

Placer County Water Agency
Middle Fork American River Project
(FERC No. 2079)

Invasive Mussel Protection Plan



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1.0 INTRODUCTION

This Invasive Mussel Protection Plan has been prepared by the Placer County Water Agency (PCWA) in compliance with California state law to prevent the inadvertent and unwanted introduction of invasive mussel species into:

- (1) PCWA-owned reservoirs associated with the Middle Fork American River Project (MFP or Project), a multi-purpose water supply and hydro-generation project operated under the jurisdiction of the Federal Energy Regulatory Commission (FERC) Project No. 2079; and
- (2) Water conveyance systems and small reservoirs and lakes associated with PCWA's delivery of consumptive water to retail customers in its service area.

This plan will be reviewed and modified annually in accordance with the findings of previous years and/or as the result of new information on the spread of zebra/quagga mussels elsewhere in California. Immediate emergency actions not specifically addressed in this plan may be undertaken by PCWA in consultation with the California Department of Fish and Game (CDFG) at any time to protect PCWA facilities and resources.

2.0 BACKGROUND

In September 2008, Governor Arnold Schwarzenegger signed into law Assembly Bill (AB) 2065. Introduced by California State Assembly member Loni Hancock, the bill was designed to stop the spread of non-native dreissenid mussels (zebra and quagga mussels) throughout California. AB 2065 was enacted as Fish and Game Code Section 2302 (FGC §2302) which requires, in pertinent part,

- (a) *Any person, or federal, state, or local agency, district, or authority that owns or manages a reservoir, as defined in Section 6004.5 of the Water Code, where recreational, boating, or fishing activities are permitted, except a privately owned reservoir that is not open to the public, shall do both of the following:*
 - (1) *Assess the vulnerability of the reservoir for the introduction of nonnative dreissenid mussel species.*
 - (2) *Develop and implement a program designed to prevent the introduction of nonnative dreissenid mussel species.*
- (b) *The program shall include, at a minimum, all of the following:*
 - (1) *Public education.*
 - (2) *Monitoring.*
 - (3) *Management of those recreational, boating, or fishing activities that are permitted*

Zebra (*Dreissena polymorpha*) and quagga (*Dreissena rostriformis bugensis*) mussels are small, freshwater bivalve mollusks. The zebra mussel gets its name from dark and

white striped markings on its shell. The closely-related quagga mussel is named for the quagga, an extinct subspecies of the African zebra. Natives of Ukraine, the mussels first appeared in 1988 in the Great Lakes region, presumably transported via ballast water from a transoceanic vessel. Over the past two decades, the mussels have spread throughout the Mississippi River drainage. In recent years, they have crossed the plains and intermountain states, likely transported on trailered boat hulls or in bilge water, and are in Lake Mead, Nevada. The mussels now reside in the lower Colorado River and many of Metropolitan Water District's water transport and storage facilities in southern California. At present, the spread of invasive mussels appears to be limited to southern California. As of May 2010, the CDFG has not reported the presence of invasive mussels in northern California waters except in San Justo Reservoir near Hollister (<http://www.dfg.ca.gov/invasives/quaggamussel/>).

Like many invasive species, zebra/quagga mussels have the potential to significantly alter aquatic ecosystems and foul water works. As filter feeding organisms, the mussels consume free-floating algae. The mussels can consume substantial amounts of phytoplankton, thereby disrupting the food web of aquatic ecosystems. The economic impact is generally associated with large colonies of mussels that can block or seriously compromise water intake and transport facilities in rivers and reservoirs. The cost to control zebra/quagga mussels populations by the power industry in the Great Lakes area was estimated at \$3.1 billion for the period 1993-1999.

3.0 PLAN IMPLEMENTATION

This plan was prepared in response to the requirements FGC §2302. It is intended to protect the unwanted invasion of invasive mussels into PCWA's reservoirs, water conveyance facilities (canals, penstocks), and water cooling systems. This plan is based on: (1) Invasive Mussel Protection Plan for Sacramento Municipal Utility District (SMUD) (SMUD 2010); (2) MFP recreation use surveys (PCWA 2010a); and (3) MFP water quality information (PCWA 2010b).

The areas of focus include PCWA-owned reservoirs associated with the MFP, water conveyance systems, and small reservoirs and lakes associated with PCWA's delivery of consumptive water to retail customers in its service area (see IMPP Map 1). This plan has been prepared for implementation in calendar year 2010, pending approval by CDFG.

This plan is considered active until notice of discontinuation is given by CDFG. This plan may be updated by PCWA in response to future regulatory actions, new scientific discoveries, or revised management techniques. Any revisions or modifications of this plan will be approved in writing by the CDFG before implementing the revised actions.

4.0 VULNERABILITY TO INVASIVE MUSSELS

4.1 MIDDLE FORK AMERICAN RIVER PROJECT

The reservoirs and water conveyance systems associated with the MFP have a low level of vulnerability to the introduction of invasive mussels. This assessment is based

on the MFP's geographical location, recreational uses, and water quality. The following describes details of the assessment.

