LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix A: Regulations and Programs

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Acronyms

AIS	Aquatic Invasive Species
ANSTF	Aquatic Nuisance Species Task Force
BLM	Bureau of Land Management
BMPs	Best Management Practices
CADPR	California Department of Parks and Recreation
CDFA	California Department of Food and Agriculture
CDFW (CDFG)	California Department of Fish and Wildlife, formerly California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CSLC	California State Lands Commission
EIP	Environmental Improvement Program
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
F & G	Fish and Game
LRWQCB	Lahontan Regional Water Quality Control Board
LTAISCC	Lake Tahoe Aquatic Invasive Species Coordination Committee
LTAISWG	Lake Tahoe Aquatic Invasive Species Working Group
LTBMU	Lake Tahoe Basin Management Unit
LTFAC	Lake Tahoe Federal Advisory Committee
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NDEP	Nevada Department of Environmental Protection
NDOW	Nevada Department of Wildlife
NEPA	National Environmental Policy Act
NISA	National Invasive Species Act
NISMP	National Invasive Species Management Plan
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
P.L.	Public Law
SNPLMA	Southern Nevada Public Land Management Act
TERC	Tahoe Environmental Research Center
TIE	Tahoe Interagency Executive
TKPOA	Tahoe Keys Property Owners Association

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TRCD	Tahoe Resource Conservation District
TRPA	Tahoe Regional Planning Agency
TSC	Tahoe Science Consortium
TWSA	Tahoe Water Suppliers Association
USACE	United States Army Corps of Engineers
USBOR	United States Bureau of Reclamation
USC	United States Code
USDA	United States Department of Agriculture
USDOI	United States Department of Interior
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

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Appendix A1: Existing Authorities and Programs

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Appendix A1
Existing Authorities and Programs

The Lake Tahoe Basin is located on the California-Nevada border and crosses three counties in California and two counties and rural Carson City in Nevada. The majority of the land in the Basin is owned and managed by public agencies (e.g., U.S. Forest Service – Lake Tahoe Basin Management Unit, California Department of Parks and Recreation, Nevada Division of State Parks, and the California Tahoe Conservancy). Most of the private lands are commercial and residential development located in the low-lying areas near the lake.

Numerous aquatic invasive species (AIS) are established in or threatening introduction to aquatic ecosystems throughout California and are addressed in the California AIS Management Plan. The State of Nevada does not currently have an AIS management plan or a well-coordinated AIS program. Instead, the state must rely on the disparate efforts of regional, state, and federal agencies.

The following summarizes federal, state, and regional regulations and programs pertinent to AIS issues in the Lake Tahoe Basin. Information sources included the Tahoe Integrated Information Management System, the California AIS Management Plan, and stakeholder input (Appendix I).

1 Federal

1.1 Endangered Species Act (ESA) of 1973 (16 USC A. §§ 1531 to 1544)

http://www.fws.gov/endangered/

The ESA is jointly administered by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), and allows them to "use all methods and procedures which are necessary to bring any endangered or threatened species to the point at which the measures provide pursuant to this Act are no longer necessary." Listed species in Lake Tahoe are all freshwater species and are therefore under the jurisdiction of the USFWS (NMFS regulates anadromous and marine species). The purpose of the ESA is to provide the means to identify and protect species that are in danger of significant population loss or extinction and to conserve the ecosystems upon which endangered and threatened species depend. Relevant permits (e.g., USFWS ESA Section 7 consultation) will be obtained prior to commencing potentially harmful management actions.

1.2 Executive Order (EO) 13057 (7/26/97)

http://www.epa.gov/region09/water/watershed/1997-2007-fip-report.pdf

Under EO 13057, federal agencies with responsibilities at Lake Tahoe are directed to form the Lake Tahoe Federal Interagency Partnership. The purpose of the Partnership is to coordinate federal, tribe, state, regional (i.e., Tahoe Regional Planning Agency), and local government

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activities in the Basin to improve environmental efforts. The Partnership consults with the Lake Tahoe Basin Federal Advisory Committee (LTFAC) to ensure diverse input from a range of stakeholders on issues critical to the Basin and facilitates the integration and coordination of appropriate federal programs and funds to help achieve the goals of the Lake Tahoe Regional Environmental Improvement Program (EIP).

1.3 EXECUTIVE ORDER (EO) 13112 (64 FR 6183, 2/3/99)

EO 13112 established the National Invasive Species Council, tasked with preparing a National Invasive Species Management Plan (NISMP) to ensure that federal agency activities are "coordinated, complementary, cost-efficient, and effective" in their efforts to address invasive species issues. The 2008-2012 NISMP was released August 2008 and is available at http://www.invasivespeciesinfo.gov/council/mp2008.pdf. EO 13112 also calls for federal agencies "whose actions may affect the status of invasive species…to identify such actions [and] use relevant programs and authorities to detect and respond rapidly to and control populations in a cost-effective and environmentally sound manner." The Environmental Protection Agency (EPA) provides an overview of authorities affected by the development of rapid response plans for AIS: http://water.epa.gov/type/oceb/habitat/invasives_management_index.cfm.

1.4 INJURIOUS WILDLIFE PROVISIONS OF THE LACEY ACT (18 USC 42; 50 CFR 16)

http://www.fws.gov/contaminants/ANS/ANSInjurious.cfm
http://www.fws.gov/laws/lawsdigest/lacey.html

The USFWS has broad authority to detain and inspect any international shipment, mail parcel, vehicle, or passenger baggage and all accompanying documents, whether or not wildlife has been formally declared. The injurious wildlife provision of the Lacey Act is one tool that the USFWS uses to manage and prevent illegal introductions of invasive species. Under the Lacey Act, importation and interstate transport of animal species determined to be injurious may be regulated by the Secretary of the Interior. The USFWS implements the injurious wildlife provisions (18 USC 42) through regulations contained in 50 CFR Part 16. Species are added to the list of injurious wildlife to prevent their introduction or establishment through human movement in the United States to protect the health and welfare of humans, the interests of agriculture, horticulture or forestry, and the welfare and survival of wildlife resources from potential and actual negative impacts.

Species listed as injurious may not be imported or transported between states, the District of Columbia, the Commonwealth of Puerto Rico, or any territory or possession of the U.S. by any means without a permit issued by the USFWS. Permits may be granted for the importation or transportation of live specimens of injurious wildlife and their offspring or eggs for bona fide scientific, medical, educational, or zoological purposes. This section of the Lacey Act also regulates that health certificates must accompany all imports of fresh or frozen fish produced

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commercially and salmon and trout harvested recreationally outside North American waters. Live salmon eggs also require health certificates.

The penalty for an injurious wildlife Lacey Act violation is up to six months in prison and a $5,000 fine for an individual or a $10,000 fine for an organization. Another section of the Lacey Act (16 USC 3371-3378) pertains to prohibited acts for wildlife and plants; this is different from the injurious wildlife provisions of the Lacey Act, though an enforcement relationship between the two does exist. Please see http://www.fws.gov/le/LawsTreaties/USStatute.htm for more information.

The current federal list of injurious wildlife species (50 CFR 16.11-16.15) may be found at http://www.gpoaccess.gov/cfr/index.html and do a "Quick Search" for "50CFR16."

1.5 LAKE TAHOE FEDERAL ADVISORY COMMITTEE (LTFAC) (5 USC APP. 7/17/98)

http://www.fs.fed.us/r5/ltbmu/local/ltfac/

The LTFAC was chartered under the Federal Advisory Committee Act by the Secretary of Agriculture. This citizen committee is concerned with environmental and economic issues in the Lake Tahoe Region. The LTFAC provides guidance to the Secretary of Agriculture and, according to Executive Order 13057, the Federal Interagency Partnership to achieve the goals outlined in the Lake Tahoe Regional EIP.

1.6 NONINDIGENOUS AQUATIC NUISANCE PREVENTION AND CONTROL ACT OF 1990 (NANPCA) AND NATIONAL INVASIVE SPECIES ACT OF 1996 (NISA)

The NANPCA (P.L. 101-636) establishes federal authority to prevent the introduction of nuisance aquatic organisms and control their spread through coordinated research, control strategies, priorities, and education efforts. It mandates that the Aquatic Nuisance Species Task Force (ANSTF) implement the NANPCA. In 1996, NANPCA was amended by NISA to require ballast water exchanges for vessels entering the Great Lakes and Hudson River. NISA also establishes guidelines for vessels entering U.S. waters from outside the exclusive economic zone to voluntarily exchange ballast.

