary funding for implementation. The monitoring stations are scheduled to be installed November 2010.

- Caltrans maintains a statewide Stormwater Program, which integrates appropriate stormwater control activities into ongoing projects, making control of stormwater pollution a part of Caltrans normal business practices (Caltrans, 2003). The Stormwater Program includes a *Stormwater Management Plan*, District workplans, monitoring and best management practice development, public education, and guidance for design, construction and maintenance activities (Caltrans, 2007). The *Stormwater Management Plan* identifies how Caltrans will comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) permit Order No. 99-06-DWQ, issued by the State Water Board on July 15, 1999 (SWRCB, 1999).

In 2010, in accordance with Caltrans' Stormwater Program, the *District 1 Workplan for the North Coast and Central Valley Regions for Fiscal Year 2010-2011* has been developed. This workplan outlines activities that will implement the program during the next fiscal year, including those activities located within the Clear Lake Watershed (Caltrans, 2010).

- Caltrans implements best management practices for both construction and maintenance activities as part of Caltrans normal business practices. In addition Caltrans installs and maintains post construction best management practices on new projects throughout Clear Lake Watershed.

Local Agencies and Actions

Lake County, City of Clearlake and City of Lakeport

Lake County, City of Clearlake and City of Lakeport are co-permittees in the Municipal Stormwater Program, thus this discussion integrates all three jurisdictions. The following actions have contributed to or will contribute to the reduction of sediment loading to Clear Lake:

- As co-permittees in the Municipal Stormwater Program, the County and Cities have collaborated and coordinated in the development of a Stormwater Management Plan (Lake County, *et al.*, 2003a). This plan describes the Lake County Clean Water Program's approach to reducing storm water pollution, while serving as the basis for the National Pollution Discharge Elimination System (NPDES) permit application to the Central Valley Water Board (Lake County, *et al.*, 2003b). This plan contains a component to review and evaluate impacts to storm water from existing road repair and maintenance activities, including the development of best management practices. The Lake County Clean Water Program was developed as requirement of the NPDES Phase II regulations and is compliance with the provisions described in NPDES General Permit No. CAS000004 (Lake County, *et al.*, 2003b; SWRCB, 2003).

The plan describes best management practices, and associated measurable goals, that include:

- Public participation and outreach on storm water impacts;
- Public involvement/participation;
- Illicit discharge detection and elimination;
- Construction site storm water runoff control;
- Post-construction storm water management in new development and redevelopment; and
- Pollution prevention/good housekeeping for municipal operations.

The County and Cities have made significant progress in starting to address these minimum control measures. The County and Cities participate in regular meetings of the Lake County Water Quality Council and produce an annual report on the planning and implementation efforts of the Lake County Clean Water Program (Lake County, *et al.*, 2009b). Most notably, the County and Cities have collaborated in an a public outreach and education campaign, providing pertinent storm water information on the Lake County and City of Lakeport's websites (Lake County, 2009c, 2010a). The County and Cities have also completed a project mapping inputs and outflows of storm water drains within their jurisdictions.

- In 2009, the final report for the 2003 Proposition 13 grant was submitted by Lake County and approved by Central Valley Water Board staff (Lake County, 2009a). The grant was awarded for \$147,182.000 and applied to both the Clear Lake Mercury and Nutrient TMDLs. Specific to the Clear Lake Mercury TMDL, project objectives included estimating mercury loads, determining mercury sources, and identification of mercury properties that had been mined around the lake. This project provided valuable water quality data for the Clear Lake Watershed.
 - Total and methyl mercury loadings were estimated for the watershed based on two years of sampling of three tributaries. Average annual watershed loadings were estimated at 11.8 to 16.4 kg/yr total mercury and 0.0386 to 0.0536 kg/yr methyl mercury.
 - Chloride and sulfate concentrations in the watershed did not indicate a significant hydrothermal water or acid mine drainage contribution to the Clear Lake inflow.
 - The Utopia Mine is located on Highway 20, adjacent to the northeastern portion of Clear Lake. The Utopia Mine is not a "mine", rather it is a categorized as a prospect, due to relatively low mercury production (USBM, 1965). Although relatively high readings for total mercury concentrations near the mine were found, it was determined that the mine was not contributing

significantly to elevated levels of mercury and methylmercury in Clear Lake (Lake County, 2009a).

- Stream sediment samples were collected throughout the Clear Lake watershed. The background mercury concentration in the Clear Lake watershed appears to be significantly less than that of the North Coast region. No hot spots were identified through the monitoring. Significant anthropogenic mercury sources were not identified in the watershed.
- In 2010, Lake County, in collaboration and coordination with Clear Lake stakeholders, finalized the *Clear Lake Integrated Watershed Management Plan* (Lake County and West Lake Resource Conservation District, 2010b). The plan described past and current conditions of the watershed and watershed management, with a goal to plan and work towards an environmentally and economically healthy watershed that benefits the community and is sustainable for future generations. This plan addresses both surface and groundwater quality concerns.

In addition to the *Clear Lake Integrated Water Management Plan*, the Kelsey Creek, Middle Creek and Scotts Creek Watershed Assessments were also finalized in 2010 in collaboration and coordination with Clear Lake stakeholders. The purpose of each assessment was to collect and integrate information on past and present watershed conditions and management in order to educate landowners on watershed conditions and management needs (Lake County and West Lake Resource Conservation District, 2010c, 2010d, 2010e).