4.1.1. Geographical Location

Project reservoirs are more than 400 road miles from the nearest location of known large mussel infestations. As of mid-2010, the verified locations of zebra/quagga mussels in California are centered largely in the southern counties of San Bernardino, Orange, and San Diego. In these counties, mussels have appeared throughout the waterways and reservoirs of the Metropolitan Water District. The source of introduction has been Lake Mead via the Colorado Aqueduct. Based on distance, Southern California waterbodies are not likely sources of introduction to MFP reservoirs. With recreational boating serving as the primary means of transporting mussels from one waterbody to another (California Resources Agency 2008), this distance reduces the vulnerability of introduction to a low level. Mussels have also been verified to reside in San Justo Reservoir, in San Benito County, near Hollister (in 2008). This reservoir is presently under quarantine, with the Department of Water Resources banning recreational boating at the reservoir. Lastly, the MFP reservoirs are not subject to potential mussel introduction from upstream sources because source water derives mainly from Desolation and Granite Chief Wilderness Areas and other remote areas of the Eldorado National Forest (ENF) and Tahoe National Forest (TNF).

4.1.2. Recreational Use

The MFP consists of two large reservoirs and one medium reservoir that have boat ramps that support recreational motorized boating (Hell Hole Reservoir, French Meadows Reservoir, and Ralston Afterbay, respectively). Four other Project waterbodies are very small and do not have boat ramps to facilitate recreational boating including Middle Fork Interbay (approximately 7 surface acres), Duncan Creek Diversion Pools (2 surface acres), North Fork Long Canyon Diversion Pool (less than 2 surface acres), and South Fork Long Canyon Diversion Pool (less than 2 surface acres) (IMPP Table 1). Two reservoirs (French Meadows and Hell Hole) support recreational boating with trailered boats (IMPP Table 2).

In 2008, PCWA conducted surveys of public boat ramp use at MFP reservoirs (PCWA 2010a). As part of the survey, each boater was asked for their county of origin. Based on 166 interviews, the majority of the boaters were from a limited geographic range (IMPP Table 3). About 80 percent of recreational boaters visiting MFP reservoirs originated either in Placer or a bordering county. Specifically, 33 percent of boaters were from Placer County, 29 percent from Sacramento County, and 16 percent from El Dorado County. A small percentage (4 percent) of boaters visiting MFP reservoirs resided in counties bordering San Benito County (Santa Cruz, Fresno, and Santa Clara) and one survey participant resided in San Diego County. These data suggest a low probability that invasive mussels from known infested waterbodies are likely to be introduced into MFP reservoirs.

4.1.3. Water Quality

Low calcium concentrations in MFP reservoirs (PCWA 2010b) are not conducive to rapid growth of mussel populations. Based on laboratory and field studies, calcium concentrations less than 15 mg/L are associated with decreased zebra/quagga mussel health and low population growth, including low growth rates, loss of shell material, and poor larval production (California Resources Agency 2008). Water quality studies performed in spring and fall 2007 at MFP reservoirs indicate that calcium concentrations range from 2.1 to 6.8 mg/L, with an average of 3.1 mg/L (n=30) (IMPP Table 4) (PCWA 2010b). These data suggest that even if mussels were introduced to MFP reservoirs, there is a low probability that they would reach population levels that could cause adverse ecological or operational impacts, as is common in high calcium waters.

4.2. PCWA'S WATER CONVEYANCE SYSTEM AND RELATED FACILITIES

PCWA-owned water conveyance system and related facilities (including several small reservoirs and lakes) have a low level of vulnerability to the introduction of invasive mussels. This assessment is based on these facilities' geographical location, recreational use, and water quality. Details of the assessment are described below.

PCWA's water conveyance system is comprised of an extensive canal network operated in coordination with Pacific Gas and Electric (PG&E) and Nevada Irrigation District (NID) throughout Placer County (IMPP Map 1). This network begins below Alta Powerhouse (with a delivery from PG&E to PCWA via the Boardman Canal). Lower in this system, PCWA receives water above, between, and below PG&E's Halsey and Wise powerhouses. At the lowest elevations, the canal system branches out to serve residential, industrial, and agricultural customers. The system contains numerous delivery points owned by PG&E. In addition, PCWA operates eight water treatment plants along the canal system for water deliveries to Placer County residents. The water conveyance system also incorporates seven PCWA-owned small reservoirs (McCrary, Mammoth, Caperton, Clover Valley, and Whitney) and lakes (Lake Arthur and Lake Theodore).

4.2.1. Geographical Location

Similar to the MFP reservoirs, PCWA's water conveyance system (including its source water and PCWA-owned reservoirs and lakes) is located approximately 400 miles from the nearest locations of known mussel infestations (see Section 4.1.1). This results in a low level of vulnerability to the introduction of invasive mussels.

