Clear Lake Integrated Preparedness and Resilience Plan for Dreissenid Mussel Management

A Rapid Response and Transition to Containment Plan

Our goal is to improve the current aquatic invasive species prevention program while preparing for an invasive quagga or zebra mussel introduction into Clear Lake.

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- Angela DePalma-Dow, County of Lake Water Resources Department
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- Ben Ewing, California Department of Fish and Wildlife

This document was prepared for Lake County Water Resources Department by Lisa DeBruyckere of Creative Resource Strategies, LLC and Leah Elwell of Conservation Collaborations, LLC.

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EXECUTIVE SUMMARY

The County of Lake Watershed Protection District (the "District") initiated the development of this *Clear Lake Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management: A Rapid Response and Transition to Containment Plan* to improve the preparedness capabilities of Clear Lake water managers to protect Clear Lake water resources in the event of an invasive dreissenid mussel introduction and/or establishment. The plan provides guidance to prepare partners to efficiently and effectively respond to a dreissenid mussel detection to minimize spread within and beyond Clear Lake, and protect natural, recreational, cultural, economic, and other resources.

Clear Lake is at high risk for introduction of dreissenids because of the volume of out-of-county boaters that use the water body, its reputation nationally as a blue-ribbon warm water fishery, numerous and free access points for visiting boaters, and water chemistry conducive to invasive mussel establishment. The District administers the quagga and zebra (QZ) mussel prevention program and monitors for QZ in Blue Lakes, Clear Lake, Hidden Valley Lake, Highland Springs, Indian Valley Reservoir, and Lake Pillsbury per California Department of Fish and Wildlife (CDFW) monitoring protocols. The District monitors for QZ mussels using artificial substrates, infrastructure/surface structure observations, and veliger tows. District water purveyors (Appendix A) monitor for mussel presence during maintenance of facilities.

Potential effects of invasive mussels are numerous, and include, but are not limited to, ecological disruption, reduction in property values, increased maintenance costs, beaches and shorelines with sharp shells, loss of revenue to Lake County communities, restrictions on boating and fishing tournaments, and increases in costs to maintain boats and water infrastructure delivery systems.

The District is the primary agency responsible for managing the dreissenid mussel prevention program in Lake County and plans, manages, maintains, imple-

ments, and evaluates all Lake County aquatic invasive species programs. The CDFW, California State Parks Division of Boating and Waterways, water supply system operators, citizen scientists, and Pacific Gas and Electric also have roles and responsibilities relative to dreissenid prevention and management in the county. Numerous state statutes and county ordinances govern the implementation of these programs. Numerous recommendations were made to strengthen county ordinances to improve the ability and effectiveness of the District to prevent and ultimately contain dreissenids.

There are specific steps that can be taken during a dreissenid response, including confirmation of detection, declaration of emergency, notification communication, activation of the Incident Command System, communication and outreach, response actions, containment, monitoring, and termination of the Incident Command System.

Containment of dreissenids is costly. An analysis of estimated costs were done for various reservoirs in Wyoming and suggest the cost to contain mussels could be between $.75-$1M annually. Sources of funding available for containment include federal grant funding, state and regional funding, and fee-based user funding, e.g., funding from the sale of resident and visitor mussel stickers.

The District should consider making significant infrastructure investments around the perimeter of Clear Lake to prevent an introduction of dreissenids, and, in the case of an eventual introduction, have the capacity to decontaminate all watercraft exiting the lake to ensure minimal disruption to revenue-generating recreational activities. A permanent watercraft decontamination station feasibility analysis has identified the cost and criteria that should be considered to site stations.

Numerous long-term management recommendations will improve the ability of the District to prevent and ultimately contain dreissenids. Recommendations in funding, reporting, capital expenditures, containment and control, collaboration, and fishing regulations will enhance the readiness of the District.

CHAPTER ONE 1

Purpose of the Plan

The purpose of this *Clear Lake Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management: A Rapid Response and Transition to Containment Plan* is to improve the preparedness capabilities of Clear Lake water managers to protect Clear Lake water resources in the event of an invasive dreissenid mussel introduction and/or establishment. The plan provides guidance to prepare partners and other entities to efficiently and effectively respond to a dreissenid mussel detection to minimize spread within and beyond Clear Lake, and protect natural, recreational, cultural, economic, and other resources. This plan is intended to build upon the *Lake County Quagga and Zebra Mussel Prevention Plan* (2019), which guides prevention efforts associated with an introduction and establishment of dreissenids in Lake County water bodies. The contents of this plan are limited to containment via overland transport (i.e., watercraft), which is within the jurisdiction of County of Lake Water Resources Department (LCWRD). This plan highlights the critical role LCWRD plays in preventing the spread of dreissenids through containment and potential control efforts.

Objectives and Capability Targets

The plan will be used to routinely test core capabilities associated with prevention and response:

- **Planning** – Identify critical objectives, describe the sequence and scope of tasks to achieve objectives, ensure objectives can be implemented, and develop and execute actions in coordination with regional jurisdictions.
    - **Capability Target** – Within one week of a dreissenid confirmation, describe the roles and responsibilities of partner organizations involved in incident management response across all jurisdictions, and sequence the scope of tasks needed to prevent, protect, mitigate, and respond to the introduction.
    - **Capability Target** – Maintain, on a regular basis (i.e., quick annual review and thorough 5-year review), this *Clear Lake Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management: A Rapid Response and Transition to Containment Plan*, to ensure roles and responsibilities across jurisdictions as well as sequence and actions needed to prevent an introduction and/or establishment of dreissenids is understood by all jurisdictions.
- **Public Information** – Deliver coordinated, prompt, reliable, and actionable information to the entire community through clear, consistent, accessible, culturally competent and appropriate methods (based on best available science/laboratory methods and standardized field methodologies) to relay information regarding dreissenid detection as subsequent actions.
    - **Capability Target** – Within 24 hours of a dreissenid detection, notify California Department of Fish and Wildlife QZM-AIS Regional Coordinator (Environmental Scientist) and invasive species hotline @ invasives@wildlife.ca.gov and/or Invasive Species Program @ 866-440-9530.
    - **Capability Target** – Within one week of a dreissenid detection, and within three

days of a dreissenid confirmation, deliver reliable and actionable messages to the public and collaborators that define the threat, describe actions being taken, and include required actions by the public and collaborators.

- **Capability Target** – One month prior to taking action to attempt to eradicate, or limit the spread of dreissenids, deliver reliable messages to the public and collaborators about potential control actions and any necessary temporary closures, or shutdowns (e.g., municipal water suppliers, self-supplied water users).

- **Operational Coordination** – Establish and maintain a unified and coordinated operational structure and process that appropriately integrates all critical collaborators.
  - **Capability Target** – Within one week of a dreissenid detection, establish and maintain an Incident Command Structure (ICS) and process with partner organizations.
  - **Capability Target** – Annually test and update the *Clear Lake Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management: A Rapid Response and Transition to Containment Plan*, validating roles and responsibilities and other core plan elements.
  - **Capability Target** – Ensure adequate resources exist to respond to an introduction of dreissenids in Clear Lake and neighboring regional water bodies by coordinating and positioning equipment (e.g., booms) in an easily accessible location, establishing protocols and procedures for accessing and replacing that equipment.
  - **Capability Target** – Share information about water body surveillance results across regional water body jurisdictions. Within one week of a dreissenid detection, provide notification to decision makers and partners involved in incident management of the current and projected situation.
- **Screening, Search, and Detection** – Identify, discover, or locate dreissenids through active and passive surveillance and search procedures, including assessments, surveillance methods, or physical investigation.
  - **Capability Target** – Monitor Clear Lake and other county water bodies on a regular basis using plankton tows, settling plates, and physical observations to detect an introduction of dreissenids.
  - **Capability Target** – Per Lake County Code Chapter 15, Article IX (https://library.municode.com/ca/lake_county/codes/code_of_ordinances?nodeId=COOR_CH15RE_ARTIXWAVEINPR), ensure all watercraft launched in Clear Lake have both local inspection stickers and state mussel fee stickers, and are clean, drained, and dry prior to launch.
  - **Capability Target** – Ensure all high-risk watercraft launched in Clear Lake are inspected prior to launch.
- **Risk Management for Protection Programs and Activities** – Identify, assess, and prioritize risks to inform activities, countermeasures, and investments.
  - **Capability Target** – Annually conduct a review of relevant threats and hazards, vulnerabilities, and strategies for risk management covering publicly managed and/or regulated critical infrastructure (e.g., water delivery).
- **Response** – Implement appropriate actions to eradicate an introduction of, or limit the spread of, dreissenids within Clear Lake and other regional water bodies.
  - **Capability Target** – Per California Code of Regulations Title 14, Section 672.1(a)(1), within 60 days of a dreissenid detection, describe the suite of options available to eradicate, or limit the spread of, the dreissenid population, and obtain the necessary permits and marshal the necessary resources to effect action.

CHAPTER TWO 2

Preparing for an Introduction of Dreissenids in Lake County

In December of 2022, the County of Lake Water Resources Department launched this project to develop an *IClear Lake Integrated Preparedness Plan/Resilience Plan for Dreissenid Mussel Management: A Rapid Response and Transition to Containment Plan*. The overall goal for the project is to improve the current aquatic invasive species prevention program while preparing for an invasive quagga or zebra mussel (QZ) introduction into Clear Lake, or neighboring Lake County water bodies (Clear Lake, Indian Valley Reservoir, Lake Pillsbury, Blue Lakes, Hidden Valley Lake, and Highland Springs Reservoir). Preparing for an introduction is a process to understand and determine potential response options and develop a containment strategy that can be implemented quickly and efficiently to reduce local economic, environmental, cultural, and social impacts as well as prevent the spread of invasive mussels in northern California and other uninfested western waters. Any potential response to an introduction of dreissenids to Clear Lake will vary based on a variety of factors, including dreissenid life stage detected, and the scope of an infestation upon discovery. The materials and information provided in this document are guidelines for consideration of the actions that may be taken.

Clear Lake Water Management and History

Clear Lake and its associated 520 square mile watershed are a complex ecosystem consisting of a large, shallow, eutrophic lake that is used for recreation, tourism, and municipal, domestic, and agricultural water supply and provides important habitat for fish and wildlife. The lake is California's largest, natural freshwater lake located entirely within the state, has 68 miles of surface area, and an average depth of 26 feet.

The lake drains into the Sacramento River via Cache Creek (Lake County 2010). The major tributaries to Clear Lake, which flow primarily during the winter months and contribute 73 percent of the total stream flow into Clear Lake, include Scotts and Middle creeks (northwest) and Kelsey Creek in Big Valley (south) (Lake County 2010).

Extensive modifications of the lake, shoreline, and watershed since the mid-1800s have resulted in an 85 percent loss of natural wetlands as well as nitrogen and phosphorus cycling imbalance contributing to frequent cyanobacteria algal blooms (Giusti 2009). These algal blooms are predicted to worsen with climate change stressors (Kennard 2021). Several Clear Lake water purveyors have developed cyanotoxin management plans (Highlands Mutual Water Company 2016) to prepare for and mitigate risks from harmful algal blooms and cyanotoxins to protect public drinking water. Clear Lake was added to the federal Clean Water Act Section 303(d) list of impaired water bodies for nutrients in 1986 (Lake County 2010). The Lake County Clean Water Program (LCCWP) established a *Program Effectiveness and Improvement Plan* in 2021 to mitigate polluted stormwater runoff, and in particular, high priority pollutants of concern (phosphorus associated with sediment and nutrients) and increases in peak flows caused by development (EOA 2021). Drought, mining, chemicals, and invasive species have contributed to water and natural resource impairments:

- Extended periods of drought correlate with increases in phosphorus in all three arms of the lake (Suchanek et al. 2002; DePalma-Dow et al. 2022). A major factor in the stimulation

and persistence of cyanobacteria blooms in Clear Lake relates to periods of anoxia (during periods of calm) that reduce dissolved oxygen and may act to release phosphorus from the sediments. This is followed by periods of active water column mixing (windy periods), which distribute those nutrients throughout the water column (Florea et al. 2022).

- Clear Lake contains elevated levels of mercury caused by the Sulphur Bank Mercury Mine, an open pit mercury mine on the Oaks Arm of Clear Lake. The mine opened in 1865, became an open pit mine in 1927, ceased operations in 1957, and is now a Superfund site (Lake County 2010).
- Dichlorodiphenyldichloroethane (DDD) was applied to Clear Lake in the 1940s and 1950s to control the Clear Lake gnat (*Chaoborus astictopus*), a nuisance to residents and recreationists (Giusti 2009). Contamination of the ecosystem and collapse of Western Grebe (*Aechmophorus occidentalis*) populations occurred.
- Introduction and establishment of nonnative fishes and invasive plants, such as Hydrilla (*Hydrilla verticillata*), have displaced native fish species (Guisti 2009; Feyrer 2019).

Drinking Water Systems that Draw Water from the Clear Lake Watershed

Clear Lake provides drinking water to 60 percent (serving ~40,000 people) of the population of Lake County and provides a reliable water source for nearby agriculture production within the basin and downstream through Yolo County and to the California Central Valley. Clear Lake has been described as the county's most valuable asset, providing economic and ecological stability to the entire region. The popularity and accessibility of Clear Lake combined with water quality conditions suitable for dreissenid mussel establishment, make the risk of an invasive mussel invasion extremely high (County of Lake Watershed Protection District 2019).

About 1.5 miles from Clear Lake, a rock ledge called the Grigsby Riffle crosses Cache Creek. The riffle controls outflow from Clear Lake because it is at a narrow point in the creek that limits the amount of water that can pass. The riffle maintained lake levels before the construction of the Cache Creek Dam in 1914. There were no dams controlling the outflow of Clear Lake between 1868 and 1914.

According to the California Rural Water Association (CRWA), there are a total of 17 utility surface water systems with a total of at least 17,545 service connections that draw water from the lake (Appendix A) (https://gispublic.waterboards.ca.gov/portal/apps/webappviewer/index.html?id=272351aa7db14435989647a86e6d3ad8). Service area boundaries of Clear Lake drinking water have been verified by the Division of Drinking Water of the California Water Resources Control Board (Figure 1). Stored water is managed by Yolo County Flood Control and Water Conservation District.

Yolo County Flood Control and Water Conservation District owns the rights to use the water in the lake (Suchanek et al. 2002) and regulates the depth of the lake (determined by the Rumsey gauge) between 0–7.56 feet, under non-flood conditions and 0–9.00 feet under flood conditions (Lake County 2010). Clear Lake can drop between 3–6.5 feet in any given summer and fluctuates 5.5 feet each year on average (Lake County 2010). If the lake falls below 3.22 Rumsey on May 1, Yolo County receives no water. However, when the lake is full, the county receives increasing amounts of water up to 150,000 acre-feet (Lake County 2010).

There are numerous private self-supplied water users that remove water from Clear Lake. These entities are not required to report their water use. No estimates exist for the number of users, nor the amount of water they remove from Clear Lake.

The drinking water treatment rates in Clear Lake are among the highest in the state of California because of Clear Lake water quality issues and conditions, including harmful algal blooms. Although Lake County surface water systems adequately remove microcystins from finished drinking water, the cost to treat the water is proportional to the presence of harmful algal blooms. Funding has not been identified to adequately address predicted water treatment costs (Kennard 2021).

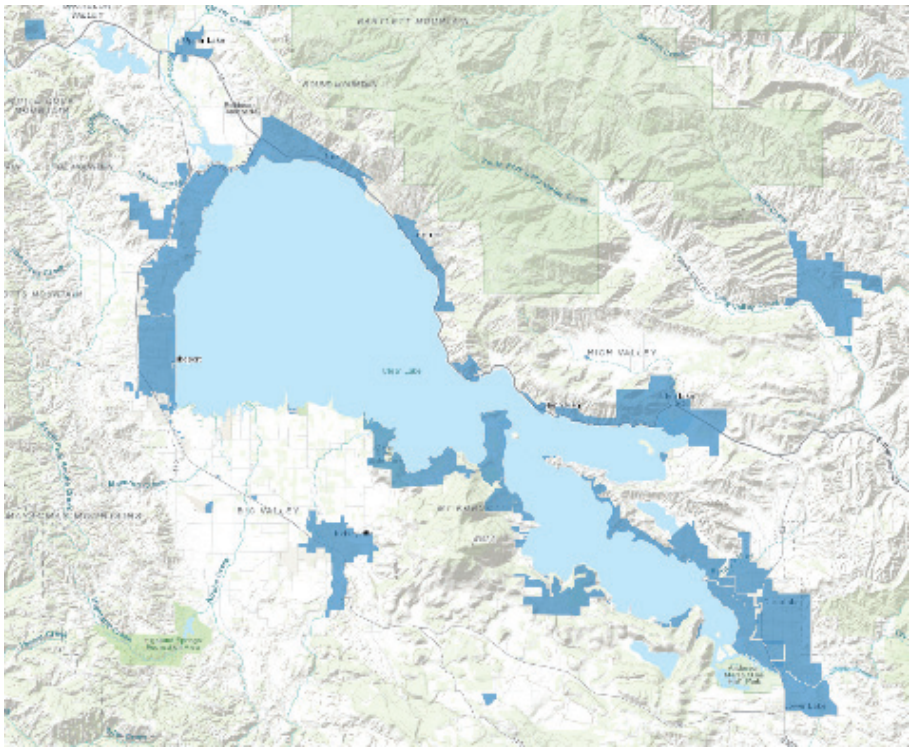

Figure 1. Clear Lake Water System Area Boundaries for Drinking Water. Dark blue areas represent verified service area boundaries. Source: California Water Boards Water System Area Boundaries map (September 2023).

Clear Lake Recreation, Tourism, and Access

Lake County's economy is based largely on tourism and recreation. In 2021, travel-related spending totaled $175.7 million, and state and local tax revenue totaled $13.6 million (Dean Runyon Associates 2022). Travel-related industry employment in the county was the highest on record in 2021 and contributed to 1,820 jobs (Dean Runyon Associates 2022).

Clear Lake has about 100 miles of shoreline and nearly 10 miles of public access, including public parks, open space, Caltrans right-of-way, road ends, islands, and county-owned property (Konocti Regional Trails). An online map provides access points with and without amenities. Appendix B lists the Clear Lake marinas, boat rental facilities, public boat launches, marine services, and sailing facilities on Clear Lake. There are currently 11 free public boat launches, and five marinas and harbors that are open year-round to trailered vessels. Lake County Public Services Department maintains 13 free public swim beaches on Clear Lake. California State Parks owns and operates Clear Lake State Park, which has both beach access, docks, and boat launch facilities, and Anderson Marsh State Historic Park, which boasts non-motorized water trails. Both parks are significant attractions for lake visitors. Clear Lake has at least 20 private resorts with launch ramps, and numerous private access points. There are at least 749 private or public access points on the lake; about 450 access points are accessible by motorized vessels.

Clear Lake hosts thousands of visitors, and their watercraft, each year. The pre-pandemic 2017 Lake County QZ mussel mandatory boater sticker program documented the sale of more than 6,000 resident vessel stickers and more than 9,000 non-resident vessel stickers. Although global pandemic and drought conditions reduced travel and access to Clear Lake, about 15,000 stickers were sold annually from 2020–2022. There are multiple Mussel Screening Locations staffed by Lake County boat ramp monitors that are available for

recreationists to access prior to launch on Clear Lake (Appendix C).

Bass Master Magazine has ranked Clear Lake as one of the top six bass fishing lakes in the United States since 2013. In 2023, the California Department of Fish and Wildlife (CDFW) approved a total of 120 sport fishing tournaments on Clear Lake (the number of tournaments listed is as of 14 August 2023), including tournaments for crappie/sunfish, catfish, black bass, and carp. Tournaments range from one to three days in length. Each Clear Lake angler spends an average of about $58 per day (U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau 2011). Fishing on Clear Lake is at least a million-dollar-a-year activity (Giusti 2016).

Climate Change Stressors: Lake County Water Bodies

Climate change adaptation is the adjustment of natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2022). The goal of climate change adaptation is to reduce risk from climate-related hazards while seeking opportunities for other benefits and reducing vulnerabilities across community systems.

Physical changes drive response in individual species, communities, and whole lake ecosystems (Parmesan et al. 2022). Yet there remains high confidence that protection and restoration of natural and semi-natural ecosystems are key adaptation measures that can lessen the impacts of climate change on biodiversity and people (Parmesan et al. 2022).

Climate change is predicted to increase the frequency of 100-year storm events, which is projected to increase risk from natural flooding to lakeside real estate and public utilities as well as additional risk of increased sedimentation, nutrient inputs, and acid mine drainage from the Sulphur Bank Mercury Mine (Suchanek et al. 2002). Conversely, climate change is forecasted to extend drought conditions (Gamelin et al. 2022). During the historic dry season, drought may cause lower lake levels that could condense and concentrate populations of dreissenids into smaller areas as shorelines become dry and exposed.