Under Section 1204, the NANPCA calls on states to develop comprehensive management plans to coordinate efforts aimed at preventing and controlling nuisance species through technical, enforcement, or financial assistance as needed. Section 1204 also allows for federal contributions up to 75 percent of the cost incurred by states each fiscal year for implementing AIS plans.

The ANSTF is an intergovernmental organization responsible for implementing mandates under the NANPCA. The goals of the task force are to: 1) reduce AIS introduction, 2) minimize their effects, 3) increase public awareness, and 4) maximize ANSTF effectiveness (ANSTF 2012). The ANSTF provides guidance for writing state and interstate management plans as outlined in *Guidance for State and Interstate Aquatic Nuisance Species Managements Plans* and has established formal review and submission processes leading to plan approval and Section 1204

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support. Other western states with approved management plans include Oregon, Washington, Idaho, and Montana. Western states with plans in development include Arizona, Utah, New Mexico, Colorado, and Wyoming. The *Lake Champlain Basin ANS Management Plan* and *St. Croix Natural Scenic Riverway Interstate Management Plan* are the only other regional management plans.

1.7 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) OF 1970 (42 USC A. §§ 4321 TO 4370E)

http://www.epa.gov/compliance/nepa/index.html

NEPA requires the consideration of environmental impacts for any federal action, including direct federal activities, permitting, and federal funding of activities by another entity. NEPA environmental documents may include an environmental assessment or a full environmental impact statement. Potential impacts of invasive species, both direct and indirect, may be among the issues that should be considered under NEPA.

1.8 U.S. ARMY CORPS OF ENGINEERS (USACE)

http://www.spk.usace.army.mil

The USACE serves the Armed Forces and the nation by providing vital engineering services and capabilities through planning, design, and construction for the nation's water resources, environmental restoration, infrastructure, Homeland Security, and military needs.

In the Tahoe Basin, the USACE provides program and project-level technical assistance to non-federal agencies in implementation of authorized programs including stream and wetland restoration, stormwater management and treatment effectiveness, shorezone sanitary sewer line replacement, water quality assessment, and management of aquatic invasive species. Additionally, the USACE has responsibility for Clean Water Act Section 404 permitting and Section 10 navigation hazards permitting. Any management activities that may affect wetlands or other jurisdictional waters, or which may affect navigation, will require consultation with the USACE.

1.9 U.S. DEPARTMENT OF AGRICULTURE (USDA)

www.usda.gov/

The mission of the USDA is to provide leadership on food, agriculture, natural resources, rural development, and related issues based on sound public policy, the best available science, and efficient management (USDA Strategic Plan FY 2005-2010). The USDA is part of the executive branch of the federal government with 17 agencies associated with specific mission areas. Those agencies with mission areas related to AIS in the Tahoe Basin include:

> USDA-Animal and Plant Health Inspection Service: Responsible for protecting and promoting U.S. agricultural health: http://www.aphis.usda.gov/.

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USDA-Animal and Plant Health Inspection Service-Plant Protection and Quarantine: Enforces federal noxious weed regulations (Plant Protection Act of 2000, Subtitle A, Section 412) prohibiting the import into the U.S. and/or interstate movement of federal noxious weeds (7 CFR 319.37 -2): www.aphis.usda.gov/ppq.

USDA-Agricultural Research Service: Conducts scientific research on agricultural problems including food safety, nutrition, economics, and the environment. At Lake Tahoe, Agricultural Research Service has monitored the introduction and spread of Eurasian watermilfoil and curlyleaf pondweed since 1996: http://www.aphis.usda.gov/.

USDA-Natural Resources Conservation Service: Provides leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and environment. In partnership with the Natural Resources Conservation Service, National Information Technology Center, the National Plant Data Center maintains the online PLANTS database. The searchable database provides plant descriptions, distribution maps, references, plant abstracts, and plant images: http://plants.usda.gov.

USDA-National Agricultural Library: Provides a comprehensive list of federal laws and regulations associated with invasive species, including freshwater, marine, and terrestrial organisms through the website: http://www.invasivespeciesinfo.gov/laws/publiclaws.shtml.

USDA can restrict the introduction and spread of noxious weeds (under the Plant Protection Act 7 USC, 6/20/00; noxious weed defined in the Sec. 403, 7 USC 7702[10]) and regulated pests (7 CFR 300-399). The Noxious Weed Control and Eradication Act (P.L. 108-412, 10/30/04) established a program to provide financial and technical assistance to control or eradicate noxious weeds. The Act allows for grants (Section 454) to control or eradicate noxious weeds, subject to availability of appropriations under Section 457(b): http://www.invasivespeciesinfo.gov/laws/publiclaws.shtml.

USDA – U.S. Forest Service (USFS): The mission of the USFS is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations.

USDA-USFS-Lake Tahoe Basin Management Unit (LTBMU): The LTBMU manages 80% of the land in the Lake Tahoe Basin as a unique kind of national forest. The LTBMU is managed in many ways like other national forests, but because of the needs of the lake and the relationship it has with the forests that surround it, the LTBMU has special focus areas, including watershed restoration.

The National Forest Land Management Act directs Forest Service units to draft and implement Land and Resource Management Plans. The LTBMU's "Forest Plan" is the road map that guides multiple use management and sets direction for accomplishing aquatic ecosystems goals and objectives, which includes AIS considerations.

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LTBMU aquatic biologists are engaged in a number of AIS management functions including prevention, treatment, and research. The LTBMU manages a variety of recreation sites that provide the public both direct (i.e., boat launches) and indirect (i.e., campgrounds) access to Lake Tahoe and other waterbodies. LTBMU aquatic program staff are engaged in AIS prevention strategies at recreation facilities. In addition, LTBMU aquatic biologists have taken a leadership role in restoring aquatic habitat for native species by removing and/or controlling aquatic invasive species: http://www.fs.fed.us/r5/ltbmu/.

1.10 U.S. DEPARTMENT OF INTERIOR (USDOI)

http://www.doi.gov/

The USDOI is the nation's principal conservation agency responsible for natural resources, natural and cultural heritage access, recreation, scientific research, energy and mineral resources, land and water resources, and fish and wildlife. The USDOI is composed of eight bureaus with specific mission areas. Those bureaus with mission areas related to AIS in the Tahoe Basin include:

Bureau of Land Management (BLM): The BLM manages 264 million acres of surface acres of public lands located primarily in the 12 western states, including Alaska. The agency manages an additional 300 million acres of below ground mineral estate located throughout the country. Originally, these lands were valued principally for the commodities extracted from them; today, the public also prizes them for their recreational opportunities and the natural, historical, and cultural resources they contain.

Under the Southern Nevada Public Land Management Act (SNPLMA), the BLM is allowed to sell public land within a specific boundary around Las Vegas, Nevada. The revenue derived from land sales is split between the State of Nevada General Education Fund (5%), the Southern Nevada Water Authority (10%), and a special account available to the Secretary of the Interior for Lake Tahoe restoration projects, among other conservation efforts. In the Tahoe Basin, SNPLMA funds have been used to support numerous AIS-related projects (see Appendix G).

USDOI - U.S. Bureau of Reclamation (USBOR): The mission of the USBOR is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

USDOI - USFWS: The mission of the USFWS is to work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. Nationally, the USFWS has partnered with several agencies and organizations to provide widely recognized education/outreach information and downloadable materials, including the 100th Meridian Initiative (http://www.100thmeridian.org/), the Stop Aquatic Hitchhikers Campaign (www.protectyourwaters.com), and Habitattitude™ (www.habitattitude.net).

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USDOI - U.S. Geological Survey (USGS) – Nuisance Aquatic Species: This USGS website (http://nas.er.usgs.gov/) serves as a "central repository for accurate and spatially referenced biogeographic accounts of nonindigenous aquatic species," including freshwater and marine fishes, invertebrates, and plants. The website is managed from the USGS Florida Integrated Science Center.