These plans were completed under a DWR Proposition 50 CalFED Watershed grant for \$400,000 obtained by the West Lake Resource Conservation District. The West Lake Resource Conservation District was the grantee and lead agency in the production of each of these plans, and Lake County was a partner in this effort.

- Enforcement of active ordinances, including, but not limited to those listed in the *Lake County General Plan* or other local planning or guidance documents (Lake County, 2008b). Of particular interest is any County or City ordinance relating to development dedications, erosion, grading, sediment control, use of off-highway vehicles, Clear Lake (shoreline or near shoreline), rezoning, roads, geothermal, groundwater extraction, Sulphur Bank Mercury Mine, wetlands, and storm water.
- Lake County's Solid Waste Disposal Program and landfill has participated in separating hazardous waste from the landfill bound waste stream, including disposal of waste that contains mercury (Lake County, 2010f). In cooperation with Mendocino County, Lake County operates a

hazardous waste disposal program with scheduled free collection of hazardous waste with the “Hazmobile.”

- Lake County Fire Safe Council promotes fire safety education and encourages citizens to create and maintain defensible space, in order to protect life and property in the event of a wildfire.
- Lake County’s Environmental Health Department has posted a link to the Office of Human Health Assessment’s fish consumption advisory and continues to provide outreach and education to the community, emphasizing portions of the population that are at risk, such as pregnant women and children, as feasible (Lake County, 2010g).
- The County continues to collaborate and coordinate with Clear Lake stakeholders and researchers to improve the understanding of the lake limnological processes. Recently, the County has contracted with the Tahoe Environmental Research Center to update the analysis of water quality and other data collected by DWR. The final report is expected to be completed in June 2010. Further investigations by the County will depend on the findings of this report.

TMDL Implementation Efforts for Next Five Years (2010-2015)

Over the next five years, the following actions will continue implementing the objectives the Clear Lake Mercury TMDL. Actions are not listed in any particular priority.

- Continue building positive working relationships amongst all land management agencies, Tribes and other Clear Lake stakeholders, in order to support, collaborate and coordinate efforts to improve water quality across the entire Clear Lake Watershed. Efforts may include, but are not limited to, collaborative and integrated water quality monitoring, determining changes in existing loads, load allocation refinements, information exchange, project development and implementation, pursuing plan and project implementation funding, research, measuring progress toward meeting loads, and leveraging resources across the watershed.
- Coordination with the Native American Tribes in the Clear Lake Watershed on mercury reduction programs for the tributaries and surface water runoff. Central Valley Water Board staff will work to engage and integrate the Lower Lake Rancheria Koi Nation Tribe in Clear Lake Mercury TMDL implementation efforts.
- Provide guidance on and facilitate the collection of information on past and current fish consumption levels for Tribes and other stakeholders in the

Clear Lake watershed in order to perform a comprehensive review to determine the appropriateness of the current fish tissue objectives.

- Evaluate Clear Lake mercury level trends by Clear Lake Tribes. This will include the development of a GIS map of areas of low mercury contamination to educate on safe fish eating areas, as well as development of environmental justice initiatives, including a proposed pilot project to conduct baseline testing on Tribal subsistence foods.
- Attendance by all land management agencies to coordination meetings to discuss existing or planned TMDL implementation efforts.
- Compliance with all permits and programs related to improving the water quality of Clear Lake Watershed.
- Continue implementation of existing best management practices to control sediment erosion in the Clear Lake Watershed, including integrating these practices in the mitigation measures or environmental commitment discussions of those proposed projects or actions subject to CEQA or NEPA, as applicable and feasible.
- Evaluate pre- and post-construction and maintenance best management practices to ensure effectiveness in controlling sediment erosion and reducing the potential for methylmercury production in the Clear Lake Watershed.
- Implement effective best management practices to control sediment erosion in the Clear Lake Watershed.
- Implement maintenance and post-construction best management practices shall be implemented, as applicable to construction projects within the Clear Lake Watershed in accordance with State Water Resources Control Board's Construction General Order No. 2009-0009-DWQ, effective September 2011 (SWRCB, 2009b).
- Development and implementation of projects identified in any plan referenced in this document, as applicable and feasible, to improve the water quality of Clear Lake, and reduce mercury loading to the lake.
- Implement consistent and adequate water quality monitoring across the Clear Lake Watershed to better understand lake limnology and processes impacting the ecological health of the watershed.
- Identify locations of mercury prospects, claims and mines and associated workings or other commodities, and mining waste, known to be located in

the Clear Lake Watershed, in order to conduct focused hot spot monitoring. Geological studies should include the development of accurate geological maps of the area, in order to identify deposits rich in mercury, and should be correlated with stream data, geothermal springs, surface and groundwater information, among other considerations.

- Coordination between all land management agencies, Tribes and other Clear Lake stakeholders should be coordinating with the appropriate federal, state and local agencies in site characterizations, investigations, and remediation efforts for properties contaminated with mercury. This requires compliance with, and implementation of, all applicable and appropriate federal, state, and local laws, regulations, ordinances and standards.
- Coordination between USEPA and other local and state regulatory agencies to ensure compliance and implementation of all applicable and appropriate federal, state, and local laws, regulations, ordinances and standards, for remediation of SBMM.

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