As diurnal temperatures (daytime highs/overnight lows) increase due to changing climate, water temperatures also will increase, keeping waters warmer and more hospitable to dreissenids. Although dreissenids prefer temperatures of 68–77 degrees F, which is a typical temperature range during the summer, dreissenids can persist in water temperatures up to 86 degrees F (Karateyev et al. 1998).

Climate change impacts could influence dreissenid prevention or containment management operations. Lake County would benefit from a comprehensive exploration of mitigating climate impacts and concurrent dreissenid management. Some factors that should be considered include:

- Watercraft decontamination stations that minimize the use of water, or use waterless cleaning systems, which would be especially important during times of drought.
- Watercraft decontamination stations that are energy contained units (e.g., solar powered), which may be important during times of widespread power outages.
- Modification of monitoring techniques to ensure lake locations with high risk of dreissenid introduction are regularly sampled, including during periods of drought. Moderate and high risk waters should be monitored monthly for dreissenids.
- Use of emerging technologies (e.g., eDNA and newly developed assays (Marshall et al. 2022)) to complement standardized prevention monitoring methods (e.g., veliger tows, visual surface surveys, reading artificial substrates) to efficiently and effectively detect dreissenids. Moderate and high calcium/risk waters would be sampled using the primary methods and supplemented using eDNA sampling.
- Human use patterns (e.g., boat ramp use, or concentrated use at specific boat ramps) that change because of severe climatic events and ramp closures caused by low lake water levels.

Vulnerability of Clear Lake and Regional Water Bodies to Dreissenids

Clear Lake is at high risk for introduction of dreissenids because of the volume of out-of-county boaters that use the water body, its reputation nationally as a blue-ribbon warm water fishery, numerous and free access points for visiting boaters, and water chemistry conducive to invasive mussel establishment (County of Lake Watershed Protection District 2019).

The lake is open year-round and provides access for trailered vessels, except during periods of extreme drought when low water levels prevent access to boaters. Clear Lake is a national fishing destination, hosting more than 100 sport fishing tournaments annually, from local club contests to large-scale commercial events that can each have more than 1,000 entries. A total of 1,094 approved fishing tournaments occurred between 1/1/2015 and 12/31/2022. The lake is also an attraction for water recreationist activities, including tubing, swimming, sailing, kayaking, paddle boarding, water skiing, jet skiing, and leisure boating. Because invasive mussels are primarily spread by adult mussels attached to boats or microscopic veligers in water within boat compartments (e.g., bilge, motor), there is a high probability of an invasive mussel introduction via one of at least 500 public or private boat ramps from a visiting vessel.

Environmental conditions (water temperature, calcium, pH, dissolved oxygen, turbidity, conductivity, and salinity) in Clear Lake and other water bodies located within Lake County, are well within the ranges preferred by dreissenids (Cohen 2005; Whittier et al. 2008; Pucherelli et al. 2016). The most important water characteristic that indicates a high risk of dreissenid colonization is a calcium level of 15 mg/L or greater. Clear Lake has an average 25 mg/L calcium level (Department of Water Resources) (https://wdl.water.ca.gov/waterdatalibrary/Map.aspx).

Extended drought periods expose more shoreline making motorized access to designated Clear Lake launch locations more difficult. This results in more boats being hand launched or launched in illegal launching locations. Hand launched watercraft are not required to participate in the mussel fee sticker program. In addition, ramp monitors are not located at every potential launch location along the lake shoreline. These factors make Clear Lake vulnerable to potential invasive mussel introductions.

Water Body Monitoring in Clear Lake and Other County Lakes

California Code of Regulations Title 14, Section 672.1 requires that any agency with a dreissenid prevention program submit an annual report by March 31 for the previous calendar year that summarizes any changes in the reservoir's vulnerability, monitoring results, and management activities to the Regional CDFW Environmental Scientist. The information included herein was extracted from 2018–2021 reports from Lake County to CDFW.

The County of Lake Watershed Protection District (LCWPD) ("District") and CDFW monitor Blue Lakes, Clear Lake, Indian Valley Reservoir, and Highland Springs Reservoir. The District, Pacific Gas & Electric, and CDFW monitor Lake Pillsbury. Hidden Valley Lake is monitored by resident citizen scientists.

The District monitors for Q/Z mussels as follows:

- Artificial substrates are monitored monthly per CDFW procedures, primarily near public boat ramps and access points.
- Infrastructure/surface structure (e.g., docks, buoys) are monitored by the district and citizens monthly. During years of low water levels, shoreline surveys are conducted.
- Veliger tows using plankton nets are conducted per CDFW mussel tow protocols. These water samples, and others (e.g., Lake Pillsbury - Pacific Gas & Electric administers and Blues Lakes, Clear Lake, and Indian Valley Reservoir – CDFW- North Central Regional (NCR) environmental Scientist) are sent to CDFW's Shellfish Health Lab in Bodega Bay for analysis using cross-polarized light microscopy.
- District water purveyors (Appendix A) monitor for mussel presence when maintenance is performed on inlet pipes, screens, and filters.

The specific details of each of these methods, the locations of surveys, and the results are documented in reports the district completes and sends to CDFW annually (https://www.lakecountyca.gov/Archive.aspx?AMID=77). Water levels, staffing, and other factors can affect the level of survey sampling, locations, and intensity on an annual basis. However, sample location, method and frequency should be standardized and based on the calcium value table.

Potential Effects of Mussels on Clear Lake

There are many factors to consider when estimating the potential effects of invasive mussels on a water body. Potential effects to Clear Lake (Figure 2) include a disrupted food chain, fouled infrastructure, shoreline degradation, recreation restrictions, increased cost and maintenance, tournament restrictions, loss of tourism revenue and reduction of property values.

A disrupted food chain that negatively affects fisheries and wildlife—Quagga and zebra mussels (Dreissena spp.) are known as ecosystem engineers because they control the availability of resources to other organisms by the physical changes they cause in the environment (Jones et al. 1994) and have profound effects on lake and river ecosystem function and structure (Zhu et al. 2006). The ecological effects of these mussels are considered the most far-reaching relative to other aquatic invasive species (AIS), causing local extinction of many native mollusks (Strayer and Malcom 2007; Burlakova et al. 2014), changing the structure of food webs and fish assemblages, and contributing to the collapse of valuable sport fish populations (Kelly et al. 2010; Bossenbroek et al. 2009; Strayer 2009; Pimentel et al. 2005). Increased occurrences of harmful algal blooms (Higgins and Vander Zanden 2010) can contribute to declines in fish populations (Knoll et al. 2008). Once established, invasive mussels commonly reach densities of more than 10,000 individuals per square meter (Depew 2021).

System-wide effects of quagga and zebra mussels depend on water mixing rates, lake morphology, and turnover rates (Karatayev et al. 2015). Quagga mussels can be found in all regions of a lake, form larger populations, may filter larger volumes of water, and may have greater system-wide effects (especially in deep lakes) compared to zebra mussels, which are restricted to shallower portions of lakes (Karatayev et al. 2015). After initial invasion, invasive mussels have direct effects on ecological communities whereas post-invasion, impacts will likely be indirect effects that cause ecosystem changes (Karatayev et al. 2015). Proactive,

Figure 2. Likely changes from an invasive mussel invasion in Clear Lake.

pre-invasion management investments that emphasize the importance of prevention and early detection are less costly than re-active, post-invasion expenditures (Cuthbert et al. 2022).

Quagga and zebra mussels filter particles from the water, resulting in improved water clarity (Karatayev et al. 1997, 2002), and corresponding increases in benthification (Mills et al. 2003). Scientists refer to this as "turning ecosystems upside down" because of the transfer of energy to littoral areas with concurrent increases in benthic biomass (Mayer et al. 2014; Rumzie et al. 2021).

Boats, engines, docks, and other infrastructure (e.g., water delivery supply lines) encrusted with invasive mussels—Dreissenid mussels grow on a variety of infrastructure systems, including water intake pipes for drinking water, irrigation, power plants, locks, and dams and canal systems, impacting operation and maintenance costs (Invasive Species Advisory Committee 2016). Continual attachment of adults can increase corrosion rates of steel and concrete (US Geological Survey 2016), leaving equipment and infrastructure vulnerable to failure. Additionally, the mussels grow on navigational buoys, docks, and hulls of boats and ships—increasing drag, affecting steering, and clogging engine intakes—all of which can lead to overheating and engine malfunctions (Invasive Species Advisory Committee 2016).

Beaches and shoreline covered with sharp shells—The shells from dead dreissenid mussels can wash ashore, covering beaches and potentially injuring swimmers and other water recreationists from cuts sustained from the shells' sharp edges (Nelson 2019).

Boating restrictions to reduce spread of mussels—Mandatory watercraft inspections prior to launch, closures of boat ramps, restrictions on shore launching, mandatory Mussel Fee Stickers, and closed water bodies are examples of effects on boating recreation that have been implemented as a result of dreissenid introductions. In 2008, zebra mussels were detected in the San Justo Reservoir in San Benito County, California, a popular recreational area. Since their discovery, the reservoir, operated by the Bureau of Reclamation (BOR), was closed to any public use and has remained closed, "resulting in a dramatic, detrimental impact on the community, economy, and environment in San Benito County" (https://panetta.house.gov/media/press-releases/rep-panetta-leads-letter-rep-lofgren-request-expedited-process-san-justo).

Increased cost and maintenance for clogged, fouled, or contaminated water delivery infrastructure— Clear Lake is a source of water for several water districts, which treat and provide municipal drinking water for thousands of people. In addition, many individual homeowners with individual water systems draw water from the lake.

Invasive mussels pose serious threats to hydropower infrastructure and operations (Rumzie et al. 2021). Invasive mussels can affect all facility components exposed to raw water; mussels can clog pipelines and water intakes and disrupt operations at hydroelectric power plants, municipal water supply facilities, and conveyance systems used in irrigation, resulting in water lines incapable of supplying a consistent and reliable source of water (Vissichelli 2018). Smell, bacteria, and decay are other key issues associated with a mussel infestation. The management response is continual cleaning, treatment, mitigation filters, and other actions. A 2021 study associated with invasive mussel impacts and management at 13 hydropower facilities in Canada and the United States (Rumzie et al. 2021) described costs associated with addressing established invasive mussels:

- Preventative control capital costs (one-time costs) ranged from $100,000 to $200,000 per facility.
- Preventative control annual costs ranged from $4,000 to $141,700 per facility.
- Increased maintenance re-occurring costs ranged from $22,000 to $505,000 per facility.
- Increased maintenance annual costs ranged from $26,000 to $112,000 per facility.
- Annual monitoring costs ranged from $1,970 to $47,245 per facility.
- Unplanned outages cost per occurrence ranged from $44,000 to $80,000 per facility.
- Unplanned outages total cost was $849,000.

Examples of preventative and maintenance costs include treating with chlorine, cleaning generator coolers 3–4 times per year to remove mussel debris, and increased labor costs to maintain all hydropower equipment.

The cost to remove mussels and manage drinking water intakes at Hoover, Davis, and Parker Dams, three facilities with invasive mussel infestations on

the Colorado River, was more than $6,026,100 in 2016. Expected costs from 2017 to 2026 totaled $10,372,108 (Boyd 2016). The State of Washington estimated direct impacts to dams from invasive mussels is $42.9 million (Community Attributes 2017). The consumer bears the cost for management response (Vissichelli 2018).

In British Columbia, where mussels are currently not found, domestic self-supply represents 21,495 licenses and routine maintenance costs vary between $237–$1,298 per license (British Columbia Ministry of Water, Land, and Resource Stewardship 2023). The average B.C. household pays about $500 per year for water and sewer services. An infestation of invasive mussels would represent a significant increase in water costs for more than 21,495 households, which could have important distributional consequences for low-income households (British Columbia Ministry of Water, Land, and Resource Stewardship 2023).

Fishing tournament restrictions—*CDFW Guidance for Developing a Dreissenid Mussel Prevention Program* (2020) acknowledges that fishing tournaments are a common human-mediated pathway of dreissenid mussel introduction. The document further states that "conditions on fishing tournaments" are a potential management action to prevent a dreissenid mussel introduction. Conditions might include mandatory decontamination of all participating watercraft, or additional measures that could change current tournament operations. Fishing regulations change on a regular basis; CDFW's website should be consulted for the latest fishing regulations.

Loss of revenue to Lake County communities—To date there are no studies estimating the impact of invasive mussels on tourism (Nelson 2019). However, Montana used a scenario-based approach for recreational fishing to estimate the economic damages at 2 percent, 5 percent, and 10 percent reductions in visitation because of dreissenid establishment. Tourism spending was assumed to be proportional to visitation. Therefore, if visitation is reduced by two percent (most conservative scenario), the amount of money spent by nonresident visitors would decrease by $17.8 million. A 10 percent reduction in visitation would decrease tourism spending by $89 million. Montana calculated estimated per day expenditures for resident anglers multiplied by the number of days of fishing to determine total angler expenditures in 2013 were about $193 million (Swanson 2016).

Reduction in property values—Mussels contribute to high filtration rates and are associated with increased water clarity and light penetration, leading to the proliferation of aquatic plants and algae, toxic algal blooms, and rotting plant material on beaches (Karatayev et al. 2015). In the nearshore, accumulated waste excreted by dreissenids contributes to excess nutrients, increased turbidity, and the development of muddy substrate, reducing water quality and causing shell build-up on shorelines and beaches (British Columbia Ministry of Water, Land, and Resource Stewardship 2023). The impacts of dreissenids on beaches, shorelines, and nearshore water quality may reduce the amenity value of waterfront properties because value of property adjacent to water can be sensitive to odor, water clarity, weed growth and eutrophication, beach closures due to bacteria and algal outbreaks, the quality of recreational fishing, and shoreline quality (Horsch and Lewis 2009; Nicholls and Crompton 2018). Residents of Lake Winnipeg reported odors from rotting shells that periodically wash up on the shores as well as negative impacts from sharp shells, which cover piers and beaches and pose a risk to people and animals (British Columbia Ministry of Water, Land, and Resource Stewardship 2023).

- The economic impacts of invasive aquatic plants, algal blooms, and degraded water quality caused by excess nutrients is well documented (Ara et al. 2006; Horsch and Lewis 2009; Zhang and Boyle 2010; Walsh et al. 2011; Bingham et al. 2015; Baron et al. 2016).
- Multiple studies in Minnesota, New Hampshire and Maine demonstrated a 1-meter decrease in water clarity decreased property values from 3.1 to 8.6 percent with a median value of 5.8 percent (Jakus et al. 2013).
- The economic impact of harmful algal blooms (HAB) to property values on Lake Erie (Bingham et al. 2015) is a 10 percent reduction in value to shoreline properties.
- A study of Ohio lakes found harmful algal blooms with microcystin levels more than 1 µg/L reduced lakefront property values by 22 percent (Wolf and Klaiber 2017).
- In northern Wisconsin, lakefront property values decreased an average of 8 percent after invasion of Eurasian water milfoil (Horsch and Lewis 2009).

- The presence of milfoil and native aquatic vegetation in Vermont lakes decreased property value ranging from 0.3 percent to 16.4 percent depending on the degree of total macrophyte (aquatic plant) coverage (Zhang and Boyle 2010).
- Montana State General Fund and county governments where affected properties are located estimated a decrease in property tax revenue from the lowered property values (Nelson 2019). Predicted losses in property tax revenue from decreases in lakefront property value ranged from $2.2 to $3.8 million per year.
- In British Columbia, using a low (high) impact scenario, reductions in the assessed value of representative waterfront housing range from $15.9 million ($27.5 million) in the Peace River region to $141.0 million ($239.9 million) in the Fraser Valley (British Columbia Ministry of Water, Land, and Resource Stewardship 2023). The British Columbia study predicted total one-time costs of $812 million based on 5.8 percent reductions in assessed property values due to invasive mussels. These estimated one-time reductions result in an annualized cost of $24.4 million ($2,269 per property) and decreased annual municipal revenues of $5.8 million (British Columbia Ministry of Water, Land, and Resource Stewardship 2023).

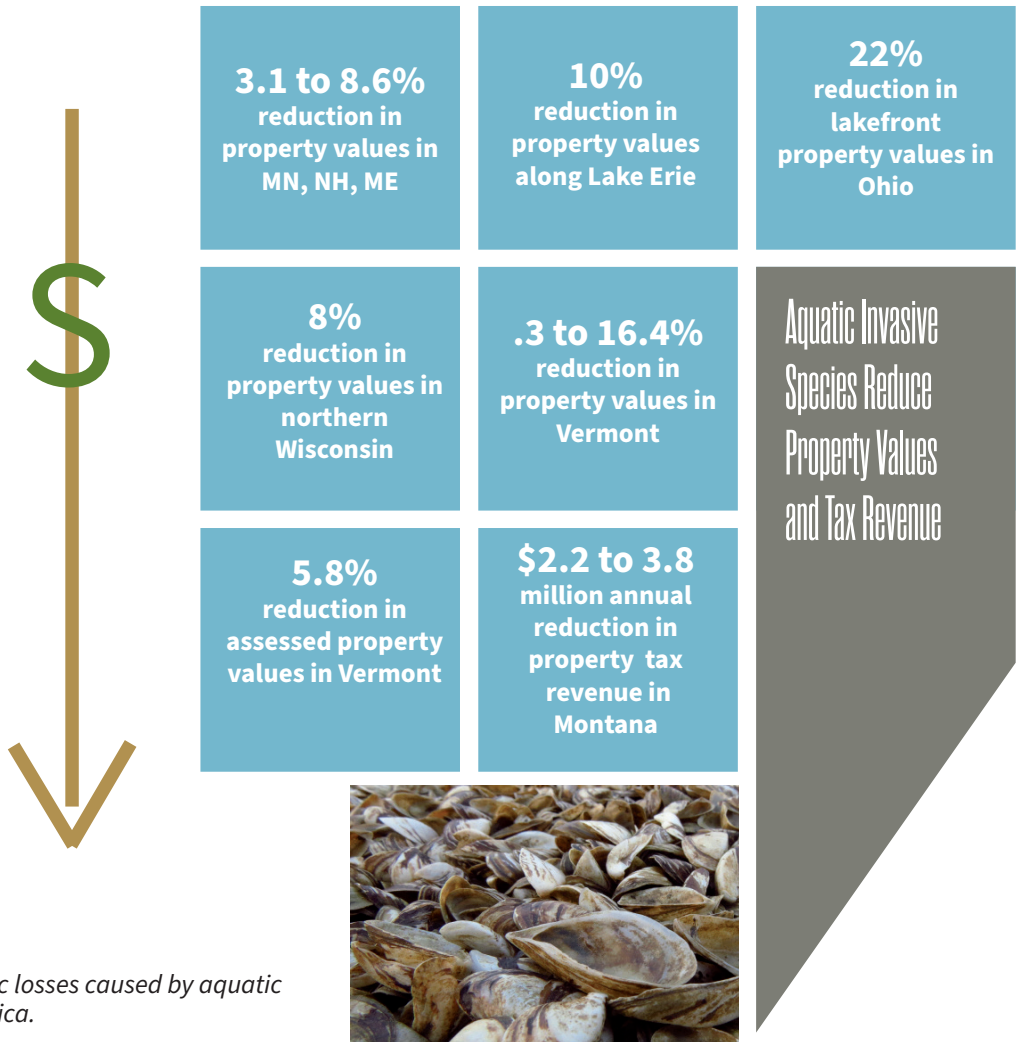

Figure 3. Examples of economic losses caused by aquatic invasive species in North America.

CHAPTER THREE 3

Legal Authorities and Statutes

The County of Lake accepted responsibility for the protection of Clear Lake's basin from the State Lands Commission in 1973; this transfer of responsibility resulted in lakebed management and shoreline protection ordinances in Lake County's Municipal Code. In 2009, Lake County's Department of Water Resources (DWR) separated from the Department of Public Works, and responsibility for District management was transferred to DWR. California delegates the responsibility for preventing and managing dreissenid mussel infestations to local water body managers (Fish and Game Code Title 14). Local codes and ordinances are therefore critically important in establishing local authorities to establish prevention programs. Relevant regulations and their associated hyperlinks are included in Appendix D.

The primary agency responsible for managing the dreissenid mussel prevention program in Lake County is the County of Lake Watershed Protection District (LCWPD) . The District, a management structure endowed with specific authorities by the U.S. Congress and the California State Legislature, is administered by the Director of Water Resources who reports to the County Board of Supervisors, which acts as its Board of Directors. The District plans, manages, maintains, implements, and evaluates all Lake County aquatic invasive species programs, such as the Aquatic Plant Management Program and the QZ Mussel Prevention Program. In March 2008, the Lake County Board of Supervisors passed an emergency ordinance establishing an inspection program for all water vessels launched in Lake County. This program, in its emergency form, introduced a mussel sticker program based on the honor system. Eventually the emergency ordinance was replaced by County Ordinances 2915 (2009), 2936 (2011), and 2976 (2012) that established a fee-based inspection program for all water vessels launched in the County of Lake. The mussel sticker ordinance is also located in Lake County Code Article IX of Chapter 15 (Appendix D). The physical prevention program is a three-tiered system based on the risk level (tier 1 - screening, tier 2 - inspection, tier 3 - decontamination) of the vessel for transporting invasive mussels to Lake County.