4.2.2. Recreational Use

PCWA's water conveyance system includes small open canals that are not regularly accessed by the public, and boating is prohibited in these canals. Recreation use on the PCWA-owned small reservoirs and lakes consists predominantly of shore-based fishing with a small amount of water-based recreation using hand-launched boats (kayaks, canoes, etc.). These types of recreation result in a low level of vulnerability to the introduction of invasive mussels.

4.2.3. Water Quality

Recent calcium sampling has occurred in PCWA's water conveyance (Summer 2010) and in the streams and reservoirs that serve as the source water (Spring/Summer/Fall 2008) (NID and PG&E 2010) (IMPP Tables 5 and 6, respectively). Calcium concentrations in the PCWA-owned small reservoirs and lakes were less than the 15 mg/L threshold for mussel tolerance (IMPP Table 5). In the source waters, average calcium concentrations for each sampling location during each sampling period were also below 15 mg/L, except for one location during Fall 2008 (Wise Powerhouse Overflow Reach [16.2 mg/L]). Average calcium concentrations in the reservoirs were below 5 mg/L during all sampling periods (IMPP Table 6).

5.0 PROGRAM MEASURES

The following describes measures that will be implemented by PCWA in compliance with California state law to prevent the inadvertent and unwanted introduction of invasive mussel species.

5.1. PUBLIC EDUCATION

Within 90 days after approval of this plan by CDFG, PCWA will implement an educational program at PCWA-owned reservoirs and lakes associated with the MFP and water conveyance system. PCWA will post large notices approved by CDFG at boat ramps associated with the MFP, the Indian Bar Rafter Access below Ralston Afterbay, and the seven small reservoirs and lakes owned by PCWA. These locations are shown in IMPP Map 2. The notices will contain message elements centered on the "Don't Move a Mussel" theme (PSMFC 2008) (IMPP Appendix A), with instructions on how to clean and dry boats between launchings. Placement and content of the signs on Forest Service lands will be coordinated with the TNF or ENF, as appropriate.

The educational program will also include distribution of small information cards with similar information (IMPP Appendix A). The cards will only be handed to boat owners who have questions about, or want more information on zebra/quagga mussels. The cards will be available at PCWA's Auburn and Foresthill Offices and the ENF and TNF Ranger stations in Foresthill and Georgetown to inform interested parties (IMPP Appendix A, Table A-1). In addition, printed cards will be provided at Project reservoirs to concessionaires, campground hosts, and USDA-FS personnel.

5.2. MONITORING

PCWA will monitor for the presence of zebra/quagga mussels at PCWA-owned facilities as a regular part of operation and maintenance activities. PCWA staff will be trained in the identification of zebra/quagga mussels and any discovery will be immediately reported to the CDFG. Further, targeted monitoring may be initiated in the future, based on consultation with the CDFG, if the risk of infestation increases (e.g., expansion towards the MFP of the current distribution of invasive mussels in California).

Monitoring in the MFP will consist of annual visual inspections for attached mussels at: (1) the French Meadows Boat Ramp; (2) the Hell Hole Boat Ramp; (3) the French Meadows Powerhouse Tailrace at Hell Hole Reservoir; (4) the Ralston Powerhouse

Tailrace at Ralston Afterbay; and (5) the Oxbow Powerhouse Intake at Ralston Afterbay.

Monitoring in the water conveyance system will consist of visual inspections for attached mussels during annual maintenance throughout the water treatment and distributions system, including raw water canals, water treatment intakes, and reservoir outlet intakes.

5.3. MANAGEMENT OF RECREATION

At present, PCWA does not manage recreation at any publically-accessible facilities. PCWA is not proposing recreation control as a component of this Invasive Mussel Protection Plan because of the current low vulnerability of introduction of invasive mussels into PCWA waterbodies. If the vulnerability of introduction of invasive mussels increases in the future, then PCWA will consult with CDFG to identify appropriate measures to manage recreation use at PCWA-owned reservoirs and lakes.

5.4. COORDINATION WITH OTHER ENTITIES

The implementation of PCWA's Invasive Mussel Prevention Plan will be coordinated with other entities with similar interests in close proximity to PCWA's facilities. With respect to the management of the canals, water treatment plants and small lakes and reservoirs in PCWA's water conveyance system, PCWA will work with representatives from NID and PG&E. At MFP reservoirs, PCWA will coordinate activities with ENF and TNF, and SMUD, which owns facilities upstream of Hell Hole Reservoir on the Rubicon Reservoir.

6.0 RAPID RESPONSE PLAN

The need to develop a rapid response plan is not necessary as invasive mussels are not found in the PCWA waterbodies and vulnerability of introduction in the future is low. If the vulnerability level increases in future years, then a rapid response plan will be developed in consultation with the CDFG.

7.0 LITERATURE CITED

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TABLES

MAPS