2 State and Regional

2.1 CALIFORNIA DEPARTMENT OF PARKS AND RECREATION (CADPR)

www.parks.ca.gov

The mission of the CADPR is to provide for the health, inspiration, and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation. The CADPR is a Tahoe Integrated Information Management System stakeholder that participated in the requirements analysis. CADPR is responsible for overseeing state parklands that lie within the California side of the Lake Tahoe Basin. As such, the agency maintains the lands and provides educational information to park visitors. Specifically, it oversees the following park units: Burton Creek State Park, D. L. Bliss State Park, Ed Z'berg Sugar Pine Point State Park, Emerald Bay State Park, Kings Beach State Recreation Area, Lake Valley State Recreation Area, Tahoe State Recreation Area, Ward Creek Unit, and Washoe Meadows State Park. CADPR participates on the Lake Tahoe Aquatic Invasive Species Coordinating Committee and various Lake Tahoe Aquatic Invasive Species Working Groups.

2.2 CALIFORNIA-NEVADA COMPACT FOR JURISDICTION ON INTERSTATE WATERS

The California Penal Code Section 853.3-853.4 (see below) essentially allows California and Nevada law enforcement agents to enforce "like" laws. For example, because mussels are a prohibited species in Nevada (NAC 503 §110) and California (California Code Regulations Title 14 §671), Nevada Department of Wildlife (NDOW) Game Wardens may stop and detain watercraft with visible (not suspected) mussels if the vessel is on Lake Tahoe. If the vessel is contaminated, then Nevada law would be enforced.

> 853.3. (a) Pursuant to the authority vested in this state by Section 112 of Title 4 of the United States Code, the Legislature of the State of California hereby ratifies the California-Nevada Compact for Jurisdiction on Interstate Waters as set forth in Section 853.4.
>
> (b) The Legislature finds that law enforcement has been impaired in sections of Lake Tahoe and Topaz Lake forming an interstate boundary between California and Nevada because of difficulty in determining precisely where a criminal act was committed.

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(c) The Legislature intends that a person arrested for an act that is illegal in both states should not be freed merely because neither state could establish that a crime was committed within its boundaries.

(d) The California-Nevada Compact for Jurisdiction on Interstate Waters is enacted to provide for the enforcement of the laws of this state with regard to certain acts committed on Lake Tahoe or Topaz Lake, on either side of the boundary line between California and Nevada.

853.4. (a) As used in this compact, unless the context otherwise requires, "party state" means a state that has enacted this compact.

(b) If conduct is prohibited by the party states, courts and law enforcement officers in either state who have jurisdiction over criminal offenses committed in a county where Lake Tahoe or Topaz Lake forms a common interstate boundary have concurrent jurisdiction to arrest, prosecute, and try offenders for the prohibited conduct committed anywhere on the body of water forming a boundary between the two states.

(c) This section applies only to those crimes that are established in common between the States of Nevada and California, and an acquittal or conviction and sentence by one state shall bar a prosecution for the same act or omission by the other.

(d) This compact does not authorize any conduct prohibited by a party state.

(e) This compact shall become operative when ratified by law by the party states and shall remain in full force and effect so long as the provisions of this compact, as ratified by the State of Nevada, remain substantively the same as the provisions of this compact, as ratified by this section. This compact may be amended in the same manner as is required for it to become operative.

2.3 CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE (CDFA)

www.cdfa.ca.gov/regulations.html

The CDFA is the lead agency for regulatory activities associated with aquatic weeds. This regulatory authority includes quarantine, exterior pest exclusion (border protection stations and inspections), interior pest exclusion (pet/aquaria stores, aquatic plant dealers and nurseries) and detection and control/eradication programs. In addition, the CDFA Plant Pest Diagnostic Center identifies plant species and assigns plant pest ratings. CDFA maintains a rated list of noxious weed species.

"A"-rated pests require eradication, containment, rejection, or other holding actions at the state-county level. Quarantine interceptions are to be rejected or treated at any point in the state. For "B"-rated pests, eradication, containment, control, or other holding actions are taken at the discretion of the agricultural commissioner. State-endorsed holding actions and eradication of "C"-rated pests occur only when these pests are found in a nursery. Action is taken to retard

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spread outside of nurseries at the discretion of the commissioner. Rejection occurs only when found in a crop seed for planting or at the discretion of the commissioner. "Q" ratings are temporary "A" ratings pending determination of a permanent rating.

2.4 CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE (CDFW)

http://www.dfg.ca.gov/invasives/
http://www.fgc.ca.gov/html/regs.html
http://www.dfg.ca.gov/ospr/organizational/scientific/exotic/exotic%20report.htm

The CDFW maintains native fish, wildlife, plant species, and natural communities for their intrinsic and ecological value and their benefits to people. This includes habitat protection and maintenance in a sufficient amount and quality to ensure the survival of all species and natural communities. The department is also responsible for the diversified use of fish and wildlife including recreational, commercial, scientific, and educational uses.

The California AIS Master Plan was directed by the CDFW to "coordinate state programs, create a statewide decision-making structure and provide a shared baseline of data and agreed-upon actions so that state agencies may work together more efficiently."

The CDFW oversees the implementation of Fish and Game (F & G) Codes related to fish and wildlife resources. According to Title 14 of the California Code of Regulations, CDFW is responsible for the following Fish and Game Codes as related to AIS (adapted from the California AIS Master Plan:

> F & G Code §§ 2080 – 2089: CDFW regulates the take of species listed under the California Endangered Species Act. In addition to the instructions in the Fish and Game Code, guidelines for this process are located in Title 14, Division 1, Subdivision 3, Chapter 6, Article 1 of the California Code of Regulations. These statutes and regulations should be consulted if AIS control measures have the potential to impact state-listed species.
>
> F & G Code §§ 2118, 2270-2300: CDFW is responsible for enforcement of importation, transportation, and sheltering of restricted live wild animals; places importation restrictions on aquatic plants and animals.
>
> F & G Code §§ 2301: Allows staff to inspect, impound, or quarantine any conveyance (e.g., watercraft) that may carry dreissenid mussels and (by delegation) allows other state agencies (e.g., California Department of Parks and Recreation) to enforce the code.
>
> F & G Code §§ 2302: Owners of publicly accessible reservoirs (as defined in Section 6004.5 of the California Water Code) where recreational activities are permitted are required to assess their vulnerability to dreissenid mussel introduction, and to develop and implement a dreissenid mussel prevention program. Owners may refuse planting of fish unless CDFW demonstrates they are not infected with dreissenid mussels.

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F & G Code §§6400-6403: It is unlawful to place live fish, fresh or saltwater animals, or aquatic plants in any waters of this state without a permit from CDFW.

F & G Code §§15000 et seq.: CDFW is responsible for regulations pertaining to the aquaculture industry, including disease issues.

2.5 CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) (CALIFORNIA PUBLIC RESOURCES CODE §§ 21000 ET SEQ.)

http://ceres.ca.gov/ceqa/

The CEQA requires public disclosure of all significant environmental effects of proposed discretionary projects. This process occurs through preparation and distribution of an Initial Study or an Environmental Impact Report. If a project would cause significant effects, final documents in the CEQA process show: 1) what mitigation measures will be required to reduce particular effects to a less significant level, and 2) provide justifications for the approval of the project with particular significant effects left unmitigated (i.e., a finding of overriding consideration). CEQA also contains lists of project types exempt from this process. A "significant" impact is a "substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, [and] fauna." The documented adverse impacts associated with invasive species can fit this broad definition.

2.6 CALIFORNIA STATE LANDS COMMISSION (CSLC)

http://www.slc.ca.gov/

The State of California acquired sovereign ownership of all tide and submerged lands and beds of navigable waterways upon its admission to the United States in 1850. The state holds these lands for the benefit of all people of the state for statewide Public Trust purposes, which include waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. The boundaries of these state-owned lands generally are based upon the last naturally occurring location of the ordinary high or low water marks prior to artificial influences, which may have altered or modified the river or shoreline characteristics. On navigable non-tidal waterways, the state holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement exists landward to the ordinary high water mark, as they last naturally existed. The state's sovereign interests are under the jurisdiction of the CSLC.

With respect to Lake Tahoe, the State of California's sovereign ownership extends waterward from the low water mark, which has been established as elevation 6,223 feet, Lake Tahoe Datum. Consequently, any activity involving the state's sovereign lands in Lake Tahoe below elevation 6,223 feet, Lake Tahoe Datum, requires a lease from the CSLC. Uses requiring approval of a lease from the CSLC must also comply with the CEQA. The area lying between the high and low marks of Lake Tahoe is subject to a Public Trust easement for commerce,

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navigation, fishing, recreation, and preservation. Uses situated between the high and low water marks must be consistent with the uses permitted under the Public Trust.