The District relies on several partners for program (Table 1) implementation including:

- Pacific Gas & Electric conducts dreissenid veliger tows in Lake Pillsbury.
- Citizen scientists perform substrate monitoring in Hidden Valley Lake.
- CDFW North Central Region conducts tow collection, visual surface surveys, water quality, and calcium sampling in Clear Lake, Indian Valley, and Lake Pillsbury.
- California State Parks Division of Boating and Waterways provides grant funds to support the County's boat ramp monitor network for Clear Lake, inspection training and equipment, and all essential educational materials.
- U.S. Fish and Wildlife Service provides QZ prevention program funds.

Jurisdictional Roles and Responsibilities

Per California Fish and Game Code Section 2301, in the event of a dreissenid introduction in Clear Lake, the lead entity in the implementation of the rapid response containment and transition plan and the development of a control plan is "a public or private agency that

operates a water supply system".

California Fish and Game Code Sections 2301 and 2302 include the following key components:

Fish and Game Code, Section 2301

- Makes it illegal to possess, import, ship, or transport in the state, or place, plant, or cause to be placed or planted in any water within the state, dreissenid mussels.

- Gives the CDFW Director, or his/her designee, the authority to conduct watercraft inspections and stop conveyances, mandate decontaminations, and impound or quarantine conveyances. This section also provides authority to conduct watercraft inspections within waters that contain dreissenids, to close or restrict access to affected waters or facilities, and to inspect, quarantine, or disinfect conveyances removed from, or introduced to affected waters.

- A public or private agency that operates a water supply system shall cooperate with the department to implement measures to avoid infestation by dreissenid mussels and to control or eradicate any infestation that may occur in a water supply system. If dreissenid mussels are detected, the operator of the water supply system, in cooperation with the department, shall prepare and implement a plan to control or eradicate dreissenid mussels within the system.

- Any entity that discovers dreissenid mussels within this state shall immediately report the discovery to the department.
- Provides penalties for entities that violate this section.

Fish and Game Code, Section 2302

- Any person, or federal, state, or local agency, district, or authority that owns or manages a reservoir where recreational, boating, or fishing activities are permitted must assess the vulnerability of the reservoir for the introduction of dreissenid mussels and develop and implement public education, monitoring, and management of recreational, boating or fishing activities designed to prevent the introduction of dreissenids. The entity must also visually monitor for the presence of mussels.
- Provides penalties for entities that violate this section.

California Code of Regulations, Title 14 Section 672 relates to the possession, importation, and transportation of dreissenid mussels. Key elements include:

- Dreissenid Mussel Permits authorize entities to possess, import, ship, or transport dead dreissenids for the purposes of outreach, education, species verification, training, or other purposes deemed by CDFW.

- Provisions are included relative to denial and revocation of permits as well as requests for reconsideration.

California Code of Regulations, Title 14 Section 672.1 relates to dreissenid control and prevention. Key elements include:

- **Prevention Program** – Entities that own or manage a reservoir where recreational, boating, or fishing activities are permitting must implement a dreissenid mussel prevention program that includes a vulnerability assessment for dreissenids, a monitoring program, and management of recreational activities that prevent the introduction of mussels, and to keep them from being moved from the waterbody. Annual prevention program summary reports are due by March 31. This section provides penalties for violation of the section.

- **Inspection of Conveyances** – This section makes it unlawful for anyone to refuse to comply with or interfere with a CDFW employee or their designee for impounding or quarantining a conveyance suspected to contain dreissenids, and makes it unlawful to tamper with a method used to identify a conveyance as quarantined. This section provides penalties for violation of the section.

- **Control Plan** – Within 60 days of CDFW requesting, or within 60 days of dreissenids being detected, public or private agencies that operate water supply systems must immedi-

ately develop a dreissenid mussel control plan and implement measures to prevent further spread. The plans must include a description of the status of the dreissenid population at the time of plan development, control activities, and monitoring to determine dreissenid population changes. The plan may also include maintenance activities to maintain functionality of the water supply facility. Annual reports are submitted by March 31 of each year, including information on changes in dreissenid populations, control activities implemented, and monitoring results. This section provides penalties for violations of the section.

California Code of Regulations, Title 14 Section 672.2 is related to dreissenid mussel penalty and appeal procedures.

Recommendations to Modify Current Ordinances to Strengthen Dreissenid Management Capabilities

The National Sea Grant Law Center reviewed existing ordinances and proposed Lake County consider the following to strengthen dreissenid prevention and containment efforts:

- Add a definition for "pollutant" and explicitly include a reference to AIS. Aquatic invasive species are pollutants under the federal Clean Water Act; thus, the reference is probably not necessary from a legal standpoint.

- Add a definition of "significant impact" that includes the decision threshold. "Significant impact" is the term used in the "catch-all" permit procedure in Sec. 23-4.

- Consider mentioning AIS in Section 6.4(B) Construction (page 11) – e.g., materials used in construction should be free from AIS, materials should be decontaminated before moving to another site, etc.

- Ordinance sections that have the potential to include language associated with containment:

    - Sec. 6.8(D) for relocation of floating structures (page 14). Incorporate language that requires inspection and decontamination before relocation.

    - Sec. 23-8 for Marinas and Harbors (page 15). The county could encourage/require marinas to offer decontamination facilities or require inspections before boats leave marinas, etc.

    - Section 23.13.4 Removal of improvements (page 20). The county could require inspection/decontamination upon removal of an improvement if the structure is being moved to another location; or, the county could require proper disposal.

    - Section 12.4 – Littering and pollution (page 18). Add a provision regarding AIS to reinforce that AIS are pollutants and introduction is prohibited.

    - Section 12.6 for discharge. Explicitly reference AIS and potentially require use of best management practices.

- As a condition of the shoreline encroachment permit, the county could require an annual inspection/monitoring and reporting of results, and then identify actions that needed to be taken if mussels are detected.

- In addition, and outside the scope of the shoreline ordinance, but potentially associated with other statutes, the county could impose an annual inspection of structures as part of routine county inspections; these inspections could incorporate both safety issues as well as AIS.

- The county could state in its ordinances that it is unlawful to launch a boat from any place other than a ramp, private dock, pier, designated beach. This would allow the county to cite or fine people who are launching their watercraft from any shoreline or undeveloped location and help to ensure that watercraft are inspected prior to launch. There are examples of counties that define "boat launch facilities" as being "a boat ramp, dock, pier or other facility designated by the department for launching boats into the water" (e.g., Island County, Washington, Chapter 9.40). This Washington

county states that “It is unlawful for any person to launch or recover a boat in any Island County park except in areas specifically designated and/or marked for that purpose; provided, that this provision does not apply in case of an emergency (9.40.165).” Tempe, Arizona mandates that “all public watercraft must be launched at a designated boat launch facility.”

Figure 4. Watercraft inspection and decontamination enhances prevention efforts at Clear Lake.

Table 1. Summary of roles and responsibilities relative to dreissenid prevention and management.

Entity	Roles and Responsibilities
County of Lake Watershed Protection District (administered by the Director of Water Resources)	• Prevent and manage mussel infestation. • Plan, manage, maintain, implement, and evaluate all Lake County aquatic invasive species programs. • Assess the vulnerability of Clear Lake for the introduction and establishment of dreissenid mussels. • Develop and implement public education, monitoring, and management of recreational, boating, or fishing activities designed to prevent the introduction of dreissenids. • Visually monitor for the presence of mussels. • Manage recreational activities to prevent the introduction of mussels, and to keep them from being moved from the waterbody. • Produce and submit to CDFW by March 31 an annual prevention program summary report. • Lakebed management and shoreline protection. • Immediately report any discovery of dreissenid mussels to CDFW's Regional Environmental Scientist.
California Department of Fish and Wildlife North Central Region	• Conduct veliger tows, visual surface surveys, water quality, and calcium sampling at Clear Lake, Blue Lakes, and Indian Valley Reservoir. • Issue Dreissenid Mussel Permits that authorize entities to possess, import, ship, or transport dead dreissenids for the purposes of outreach, education, species verification, training, or other purposes. • Work in partnership with Lake County staff and other water managers to develop and/or enhance existing dreissenid prevention efforts. • Work with water supply system operators to develop and monitor control plans.
California State Parks Division of Boating and Waterways	• Provide grant funds for County's Clear Lake boat ramp monitor network, inspection training and equipment, and educational materials.
Water Supply System Operators (e.g., Yolo County Flood Control & Water Conservation District, Solano County Water Agency)	• Cooperate with CDFW to implement measures to avoid infestation by dreissenid mussels and to control or eradicate any infestation that may occur in a water supply system. • Within 60 days of CDFW requesting, or within 60 days of dreissenids being detected, cooperate with CDFW to develop a dreissenid mussel control plan and implement measures to prevent further spread. Annual reports are submitted by March 31 of each year. • Immediately report any discovery of dreissenid mussels to the department.
Water purveyors	• Monitor their intakes, screens, and pipes in Clear Lake.
Citizen scientists	• Conduct substrate monitoring in Blue Lakes, Lake Pillsbury, and Hidden Valley Lake. • Immediately report any discovery of dreissenid mussels to the department.
Pacific Gas & Electric	• Conduct dreissenid veliger tows in Lake Pillsbury. • Immediately report any discovery of dreissenid mussels to the department.

CHAPTER FOUR 4

Rapid Response Strategy

Mechanisms of Response

In the event of a detection of dreissenid mussels, deliberate actions will be taken to determine the scope of the detection, and appropriate containment, control, and eradication responses (Figure 5). The District is engaged in active monitoring to detect dreissenid mussels through regular monitoring efforts for veligers and adults. Additional entities are also engaged in monitoring infrastructure or water delivery systems for adult dreissenids. Once a detection is made, key response activities may occur simultaneously at various stages of response but may also be influenced by the nature of the detection. The rapid response process begins the moment there is a report of a dreissenid detection.

Confirmation of Detection

Purpose: Determine if the report of detection is factual and confirm the species identification.
Lead: LCWPD in collaboration with CDFW

The nature of an initial dreissenid detection may be from routine monitoring by the District, partner monitoring, public surveillance, or public reporting. Regardless of the nature of the initial detection, per Fish and Game Code Section 2301, "any entity that discovers dreissenid mussels within the state shall immediately report the discovery to the CDFW." The discovery should be reported to the CDFW Region 2 Quagga/ Zebra Mussel Scientist (or CDFW wildlife officers if Region 2 Mussel Scientist is not available) and via the CDFW online Quagga Mussel Observation Report Form (Appendix E) (https://wildlife.ca.gov/Conservation/Invasives/Quagga-Mussels/Observation-Report). CDFW will work with the reporting entity to confirm the detection once the report is received. It may be possible that a detection is made of an adult or veliger, which will prompt action, however, methods of confirmation and speed at which actions are taken will vary. The dynamics of the situation may be highly variable.

- A detection of one or more adult mussels will be confirmed visually by CDFW.
- A detection of one or more veliger mussels will be verified by the best available laboratory methodologies. The independent identification methods will include cross-polarized light microscopy (CPLM) and polymerase chain reaction (PCR). The sample may also be sequenced for dreissenid mussel species differentiation. Veliger samples collected by CDFW, the District, and PG&E in the county are analyzed by CDFW Shellfish Health Lab in Bodega Bay, California. CDFW's Office of Spill Prevention and Response Santa Cruz Laboratory processes veliger samples collected by the Region 2 Quagga/ Zebra Mussel Scientist.

Classification of a water body following confirmation of detection is important for communication purposes and to inform the level of decision-making needed by the District and CDFW.

Declaration of Emergency in Lake County

Purpose: Brings the situation of dreissenid detection and response into a county-wide scale of response.
Lead: LCWPD with Office of Emergency Services

Per County Ordinance 31, Lake County may declare a local state of emergency. The scope of a dreissenid situation will influence the level of response and the

scale of that response. An emergency declaration helps to inform the level of concern of the situation to all in Lake County and may be vital for the mobilization of funding to conduct response actions.

Notification Communication

Purpose: Ensure that factual and timely information is communicated with appropriate entities, including regional water body managers.
Lead: LCWPD

With the confirmation of detection and species identification complete, there will be multiple notifications made to allow area partners to respond in tandem to the developing situation. Communication is needed early in the response process.

1. CDFW requires immediate notification of a dreissenid detection. Once the District provides notification to CDFW, a recognition of that notification will be made by CDFW to ensure that it has been received.
2. Once the detection and species identification has been confirmed, detailed information will be provided to US Geological Survey's Non-Indigenous Aquatic Species Database by CDFW. This information sharing allows for a broad distribution of information via the USGS national alert system.
3. All regional waterbody managers should be notified upon confirmation of dreissenids in Clear Lake (Table 2). Timing of communication to managers will vary and be based on the details of the scope of the situation.
4. The Office of Emergency Services (OES) in Lake County would play an important role in notification once a detection of dreissenids has been confirmed. OES staff can push Lake County Alerts (LakeCoAlerts), notifying residents that opt into the system that there has been a confirmed detection of invasive mussels. This system can also be used to provide any updates, such as notifications about mandatory decontaminations for watercraft, etc. In addition, numerous other tools exist to notify the public of a confirmation, including social media, press releases, radio advertisements, signage, Nixle 360 alerts, highway signs, and billboards entering Lake County.

Delineate Scope of Response

Purpose: Determine the scope of the dreissenid detection to inform management response.
Lead: LCWPD

Following the confirmation of detection, multiple strategies will be deployed to further delineate the scope of the infestation. To understand and characterize the nature of the detected population (e.g., if there are multiple age classes, multiple locations, or isolated populations), deliberate searches using canine shoreline teams, volunteer shoreline teams, eDNA samples, self-supplied water users (check water filters), and dive teams may be deployed simultaneously. A coordinated strategy will capture all search information into digital visualization to better understand the management scope and subsequent management actions. The timing to deploy delineation methods will be based on the details of a confirmed detection, in some cases delineation methods may be deployed immediately.

Activate Incident Command System and Response Team
Purpose: Engage in process to adequately address scale of management situation.
Lead: LCWPD

If it has been determined that there is potential to implement control options based on the scope and scale of the infestation, then containment options and monitoring options must be initiated. The incident command system (ICS) will be activated (Figure 4) to ensure that the response proceeds with adequate support. The ICS brings structure and organization to a complex management situation. Moreover, if the incident has important legal, political, and public ramifications, then ICS will be needed to support the management of the situation. The lead action agency/incident commander for a dreissenid response at Clear Lake is LCWRD.

Waterbody Classifications[1]

Based on sampling results, waters are given classifications related to their dreissenid mussel status:

U **Unknown/not tested**
A water body that has not been sampled for aquatic invasive species.

N **Negative**
A water body at which sampling is ongoing and nothing has been detected (or nothing has been detected within the time frames for de-listing).

I **Inconclusive**
A water body that has not met the minimum criteria for detection but evidence of dreissenids has been documented. This is a temporary classification and additional sampling of this water will be conducted to determine whether the water body is classified as negative (no detections in subsequent sample) or suspect (verified detection in subsequent sample).

S **Suspect**
A water body at which one sample has been verified by visual confirmation (visual identification of adult or microscopy identification of veliger) and this sample was confirmed as dreissenid by DNA analysis (PCR and gene sequencing). Additional sampling will be conducted to determine whether another sample taken within 12 months detects evidence of dreissenids. If a subsequent sample does detect dreissenids, this water will then be classified as Positive.

P **Positive**
A water body at which two or more sampling events within a 12-month period meet the minimum criteria for detection. For example, samples from two different sampling events are verified by both visual identification (including microscopy) and DNA confirmation (PCR and gene sequencing).

I **Infested**
In many cases, a water classified as Positive will become Infested, which is a water body with an established (recruiting and reproducing) population of dreissenid mussels. For example, lakes Mead and Powell are considered infested waters as they have large populations of reproducing dreissenids and mussels are readily evident on the shoreline and submerged materials such as docks and buoys.

Notes

In some instances, the classification of a water body can be downgraded over time. The exact reasons why dreissenids are detected at a water once, then not again in subsequent sampling, or are detected in a water classified as Positive but never establish a population, remains unknown.

A water body initially classified as Inconclusive can be de-listed to Negative status after one year of negative testing results including at least one sample taken in the same month of subsequent year as the initial positive sample (to account for seasonal environment variability). The time frame for de-listing a water body extends from there with a water body initially classified as Suspect requiring three years of negative testing to re-classify to Negative, a Positive water body requiring five years of negative testing to re-classify to Negative, and an Infested water body requiring a successful eradication or extirpation event and a minimum of five years of negative testing results post-eradication event to re-classify to Negative.

1 The State of California Developed waterbody classifications prior to the Building Consensus in the West Effort that culminated with new classifications developed by the Western Regional Panel on Aquatic Nuisance Species, Building Consensus in the West Committee (WRP 2019). The State of California is currently undergoing an effort to incorporate delisting guidelines into California Fish and Game Code. Currently, the State of California defines "detected" as a) There has been an observed presence of one or more adult dreissenid mussels, or; b) There has been an observed presence of one or more veliger dreissenid mussels that has been verified by the best available laboratory methodologies.

Table 2. Contact Information for Clear Lake dreissenid prevention and management (January 2024).

Waterbody	Managing Agency	Key Contact	Email	Phone Number(s)
Clear Lake	Lake County	Angela DePalma-Dow	Angela.Depalma-Dow@lake-countyca.gov	Office: (707) 263-2344 Mobile: (530) 304-1809
Indian Valley Reservoir	Yolo County Flood Control and Water Conservation District	Jennifer Reed Kristin Sicke	jreed@ycfcwcd.org ksicke@ycfcwcd.org	Office: (530) 662-0265
Lake Mendocino	U.S. Army Corps of Engineers	Poppy Lozoff	Poppy.L.Lozoff@usace.army.mil	Office: (707) 467-4200 Mobile: (707) 471-8350
Lake Pillsbury	U.S. Forest Service	Frank Aebly	faebly@fs.fed.us	Office: (707) 275-2361
	PG&E	Ray Swordle		Office: (707) 743-1513
Lake Sonoma	Sonoma County Water Agency	Hailey Norman	Lake.Sonoma@usace.army.mil Haileyrenee93@gmail.com	Office: (707) 431-4590
Lake Berryessa	U.S. Bureau of Reclamation	Nathan Kyle	nkyle@usbr.gov	Office: (707) 966-2111
Lake Shasta	U.S. Forest Service	Sara Acridge	Sara.acridge@usda.gov	Office: (503) 275-1587
Lake Tahoe	Tahoe Regional Planning Agency	Dennis Zabaglo	dzabaglo@trpa.gov	Office: (775) 589-5255
Solano County	Solano Parks and Recreation	Chris Drake	CRDrake@solanocounty.com	Office: (707) 784-6765
Solano County	Solano County Water Agency	Drew Gantner	dgantner@scwa2.com	Office: (707) 455-4450

The scope of a dreissenid infestation will influence the number of individuals needed for response. A veliger detection followed by unconfirmed results can be handled by several Lake County staff. However, a veliger detection that leads to an adult detection or established population likely will require staff from multiple agencies in addition to a cadre of volunteers. Suggested representation for a response at Clear Lake may include Yolo County Flood Control Water District, CDFW, the Lake County Office of Emergency Services, and other relevant partners (Figure 7). The operations of the incident will take multiple pathways to formulate and explore control, containment, and monitoring options. Control options may include small- or large-scale chemical application (in combination with mechanical methods such as curtains) to attempt to eradicate or minimize a population of dreissenids.

Activation of Communication

Purpose: Provide appropriate and timely information to specific entities.
Lead: LCWRD
Upon assembling the ICS team, a communication strategy can inform key regional partners, collaborators, lake users, and the public (Table 3). Weekly public information sharing (e.g., meetings, webinars, or conference calls) and a web page may be created by the county. Press releases, social media, and other information products can be delivered. Clear communication will ensure affected parties understand activities and roles of everyone involved.

Draft templates of outreach materials (Figure 8) may be used to communicate with different entities about actions that may be taking place. The materials, which include an 8.5 x 11 flyer, door hanger, and social media post, and draft press release (Appendix F) allow district staff to modify and update the templates as needed.

There are numerous opportunities to communicate an introduction of mussels to residents and others in the Clear Lake region, including social media, press releases, radio advertisements, signage, Nixle 360 alerts, Lake County alerts, the California and U.S. Geological Survey infested waters maps, billboards, and outreach through neighboring water body managers.

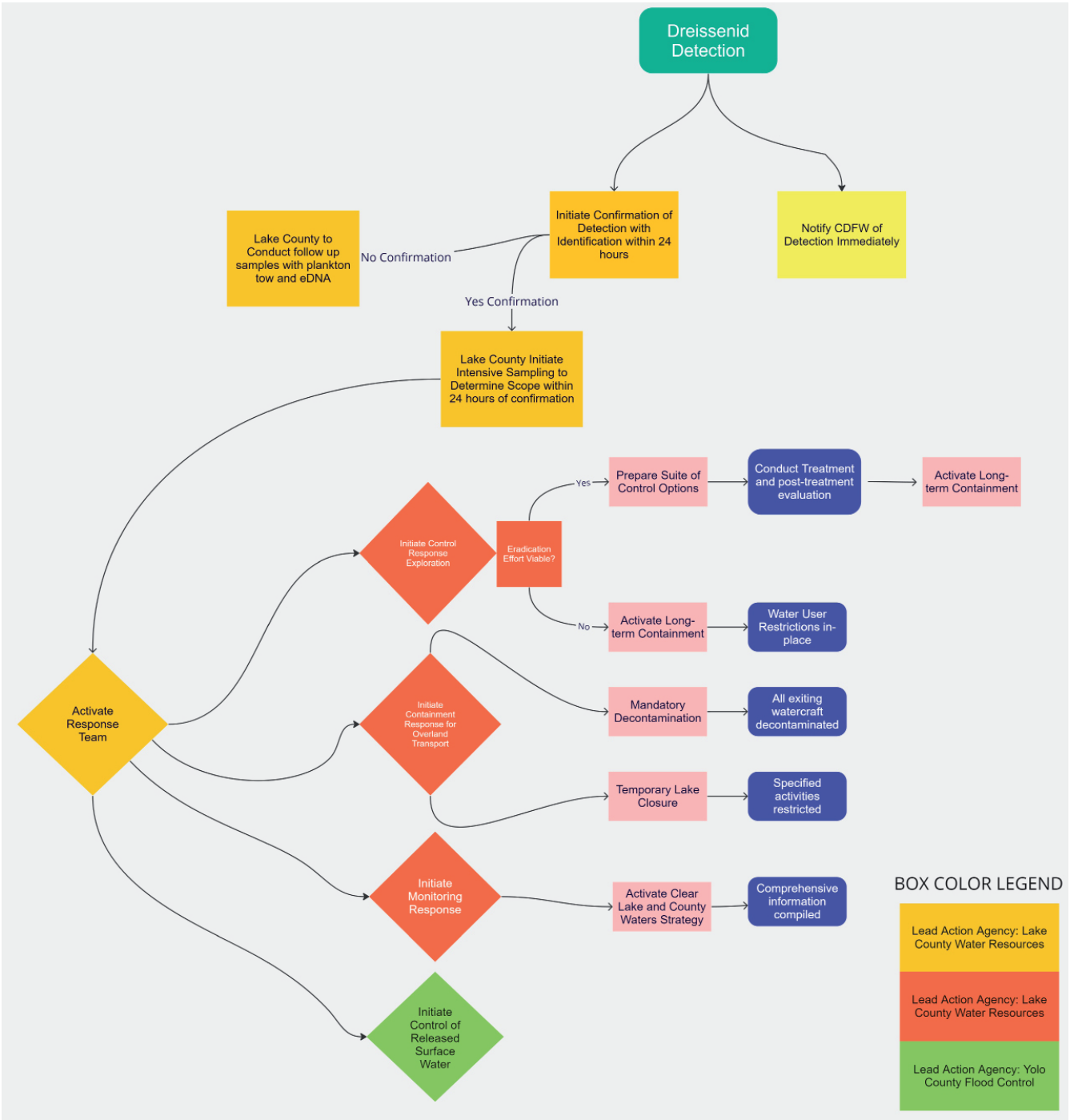

Figure 5. Dreissenid management response decision matrix. This matrix provides a flow of possible steps upon the initial detection of dreissenids.

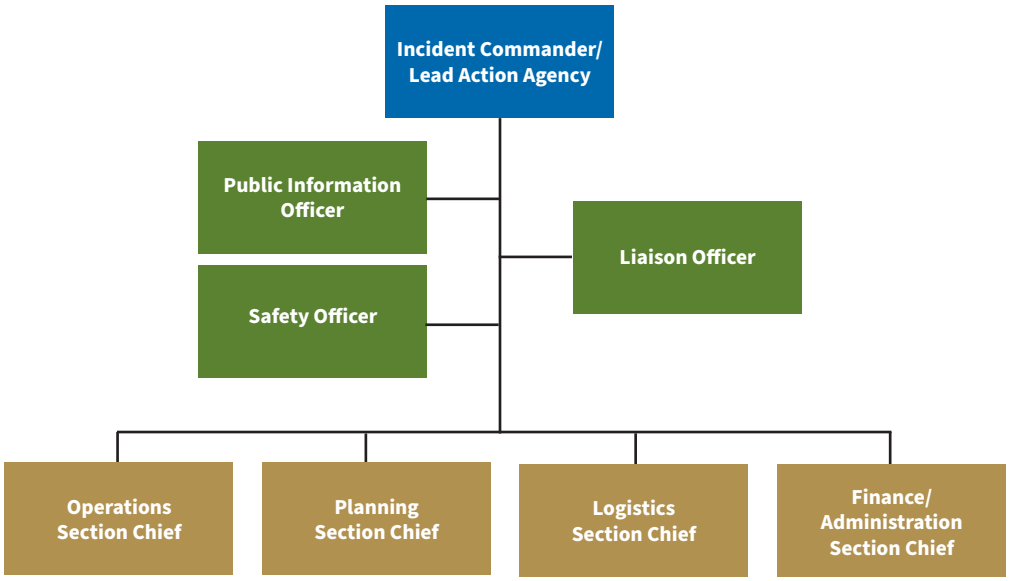

Figure 6. The Incident Command System structure with identified roles and lines of communication.

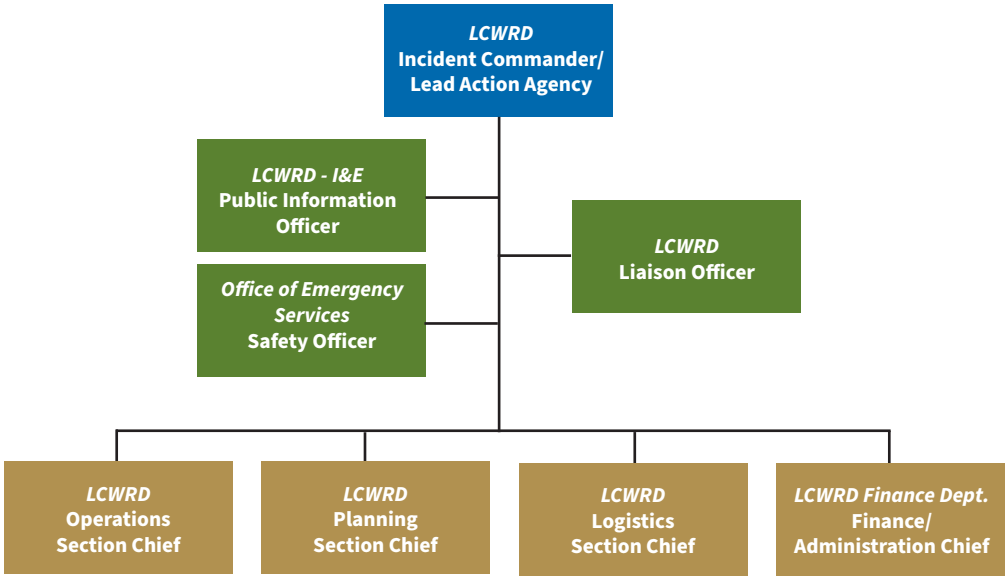

Figure 7. Potential Lake County entities that would be involved in a dreissenid response visualized in Incident Command System roles.

LCWRD = County of Lake Water Resources Department, the entity responsible for the stewardship of Clear Lake.

Table 3. Three types of communication hubs, including the type of information shared, method of communication, frequency, and entities involved.

	Communication Hub 1	Communication Hub 2	Communication Hub 3
Type of Information Shared	Initial confirmed detection Milestones	Waterbody status Management actions	Prevention requirements Closures Decontamination requirements and location
Method of Communication	Phone Briefing documents	Online meetings Email briefings	Social media Website Press releases
Frequency	Upon confirmed detection, weekly progress updates as needed with key decision points	Weekly	As new requirements are needed
Primary Entities	Governor staff County officials State legislators	Surrounding county managers Surrounding state AIS managers	Local businesses Boaters Recreationists Homeowners Area residents

Figure 8. Outreach materials to share information about a detection of dreissenids in Clear Lake include a social media post, flyer, and door hanger.

Potential Solutions to Mitigate, or Eradicate, Invasive Mussels from Clear Lake

The Columbia River Basin Dreissenid Incident Response Toolkit website (https://www.crbdirt.com) (Figure 7) documents commonly used control methods to eradicate dreissenids. The website describes a suite of physical, biological, and chemical options for controlling invasive mussels (https://www.crbdirt.com/control-methods). Some methods are appropriate solely for hydropower facilities and water delivery systems, in which fish and other aquatic species are not present and the water can be treated before being released. Other methods, which may have reduced toxicity to fish and living organisms, are more appropriate for open water situations. Many treatments may not be appropriate, or feasible, for response in open water systems because of their toxicity to other aquatic species.

Dahlberg et al. (2023) documented lessons learned from an analysis of 33 open water dreissenid mussel control projects in 23 North America lakes, including:

- **Physical methods**, such as manual removal by divers, creating anoxia with benthic mats, and desiccation from waterbody drawdowns (Wimbush et al. 2009; Hargrove and Jensen 2012; Leuven et al. 2014).

- **Biological methods**, such as the use of fish, crayfish, parasites, and microbes intended to reduce mussel populations by predation or infection (Molloy 1998; Kirk et al. 2001; Reynolds and Donohoe 2001). Zequanox®, a U.S. Environmental Protection Agency registered molluscicide for dreissenid control, is included in this category.

- **Chemical methods**, including copper-based pesticides (e.g., Natrix™ and EarthTec QZ® are copper-based products registered by the U.S. Environmental Protection Agency for dreissenid control); potassium chloride (KCl), which is not registered by the U.S. Environmental Protection Agency as a molluscicide, but has been used in open water to control zebra mussels through the use of a Section 24c Local Needs exemption and Section 18 Emergency Exemption. Scientific studies on the potential effects of dreissenid chemical treatments on listed species and critical habitats have been documented (DeBruyckere 2019).

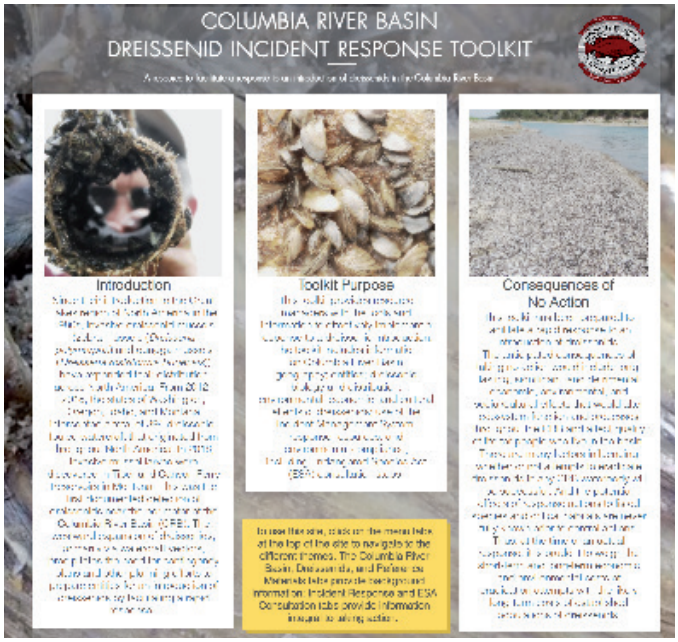

Figure 9. Columbia River Basin Dreissenid Incident Response Toolkit (CRBDIRT) website.

The potential methodology Clear Lake water managers would use to mitigate or eradicate invasive mussels would depend upon numerous factors, including, but not limited to, the extent of the infestation, whether or not adults were detected, if the preferred chemical control is registered for use as a molluscicide by the U.S. Environmental Protection Agency, and potential impacts to Clear Lake Hitch *(Lavinia exilicauda chi*) and its habitats. The website, https://www.crbdirt.com, documents the potential steps associated with a dreissenid response. Although the website is focused on the Columbia River Basin states, similar steps would occur for any jurisdiction, and include the steps described in this report (e.g., Initial Detections and Notifications, Verification, Activate Incident Management System).

Lake County has historically explored other treatment options for dreissenid mussels, including the use of redear sunfish stocked at high densities to reduce adult dreissenids (Wong et al. 2012) and increasing turbidity levels at detection sites (Steele and Wong 2015) (no longer considered a viable option). However, approaches to addressing dreissenid introductions are focused on eradication, and there are no published studies that indicate either of these two approaches achieve the eradication goal.

Response Actions

An exploration of a variety of responses will help determine the transition to successful long-term management and containment. As more information becomes available about the situation and a response progresses, existing prevention management actions will proceed in the protection of Clear Lake from all AIS, but likely with modifications. Considerations that may inform which response actions are taken include:

- Anticipated costs of eradication effort and subsequent monitoring, coupled with available funding.
- Available resources (personnel, equipment, etc.) for all aspects of response (e.g., signage, barrier curtains, chemicals, grants to partners, increased monitoring, additional oversight of watercraft monitoring).
- Regional and local distribution of dreissenids
    - single vs. multiple, continuous vs. patchy, isolated vs. widespread.
    - upstream vs. downstream, edge vs. interior.
- Dreissenid age class structure or life stages present.
- Pathways/source of introduction (if known) – identified, controlled, eliminated, etc.
- Species track record of eradication/control attempts.
- Ability to obtain required permits and permissions (e.g., application of chemicals to water) in an expedited time frame.
- Confidence in surveillance and subsequent results.
- Affected native fish and wildlife habitats.
- Time of year in relation to reproduction, migration, etc.
- Amount of water in the system to be treated. Consider the following:
    - Potential for drawdown or flows reduced before treatment.
    - Flow sources, including springs, and the potential to regulate that flow.
- Land use patterns.
- Presence of state or federally listed rare, threatened, or endangered species.
- Presence of critical or significant habitats.
- Regulatory hurdles associated with control actions (e.g., use of chemicals).

Prevention Response Actions

Purpose: Address active prevention program needs and adjustments as response is implemented.
Lead: LCWPD

As Control and Monitoring response teams are examining options, actions that address the current program may be implemented in recognition of modifications or adjustments that may be needed to conform to new needs to manage waterbody users and water usage users. Considerations of the following areas of the prevention operations will include:

- Directions and actions for local Lake County Mussel Sticker Program
- Alteration/amendments to Ordinance 15 of Lake County Code

Control Response Options

Purpose: Determine the possible eradication or control options and their feasibility to minimize spread.
Lead: LCWPD

Implementation of any control response may include chemical, biological, or physical methods, and will require a full analysis of potential ecological, economic, cultural impacts to Clear Lake.

There is a limited number of chemicals that currently exist for controlling dreissenid mussels, including potassium chloride and Earth TechQZ®. Methods to contain chemical control applications with the use of a temporary physical barrier or boom will be required. A suite of permits and compliance (Appendix G) will be required for any control response using chemicals and associated barriers. For example, a response action in a marina would involve temporarily installing vertical curtains/barriers from the surface of the water to the sediment to create an enclosed area for chemical treatment. If threatened or endangered species, or their critical habitats, exist within the geographic scope of the project, an Endangered Species Act consultation process will be triggered (see Fish and Wildlife Service Section 7 Consultation section of Appendix F) (https://www.crbdirt.com/introduction). Other considerations, including safety, best management practices, and tradeoffs associated with taking containment response options.

Containment Response Options

Purpose: Determine containment response options and their feasibility to minimize spread.
Lead: LCWPD

Minimizing spread of dreissenid mussels from Clear Lake will require containment. Containment options may include a suite of strategies to address watercraft, infrastructure, water delivery systems, and other human activities. Containment options will be weighed by a response team and will be determined based on the specific details of the detection and scope.

Immediate containment will be implemented while Control Response Options are explored. Immediate containment response may require:

- Temporary closure of the lake to all motorized, non-motorized activity, including the installation of temporary signage and barriers. This could be achieved through County Ordinance 31, declaring a state of emergency, in which the Sheriff of Lake County, or their designee, can issue closure orders for water bodies.
- Mandatory decontamination of all watercraft exiting Clear Lake (note: It has been recommended that Lake County modify its ordinance to mandate mandatory decontamination of watercraft exiting Clear Lake upon infestation by dreissenids).
- A moratorium of all current and future fishing tournaments permitted within Clear Lake.

The District would make the determination if Clear Lake will be closed to use and for what duration. See section on Containment for further details.

Monitoring Response Options

Purpose: Address active prevention program needs and adjustments as response is implemented.
Lead: LCWPD

Monitoring options may include a strategy to understand dreissenid distribution within Clear Lake and relevant neighboring waterbodies. Monitoring options will be weighed by a response team and will be determined based on specific details of the detection and scope. Each category of management options must identify staff and resource needs, budget requirements, feasibility of success, and results of taking a no-action approach.

Additional monitoring of the waterbody and nearby waters will be important for understanding the scope and scale of the infestation. Expanded monitoring efforts will also be needed during implementation of control options. These include, but are not limited to, monitoring within the following systems:

- Municipal water intakes
- Private water intakes
- Thurston Lake (a private lake and would require discussions with landowners to expand monitoring efforts), Hidden Valley Lake, Indian Valley Reservoir, Lake Pillsbury, Lake Mendocino, Highland Spring Reservoir, Blue Lakes, Adobe Creek, Cache Creek, Tule Lake
- Cache Creek dam infrastructure
- High priority water delivery systems within the watershed

Appendix H includes several examples of monitoring strategies that can be employed in water bodies that have had detections of dreissenids.

Termination of ICS Response

Understanding when an ICS led response is complete will be determined by a variety of factors, but will be at the discretion of the lead action agency. However, there are valuable indicators that may help determine that the incident has shifted to a long-term management situation, rather than a response situation. In general, when all the actions for monitoring, containment, and control have been exhausted, a response team is terminated. Factors that may indicate there is no longer a need to operate ICS for the incident include:

- A shift to long-term monitoring strategies to understand dreissenid population dynamics has been initiated (e.g., all municipal water users are actively participating in strategic sampling in cooperation with Lake County) (Lake County mobile watercraft decontamination stations, two are operational and staffed in designated areas with drains to water treatment systems).
- A shift to long-term containment has been initiated. Note: Lake County mobile watercraft decontamination stations (three) are operational and staffed in designated areas. Permanent de-

contamination stations are being considered.
- Control efforts have been conducted and post-monitoring efforts to understand the success/failure of control have been completed.
- The frequency of communication about the project to local collaborators becomes minimal. Communication about the status of the infestation will continue in perpetuity as part of ongoing containment efforts, however, the frequency of communications lessens.
- Emergency resources (e.g., signage, mobile watercraft decontamination stations) are dismantled/reassigned/returned.

A report post-response should be completed to help identify all aspects of the response and inform improvement of capabilities, capacity, and training. Documentation of the response will be a critical aspect to assist in improving response strategies for other natural resource emergency situations and may also be useful for surrounding jurisdictions to successfully respond to different dreissenid situations.

CHAPTER FIVE 5

Transition to Containment

Immediately after verification, short-term containment actions should be implemented. If dreissenids cannot be eradicated using chemical, biological, or mechanical methods, then long-term containment strategies must be implemented to contain dreissenids to the source water body.

The following timeline illustrates verification of identification, accompanying tasks, and water body status following a preliminary detection of dreissenid mussels (Figure 10). In this illustration, the assumption is that veligers were detected.