Permission from the CSLC would be required to implement the proposed activities contemplated by resource managers and researchers. The form of that permission would vary in accordance with the specific activity and its location and, therefore, would be determined on a case-by-case basis.

2.7 CALIFORNIA TAHOE CONSERVANCY

http://www.tahoecons.ca.gov/

The California Tahoe Conservancy is an independent state agency within the Resources Agency of the State of California. It was established to develop and implement programs through acquisition and site improvement to improve water quality in Lake Tahoe, preserve the scenic beauty and recreational opportunities of the region, provide public access, preserve wildlife habitat areas, and manage and restore lands to protect the natural environment.

2.8 ENVIRONMENTAL IMPROVEMENT PROGRAM (EIP)

http://www.trpa.org/default.aspx?tabid=227

The EIP was first envisioned at the 1997 Presidential Summit at Lake Tahoe. The EIP is a collaborative effort to preserve, restore, and enhance the environment and water clarity of Lake Tahoe. The program provides capital investment in projects and programs under the EIP to restore the Lake Tahoe Basin. Funds for the EIP are provided by the States of California and Nevada, as well as local, regional and federal sources.

2.9 LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD (LRWQCB)

http://www.waterboards.ca.gov/lahontan/

The State Water Resources Control Board along with nine regional boards were established (according to drainage basins) under the Porter-Cologne Water Quality Control Act. The State Water Quality Control Board and regional boards are responsible for implementing the Clean Water Act in California. The mission of the LRWQCB is to develop and enforce water quality objectives and implementation plans that will best protect the beneficial uses of the state's waters, recognizing local differences in climate, topography, geology, and hydrology. The LRWQCB works to preserve and enhance the quality of California's water resources and ensure their proper allocation and efficient use for the benefit of present and future generations.

The Porter-Cologne Act directs regional boards to develop basin plans. In the Tahoe Region, the *Water Quality Control Plan for the Lahontan Region* (Basin Plan) is the guiding document for water quality objectives and implementation measures (LRWQCB 1995). With respect to managing AIS, at the time of the adoption of the Lake Tahoe Aquatic Invasive Species Management Plan, the Basin Plan stated that regionwide water quality objectives for pesticides, and related objectives for nondegradation and toxicity, essentially preclude direct discharges of

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pesticides such as aquatic herbicides. The LRWQCB's regionwide control measures for pesticides (as defined by California Agriculture Code § 12753), discussed in Chapter 4 of the Basin Plan, are applicable in the Lake Tahoe Basin.

Since some strategies to control AIS may involve chemical controls, the LRWQCB initiated a Basin Plan amendment process to allow for such application when appropriate. The Basin Plan amendment removed the restrictive water quality objective for pesticides, and replaced it with a prohibition on pesticides in water. The amendment also provides procedures for private and government parties to seek exemption to the prohibition when seeking to use aquatic pesticides. All instances of terrestrial pesticides in water are enforceable violations. If granted, a prohibition exemption allowing the use of aquatic pesticides would be regulated by the appropriate permit, such as a general National Pollutant Discharge Elimination System (NPDES) permit adopted by the State Water Resources Control Board, or an individual NPDES permit or Waste Discharge Requirement. The projects seeking exemption from the prohibition on pesticides in water must either be for the purpose of human health and safety or for the preservation of ecological integrity. Additionally, the criteria required of the project proponent's request for exemption varies depending on if the project is an emergency (defined in Basin Plan), time sensitive, or if it is in response to an existing and ongoing need to control pests.

Before they take effect, Basin Plan amendments adopted by the regional board must be approved by the State Board and the California Office of Administrative Law. These adoptions and approvals have taken place as of the writing of this Appendix. Because the amendment replaces a water quality objective (Clean Water Act water quality standard), the amendment must also be approved by the EPA. Such approval is pending as of press time.

2.10 LAKE TAHOE AIS COORDINATION COMMITTEE (LTAISCC)

The LTAISCC develops and oversees a comprehensive Lake Tahoe Region AIS program to attain the goals of prevention, early detection and rapid response, and control using integrated methods. The LTAISCC facilitates and promotes communication and partnerships to ensure the efficient and effective deployment of resources in order to implement a sustained intergovernmental and private sector program that meets all state and federal requirements.

The LTAISCC is composed of state and federal agency representatives, researchers, and other groups responsible for management, regulatory, or cultural heritage activities in the Basin. Formed in late 2007, the Committee has overseen the development, approval, and implementation of the Lake Tahoe AIS Management Plan adopted in 2009. The LTAISCC develops an annual work program, allocates funding based upon a priority assessment, and is continually seeking new and additional funding. Committee members are also tasked with ensuring that activities proposed by the Plan are either consistent with their current agency policy or they are working within their respective agency to modify their policies as needed.

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2.11 LAKE TAHOE AIS WORKING GROUPS (LTAISWGS)

Under the overall management of the LTAISCC, individual topic working groups provide daily direction on project-level AIS work that has been identified by the LTAISCC in the annual work plan. The Lake Tahoe AIS Working Groups include the Asian Clam Working Group, the Nearshore Aquatic Weed Working Group, the Tahoe Keys Working Group (including aquatic weeds and warm water fish), the Outreach and Education Committee, the Tahoe Keepers, and the Watercraft Inspection Working Group. Additional subcommittees are created on an as needed basis.

Twice a year, in the spring and fall, the LTAISCC and the working groups present public forums to inform and educate the public regarding AIS activities in the Lake Tahoe Region and to reaffirm the risks and costs of AIS introductions. The forums present information on the overall program and partnerships, early detection and rapid response, Emerald Bay and lakewide aquatic weed control, warm water fish control, aquatic herbicide regulations, Asian clam control, bull frog control, watercraft inspections and decontamination, education and outreach, the Tahoe Keepers, and volunteer and stewardship opportunities.

2.12 LEAGUE TO SAVE LAKE TAHOE

http://www.keeptahoeblue.org

Started in 1957, the League to Save Lake Tahoe is dedicated to protecting and restoring the environmental quality, scenic beauty, and low-impact recreational opportunities of the Lake Tahoe Basin. The group focuses on water quality, its clarity, and other critical environmental issues to “Keep Tahoe Blue.”

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2.13 NEVADA DEPARTMENT OF ENVIRONMENTAL QUALITY - BUREAU OF SAFE DRINKING WATER

http://ndep.nv.gov/bsdw/index.htm

The mission of the Bureau of Safe Drinking Water is to protect the public health of the citizens, tourists, and visitors to the state by ensuring that the public water systems provide safe and reliable drinking water. Nevada Revised Statute 445A.800 states, "it is the policy of this state to provide for water which is suited for drinking and other domestic purposes and thereby promote the public health and welfare." With respect to AIS, control activities in and around water intakes that involve physical removal processes (e.g., that could disturb sediment and increase turbidity) or the application of pesticides can have an impact on compliance with regulations and serving potable water.

2.14 NEVADA DEPARTMENT OF WILDLIFE (NDOW)

www.ndow.org/fish/exotic/
http://www.ndow.org/law/regs/index.shtm#boat

NDOW is the state agency responsible for the restoration and management of fish and wildlife resources, and the promotion of boating safety on Nevada's waters. NDOW's mission is to protect, preserve, manage, and restore wildlife and its habitat for the aesthetic, scientific, educational, recreational, and economic benefits to citizens of Nevada and the United States, and to promote the safety of persons using vessels on the waters of Nevada.

NDOW is primarily funded by sportsmen's license and conservation fees and a federal surcharge on hunting and fishing gear. Under NRS Title 14 Chapter 171.123, any peace officer (e.g., NDOW Game Warden, county sheriff deputy, city police agencies) may detain a person that has committed, is committing, or is about to commit a crime (e.g., possession of state-listed prohibited wildlife [NAC 503.110] or plant [NAC 555.010] species). A person must not be detained longer than is reasonably necessary to ascertain his identity and the suspicious circumstances, and no longer than 60 minutes.

NDOW Game Wardens, as deputized by the USFWS, can enforce federally listed prohibited animal species laws [Lacey Act 50 CFR 16.11-16.15] if prohibited organisms are transported across state lines. Within the state of Nevada, NRS 503.597 states that it is unlawful to introduce or remove aquatic life or wildlife, including their spawn, eggs, or young and a Game Warden may enforce the statute if aquatic organisms are observed being transported. NDOW maintains the Operation Game Thief Hotline at (800) 992-3030, which may be used to report prohibited species. The penalty for possessing prohibited organisms in Nevada may be as high as six months in jail and a $500 fine.