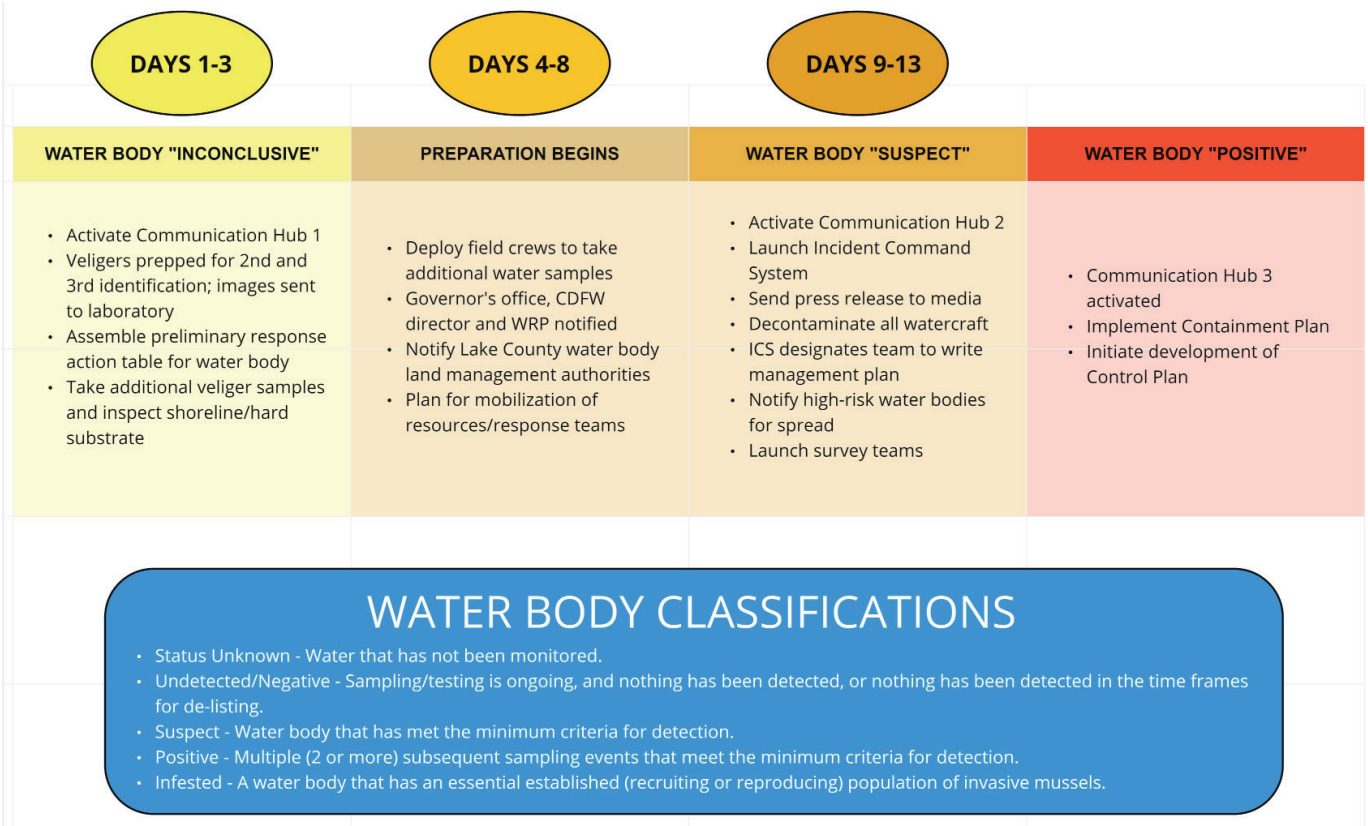

Figure 10. Timeline illustrating verification of identification, accompanying tasks, and water body status following a preliminary detection of dreissenids.

Initial Actions

The following actions should be implemented upon verification of dreissenids (modified from *State of Montana Dreissenid Mussel Rapid Response Guidelines* (2018)):

- Per Section 2301, any entity that discovers dreissenid mussels within this state shall immediately report the discovery to CDFW.

- Per Section 2301, public or private agencies that operate a water supply system shall cooperate with CDFW to implement measures to avoid infestation by dreissenid mussels and to control or eradicate any infestation that may occur in a water supply system. The operator of the water supply system, in cooperation with CDFW, shall prepare and implement a plan to control or eradicate dreissenid mussels within the system. In the case of Clear Lake, the County of Lake Water Resources Department has jurisdictional authority to manage Clear Lake per State Land Commission Chapter 639, adopted in 1973. This chapter authorizes Lake County to act on behalf of the State Lands Commission to manage the water ways and water supply to protect the assets described in 639. Lake County has jurisdiction to contain/control recreation activities and Yolo County Flood Control and Water District has jurisdiction to contain/control the flow of water out of Clear Lake.

- Work with CDFW to evaluate the need to quarantine Clear Lake as needed to prevent spread by watercraft. If the determination is made that the lake should be quarantined, conduct public outreach to notify visitors and residents.

- If infrastructure is in place to inspect and decontaminate all watercraft exiting Clear Lake, implement mandatory watercraft inspection and decontamination program. Mandatory exit inspections and decontamination would occur at designated locations around the perimeter of Clear Lake by staff trained in Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination (Elwell and Phillips 2021) procedures. All vessels inspected or decontaminated will be identified with paperwork and if appropriate a seal. Inspections and decontamination records shall be captured in an online database.

- Identify all dispersal vectors (including movement by humans, fish and wildlife, water traffic, water flow, and other processes). Assume measures are needed to prevent the release of veligers as well as movement of adult mussels.

- Assess the likely movement of boats and other watercraft that recently used the mussel affected water body to identify inspection needs in other water bodies within the county.

- Develop and implement Hazard Analysis and Critical Control Point (HACCP) plans (Britton et al. 2014) to ensure that personnel (i.e., water quality monitoring staff) do not further spread dreissenids.

- Identify other aquatic operations (e.g., hatcheries, aquaculture) that are likely to spread the species outside the affected watershed(s). Consider temporary quarantine measures to prevent spread.

- Consider overland or aerial transport to other water bodies and implement any needed prevention.

- Working in partnership with water purveyors, stop or slow water release to potentially uninfested sites.

- Notification to firefighting units in the county as they use lake water during emergency operations.

- Stop all sanctioned water related events (i.e., sport fishing tournaments) on the waterbody until appropriate containment protocols can be established.

- Watercraft inspection and decontamination stations

    - Establish inspection and decontamination requirements on boats and equipment

(following Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination (Elwell and Phillips 2021) and CDFW Aquatic Invasive Species Decontamination Protocol (Lake County will modify operations as standardized protocols are updated (if needed)).
    - Secure all operational needs to effectively implement mandatory decontamination, including decontamination units, associated decontamination equipment, signage, safety equipment, and data collection tools.
    - Ensure decontamination units are positioned at key points to capture the majority of watercraft exiting the waterbody.

- Implement mandatory inspection and decontamination of boats upon entry and exit of waterbody.

Dreissenid Mitigation by Water Purveyors

Dreissenids can colonize any surface where flows are less than 6.5 feet/second (O'Neill 1993). Costs associated with the management and control of dreissenid mussels varies with the extent of the mussel infestation in the source water and associated water treatment facility(ies), the complexity and size of the water treatment facility, the treatment goals, and other factors (Chakraborti et al. 2022). Maintaining adequate flow in pipelines and intakes adds to capital and annual operations and maintenance costs for a drinking water treatment facility (Chakraborti et al. 2022).

Most facilities apply chlorine or $KMnO_4$ to protect water intake structures, conveyance pipes, and pumps, whereas less common control methods included the use of chloramines and copper ion treatment (Chakraborti et al. 2022). The operations and maintenance (O&M) of 10 drinking water facilities addressing ongoing mussel infestations demonstrated operations and maintenance-based unit costs of mussel control varied from $34.32/mil gal for 1-mgd capacity to $12.63/mil gal for 2,640-mgd capacity. The capital cost and O&M-based equivalent annual unit cost for treatment varied from $78.56/mil gal for 1-mgd capacity to $13.41/mil gal for 2,640-mgd capacity, and costs for larger water treatment plants (i.e., >10 mgd) varied between $1.00/mil gal and $13.00/mil gal (Chakraborti et al. 2022). The Coachella Valley Water District, an irrigation supplier in Southern California, assesses a quagga mussel mitigation surcharge of $3.18-4.31 per acre-foot (2022 rates) (http://www.cvwd.org/documentcenter/view/5381), which pays for monitoring and to prevent dreissenid colonization in the Coachella Canal infrastructure (Nelson 2019).

Dreissenid Mitigation by Self-supply Drinking Water Systems

Self-supplied water users that extract their water from Clear Lake are not required to report their use. Currently, there is no estimate of self-supply domestic users, or the amount of water they withdraw for Clear Lake. Private residence water intake systems include an onshore component (pump and distribution pipes to residence) and an offshore component (the pipe from its intake in the lake to the onshore pump) (O'Neill 1993). Two strategies can address mussels in these systems: whole residence in-line filters that remove mussel veligers, and in-line chlorine injection systems, which kills mussel veligers, juveniles, and adults drawn into the system, which also address taste and odor issues caused by mussels (O'Neill 1993). Costs per Mg of water withdrawn to treat ranged from $1,345 for in-line filters and $7,348 for chlorine injection systems (O'Neill 1993).

Transition Goal

Upon an introduction of dreissenid mussels to Clear Lake, the initial goal is to avoid the risk of spreading mussels to other water bodies while follow-up sampling determines the extent of infestation. During this estimated six-week period, all watercraft leaving Clear Lake would be inspected and decontaminated at four inspection stations located around the perimeter to intercept all watercraft of Clear Lake. Ideally, these would be permanent watercraft inspection and decontamination stations already established prior to an introduction of dreissenids. Make night launching illegal (before 6am) at public and private ramps, and collaborate with enforcement agencies to monitor the parking areas and lakes.

The results of sampling efforts post-detection will determine if Clear Lake remains Suspect, or is elevated to Positive, or Infested, status. Regardless, longer-term response would require administration and oversight

of check stations to inspect and decontaminate all watercraft leaving Clear Lake. Implementation of a Local Boater Program, which identifies watercraft that recreate only in Clear Lake, would reduce staffing, equipment, and maintenance costs. Costs to operate the inspection stations includes initial capital costs for equipment and staff costs associated with training staff and operating check stations.

Short-Term Suspect Status

If Clear Lake is confirmed positive for dreissenid mussels, the lake will be considered Short-term Suspect. After the initial detection, follow-up sampling will occur while minimizing the risk of spreading mussels to other waters. Within one week, available resources will be necessary to perform required Clean, Drain, Dry exit inspections of all boats leaving the lake and decontamination of undrainable areas, such as ballast tanks. All watercraft leaving Clear Lake will receive a seal and paperwork to verify the watercraft received an exit inspection. Quick action will be needed to mobilize the necessary personnel and resources to effectively meet these obligations.

At Short-term Suspect Status, existing resources must be used to inspect, decontaminate, and seal boats. However, all financial support from the State of California ceases immediately upon detection, therefore it is imperative Clear Lake take steps now to create an emergency fund that can be used upon an initial detection. Immediately after initial detection, job announcements and requisitions should be prepared so personnel can be hired, and additional equipment can be purchased as quickly as possible.

Closures

Temporary, full closure of Clear Lake boat ramps and long-term closure of individual boat ramps to concentrate boating traffic are not recommended during the Short-term Suspect Status period. However, closure of shore launching is recommended during Short-term Suspect Status because vehicles accessing these areas do not encounter a check station. Night closure of boat ramps is recommended at this status level to ensure every vessel leaving Clear Lake receives an exit inspection. Boat ramps should be closed with a gate, or cable, and sign indicating the purpose and estimated duration of the closure. Hours when Clear Lake boat ramps are open will be ½ hour before sunrise to ½ hour after sunset. If a boat has not exited the water by ½ hour after sunset, it will remain in the water until the next day.
Temporary full closure of Clear Lake boat ramps is recommended if the lake is immediately classified from Short-term Suspect Status to Infested Status.

Staffing Plan

Inspection stations will need to be staffed by a minimum of two inspectors per station per day. Staffing levels will depend on the time of year and anticipated boating traffic but could require 3–14 individuals per week based on a 40-hour work week.

Supplies and Equipment

If Lake County does not have four established permanent watercraft inspection and decontamination stations upon detection of dreissenids, existing trailered and other decontamination units within the county can be used. Camper trailers may need to be secured to accommodate housing for personnel. Dynamic messaging signs (DMS) will be rented (one sign for each check station) to direct boaters to the exit inspection locations. Additional signage will explain boat ramp nightly closures, shore launch closures, and mandatory exit inspections.

Rapid Response – Long-Term Suspect Status

If initial follow-up sampling does not yield a positive result, Clear Lake would enter Long-term Suspect Status and remain at this level for up to three years if no additional positive samples are found. The goal during the Long-term Suspect Status period is to minimize the risk of spreading mussels to other waters. During the first year (from initial detection through the following boating season), capacity must exist for all non-local boaters exiting Clear Lake to efficiently obtain a required clean, drain, dry inspection, motor flush, and decontamination of ballast tanks and other undrainable areas. All watercraft leaving Clear Lake will receive a red seal and seal receipt to verify the watercraft received an exit inspection. Red seals will be designated for use on a suspect, positive, or infested water.

If there is no confirmation of dreissenid mussel presence after the first full boating season, efforts will

switch to a lower-level response, with a goal of contacting a significant number of boaters leaving the water but shifting the responsibility to the boater to obtain a required inspection. Inspectors will still conduct clean, drain, dry exit inspections on boats leaving the water and decontaminate ballast tanks and other undrainable areas. If feasible, all motors will continue to be flushed. If not, all outboard motors will be drained and only inboard/outboard and inboard motors will be flushed. Public outreach will increase and vary using multiple outlets to highlight the potential threat at the suspect water.

Closures

Except for shore launching, no closures of individual boat ramps are recommended during year 1 of a Long-term Suspect Status period. During years 2 and 3 of Long-term Suspect Status, shore launching may be allowed in some areas. Shore launching prohibited signs will be changed to communicate that an exit inspection is required.

Night closure of boat ramps is also recommended during year 1 of a Long-term Suspect Status to ensure that every vessel leaving Clear Lake receives an exit inspection. Hours when Clear Lake boat ramps are open will be ½ hour before sunrise to ½ hour after sunset. If a boat has not exited the water by ½ hour after sunset, it will remain in the water until the next day.

Check Stations

During years 1 through 3 of Long-term Suspect Status, the number and location of the four exit inspection stations will remain the same as for Short-term Suspect Status. Check station hours of operation will coincide with boat ramp hours (½ hour before sunrise until ½ hour after sunset).

Local Boater Program

A local boater program would minimize staffing levels and reduce wear and tear on equipment with fewer decontaminations. A local boater program should be implemented during year 1 of Long-term Suspect Status.

Rapid Response – Positive Status

Clear Lake will be considered positive for dreissenid mussels if two or more sampling events within a 12-month period meet the minimum criteria for detection (defined above). The goal during the Positive Status period is to minimize the risk of spreading mussels to other waters by providing capacity for all boaters coming off the water to efficiently obtain a required clean, drain, dry inspection, motor flush, and decontamination of ballast tanks and other undrainable areas. If live mussels are found on any boat during an exit inspection, they will be decontaminated, and consideration will be given to upgrading Clear Lake to Infested. All watercraft leaving Clear Lake will receive a red seal and paperwork to verify the watercraft received an exit inspection. All four permanent watercraft inspection stations will remain open from ½ hour before sunrise to ½ hour after sunset.

Closures

All shore launching is prohibited during Positive Status. Night closure of boat ramps is also recommended during Positive Status to ensure that every vessel leaving Clear Lake receives an exit inspection. Boat ramps will be closed with a gate, or cable, and sign indicating the reason for closure. Clear Lake boat ramps will be open will be ½ hour before sunrise to ½ hour after sunset. If a boat has not exited the water by ½ hour after sunset, it will remain in the water until the next day.

Rapid Response – Infested Status

Clear Lake will be considered Infested if an established (recruiting and reproducing) population of adult dreissenid mussels is found. The goal during Infested Status is to minimize the risk of spreading mussels to other waters by ensuring all boaters exiting the water are inspected and undergo decontamination. All watercraft leaving Clear Lake will receive a red seal and paperwork to verify the watercraft received an exit inspection. Boat ramp hours will undergo hour restrictions to ensure that watercraft decontamination does not occur during darkness (e.g., ramps close 2 hours prior to sunset). Lake County staff should consider an alternative method for identifying boats that cannot be decontaminated because check stations are understaffed.

Estimated Costs for Containment Operations

Containment of a dreissenid infestation will require

significant personnel for supervision, operation of inspection and decontamination stations; supplies in the form of new signage, decontamination units, possible water storage tanks for decontamination unit operation, hand held tablets to enter inspection and decontamination information, and watercraft seals; vehicles may be needed for personnel to travel between stations or to move equipment and supplies; housing for short-term inspection staff may be needed in peak watercraft access to Clear Lake this may come in the form of movable campers/trailers. Additional infrastructure may be needed to control access to the lake with removable barriers or gates.

There are examples of operations costs that have been assembled for other western waterbodies. These are provided for reference here; however Clear Lake containment needs may differ. Clear Lake is 1,155,000

Example 1. Flaming Gorge Reservoir Wyoming – Utah (excerpted from Flaming Gorge Reservoir, Flaming Gorge Unit of the Colorado River Storage Project Interagency Rapid Response and Control Plan for Dreissenid Mussels. https://wgfd.wyo.gov/Fishing-and-Boating/Aquatic-Invasive-Species-Prevention/AIS-Rapid-Response-Plans. Reservoir size: 3,778,700 acre feet. The estimates describe inspection and decontamination operations for a positive waterbody.

Expenditure Categories	Description	Quantity	Cost Each	Total Cost (U.S. dollars/annual)
Personnel	21 Technicians, Feb 22 - Dec 7	339 months	$2,160	$732,564
	3 Technicians, May 1 - Sep 30	15 months	$2,160	$32,400
	Extra help - holidays, etc.	1 month	$2,160	$2,160
			SUBTOTAL	**$767,124**
Vehicle	7 State Motor Pool Vehicles (8-9 mos. each)	62 months	$700	$43,400
			SUBTOTAL	**$43,400**
Supplies	Dynamic Message Signs	3	$17,000	$51,000
	Generators	2	$1,000	$2,000
	Water Pump for Sheep Creek	1	$500	$500
	Gas - generator, decon. units/ month	26	$700	$18,200
	Light Tower (2 per station)	6	$10,000	$60,000
	Misc. supplies and repairs - cost/mo.	26	$200	$5,200
	Tablets	5	$250	$1,250
	Replacement signs	15	$100	$1,500
	Posts and hardware	15	$18	$263
	Storage (Dec-Feb; cost/mo.)	81	$24	$1,944
	Seals	31,000	$0.03	$806
	Wire for seals	31,000	$0.09	$2,635
			SUBTOTAL	**$145,298**
Construction	HWY 191 exit inspection station construction	1	$250,000	$250,000
			SUBTOTAL	$250,000
			TOTAL	**$1,205,822**

Example 2. Keyhole Reservoir, Wyoming (excerpted from *Rapid Response Plan Following Detection of Dreissenid Mussels in Keyhole Reservoir, Wyoming*). Reservoir size 334,200 acre feet. The estimates describe inspection and decontamination operations for an infested waterbody.

Expenditure Categories	Description	Quantity	Cost Each	Total Cost (U.S. dollars/annual)
Personnel	Contract Biologist	8 months	$,543	$36,344
	Technician; 2 @ 8 months	16 months	$2,863	$45,808
	Technicians; 6 @ 6 months	36 months	$2,863	$103,068
	Technicians; 6 @ 3 months	18 months	$2,863	$51,534
			SUBTOTAL	**$236,754**
Vehicle	State Motor Pool Sedan 1	8 months	$500	$4,000
	State Motor Pool Sedan 2	8 months	$500	$4,000
			SUBTOTAL	**$8,000**
Travel	Camp Groceries (person days)	1,558	$24	$37,392
			SUBTOTAL	**$37,392**
Supplies	Camp Trailers	2	$20,000	$40,000
	Office Trailers	2	$20,000	$40,000
	Signs (one-time expense)	2	$500	$1,000
	Signs (local boat, infestation, decon)		$2,000	$2,000
	Recirculating Decontamination Unit	1	$300,000	$300,000
	Well drilling - East Side Check Station	1	$20,000	$20,000
	Asphalt - East Side Check Station	1	$50,000	$50,000
	Electrical to East Side Check Station	1	$25,000	$25,000
	Trailer slip rental (nights)	92	$45	$4,140
			SUBTOTAL	**$482,140**
			TOTAL	**$764,286**

Sources of Funding for Dreissenid Response and Containment

Numerous existing and potential sources of funding can support dreissenid efforts in Clear Lake. Some of the sources of funding listed below have specific uses, (e.g., some cannot be used for anything other than prevention efforts). Those listed here have the potential for Lake County to solicit funding to amplify prevention efforts, (e.g., permanent watercraft decontamination stations).

Federal

- U.S. Fish and Wildlife Service Quagga and Zebra Mussel Action Plan (QZAP) grant funding—This grant funds proposals listed in principal areas towards the fulfillment of the top priorities in the QZAP for western U.S. waters, including limiting the spread of invasive mussels via containment (e.g., inspection and decontamination of watercraft moving from invaded water bodies to jurisdictions free of dreissenids). Maximum grant award is $600,000. Grant announcement contact: Barak Shemai, barak_shemai@fws.gov.
- U.S. Fish and Wildlife Service North American Wetlands Conservation Act (NAWCA) Small Grants—This program is a competitive, matching grants program that supports public-private partnerships implementing projects in the United States that further the goals of NAWCA. Maximum grant award is $100,000. Grant announcement contact: Rodecia McKnight (Rodecia_McKnight@fws.gov).
- U.S. Bureau of Reclamation Invasive Dreissenid Mussel Activities (2024)—The Bureau of Reclamation has been funding about $2.6 annually for the past several years for projects that:
    - support Reclamation needs and impacts;
    - support one or more of the seven QZAP categories essential to dreissenid mussel management;
    - demonstrate mature planning/coordination, readiness to proceed, and pose a funding request that is reasonable, realistic, and commensurate with the approach; and
    - stimulate broader coordination and additional action on mussel management.