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2.15 NEVADA DIVISION OF STATE LANDS

http://www.lands.nv.gov/

The Nevada Division of State Lands leads the State of Nevada's programs to protect Lake Tahoe, including coordination of the Nevada Tahoe Resource Team. This interagency team is dedicated to preserving and enhancing the natural environment in the Lake Tahoe Basin. The Division also administers other special programs as well as provides staff assistance to the Nevada Tahoe Regional Planning Agency (TRPA) and the State Land Use Planning Advisory Council.

2.16 NEVADA DIVISION OF STATE PARKS

http://www.parks.nv.gov/

The Nevada Division of State Parks plans, develops, and maintains a system of parks and recreation areas for the use and enjoyment of residents and visitors. The Division also preserves areas of scenic, historic, and scientific significance in Nevada.

2.17 TAHOE AREA SIERRA CLUB GROUP

http://motherlode.sierraclub.org/tahoe

The Sierra Club is widely known as a watchdog group for development and land management issues in the Tahoe Basin and has increased efforts to spread the word about invasive species to its members in the Tahoe area. Outreach efforts include a prominent link on their website and local presentations on AIS impacts.

2.18 TAHOE INTERAGENCY EXECUTIVE (TIE) COMMITTEE

The TIE committee is composed of executive level representatives from regional (e.g., TRPA and water improvement districts), state, and federal agencies and organizations. The TIE is involved in updating the Lake Tahoe Region EIP, which includes AIS components. The committee also reviews cost estimates associated with AIS activities in the EIP. With respect to this AIS management plan, it is anticipated that TIE will continue supporting efforts of the LTAISWGs and LTAISCC.

2.19 TAHOE KEYS PROPERTY OWNERS ASSOCIATION (TKPOA)

http://www.tahoekeyspoa.org

The TKPOA is a non-profit mutual benefit corporation whose members include lot owners within the Tahoe Keys development. The Board of Directors is dedicated to managing the aquatic weed problem in the Tahoe Keys (the Keys). The TKPOA Water Company has an active program of mechanically harvesting aquatic weed in the lagoons and monitors water quality under the requirements of a NPDES water circulation permit. The TKPOA is a cooperative partner with the Aquatic Invasive Species Working Group and is working with USFS, USFWS, CDFW, TRPA, Tahoe Resource Conservation District (TRCD), USDA, and other partners and

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stakeholders to develop a more viable solution to manage/eradicate aquatic weeds and invasive species in the Keys, and to prevent the introduction of new invasive species in the Keys and the Tahoe Basin. A significant current effort of the Working Group is to develop a program to evaluate various control techniques in the Keys lagoons. The TKPOA also continues to be involved in a cooperative data collection and sharing program with USDA, CDFW, Tahoe Environmental Research Center (TERC), and others.

2.20 TAHOE RESOURCE CONSERVATION DISTRICT (TRCD)

http://www.tahoercd.org/

The TRCD was established in 1974 under Division 9 of the California Public Resources Code. The mission of the TRCD is to promote the conservation and improvement of the Lake Tahoe Basin's soil, water, and related natural resources by providing leadership, information, programs, and technical assistance to all land managers, owners, organizations, and residents. It is tasked with protecting land, water, forests, and wildlife through activities such as erosion control, runoff infiltration, native landscaping, water conservation, and wildlife enhancement. Prompted by infestations of submersed invasive plants and the threat of quagga mussels, the TRCD ramped up AIS prevention and management efforts and are actively involved in the administration and implementation of AIS-related activities with other LTAISWG partners.

2.21 TAHOE REGIONAL PLANNING AGENCY (TRPA)

http://www.trpa.org

The TRPA was founded on a bi-state compact between California and Nevada, ratified in 1969 by the U.S. Congress (P.L. 91-148, 83 Stat. 360) and amended in 1980 (P.L. 96-551, 94, Stat. 3235). In 1974, the TRPA was designated an areawide planning agency under Section 208 of the Clean Water Act. As such, the TRPA is tasked with developing and implementing the Water Quality Management Plan for the Lake Tahoe Basin (208 Plan). The TRPA maintains water quality measures specified in the 208 Plan by limiting the impacts of tourism, ranching, logging, and development on the Lake Tahoe environment and enforcing environmental thresholds.

With respect to AIS, the 208 Plan states (Vol. I, page 154) that the use of insecticides, fungicides, and herbicides shall be consistent with the BMPs (Best Management Practices) Handbook (TRPA 1988, Vol. II), and that TRPA shall discourage pesticide use for pest management. The 208 Plan provides that only chemicals registered with the EPA and the state agency of appropriate jurisdiction shall be used for pest control, and then only for their registered application. No detectable concentration of any pesticide shall be allowed to enter any Stream Environmental Zone unless TRPA finds that the application is necessary to attain or maintain its "environmental threshold carrying capacity" standards.

The TRPA's Governing Board is mandated to "set policy and to approve amendments to the Regional Plan." In 1982, the Governing Board passed Resolution No. 82-11 to adopt environmental threshold carrying capacities for the Tahoe Region (cited in TRPA Code of

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Ordinances). The TRPA's Regional Plan was updated in 2012 and a policy was added to address aquatic invasive species. This policy states: "Prohibit the release of non-native aquatic invasive species in the region in cooperation with public and private entities. Control or eradicate existing populations of these species and take measures to prevent the accidental or intentional release of such species."

The TRPA provides regulatory authority that assists in existing AIS prevention efforts. The TRPA Code of Ordinances Chapter 63.4 addresses aquatic invasive species by prohibiting the introduction of aquatic invasives, or the launching of watercraft contaminated by invasive species. Section 63.4.2 further describes requirements for watercraft inspection and decontamination in that all motorized watercraft shall be inspected by TRPA or its designee prior to launching into the waters of the Lake Tahoe region and that non-motorized watercraft and seaplanes may be subject to an inspection prior to entering the waters of the Lake Tahoe region if determined necessary by the TRPA or its designee.

Chapter 80 of the TRPA's Code of Ordinances describes the review process for all projects within the shorezone of Lake Tahoe including projects to prevent and control aquatic invasive species.

2.22 TAHOE SCIENCE CONSORTIUM (TSC)

http://www.tahoescience.org/

The TSC is a partnership among five research organizations: 1) University of Nevada, Reno; 2) University of California, Davis; 3) the Desert Research Institute; 4) the USFS, Pacific Southwest Research Station, and 5) the USGS, Carson Science Center. Established through a memorandum of understanding in August 2005, the primary objective of the TSC is to provide environmental managers and decision makers with comprehensive and well-synthesized scientific findings drawn from research, monitoring, and modeling. The TSC efforts focus on promoting scientific advancement in the Lake Tahoe Basin through science planning, independent peer review, and technical assistance. With regard to aquatic invasive species, TSC partners are active participants in the LTAISWG and the LTAISCC. In addition, scientists from various TSC partners are actively engaged in investigations to assess the potential for new introductions, quantify the extent of existing infestations, and assist management agencies in the development of effective control measures.

2.23 TAHOE WATER SUPPLIERS ASSOCIATION (TWSA)

http://www.tahoeh20.org

The TWSA is a regional partnership of Nevada and California water suppliers serving the Lake Tahoe region. The TWSA members rely on Lake Tahoe as a source for public drinking water. The TWSA is one of many organizations in Lake Tahoe working to preserve the exceptional water quality of the lake. The mission of the TWSA is to develop, implement, and maintain an effective watershed control program in order to satisfy recommendations in watershed sanitary

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surveys, advocate for the protection of Lake Tahoe as a viable source of drinking water, and satisfy additional state and federal requirements. With respect to AIS, the TWSA is particularly concerned about the introduction of quagga or zebra mussels to Lake Tahoe due to their ability to clog intake structures and cause potential taste and odor problems. Additionally, control efforts that result in increased turbidity may impact filtration avoidance status as granted by the Nevada Department of Environmental Protection (NDEP).