Regional

- The Westside Sacramento Integrated Regional Water Management (IRWM) Plan (https://www.westsideirwm.com/) provides grant funding for water management as well as emergency disasters. This small grant program provides a maximum of $25,000 per projects that align with its regional priorities, which include protecting and enhancing habitat and biological diversity; preserving, improving, and managing water quality for beneficial uses; and improving watershed and ecosystem education and awareness. Response and containment may qualify for this funding source.

State

Currently, no state funding sources exist for Lake County/Clear Lake to transition to containment. Upon an initial detection, **all prevention funding from the state ceases immediately**.

Fee-based, user funding

Recreational registered watercraft

- Per California Code of Regulations, Title 14, Section 5201, the State of California requires owners of motorized recreational vessels used in freshwater to purchase from the Department of Motor Vehicles an annual sticker, which is separate and in addition to the vessel registration. Funding from these stickers supports prevention efforts via a grant program administered by the California Division of Boating and Waterways.
    - The mussel fee amount shall be $8 when first paid during an even-numbered calendar year and $16 when first paid during an odd-numbered calendar year. The mussel fee amount shall be $16 thereafter and shall be valid for a period of two calendar years. The mussel fee sticker shall be valid through December 31 of every odd-numbered year.
- Per Lake County regulations, all vessels launched in Lake County water bodies must have a Lake County Quagga/Zebra sticker (in addition to the sticker noted above) (https://www.nomussels.com/). Resident and visitor stickers are $20. The total number of stickers

sold to residents and visitors and the total income received from 2016–2022 was $832,180 and $1,124,580, respectively (Table 4, Figure 11). The average income in 2016–2022 from sticker sales to residents and visitors was $166,436 and $224,916, respectively. These funds could be used for response and containment.

Seaplanes

- Seaplanes have the potential to introduce or spread dreissenids and other aquatic invasive species. An event, called the Clear Lake Splash In: Wings, Water & Wine (https://www.facebook.com/splashin/about), was hosted annually at Clear Lake (excluding 2022, when the event was canceled, in part because of the exceptionally low water level of Clear Lake). The Splash-In was one of the largest seaplane fly-ins on the West Coast. The event was organized by the Lake County Chamber of Commerce. Lake County Quagga/Zebra stickers were issued to seaplane pilots to land on the lake.

Table 4. Total number of stickers sold to residents and visitors, and income received, from 2016–2022.

Year	# Resident Stickers Sold	# Visitor Stickers Sold	Total Income from Sticker Sales
2016	6,987	9,561	$330,960
2017	8,978	6,279	$305,140
2018	5,849	7,763	$272,240
2019	6,282	8,872	$303,080
2020	4,981	8,480	$191,233
2021	4,939	8,851	$186,501
2022	3,593	6,423	$135,577

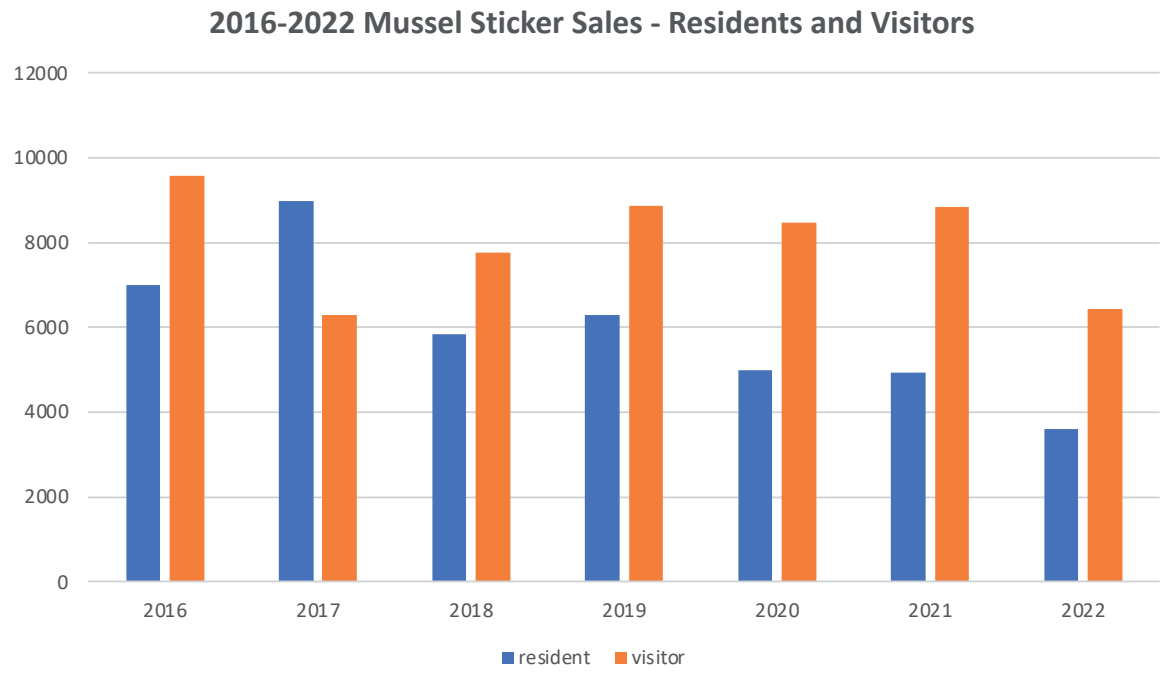

Figure 11. Mussel sticker sales to residents and visitors, 2016–2022.

CHAPTER SIX 6

Permanent Decontamination Station Feasibility Analysis

If eradication of dreissenids is not possible upon detection, actions must be taken to prevent spread of mussels from Clear Lake to other water bodies. Installation of adequate water/energy efficient watercraft decontamination stations must be completed to ensure that all watercraft leaving Clear Lake have no mussels on board, either attached to the vessel or floating in vessel/engine compartments, bilges, and other places that hold water.

Options for decontamination stations:

- Fixed base systems ($225,000 to $450,000)—Hydro Engineering, LLC (https://www.hydro-blaster.com) produces high-capacity fixed based systems consisting of a Hydrosite insulated equipment building connected to utilities (water, power, and fuel) as well as portable systems. Permanent decontamination stations range from $225,000 (single station systems with one wash pad – drive on, drive off ramp) to $400,000-plus multiple (4-station) systems (e.g., 2 wash pads).

- Dip Tank ($800,000)—Clean Wake LLC (https://www.cleanwake.net/) developed a dip tank that lowers a boat into the tank and fills and empties the ballast tank while the watercraft engine is running. This type of system was first used in Utah in 2021, and decontaminates vessels faster than manual decontamination, including those with complex systems.

The Model Regulation for State Watercraft Inspection and Decontamination Program (Otts and Nanjappa 2016) notes an agency may establish inspection stations:

- At or along publicly accessible boat ramps and conveyance launch sites, roads and highways

- At ports of entry (if the Department of Transportation authorizes the agency to use the port of entry);

- At agency facilities;

- Where there is a high probability of intercepting conveyances transporting aquatic invasive species.

- Where there is typically a high level of boat and trailer traffic; and/or

- Where the inspection of conveyances will provide increased protection against the introduction of aquatic invasive species into a water body. In addition, Otts and Nanjappa (2016) encourages stations be sited in locations that are convenient and readily accessible to boaters, in locations with the greatest chance of intercepting high-risk conveyances, and in locations with adequate space for conveyances to be stopped, inspected, and in some cases, decontaminated, without presenting a safety risk or significantly interfering with the public's use of the waterbody or highway. Otts and Nanjappa (2016) also emphasize environmental considerations if decontamination occurs at an inspection station because of the need for proper handling and disposal of potentially

contaminated effluent.

Other criteria to consider:

- Locations that intercept the greatest number of watercraft.
- Fishing tournament watercraft launch locations.
- Proximity or accessibility to water, power, and sewer connections.
- Surface, slope, and distance to Clear Lake.
- Traffic patterns that capture major/preferred routes.
- Traffic patterns at proposed station location (e.g., safety considerations including preventing left-hand turns across lanes, overflow of waiting watercraft, surrounding speed limit allows ease of access and if not then adequate signage).
- Area surrounding station has clear control points to prevent boats from launching/leaving until they have been decontaminated.
- Minimal disturbance to natural landscape.
- Adequate space to house decontamination unit, structure for staff to remain safe, structure to house operational equipment, etc.
- Near interstate roads coming into county from direction of infested waterbodies (Hwy 20 by Hwy 53).
- Near or at County- or City-owned property or empty/vacant parcel that could be acquired with minimal capital.
- Near City/County services to tap into municipal water and special districts water treatment lines for the discharge.
- A location that is easily accessible and County/City owned in Lakeport.
- Use of www.AISexplorer.umn.edu may be considered for prioritization of inspection stations.

Based on these criteria and ingress and egress associated with Clear Lake, likely locations for permanent stations are Upper Lake Park or Upper Lake Roads Yard, Moose Lodge, Konocti USD Bus Yard or the industrial area north of the town of Clear Lake, the Vista Point Shopping Center, or the Lakeport Public Works Yard (Figure 12) as well as the interaction of highways 29 and 175, which is government-owned land.

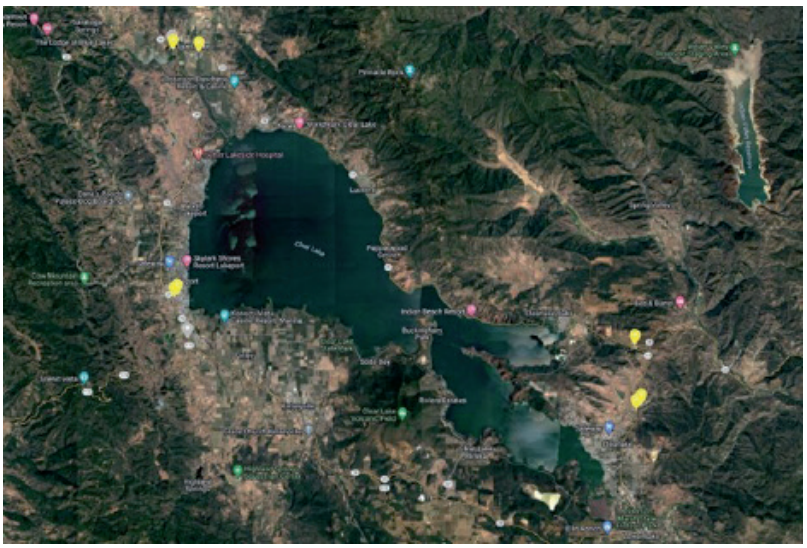

Figure 12. Potential locations for permanent watercraft inspection and decontamination stations (yellow mark) based on the criteria for establishing stations.

Case Studies: Optimizing the Location of Watercraft Inspection Stations

These case studies illustrate a variety of factors that can be considered when developing policy associated with citing watercraft inspection and decontamination stations.

Case Study #1 – Stearns County, Minnesota

An integer programming model was developed to allocate scarce inspection resources among lakes with a county, using species-specific infestations status of lakes and estimates of boat movement among lakes to maximize the number of high-risk boats inspected (Haight et al. 2021). High-risk boats were defined as those that move from infested to uninfested lakes. Modelers determined locating inspection stations at infested lakes that have the greatest number of boats moving to uninfested lakes both inside and outside the county would achieve the objective of protecting uninfested lakes. Alternatively, locating stations at both infested and uninfested lakes having the highest-risk boats arriving from within and outside the county and departing to in-county lakes would achieve the objectives of protecting only county lakes. The authors noted the tradeoffs between the objectives is significant.

Case Study #2 – British Columbia

Watercraft inspection policies that prevent the spread of dreissenids can be optimized under budget constraints using linear integer programming techniques (Fischer et al. 2020). Authors noted that inspection stations should be placed close to the border of the uninfested region (emphasizing cross-border collaborations between uninvaded jurisdictions); if traffic flows merge close to the border, inspections are most cost-effective after the merging point; if traffic predictions involve a high level of uncertainty, inspection efforts should be distributed over many locations; and if a high reduction of propagule inflow is desired, it may be cost-effective to implement measures increasing the compliance rate rather than operating more inspection stations for longer hours.

Case Study #3 – Deep Creek Lake, Maryland

Deep Creek Lake in Maryland sought to reduce the number of instances of visiting watercraft arriving at the lake contaminated with aquatic invasive species (Chase et al. 2020). Defining barriers and behavior drivers is critical to changing human behavior. The study determined that the Deep Creek Lake website and associated Maryland Department of Natural Resources sites were disconnected and difficult to navigate, including difficulty accessing information on boat launch inspection and aquatic invasive species prevention measures. Recommendations included enhancing community partnering to improve communication in the tourism community and leverage nonprofit organization funding grants, creating focus groups through boater/fishing license registrations or in-person launch steward interactions to define barriers/drivers to behavior change, improving website design, streamlining digital media to coherently and consistently communicate AIS impacts, prevention, and expected actions, and empowering boaters with on-site cleaning equipment at high-use ramps.

Suggested Training for Watercraft Inspection and Decontamination Program Staff

If the District determines that mandatory watercraft decontamination operations would be conducted, proper staff training and equipment will be needed to ensure that operations meet minimum guidelines to prevent the spread of dreissenids. The minimum standards for programs are based on the Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination (2021). The goal of a watercraft decontamination is to remove and kill dreissenid mussels from watercraft. The basis for standard procedures is derived from applied studies that examined the lethal times and temperatures of hot water for dreissenid mussel mortality. Watercraft decontamination procedures not only include proper use of the equipment, but also personal safety, watercraft owner permission, and detailed documentation.

There are several documents that regional AIS programs align with when conducting decontaminations, including:

- Uniform Minimum Protocols and Standards for Watercraft Inspection and Decontamination in the Western United States (Elwell and Phillips 2021)
- Watercraft Inspection and Decontamination Manual (Western Regional Panel on ANS 2023)
- Watercraft Inspection and Decontamination Trainer's Manual (Western Regional Panel on ANS 2021)

All staff conducting decontaminations must complete training that provides a thorough understanding of the risks from invasive species and the role that watercraft play in their spread, as well as full knowledge of the proper use of all decontamination equipment. Most comprehensive watercraft inspection and decontamination programs conduct annual training events based on the curriculum noted above. Training typically occurs during a 2-day period, and includes both classroom and hands-on activities to familiarize staff with basic steps on watercraft decontamination. Different types of watercraft (size and complexity) require different amounts of time to complete decontamination, therefore training should include different watercraft types. Multi-day training is offered regularly by Pacific States Marine Fisheries Commission (see https://www.westernais.org/, Training menu tab) and Tahoe Regional Planning Agency. Appropriate decontamination units are also an important part of the decontamination process. Minimum standards for both trailered and non-trailered units can be accessed at https://westernregionalpanel.org/key-documents. Adhering to the guidelines presented in the documents in the bulleted list (above) will align Lake County program operations with western regional programs. County staff could consider the use of on-the-job training that could follow immediately after hire to enforce objectives that were covered during the training.

CHAPTER SEVEN 7

Management Recommendations

This section of the document includes a suite of recommendations the District could implement to enhance its readiness to respond to an introduction of dreissenids to Clear Lake and transition to containment.

Funding

a. Develop a $1,000,000 to $1,500,000 emergency fund to prepare for an introduction of dreissenids to Clear Lake and neighboring water bodies.

b. Consider changes to mussel sticker pricing to increase the cost of stickers to non-resident boaters and seaplane pilots.

c. Consider establishing a mussel sticker for non-motorized non-resident watercraft.

d. Consider establishment of a local municipal fee to offset and support operational expenses of prevention and containment programs.

e. Consider a county ordinance that establishes special event fees for recreational activities occurring on Clear Lake (e.g., fishing tournaments, etc.) (see Appendix I).

Reporting

a. Develop an online reporting system that requires self-supplied water users to register their water use with the District and to create a database of self-supplied water users for notification purposes. Create a database of self-supplied water users.

b. Develop and implement a monitoring program by self-supplied water users with intake sources (e.g., citizen science monitoring).

c. Increase and diversify monitoring operations annually to reach maximum capacity for sampling.

Capital Expenditures

a. Purchase and staff four permanent watercraft inspection and decontamination units for both existing prevention and potential future containment purposes.

b. Work with other government agencies and landowners to find suitable locations for stations.

c. Purchase adequate signage and work with local Caltrans maintenance staff to sign inspection stations.

d. Acquire all necessary infrastructure for safe and successful WID station operations.

Containment and Control

a. Initiate long-term containment program to prevent the spread of invasive mussels (and other AIS) to other water bodies via overland transport.

b. Initiate internal ongoing evaluation of WID programming to identify areas of compliance, improvement, and redundancy.

c. Consider using the Tahoe Regional Planning Agency model to staff inspection stations, make appointments for boat decontaminations, and purchase decontamination units.

d. Convene regional water body managers to discuss and strategize citing watercraft inspection and decontamination stations for all water bodies in the region.

Fishing Regulations

a. Consider revising Clear Lake fishing regulations (CDFW) to reduce the allowable daily take of redear sunfish because they have been proven to remove adult quagga mussels efficiently while suppressing growth and recruitment when stocked at a high density (0.42 fish/m^3 or 1.90 fish/m^2) (Wong et al. 2012).

b. Consider habitat enhancements for Clear Lake to improve habitat for redear sunfish. Note: Lake County is promoting a natural shoreline program that encourages property owners along the edge of Clear Lake to remove hardscapes and encourage natural habitat. Shoreline ordinance amendments (in progress at the time of this report) will increase costs and processes associated with installation of hardscapes.

Collaboration

a. Conduct periodic preparedness exercises with regional partners and collaborators to identify areas for improvement.

b. Work with regional water body managers to mirror and advance funding, reporting and containment recommendations.

c. Work with county water body managers to foster prevention-to-containment processes that result in maintained recreational opportunities and self-water user abilities; serve as a model for other California affected water bodies and regions.

d. Work with collaborators to better connect water use values with protection of the lake from invasive species.

e. Create an inventory of equipment and resources available locally/regionally in the event of an infestation or a determination is made to implement a control action.

f. Identify suitable communication pathways for reporting detections of dreissenid mussels for “on-hours” and “after-hours” situations.

g. Update regional waterbody manager contact information.

h. Convene stakeholders to assess pros/cons of various biological and chemical treatments associated with ecosystem and human health risk assessments.

Local Ordinances

a. Develop and adopt ordinance that requires sticker purchase by non-motorized boat owners.

b. Develop and adopt ordinance that requires mandatory decontamination for motorized, non-motorized watercraft, and seaplanes upon exiting an infested waterbody.

c. Propose changes to other ordinances as described in section Recommended Amendments to Ordinances in Chapters 15 and 23 and other Code Ordinances in this document.

d. Consider amending the ordinance to mandate that property owners with access to the lake post county-supplied signage stating QZ program requirements.

e. Clearly state in the ordinance the primary county authority that has responsibility for enforcing mandatory watercraft decontamination when watercraft leave an infested waterbody.

f. Require property owners with short-term/vacation rentals to include verbiage about AIS inspections and QZ program requirements in their house rules.

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Appendices

Appendix A. List of Surface Water Systems that Draw from Clear Lake.

Appendix B. Clear Lake Marinas, Boat Rentals, Public Boat Launches, Marine Services, and Sailing Facilities.

Appendix C. Current Invasive Mussel Screening Locations.

Appendix D. California Regulations Pertaining to Dreissenids.

Appendix E. CDFW Quagga Mussel Observation Report Form.

Appendix F. SAMPLE Draft press release, flier, door hanger, and social media post.

Appendix G. Potential Permit Considerations for a Clear Lake Dreissenid Control Action.

Appendix H. Examples of Water Body Monitoring Strategies that can be Employed in Water Bodies in Which Dreissenids Have Been Detected.

Appendix I. Sample County Ordinance and Potential Clear Lake Fishing Contest Activity Fee Schedule.

Appendix A. List of Surface Water Systems that Draw from Clear Lake.