2.24 UNIVERSITY OF CALIFORNIA - TAHOE ENVIRONMENTAL RESEARCH CENTER (TERC)

www.terc.ucdavis.edu

Formed in 2004, the TERC is a center within the John Muir Institute of the Environment at University of California, Davis. The goals of TERC are to address water clarity loss, development, ecosystem management, and research through multidisciplinary and collaborative efforts. TERC publishes the annual *Tahoe: State of the Lake Report*, which summarizes the lake's clarity, temperature, chemistry, and biology.

2.25 UNIVERSITY OF NEVADA AT RENO

http://www.cabnr.unr.edu/chandra/Chandra_lab/AEAL_Homepage.html

Researchers at the Aquatic Ecosystem Analysis Laboratory at University of Nevada at Reno are involved in several AIS-related projects to help restore and conserve aquatic ecosystems. Projects include: monitoring the movement and assessing the number of invasive warm water fishes, evaluating the invasion potential of New Zealand mudsnails and quagga mussel to Lake Tahoe and the Lower Truckee River, evaluating the impacts of non-native crayfish and Asian clam to the lake's ecology, and creating a baseline of benthic invertebrate production prior to increased invasions in Lake Tahoe.

2.26 WESTERN REGIONAL PANEL

http://www.fws.gov/answest/

The Western Regional Panel on Aquatic Nuisance Species was formed in 1997 to help limit the introduction, spread, and impacts of aquatic nuisance species into the western region of North America. This panel of public and private entities was formed by a provision in the National Invasive Species Act of 1996 (P.L. 101-636), the amendment to the 1990 Act. There are 19 western states on the panel, including California and Nevada. In May 2009, the panel completed the Quagga-Zebra Mussel Action Plan for Western U.S. Waters, the objectives of which are to "underscore the highest priority actions and resources needed to minimize impacts of these invasive shellfish to native species, water delivery infrastructure, and other vulnerable resources in the West."

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3 Literature Cited

ANSTF (Aquatic Nuisance Species Task Force). 2012. Aquatic Nuisance Species Task Force Strategic Plan (2013-2017). http://www.anstaskforce.gov/Documents/ANSTF%20Strategic%20Plan%202013-2017.pdf

LRWQCB (Lahontan Region Water Quality Control Board). 1995. Water Quality Control Plan for the Lahontan Region. http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml

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Appendix A2: Lake Tahoe Aquatic Invasive Species Coordination Committee Charter

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Lake Tahoe Region
Aquatic Invasive Species Coordinating Committee
Charter

Final

October 9, 2012

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Purpose

The Aquatic Invasive Species Coordinating Committee (The Committee) develops and oversees a comprehensive Lake Tahoe Region aquatic invasive species (AIS) program to attain the goals of Prevention, Early Detection and Rapid Response, and Control using integrated methods. The Committee facilitates and promotes communication and partnerships to ensure the efficient and effective deployment of resources in order to implement a sustained intergovernmental and private sector program that meets all State and Federal requirements.

Authority

The Lake Tahoe Region Aquatic Invasive Species program (The Program) is governed by existing Federal, State and local laws. This non-binding charter makes use of these existing authorities through the members of The Committee to implement The Program. Those relevant to water quality and/or to aquatic invasive species include but are not limited to:

Federal

- Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990, 16 USC 4721
- Endangered Species Act (ESA) of 1973
- Lacey Act of 1990 as amended in 1998
- National Environmental Policy Act of 1970
- National Invasive Species Act of 1996 (NISA)
- Clean Water Act of 1972
- Safe Drinking Water Act of 1974

State

- California-Nevada Compact for Jurisdiction on Interstate Waters
- California Environmental Quality Act (CEQA)
- California Fish and Wildlife Code 2301
- (California)Porter-Cologne Water Quality Control Act
- Nevada Revised Statutes (NRS 503.597; NRS 488)

Regional

- Tahoe Regional Planning Compact (Public Law 96-551)
- Tahoe Regional Planning Agency Code of Ordinances (Chapter 79.3)

Further information on authorities and the parameters and abilities of the Program is provided in the *Lake Tahoe Region Aquatic Invasive Species Management Plan* which is available at http://www.trpa.org/documents/docdwnlds/AIS/LTAIS_Magmt_Plan_Final_11-2009.pdf.

Membership

Members of The Committee represent agencies and entities with significant land management, resource management, regulatory, or cultural heritage responsibilities in the Lake Tahoe Region. The Committee provides high-level leadership and direction toward implementation of The Program. Members of The Committee are mid-to-high level representatives, with the ability to speak for their agency or entity. They understand the policy and management implications of AIS actions. The Committee members are also expected to have an active level of participation to carry out the work and responsibilities of The Committee.

For agencies meeting the criteria described in the paragraph above, new members may be added to the AISCC through two methods: (1) executives may appoint a representative to serve on the AISCC or (2) the AISCC may contact an agency executive to request the agency provide a representative to serve on the committee.

Members of The Committee include representatives from the following government agencies and entities.

Federal

- USDOI, U.S. Fish and Wildlife Service
- USDA, Agricultural Research Service
- USDA, U.S. Forest Service, Lake Tahoe Basin Management Unit

State

- California Department of Fish and Wildlife
- California Department of Parks and Recreation
- California Regional Water Quality Control Board (Lahontan)
- California State Lands Commission
- California Tahoe Conservancy

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- Nevada Department of Conservation and Natural Resources
- Nevada Department of Wildlife

Regional

- Tahoe Regional Planning Agency
- Tahoe Resource Conservation District
- Tahoe Science Consortium (ex-officio)

The continuity and sustained commitment of all members are critical to the success of The Committee. Individual agencies retain the authority to determine their involvement in The Committee and their level of interaction with the Program. When a vacancy occurs, the committee co-chairs will ask the represented entity to designate a replacement within 30 days.

Roles and Responsibilities

All members of The Committee will work to ensure the Program actions:

- are consistent with their agency's mission, policies, and management strategies;
- are an effective means of achieving the Program goals and objectives; and
- are an efficient means of deploying limited resources.

Each member of The Committee will ensure that the executive of his/her agency is informed about The Program to the extent deemed appropriate by that agency. A member of The Committee also may work within his/her agency to identify opportunities to expand or modify policies and management strategies as a means to expand the tools and resources available to The Program.

The Committee is an intergovernmental forum for coordinating federal, state, bi-state, local and private actions of The Program. The Committee ensures that all activities of The Program are coordinated, complementary, cost-efficient and effective. The central tasks of the Committee include, but are not limited to, the following:

- Develop the Program's 1-year, 3-year, and 5-year priorities and associated budgets.
- Identify and pursue potential Program funding sources.
- Define the project-level priorities of the Program.
- Ongoing Program oversight and guidance to attain Program Goals of prevention, early detection and rapid response, and control of AIS.
- Produce an annual Tahoe Region AIS Program Report, which is the primary Program document intended for a public audience.

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- On a five-year basis, or more frequently as needed, the Committee leads the effort to update the *Lake Tahoe Region Aquatic Invasive Species Management Plan*—the official plan approved by the federal Aquatic Nuisance Species Task Force (USFWS) and endorsed by the governors of Nevada and California.
- Facilitate communication between the Committee and member agencies to efficiently implement projects within the Program.
- Facilitate communication between the Program and the Tahoe Interagency Executive Steering Committee.

Operating Guidelines

The Committee is a standing committee that develops and communicates recommendations on AIS policies, management strategies, program goals and priorities, and matters requiring legislation. The Committee also works to seek consensus on The Program priorities and resource allocations for effective implementation and to achieve Program goals and objectives. The Committee will seek the input and advice of relevant agency executives and the various AIS working groups to formulate its advice and recommendations.

The AISCC convenes approximately monthly, but not less frequently than quarterly.

The AISCC shall have two co-chairs: One chairperson shall be from the U.S. Fish and Wildlife Service and the other chairperson shall be from the Tahoe Regional Planning Agency. This assignment of chairpersons shall continue indefinitely unless a change proposed by a committee member is adopted by two-thirds (2/3) of the standing members.

The co-chairpersons shall assume responsibility for chairing and scheduling meetings, developing meeting agendas which identify action items, meeting facilitation, preparation of meeting notes, and any other reasonable administrative and logistical support for the Committee. With the exception of meeting chair duties, the chairpersons may delegate any of these administrative duties to a willing and capable party or develop procedures for the fair rotation of the duties among committee members.