#	Public Water System ID	System Name	Contact Person	Phone #/Email	Wastewater Treatment Plant Class	# Water Connections
1	CA1710011	Buckingham Park Water District	Ahimsah Wonderwheel	(707) 279-8568/ gm@buckinghamparkwater.us	T3	457
2	CA17100546	Clear Water Mutual Water Company	Michael Reust	(707) 349-0022 clearwtr.water@sbcglobal.net	T3	90
3	CA1710001	Clearlake Oaks County Water District	Dianna Mann	(707) 998-3322 d.mann@clocwd.org	T3	1,961
4	CA1700519	Crescent Bay Improvement Company	Mary Benson	(707) 994-1005 mary.benson.ca@gmail.com	T2	24
5	CA1710002	Golden State Water Company Clear Lake System	Keith Ahart	(707) 994-6035 kahart@gswater.com	T3	2,104
6	CA1700568	Harbor View Mutual Water Company	Jerimiah Fossa	(707) 994-9944 Jeremiahfossa@yahoo.com	T3	248
7	CA1710003	Highlands Mutual Water Company	Magen Estep	(707) 994-2393 magen@highlandswater.com	T4	2,877
8	CA1710006	Konocti County Water District	Frank Costner	(707) 994-2561 kcwd@mchsi.com	T4	1,796
9	NA - Private	Konocti Harbor Resort & Spa	Ken Lambert	(707) 461-9203 rhamel@konoctiresort.com; klambert@konoctiresort.com	T2	NA
10	CA1710022	Lake County CSA 20 (Soda Bay)	Scott Harter/ Scott Hornung	(707) 263-0119/ (707) 263-0119 scott.harter@lakecountyca.gov scott.hornung@lakecountyca.gov	T3	647
11	CA1710021	Lake County CSA 21 (North Lakeport)			T3	1,196
12	CA1710004	City of Lakeport	Paul Harris	(707) 263-5615 (ext. 402) pharris@cityoflakeport.com	T4	2,232
13	CA1710005	California Water Service – Lucerne	Meaghann Tenuta	(530)433-8737 mtenuta@calwater.com	T4	1,209
14	CA1710014	Mt. Konocti Mutual Water Company	Alan Farr	(707) 277-7466 mkonocti@yahoo.com	T3	1,572
15	CA1710008	Nice Mutual Water Company	David Fultz	(707) 274-1149 nicemwmng@mchsi.com	T4	1,064
16	CA17100603	Richmond Park Resort	Carl Olson	(415)721-0772 cedolson@yahoo.com	T3	30
17	CA1700584	Westwind Mobile Home Park	Bill Lee	(503) 702-3955 billkimlee@comcast.net	T2	38

Appendix B. Clear Lake Marinas, Boat Rentals, Public Boat Launches, Marine Services, and Sailing Facilities.

Marina	Address	Facilities	Contact Information
Braito's Buckingham Marina	1555 Eastlake Drive Kelseyville, CA	Launch Ramp, Dock (covered and open slips, dry storage), facilities (boating repairs and accessories)	(707) 279-4868
Blue Fish Cove Resort	10573 East Highway 20, Clearlake Oaks, CA	Launch Ramp, Dock (slips), facilities (picnic area, fish cleaning stations, fishing pier, private swimming beach, lodging)	(707) 998-1769
Konocti Vista Casino Resort and Marina	2755 Mission Rancheria Rd Lakeport, CA	Launch Ramp (free for hotel guests), Dock (slips), facilities (gas, convenience store, parking for boats and trailers, casino, hotel)	http://www.kvcasino.com/
Clear Lake Cottages & Marina	138885 Lakeshore Drive Clearlake, CA	Launch Ramp, Dock (10-slip marina, $10/night), facilities (trailer parking, electrical hookups at marina, swimming pool, Wi-Fi, lodging)	(707) 995-5253
Clear Lake Vista Resort	6190 Soda Bay Road Kelseyville, CA	Launch Ramp (free for resort guests, $10 for others), dock (free to resort guests), facilities (fuel dock, store, Restaurant, bait shop, lodging, kayak rentals)	http://www.kvcasino.com/

Boat Rentals	Address	Facilities	Contact Information
Disney's Boat Rentals	401 S. Main St Lakeport, CA	Jet skis, kayaks, pedal boats, paddleboards, ski and touring boat, ski/wake boat w/ tower, 115HP deluxe patio boat, fishing boat with trolling motor	(707) 263-0969

Marine Services	Address	Facilities	Contact Information
Bayshore Marine Service	7723 Hwy 29 Kelseyville, CA	Marc Linscott	(707) 279-1094 support@bayshoremarineservice.net
McAtee's Marine Repair	90 Soda Bay RD Lakeport, CA	Garret and Debi McAtee	(707) 263-0440 mcateesmarine707@gmail.com
White & Sons Boatworks		Ryan and Pilar White	(707) 279-1325 ryan@wsboatworks.com

Clear Lake Public Launch Ramps	Address	Facilities	Contact Information
Redbud Park (city park)	14655 Lakeshore Drive Clearlake, CA	Restrooms, fishing pier, park	(707) 994-8201, ext. 131
Clear Lake State Park (fees apply)	5300 Soda Bay Rd Kelseyville, CA	Docks, swimming, restrooms, picnic area, camping	(707) 279-2267
Library Park (3) (city park)	222 Park Street Lakeport, CA	Docks, swimming	(707) 263-3578 PWinfo@cityoflakeport.com
Lakeside County Park	1985 Park Street Lakeport, CA	Swimming, restrooms, picnic	(707) 262-1618
Lucerne Harbor (county park)	6225 E Hwy 20 Lucerne, CA	Fishing pier, picnic, restrooms	(707) 262-1618 parks@lakecountyca.gov
Rodman Slough County Park (undeveloped)	1005 Nice/Lucerne Cutoff Lakeport, CA	Primitive ramp, swimming, picnic	(707) 262-1618
Clearlake Oaks	12684 Island Dr Clearlake Oaks	Fishing pier, swimming, restrooms, picnic	(707) 262-1618
Nice Community Beach	647 Lakeshore Dr Nice, CA	Fishing pier, restrooms, swimming	(707) 262-1618
Keeling County Park	3000 Lakeshore Dr Nice, CA	Fishing pier, restrooms, picnic, swimming	(707) 262-1618 parks@lakecountyca.gov

Sailing/Boat Tours	Address	Facilities	Contact Information
Disney's Boat Rentals	401 S. Main St Lakeport, CA	Jet skis, kayaks, pedal boats, paddle-boards, ski and touring boat, ski/wake boat w/tower, 115HP deluxe patio boat, fishing boat with trolling motor	(707) 263-0969
Konocti Bay Sailing Club	1555 Eastlake Dr Kelseyville, CA	Sponsors events at Clear Lake	(707) 572-KBSC
Clear Lake Sailing Charters	Lakeport, CA	Scott Bennett, Captain	(707) 349-2584
Lakeport Yacht Club	PO Box 313 Lakeport, CA	Promotes sailing and power boating; holds regattas and other boating events	(707) 263-5078

Appendix C. Current Invasive Mussel Screen Locations.

Entity	Address	Days/Hours Open	Phone
Indian Beach Resort	9945 Hwy 20, Clearlake Oaks	Everyday 7:00am- 6:00pm	707-998-3760
Limit Out Tackle	12607 E. Hwy 20, Clearlake Oaks	Mon-Sun 6:00am-5:00pm	707-998-1006
Clearlake Bait & Tackle	14699 Lakeshore Dr., Clearlake	Mon-Thur 6:00am-5pm, Fri-Sat 6:30am-6pm Sun 6:30am-2pm	707-994-4399
Clear Lake Campground	7805 Cache Creek Way, Clearlake	1:00pm-4:00pm daily, by appointment	707-994-2236
McAtee's Marine Repair	3450 Hill Road, Lakeport	Mon-Fri 8:00am-5:00pm	707-263-0440
Hillside Powersports	460 S. Main St, Lakeport	Tues-Sat 9:00am-3:00pm	707-263-9000
Clearlake Outdoors	96 Soda Bay Rd., Lakeport	Mon-Sat 7:00am-6:00pm, Sun 7:00am-5:00pm	707-262-5852
Lake County Chamber of Commerce	875 Lakeport Blvd., Lakeport	Mon-Fri 9:00am-5:00pm	707-263-5092
Konocti Vista Casino Resort Marina	2755 Mission Rancheria Rd., Lakeport	Seven days a week 7:00am-Midnight	707-262-1900
Skylark Shores	1120 N. Main St., Lakeport	Seven days a week 8am-8pm	707-263-6151
Braito's Marina	1555 East Lake Drive, Kelseyville	9:00am-4:00pm daily	707-279-4868
Clearlake State Park	5300 Soda Bay Road, Kelseyville	Sun - Fri 8:00am- 6:00pm, Sat-9:00am- 5:00pm	707-279-4293
Kelseyville Lumber & Supply Co.	3555 N. Main Street, Kelseyville	Mon-Fri 7:00am-5:30pm, Sat 8:00am-5:30pm, Sun 8:00am-4:30pm	707-279-4297
Borenbega	9080 Soda Bay Road, Kelseyville	Please call, by appointment	707-530-4541
Clear Lake Vista Resort	6190 Soda Bay Road, Kelseyville	9:00am-5:00pm daily	707-289-4017
Lake Builders Supply	3694 Highway 20, Nice	Mon- Fri 7:30am- 5:30pm, Sat-Sun 8:00am- 5:00pm	707-274-6607
Narrows Resort	5690 Blue Lakes Rd, Blue Lakes	Call Ahead	707-477-8360
Konocti Bait Shop	6199 Hwy 20, Lucerne	Call Ahead	707-349-8963
Lake Pillsbury Resort	2756 Kapronos Rd, Potter Valley	Call for summer hours	707-743-9935
Soda Creek Store	26853 Elk Mountain Road, Potter Valley	Seven days a week 9:00am-9:00pm	707-743-2148
Suzanne L-B	Indian Valley Reservoir, Mobile	Call for Appointment	707-489-6792
Bob Sullivan Screening	Flexible, Mobile	Flexible, by appointment	707-337-0480
Conrad Clobrandt	Flexible, Mobile	Call for Appointment	707-245-9181
Mark Holloway	Flexible, Mobile	Call for Appointment	707-295-9112
Robert Valdez	Flexible, Mobile- Lakeport/ Kelseyville	Call for Appointment	408-691-7726

Appendix D. California Regulations Pertaining to Dreissenids.

California Aquatic Invasive Species Regulations (updated 12/16/2022)

California Aquatic Invasive Species Statutes (updated 12/16/2022)

Comparison of California's watercraft inspection and decontamination programs to the model legal framework (2018)

California Environmental Quality Act (CEQA) (CA Public Resources Code 21000 et seq)—Requires public disclosure of all significant environmental effects of proposed discretionary projects. If a project is estimated to cause significant effects, documents must describe the mitigation measures and provide justifications for approval of the project with significant effects left unmitigated.

California Porter-Cologne Water Quality Control Act (CA Water Code 1300 et seq)—A report of any discharge of waste within a region that could affect the quality of waters of the state must be filed with the appropriate Regional Water Quality Control Board. The State Water Resources Control Board considers application of pesticides to control aquatic invasive species in waters of the state as discharge of a pollutant requiring an NPDES permit.

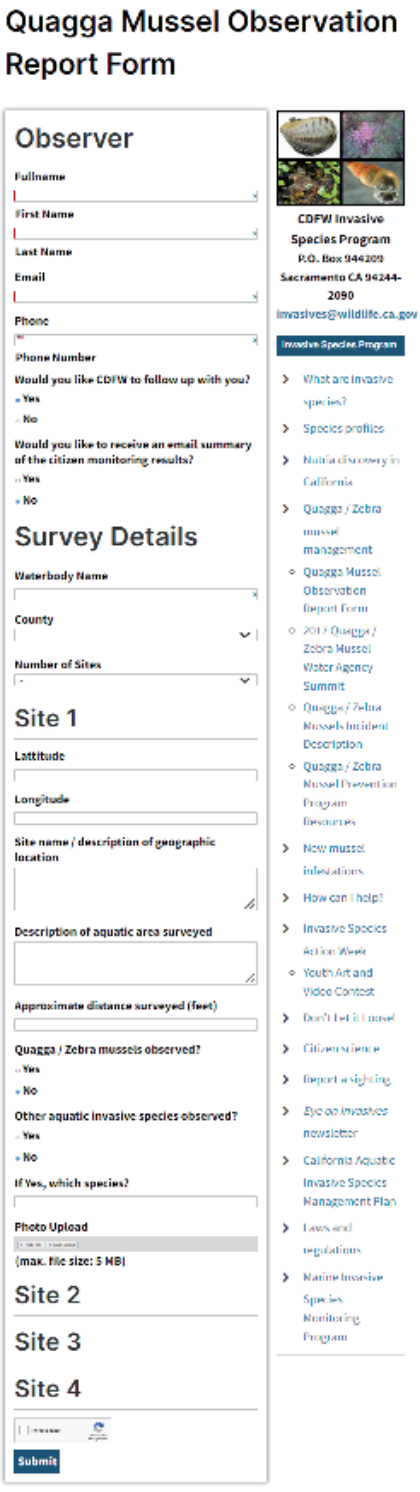
Fish and Game Code and Title 14 of the California Code of Regulations

- Fish and Game Code Section 2301 and 2302
- California Code of Regulations, Title 14 Section 672, 672.1 and 672.2

The importation or interstate transport of zebra and quagga mussels is prohibited by the federal Lacey Act, 16 U.S.C. §§ 3371-3378 (for current list of injurious wildlife: https://www.fws.gov/injuriouswildlife/pdf_files/Current_Listed_IW.pdf.

Appendix E. CDFW Quagga Mussel Observation Report Form.

https://wildlife.ca.gov/Conservation/Invasives/Quagga-Mussels/Observation-Report



Quagga Mussel Observation Report Form

Observer

Fullname

First Name

Last Name

Email

Phone

Phone Number

Would you like CDFW to follow up with you?

- Yes
- No

Would you like to receive an email summary of the citizen monitoring results?

- Yes
- No

Survey Details

Waterbody Name

County

Number of Sites

Site 1

Latitude

Longitude

Site name / description of geographic location

Description of aquatic area surveyed

Approximate distance surveyed (feet)

Quagga / Zebra mussels observed?

- Yes
- No

Other aquatic invasive species observed?

- Yes
- No

If Yes, which species?

Photo Upload

(max. file size: 5 MB)

Site 2

Site 3

Site 4

Submit

CDFW Invasive Species Program
P.O. Box 944209
Sacramento CA 94244-2090
invasives@wildlife.ca.gov

Invasive Species Program

- What are invasive species?
- Species profiles
- Nutria discovery in California
- Quagga / Zebra mussel management
  - Quagga Mussel Observation Report Form
  - 2017 Quagga / Zebra Mussel Water Agency Summit
  - Quagga / Zebra Mussels Incident Description
  - Quagga / Zebra Mussel Prevention Program Resources
- New mussel infestations
- How can I help?
- Invasive Species Action Week
  - Youth Art and Video Contest
- Don't Let It Loose!
- Citizen science
- Report a sighting
- *Eye on Invasives* newsletter
- California Aquatic Invasive Species Management Plan
- Laws and regulations
- Native Invasive Species Monitoring Program

Appendix F. SAMPLE Draft Press Release, flier, door hanger, and social media post.

Contact: Angela DePalma-Dow, Water Resources Department, County of Lake, CA, 255 N. Forbes St. Lakeport, CA 95453, O: (707)263-2344, C: (530)304-1809

The County of Lake Water Protection District (LCWPD) has declared Clear Lake a "suspect location" for infestation of invasive mussels. This report has been initially verified by California Department of Fish and Wildlife.

Efforts are underway to determine the extent of the invasive mussel infestation. This discovery is a serious environmental and economic concern for Clear Lake, Lake County water bodies, and Northern California. Invasive quagga and zebra mussels are small nonnative freshwater mollusks that have caused major problems in the United States after their introduction in the 1980s.

Officials have not yet determined how these mussels entered Clear Lake. Recreational boats are known to be a major vector of invasive mussel spread in the United States, and there are a number of past incidents where boats fouled by invasive mussels have been intercepted prior to launching in waters in the western states.

In preparation for an introduction of invasive mussels in Clear Lake, officials developed a rapid response and transition to containment plan outlining a set of actions to address the initial finding and monitor the situation long term.

Until additional surveys are conducted, the extent of the infestation is unknown. During this phase of rapid response, the District has closed all access to Clear Lake (through the Lake County Sheriff and use of Ordinance 31) to help prevent further potential dispersal of the invasive mussels. The public can help by avoiding Clear Lake and following general guidelines to prevent the spread of invasive mussels. Boaters should clean, drain, and dry all boats, trailers, and other equipment after leaving a lake or stream and never release any live organisms into the wild.

The District's Angela DePalma-Dow administers Clear Lake's boat inspection program and commented on its importance. "We recognize the inconvenience to boaters and understand the need for additional sampling and identification to determine if this water body is positive for quagga mussels," said DePalma-Dow. "Our staff will ensure that boats will go through the inspection process as efficiently as possible."

Boaters can assist with the process by arriving at Clear Lake with a clean, drained, and dry vessel. For more information, visit the District's website at https://www.nomussels.com/.

##

Invasive Mussels Found in Clear Lake

What is the situation?

Invasive aquatic mussels were recently detected in Clear Lake. Sampling is continuing at the suspect locations, and the results will be used to develop a response plan.

What are invasive mussels?

Zebra and quagga mussels are small (¼ to 1½ inch long) freshwater mollusks with yellow and brown striped shells. Both mussel species can attach to hard surfaces in the water of lakes and rivers, and quagga mussels also attach to soft surfaces. Their microscopic larvae, called veligers, attach to suitable substrates to grow.

Why are we concerned?

Zebra and quagga mussels can:

- Disrupt the food chain in the lake, negatively affecting fish and other wildlife
- Reduce property values
- Increase costs to maintain and deliver water because of clogged, fouled, or contaminated water delivery infrastructure
- Result in fishing tournament and boating restrictions
- Increase costs to maintain docks and ramps
- Foul beaches and shorelines with sharp shells
- Increase costs to maintain encrusted boats and engines

What is LCWPD doing about invasive mussels?

Lake County Water Resources Department has been preparing for an introduction of invasive mussels for more than a decade.

The mussel sticker program has funded numerous prevention efforts, including lake monitoring, watercraft inspections and decontaminations, staff to implement the program, prevention planning and coordination with regional water body managers, and planning and other activities to prepare for an introduction.

Our program staff and resources will be dedicated to transitioning from prevention to containment as we focus on containing the infestation and assessing whether or not it is possible to eradicate the invasive mussels.

Additional resources:

- https://www.lakecountyca.gov/1248/Invasive-Mussel-Prevention
- https://www.clearlakemusselprevention.org/

What Can I Do to Prevent the Spread of Invasive Mussels in Lake County and Beyond?

- Clean, Drain, and Dry your watercraft and irrigation equipment before use in other water bodies.
- Spread the word to others about the importance about what each one of us can do to prevent the spread.

STOP AQUATIC HITCHHIKERS!™
Be A Good Steward.
Clean. Drain. Dry.
StopAquaticHitchhikers.org

Invasive Mussels Found in Clear Lake

Invasive mussels have been detected in Clear Lake. The Lake County Water Resources Department is implementing its containment plan to determine the extent of the invasion, prevent further spread in Lake County and beyond, and assess whether it is possible to eradicate the mussels.

To learn the latest about potential effects on Clear Lake water users, please check the county website and social media posts here:

- https://www.lakecountyca.gov/407/Water-Resources
- https://www.clearlakemusselprevention.org/
- https://www.facebook.com/lakecountywater/

What can I do?

- Clean, Drain, and Dry your watercraft and irrigation equipment before use in other water bodies.
- Spread the word to others.

Invasive Mussels Found in Clear Lake

Invasive mussels have been detected in Clear Lake. The Lake County Water Resources Department is implementing its containment plan to determine the extent of the invasion, prevent further spread in Lake County and beyond, and assess whether it is possible to eradicate the mussels.

To learn the latest about potential effects on Clear Lake water users, please check the county websites:

- https://www.lakecountyca.gov/407/Water-Resources
- https://www.clearlakemusselprevention.org/

We will also be providing regular updates on this Facebook page.

What can you do?

- Clean, Drain, and Dry your watercraft and irrigation equipment before use in other water bodies.
- Spread the word to others.

Appendix G. Potential Permit Considerations for a Clear Lake Dreissenid Control Action.

Federal

- **National Pollutant Discharge Elimination System Permit**—The application of chemicals to control of dreissenid mussels at Clear Lake would require a National Pollutant Discharge Elimination System (NPDES) permit under Section 402 of the Clean Water Act. The U.S. Environmental Protection Agency has delegated to the State of California the NPDES Program through the State Water Resources Control Board and the nine Regional Water Quality Control Boards. Lake County falls within Region 5; the Regional Water Board NPDES Program Manager is Jim Marshall, Supervising Water Resource Control Engineer, james.marshall@waterboards.ca.gov, (916) 464-4772. California's Aquatic Animal Invasive Species Control Permit covers the discharges of biological and residual chemical pesticide applications into waters of the United States for aquatic animal invasive species control. The current permit is Statewide NPDES Permit No. CAG 990006; the permit contact is Gurgagn Chand, Gurgagn.Chand@waterboards.ca.gov, (916) 341-5780. The NPDES permit does not authorize any act that results in the taking of a threatened or endangered species under the California Endangered Species Act (CEQA) (Fish and Game Code sections 2050 et. seq) or the Federal Endangered Species Act (16 U.S.C.A. sections 1531 et. seq). An emergency exemption would be requested for the use of the chemical potassium chloride, because it is not registered as a molluscicide in the United States, or California.

- **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)-Section 18 exemption**—Control actions to address dreissenids have been exempted from FIFRA if an emergency exemption is declared. An Emergency Quarantine Exemption under Section 18 of FIFRA would be required because the use of chemical, potassium chloride, is not registered for pesticide use.

- **National Historic Preservation Act Permit**—Any dreissenid control project undertaken with federal funds requires an evaluation according to Section 106 of the National Historic Preservation Act (NHPA). California's Office of Historic Preservation (OHP) would conduct the evaluation and determine whether historic properties are affected. The OHP assists local governments with meeting CEQA responsibilities with regard to historical resources.