All AISCC members agree to follow the codes of conduct identified below:

- Be professional and respectful;
- Be outcome focused and avoid side issues;
- Listen for understanding;
- Make decisions and resolve issues in a timely manner;
- Be sensitive to others and the political environment;
- Proactively identify issues and clearly communicate expectations;
- Be mindful of potential conflicts of interest;

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- Actively engage in considering needs across the missions of participating agencies and entities; and
- Allow a minimum of two weeks review time prior to committee consideration of any item requiring a decision of formation of formal advice.

Consensus Seeking Process

As full and equal partners, the management-level representatives or appointed designees, agree to use a consensus seeking process to develop The Committee's advice and recommendations. Actions requiring consensus are only taken on issues or items listed on the meeting agenda unless otherwise agreed to by all AISCC members present.

For the purpose of the AISCC, consensus means that everyone agrees that they can live with the final proposal after every effort has been made to meet any outstanding interests. This is not the same as unanimity, where all parties agree. The consensus gauge below shall be used to indicate the degree of agreement of any committee member. If all committee members are in the range of 1 through 4, the group shall be considered in consensus and no further discussion is needed. If several individuals are at a 4 then additional discussion may be needed. Further discussion is required if one or more members are at a 5 or 6.

Consensus Gauge

1. The proposed decision is fully acceptable. Support the committee's decision or recommendation.
2. The proposed decision is acceptable with minor reservations. Support the committee's decision or recommendation.
3. The proposed decision is acceptable, even with major reservations, but it is the best decision at this time. Support the committee's decision or recommendation.
4. Stand aside/abstain; won't block but cannot offer support.
5. Cannot live with the decision (must be able to offer an alternative).
6. Need more information (must be able to identify the information needed).

The following process shall generally be followed for any item necessitating consensus. Each agency representative or designated alternate representative on The Committee present is to be polled to determine if consensus has been achieved. The alternate representatives are empowered to act on behalf of the members they represent. The Committee members must be fully informed of the issue to register their level of consensus. There is no absentee participation in the consensus process, but participation via teleconferencing may be permissible if agreed to, and arranged for, in advance. Meeting agenda will include notification of any items requiring consensus. The Tahoe Science Consortium representative shall serve in an ex-officio capacity: the representative can provide advice and opinions on the issue but not polled as part of group consensus. As this

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is a non-binding charter any consensus achieved will not supersede any member agency's policies, regulations, or other guiding documents.

AIS Working Groups

The AISCC may establish one or more issue-specific working groups. Generally, these groups are intended but not limited to:

- Guide the specific AIS work-plan elements and tasks;
- Develop recommendations for near term program actions and priorities;
- Provide public education and outreach and forums to ensure stakeholders and the interested public remain informed of AIS and The Program actions and priorities;
- Identify issues impacting program implementation and communicate those issues to the AISCC;
- Develop content for The Program annual report; or
- Develop subject-specific implementation plans.

Communication Efforts

Communication is critical to the success of the Program and will happen at multiple levels among the agencies. Although members of The Committee will communicate informally with agency technical staff through ordinary Basin and Regional discourse, it is the responsibility of each member of The Committee to ensure that pertinent information regarding needs of The Program is fully communicated from the agency executives to the technical staff and from technical staff to executives within his/her agency.

Members of The Committee or AIS working group all have the responsibility to communicate Program activities and priorities, and to solicit input from contemporary groups and any other stakeholders as agreed to by The Committee.

The Committee will support communication protocols to insure venues exist for the working groups and The Committee to benefit from "lessons learned." This is an informal process for receiving input on The Program activities that can occur in one or more ways including through direct communication with executives of participating agencies; through direct communications between The Committee and working group members; or through communication stakeholders and the interested public.

The Committee meetings are open to the public, but will generally not be conducted as public meetings unless otherwise agreed to by consensus of the members. Presentations to The committee may be made by non-members provided that said presentations are included on the meeting agenda in advance.

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Public announcements, including news releases and other information relative to efforts or activities of The Program or The Committee, will be disseminated on a case-by-case basis. Joint press releases may be released on behalf of the agencies by explicit consent.

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LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix B: Aquatic Invasive Species of Concern

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Acronyms

AIS	Aquatic Invasive Species
CDPR	California Department of Pesticide Regulation
eDNA	Environmental DNA
IPM	Integrated Pest Management
LRWQCB	Lahontan Regional Water Quality Control Board
NDA	Nevada Department of Agriculture
TRPA	Tahoe Regional Planning Agency
UNR	University of Nevada, Reno
USEPA	United States Environmental Protection Agency

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Glossary

Algae bloom: A rapid increase in a population of algae in an aquatic system; usually occurs resulting from a nutrification event.

Aquatic species: All animals and plants as well as pathogens or parasites of aquatic animals and plants totally dependent on aquatic ecosystems for at least a portion of their life cycle.

Aquatic invasive species: A nonindigenous species that threatens the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters.

Ballast: An often water-filled device used on ships and submersibles to control buoyancy and stability.

Benthic (benthos): The ecological region located at the deepest level of a body of water; this includes the area around the interface between the sediment surface and water column.

Bilge: The lowest compartment on a ship or boat where water that is taken-on while floating on a waterbody collects and pools.

Biocide: A substance that is destructive to many different organisms, examples include: pesticides, herbicides, fungicides.

Biocontrol: The use of living organisms, such as predators, parasites and pathogens, to control pest animals (e.g., insects), weeds or diseases.

Bio-fouling: The undesirable accumulation of living or dead organisms on submersed structures (pipes, boat hulls, piers, anchors, rocks, et cetera) or other organisms.

Biomass: The amount of living matter (as in a unit area or volume of habitat).

Bivalve: Mollusks belonging to the class Bivalvia that are characterized by having a shell composed of two parts or valves.

Byssal threads: Fibers produced by bivalves that function to anchor individuals to their substrate.

Cold water fish: Fish species that prefer and inhabit colder waters; examples are salmonid species such as trout and salmon.

Concentration (chemistry): The density of an environmental component in a defined area.

Control: Eradicating, suppressing, reducing or managing invasive species populations, preventing spread of invasive species from areas where they are present and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

Desiccation: The process by which a substance is dried out and the moisture is removed.

Detritus: Non-living particulate organic material derived from living organisms.

Dreissenid: A family of small, often invasive, freshwater mussels in the phylum Molllusca.

Ecosystem: The complex of a community of organisms and its environment functioning as an ecosystem unit.

Eradicate: For the purpose of this Plan, eradication is the complete elimination of an invasive species from a specific part of the Lake Tahoe Region.

Established: An introduced organism with a permanent population(s), i.e., one that has the ability to reproduce and is not likely to be eliminated by humans or natural causes.

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Exotic: Any species or other variable biological material that enters an ecosystem beyond its historic range, including such organisms transferred from one country to another. Also known as nonindigenous or non-native.

Filter feeder: An aquatic animal, such as a mussel or clam that feeds by filtering particulate organic material from water.

Fouling: An accumulation of organisms that attaches to naturally occurring and manmade submerged hard surfaces such as rocks, shells, ships, intake pipes, and other submerged equipment or machinery. Mobile organisms that may be tucked in nooks created by the larger animals are also considered part of the "fouling community."

Host: A living animal or plant that supports parasitic animals, plants or microbes, internally or on its surface.

Integrated Pest Management: A decision-based process involving coordinated use of multiple tactics for optimizing the control of all classes of pests (insects, pathogens, weeds, vertebrates) in an ecologically and economically sound manner.

Intentional introduction: All or part of the process by which a nonindigenous species is purposefully introduced into a new area.

Introduction: The intentional or unintentional escape, release, dissemination or placement of a species into a California ecosystem as a result of human activity.

Invasive species: An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112 [Federal Register: Feb 8, 1999, Vol. 64, No. 25]). Species that establish and reproduce rapidly outside of their native range and may threaten the diversity or abundance of native species through competition for resources, predation, parasitism, hybridization with native populations, introduction of pathogens, or physical or chemical alteration of the invaded habitat. Through their impacts on natural ecosystems, agricultural and other developed lands, water delivery and flood protection systems, invasive species may also negatively affect human health and/or the economy.

Invertebrate: Any animal that does not possess a backbone.

Littoral zone: The area in an aquatic environment found between the high-water mark and the permanently submerged nearshore area.

Macroinvertebrate: An invertebrate large enough to be visible to the naked eye.

Macrophyte: An emergent, submerged or floating aquatic plant large enough to be visible to the naked eye that provides cover, substrate, and oxygen for aquatic animals.