- **Fish and Wildlife Service Section 7 Consultation**—The Endangered Species Act (ESA) directs federal agencies to conserve endangered and threatened species. Under Section 7 of the Act, federal agencies must consult with the U.S. Fish and Wildlife Service (USFWS) when an action the agency carries out, funds, or authorizes may affect a listed endangered or threatened species. Emergency consultation is an expedited consultation process that considers listed species while allowing an action agency to respond to an emergency situation. Even if a non-federal jurisdiction is leading a rapid response operation, an associated federal action may trigger a need for compliance with Section 7 of the ESA, such as actions that require a federal permit, or actions using federal funds. In general, state response actions involving emergency circumstances and take of listed species are likely to have a federal nexus that will facilitate take coverage under the emergency consultation providing of the implementation regulations for Section 7 of the ESA. Take is defined under the ESA to include: kill, harm, harass, capture, pursue, hunt, shoot, wound, trap, capture, or collect, or attempt to engage in such conduct. In addition, Section 6 of the ESA allows for the take of listed species by a state agency when it is either:

    (a) an action carried out by the state agency (or its designated agent) that is signatory to a current and valid Section 6 cooperative agreement with the Service; is carried out for conservation purposes consistent with the cooperative agreement, a species' specific recovery plan, and the ESA; and is not reasonably anticipated to result in death, disabling, out-of-state removal, introduction outside of native range, or captivity exceeding 45 days of any federally-endangered species. See Appendix A for

the underlying regulatory provision from 50 CFR § 17.21(c)(5).

(b) in accordance with a Section 10 permit issued by the Service.

Rapid response to eradicate an incipient introduction of zebra or quagga mussels would fall under the "conservation purposes" criterion in (a).

In emergency situations, consultation does not occur on the emergency; rather, consultation is conducted on the agency response to the emergency, and consultation is handled in an expedited manner. If a formal consultation is required, it is initiated as soon as practicable after the emergency is under control. Typically, when an emergency situation occurs, the federal action agency (or its designee) contacts the USFWS Regional Ecological Services Office by telephone if an emergency event is determined to be in proximity to listed species or critical habitat and warrants Section 7 consultation. The ESA consultation process is further described here: https://www.crbdirt.com/process.

After containing the infestation and defining the extent of the infestation, Clear Lake authorities must define any threatened or endangered species and their critical habitats within the proposed action area as well as compile relevant information that would influence potential control actions (e.g., water depth, water quality information). Threatened or endangered species and their critical habitats are defined for the proposed action area using Information for Planning and Consultation (IPaC). Then potential response actions are defined based on those species and habitats and any other relevant information about the proposed action area and its footprint. At this stage, local authorities should engage regional USFWS staff to initiate an emergency consultation. The goal of this activity is to inform the federal agency of the detection and its estimated extent, describe the listed species and critical habitats within the potential action area, and discuss the suite of potential actions and the recommended action to control, or eradicate, the dreissenids. Even if no listed species and habitats are detected using IPaC, it is a good practice to consult regional USFWS staff as a check on local authority analyses and to discuss other native fish and wildlife considerations with the partner federal agency.

Note: At the time this plan was developed, the Clear Lake hitch (*Lavinia exilicauda chi*) and the Foothill Yellow-legged frog (*Rana boylii*) were state listed. In December of 2022, the Center for Biological Diversity requested an emergency listing for the Clear Lake hitch, noting the fish was at significant risk of extinction. The Clear Lake hitch was designated a threatened species under the California's Endangered Species Act in 2014; spawning has been limited since 2017. A draft conservation strategy (https://lakecountyca.gov/DocumentCenter/View/5951) exists for the Clear Lake hitch. The strategy is intended to guide conservation actions to increase reproduction and recruitment, continue and expand monitoring efforts, continue water quality monitoring, develop, and support research projects to inform adaptive management and success criteria for conservation actions, and expand outreach and education programs relating to the hitch. The USFWS is scheduled to re-evaluate the status of the Clear Lake hitch in January of 2025.

State

California Department of Fish and Wildlife

- **California Environmental Quality Act (CEQA)**—CEQA requires state and local agencies to identify any significant environmental impacts of a project and if feasible, avoid or mitigate those impacts. Generally, CDFW acts as a responsible or trustee agency, supporting a lead agency in determining potentially significant environmental impacts. CDFW provides informal consultation and comments on CEQA documents. When CDFW is required to act as lead agency, the department may charge and collect a reasonable fee

from the entity to recover its estimated CEQA-related costs ranging from $7,500 to $44,000 (in 2023). CEQA requires lead agencies to submit draft environmental impact reports (EIR), proposed negative declarations (ND), and proposed mitigated negative declarations (MND) to the State Clearinghouse (SCH) at the Office of Planning and Research. A future Clear Lake Dreissenid Control Plan may need to go through the CEQA process and conduct various studies and surveys to support the associated CEQA document. Depending on the scope of a proposed project, this process can be very time-consuming, taking months or years.

- **California Department of Pesticide Regulation (CDPA**)—CDPA protects human health and the environment by regulating pesticide sales and use, and by fostering reduced-risk pest management.

- **Specific use Scientific Collecting Permit (CDFW)**—Fish and Game Code (FGC) sections 1002, 1002.5 and 1003 authorize the California Department of Fish and Wildlife (Department) to issue permits for the take or possession of wildlife, including mammals, birds and the nests and eggs thereof, reptiles, amphibians, fish, certain plants and invertebrates for scientific, educational, and propagation purposes. The Department currently implements this authority through Section 650, Title 14, California Code of Regulations (CCR), by issuing Scientific Collecting Permits (SCP) to take or possess wildlife for such purposes. For more information on SCPs and the associated fee schedule please refer to the following link: Scientific Collecting Permits (ca.gov).

- **California Endangered Species Act (CESA) Permits** (https://wildlife.ca.gov/Conservation/CESA/Permitting)—A Clear Lake Dreissenid Control Action Plan may also include activities that would result in the take of one or more state listed species, including the Clear Lake hitch Lavinia exilicauda chi. If it is determined project activities included in the action plan will result in the take of hitch or other protected plant or animal species, an Incidental Take Permit (ITP) will be required by CDFW. If the proposed action plan has already acquired take authorization from a federal entity, a consistency determination (CD) can be obtained from CDFW instead of an ITP. The cost associated with ITPs and CDs can be found at: FileHandler.ashx (ca.gov). The timeline for acquiring these permits is contingent on the complexity of the project as well as how prepared the environmental documents are, therefore, early consultation with CDFW is highly recommended. Generally, 3–6 months is a reasonable timetable to complete the ITP process.

- **Lakebed Alteration Agreement (CDFW)**—A Clear Lake Dreissenid Control Action Plan may include activities that would require a Lakebed Alteration Agreement (LAA) from CDFW. CDFW requires notification by an entity that proposes an activity that will substantially divert or obstruct the natural flow of any river, stream, or lake, substantially change or use any material from the bed, bank or channel of any river, stream, or lake, or deposit or dispose of material into any river, stream, or lake. After submitting a notification, the department has 30 days to review the notification for completeness and an additional 60 days to provide a draft Agreement. The costs associated with LAA can be found in the attached fee schedule. An additional attachment provides instructions on acquiring an LAA Agreement.

  To obtain a streambed alteration agreement from CDFW using the Environmental Permit Information Management System (EPIMS), register with EPIMS for an external account and submit a notification application.

California Regional Water Quality Control Boards

- The State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) are housed within the California Environmental Protection Agency. The SWRCB allocates the rights to the use of surface water, and the RWQCBs protect surface, ground, and coastal waters statewide. The RWQCBs also issue permits that govern and restrict the amount of pollutants that can be discharged

into the ground or a water body.

- Any activities or discharges that affect California's surface, coastal, or ground waters require a permit from the appropriate RWQCB. Dreissenid control activities would require an NPDES permit from the appropriate RWQCB (see NPDES permit information above).

- A report of Waste Discharge would be required to be completed to the local RWQCB.

- A Water Quality Certification would be required to be completed for discharges of dredged and fill materials. Under the Clean Water Act Section 401 Certification Rule, a "pre-filing meeting" is required with the appropriate Water Board at least 30 days prior to submitting an application for an individual Clean Water Action Section 401 Water Quality Certification. CentralValleySacramento@waterboards.ca.gov and Stephanie.Tadlock@waterboards.ca.gov

  For more information on the Clean Water Act Section 401 Certification Rule, visit the Environmental Protection Agency's webpage.

  - Application for Water Quality Certification and/or Waste Discharge Requirements - (MS Word)
  - Application for Water Quality Certification and/or Waste Discharge Requirements
  - Dredge and Fill Fee Calculator (effective 11/28/2022)
    - Application fees shall be based on the current fee schedule. After the certification has become effective, annual fees will be based on the fee schedule at the time of billing.
- Application Information - (updated 01/05/2021)
- General Orders
  - Issued for Coverage under Federal Permits
  - Issued for Coverage under State Water Board initiatives
- More Information on the Water Quality Certificate Program

Appendix H. Examples of Water Body Monitoring Strategies That Can Be Employed in Water Bodies in Which Dreissenids have Been Detected.

The following are examples of monitoring strategies in water bodies in which dreissenids have been detected. The purpose of including these in Lake County's plan is to illustrate the types and quantities of resources that may be needed to monitor a water body after an initial detection. Clear Lake is estimated to be about 43,520 acres in size. The water bodies used as examples range from 267 acres to 21,244 acres.

Christmas Lake (Minnesota) (excerpted from Lund et al. 2017) — 267 acres
2010-2014 Pre-detection monitoring included surveying for all AIS using snorkels, plant and invertebrate sampling, plankton tows for zebra mussel veligers, and settling plates checked twice monthly during open water season.

August 2014 A total of four attached mussels were observed near a settling plate. Within four days of the discovery, a containment barrier (vinyl floating curtain) was placed around the 15m × 18m area to confine the zebra mussels. Plankton tows were taken at three sites across the lake, and no veligers were found using cross-polarized light microscopy analysis. In the following weeks, a systematic zebra mussel population assessment using SCUBA, snorkel, and wading was conducted within the containment area. About 5,500 zebra mussels were found ranging in size from 2mm to 11mm.

September 2014 Treatment occurred. Following treatment, monitoring occurred every 1–2 days for 14 days post-treatment. Monitoring consisted of collecting surface water samples at various locations inside the treatment area.

Post-treatment Belt transect surveys (30m transect line) parallel to shore were conducted regularly using SCUBA, snorkel, and wading. A comprehensive search of the entire shoreline was also conducted by 18 surveyors using both SCUBA and snorkel gear. In addition to active searches, settlement samplers (four stacked grey PVC plates, 15cm × 15cm) were suspended from docks and buoys at several locations around the lake perimeter. Samplers were checked for juvenile zebra mussels periodically throughout the 2015 summer and removed in the fall.
In May 2015, an extensive lake-wide search led to the discovery of 10 zebra mussels attached to native freshwater mussels outside of previously treated areas at distances ranging from about 10m to 50m from the previous containment barrier's edge.

After the final 27 June potash treatment, monthly zebra mussel searches occurred in July, August, and September of 2015. Searches consisted of 2–5 divers examining multiple areas around the lake either using snorkeling or SCUBA gear. Zebra mussel sampler plates were checked weekly at the public access dock; 13 volunteer homeowners had zebra mussel sampling plates attached to their docks in various locations on the lake.
After more than a year of extensive efforts to eradicate zebra mussels in Christmas Lake, 16 zebra mussels were found attached to docks, boat lifts, and sampler plates in untreated areas in October 2015.

Tiber Reservoir (Montana) — 21,244 acres
Prior to detection in 2016, 18 plankton tows and two shoreline surveys were conducted annually. In 2017, Tiber was labeled positive for dreissenid mussels based on a plankton tow sample. A total of 85 plankton tows, 28 eDNA samples, 86 shoreline surveys, four substrate samples, four scuba surveys and 14 canine shoreline surveys were conducted in 2017. In 2018, a similar number of samples and sample methods were used, but significantly fewer shoreline surveys were done. In 2019, 120 plankton tow samples and 205 substrate samples were taken. In 2020, a similar number of samples and sample methods were used, but with very few substrate samples taken. In 2021, 258 plankton tow and 59 eDNA samples were taken, in addition to similar numbers using the remaining previously used methods. In 2022, 70 plankton tow, 4 eDNA, and 12 substrate and 12 shoreline samples were taken. Between 2017–2022, mussels were not detected. Tiber was delisted from mussel positive status that same year. In 2023, sampling effort will mirror the 2022 effort.

Canyon Ferry (Montana) — 9,360 acres
In 2016, 31 plankton tows and three shoreline surveys were conducted. In 2017, Canyon Ferry was labeled as suspect for dreissenid mussels. A total of 148 plankton tows, seven shoreline surveys, 20 substrate samplers, four scuba surveys, and two canine shoreline surveys occurred in 2017. In 2018, 84 plankton tows were conducted, and a similar number of samples and sample methods used similar to the previous year. In 2019, the number of samples taken and sample methods used were similar to the previous year, with the exception of canine shoreline surveys, which were not conducted. Between 2017–2020, mussels were not detected. In 2020, Canyon Ferry was delisted as suspect. Since 2020, annual sampling includes 60 plankton tows and 10 shoreline surveys.

Highline Reservoir (Colorado) — 563 acres
Colorado Parks and Wildlife staff discovered zebra mussels during a routine AIS inspection in September of 2022. Highline Reservoir was sampled monthly from May–October, including three plankton tows and three settler plates. eDNA sampling was not conducted. A dive team was deployed, however water clarity limited their success. After control actions were taken in early 2023, the reservoir is now monitored on a weekly basis, and will continue to be monitored through October using plankton tows (10 tows per week) that are evaluated via both microscopy and eDNA (50-50). A total of 10 settler plates have been deployed on the reservoir and are checked monthly.

Appendix I. Sample County Ordinance and Potential Clear Lake Fishing Contest Activity Fee Schedule.

ORDINANCE NO. _____

RESOLUTION ESTABLISHING SPECIAL EVENT FEES FOR ACTIVITIES OCCURRING ON CLEAR LAKE, LAKE COUNTY, CA

WHEREAS, Chapter 23.4.2 of the Lake County Code states that The Board of Supervisors shall establish by ordinance fees for an administrative encroachment permit, a buoy permit, and for a special event permit which shall be paid to Lakebed Management; and

WHEREAS, the existing ordinance chapter 23.3.60 defines "Special events" as any organized or planned event taking place on the lake that requires exclusive use of a defined area of the lake for which a publicly recognized organization, business, person, or other entity (profit or non-profit) advertises, invites, or seeks entrants to participate; and

WHEREAS, the existing ordinance chapter 23.3.55 also defines a "Racing event" as a planned event wherein participants compete against each other or are timed or where awards, prizes or points are issued; and

WHEREAS, Chapter 23.4.1 specifies that No person shall undertake or carry out [D] any use, operation, or activity with a significant impact on the public trust purposes of commerce, navigation, recreation, and fisheries … without first obtaining an administrative encroachment permit from the Lakebed Management; and

WHEREAS, The fees will be used to support continued operations by Lakebed Management and the Water Resources Department to continue the needed and required monitoring and management of Clear Lake, to ensure that the items listed in Chapter 23.5.1 are being maintained with minimal to no significant harm from racing or special events; and

WHEREAS, the fees being proposed will follow a tiered schema that will have no / minimum financial impact to local, charitable events, or non-profit organizations, and be commiserate with the special event fees being issued in other areas or regions with similar facilities, fisheries, and events.

NOW, THEREFORE, THE BOARD OF SUPERVISORS OF THE COUNTY OF LAKE ORDAINS AS FOLLOWS:

The proposed fee schedule was introduced before the Board of Supervisors on the _____ day of _____ , 2020, and passed by the following vote on the ____ day of _____ , 2020.

AYES: NOES: ABSENT OR NOT VOTING:

_____
Chair Board of Supervisors

ATTEST:
JOHANNA DeLONG
Clerk of the Board

By: _____

APPROVED AS TO FORM:
ANITA L. GRANT
Legal Counsel

By: _____

DRAFT Proposed 2020 -2021 Clear Lake Fishing Contest Activity Fee schedule

Table 1. Proposed Lake County Lake Event Fee Tiers

Lake County Tier #1	CDFW Category	Lake County Contest Description	MAXIMUM Proposed Fee Assessed	Example Events
1	Annual	Local & High School Clubs (25 vessels or less)	$0	High School Bass Club Clear Lake Bassmasters
2	Annual	Non-local Clubs & organizations, Non-Profit (must show 301c ID # or charitable event information), school clubs, high school tournaments (25 vessels or less)	$50	Team Tournaments Annual Leukemia Benefit Soldiers Wish Annual
3	Annual	Local and non-local club events, organization events non-commercial (25 – 49 vessels)	$200	American Bass NewGen
4	Event	Major Non-local Commercial Tournaments (50 vessels or more)	$500	FLW W.O.N. Bass

1. Fees can be paid over the phone or in person at Water Resources prior to a scheduled contest event.
2. Fees not paid prior to an event will be issued via invoice retroactively, either hand delivered to event director during event or via USPS, after the event based on registered participating boats present on the day of tournament, according to posted standings at the end of the first day.

Table 1. Example of could-be dollars generated based on 2018 & 2019 contest schedule.

2018	Tier 2	Tier 3	Tier 4
Number of Events	27	55	59
Max Price	$50	$200	$500
Subtotal Range	$0-$1350	$11,000	$29,000
Total for 2018	**Max = $42,700**		

2019	Tier 2	Tier 3	Tier 4
Number of Events	27	55	61
Max Price	$50	$200	$500
Subtotal Range	0-$1350	$11,000	$30,500
Total for 2019	**Max = $42,850**		
GRAND TOTAL FOR 2018 AND 2018	**Max = $85,550 (2 years)**		

Discussion of Fees proposed:

Unlike many of the public-access lakes in Northern California, Clear Lake does not have daily use or launch fees. The above proposed fee amounts are based on the expected number of vessels participating in the event and the estimated amount generated during other lake's day use vessel fees. Currently, Clear Lake does not impose any day-use fees or launch fees for any water craft, vessels, or activities on the lake. This is in comparison to other regional lakes which do impose small, similarly-priced fees (Table 3).

The cost for maintaining the water quality and quantity of Clear Lake to a standard that supports a beneficial fishery is increasing every year and the funds generated to maintain the level of management and maintenance on the Lake are stagnant. The County has proposed several tax-generating water quality related ballot measures over the last ten years, although none of them have passed the majority needed to raise revenue. Implementing a special event "fishing contest" fee system will help the County maintain and improve the current standard of management and maintenance of the lake and its physical, chemical, and biological quality.

Participants of fishing contests travel long distances to experience the Clear Lake fishery (Figure 1.), sometimes participating in highly competitive large-scale commercial multi-day fishing tournaments that sometimes require a $500 entrance fee or more. The proposed one-time contest fee of $10 or less per boat, per event, is miniscule compared to the overall investment of what these participants are paying to travel to, prepare, and participate in these contests.

Additionally, this small fee per event is going to help maintain the lake to a standard that will only continue to support the fisheries that is the main draw for these contests while simultaneously providing support for improved management for a resource that locals depend on for fishing, swimming, boating, and drinking.

Table 3. Current day-use or launch fees for northern California regional lakes.

Lake / Reservoir Name	Use / Launch fee per day as of December 2020
Folsom	$10
Natoma	$10
Berryessa	$10
Sonoma	$15
Shasta	$12
Tahoe	$55-75
Mendocino	$3
New Hogan	$4
Almanor	$0

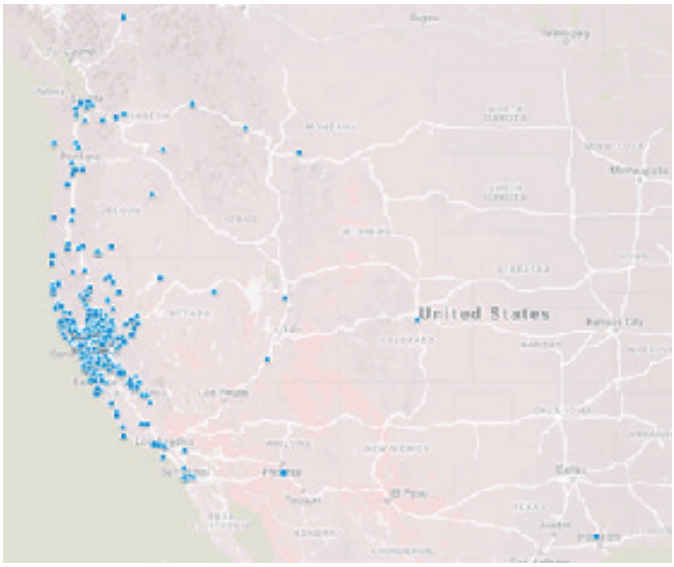


Figure 1. Map of source locations of vessels that visited Clear Lake in 2018 only. Data derived from QZ screening from zipcodes.