Metamorphs: A change in the form and often habits of an animal during normal development after the embryonic stage; also refers to the individual who is undergoing the change.

Microzooplankton: A community of zooplankton composed of animals too small to be seen with the naked eye.

Native species: A species within its natural range or natural zone of dispersal (i.e., within the range it would or could occupy without direct or indirect introduction and/or care by humans).

Nearshore: The zone extending from the low water elevation of Lake Tahoe (6,223.0 feet Lake Tahoe Datum) to a lake bottom elevation of 6,193.0 Feet Lake Tahoe Datum, but in any case, a minimum lateral distance of 350 feet measured from the shoreline. In other lakes, the nearshore extends to a depth of 25 feet below the low water elevation.

Neonate: New born.

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Non-native or Nonindigenous species: A species that enters an ecosystem beyond its historic geographic range. Also known as exotic or alien species. Other taxa can be considered non-native or nonindigenous, such as families, genera, subspecies or varieties.

Non-point source: Coming from a general, non-specific area.

Nuisance species: For the purpose of this plan, the term is synonymous with invasive species.

Oligotrophic: A lake condition of low production associated with low phosphorus and nitrogen.

Operculum (invertebrate): A hard covering used by gastropods (snails) to close the opening to their shell.

Organic (ecological): Matter that has come from a once-living organism; is capable of decay, or the product of decay; or is composed of organic compounds.

Pathway: Mode by which a species establishes and continues to exist in a new environment; often synonymous with vector, dispersal mechanism, and mode. Natural and human connections that allow movement of species or their reproductive propagules from place to place.

Periphyton: Microbial growth upon substrata. It is a broad term that applies to microbiota living on any substratum, living or dead, plant, animal, or nonliving.

Phytoplankton: Free-floating microscopic plants (primary producers) that compose the autotrophic component of the plankton community.

Piscicide: A chemical substance which is poisonous to fish; typically used to eliminate a dominant species of fish in a body of water.

Polytrophic: Subsisting on various types of organic material.

Propagule: Any plant material used for the purpose of plant asexual propagation.

Re-suspension: Suspending of settled sediments that have been suspended in the past.

Rhizome: A specialized plant stem that often sends out roots and shoots from its nodes for asexual reproduction.

Senesce (plant): A natural response in plants where single plant organs (e.g., leaves) or entire plants are lost as metabolically expensive nutrients are moved to surviving plant organs.

Spatial partitioning: A physical redistribution of competitive organisms in space.

Stolon: A specialized colonizing plant organ that is often a horizontal above-ground shoot that arises from an axillary bud near the base of the plant.

Substrate: The base on which an organism lives and grows.

Taxa: Groups used to classify organisms (e.g., kingdom, phylum, class, order, family, genus and species). Taxa is the plural form of taxon.

Trematode: Any parasitic flatworm in the class Trematoda.

Tuber: A specialized modified plant structure that is enlarged to store nutrients.

Turion: A wintering bud of water plant that breaks off and lies submerged and dormant until the following spring, when it produces a new plantlet that floats to the surface.

Ultra-oligotrophic: A lake condition of extreme low production commonly associated with very low phosphorus and nitrogen.

Vector: The physical means or agent by which a species is transported (e.g., boat hulls, live wells, fishing gear); often synonymous with pathway, dispersal mechanism, and mode.

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Veligers: Free-swimming larvae of mollusks such as clams and mussels.

Warm water fish: Fish species that prefer and inhabit warmer waters; examples include smallmouth bass, crappie, and other sunfish (Centrarchidae).

Watershed: The geographic area that drains to a single waterbody or hydrographic unit such as a lake, stream reach or estuary.

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Appendix B
Aquatic Invasive Species of Concern

1 Non-Native Species Present or Threatening Lake Tahoe

Nearly 30 known non-native aquatic species, including plants, fish, invertebrates, and an amphibian are established in the Lake Tahoe Region (as defined by the Tahoe Regional Planning Agency [TRPA] Compact). Many of these non-native species were purposefully and legally/incidentally introduced (i.e., as a managed game fishery), but others were introduced illegally, for example, through recreational activities, the aquarium trade, or resource management activities such as habitat enhancement projects. The states of California and Nevada further define the economic impacts, distribution, and level of establishment of many non-native species. Based on this and information provided by numerous researchers, resources managers, and published literature, a summary of aquatic invasive species (AIS) of concern to the Lake Tahoe Region was developed.

The following sections outline the general biology, impacts, and control measures for AIS that are known to occur or threat introduction to the Tahoe Region. Other invasive species present in Lake Tahoe, but not discussed further, include the mysid shrimp (*Mysis relicta*) and gill maggot (*Salmincola californiensis*) (Kamerath et al. 2009). Though not yet present, the spiny waterflea (*Bythotrephes longimanus*) threatens introduction to the Lake Tahoe Region.

1.1 Aquatic Plants

Aquatic plants play an important role in the structure and function of aquatic ecosystems. In particular, they provide habitat for fish, wildlife, and other aquatic organisms (Madsen 2009). Dense growth of invasive aquatic plants impede water flow, disrupt navigation, discourage recreational activities, deleteriously affect water quality, and reduce native plant diversity (Smith and Barko 1990; Frodge et al. 1991; Boylen et al. 1999; Mullin et al. 2000). Non-native aquatic plants known to occur in Lake Tahoe include Eurasian watermilfoil (*Myriophyllum spicatum*) and curlyleaf pondweed (*Potamogeton crispus*). These rooted plants "pump" nutrients from the sediment to the overlying water column (Carignan and Kalff 1980; Granéli and Solander 1988; Walter et al. 2000) during growth and may be contributing to increased phytoplankton and reductions in water clarity at Lake Tahoe. The ability of a plant to spread and become invasive is strongly driven by factors such as its propagule type (e.g., seed, stem fragment, tuber, turion, stolon, rhizome), propagule number, and ability to withstand harsh conditions and optimize limited resources (e.g., light and nutrients) (Haynes 1988).

Eurasian watermilfoil was likely introduced to Lake Tahoe in the 1960s to early 1970s when the Tahoe Keys were developed; however, paleolimnological data do not fully support this (Kim and Rejmánková 2001). The U.S. Department of Agriculture–Agricultural Research Service

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confirmed Eurasian watermilfoil in Lake Tahoe in 1995 and curlyleaf pondweed in 2003 (Anderson 2007). While native plant species such as Andean milfoil (*M. quitense*), Canadian waterweed (*Elodea canadensis*), coontail (*Ceratophyllum demersum*), and leafy pondweed (*Potamogeton foliosus*) are found in Lake Tahoe, Eurasian watermilfoil and curlyleaf pondweed dominate the submersed aquatic plant community (Anderson 2007). Surprisingly, prior to 1995, only one published reference to "*Myriophyllum* sp." (near Ward Creek and Tahoe City) has been documented (Flint and Goldman 1975) and all other evidence for aquatic plant distribution and species is anecdotal (L. Anderson, pers. comm., 2009).

Factors such as light penetration, wave energy, sediment texture, slope, and water temperature all influence submersed plant distribution (Duarte and Kalff 1986; Hudon et al. 2000). Areas of high energy (due to wind and waves), steep slopes, and poor substrate such as large boulders (e.g., north of Cave Rock to South Point, entrance to Emerald Bay) are unlikely to support submersed plant growth in Lake Tahoe, regardless of depth. Conversely, the leeward (west side) and isolated embayments and marinas are more likely to support aquatic plant growth. Depth information at Lake Tahoe has been shown to be the most comprehensive variable (i.e., easily mapped and readily available information) for predicting plant distribution. To determine the potential habitat available for submersed aquatic plants, we assumed a survival depth of approximately 11 meters (Sheldon and Boylen 1977; Chambers and Kalff 1985; Schwarz and Howard-Williams 2000). This represents the maximum depth under most natural conditions. Within this depth range, there are approximately 4,600 surface hectares of available habitat for submersed aquatic plants in Lake Tahoe, including the Tahoe Keys area (Figure 1).

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Figure 1. Potential distribution of submersed plants (e.g., curlyleaf pondweed and Eurasian watermilfoil) in Lake Tahoe

Control/Eradication Methods for Invasive Aquatic Plants

Controlling or eradicating unwanted aquatic vegetation may be accomplished using the methods outlined below and/or through Integrated Pest Management (IPM). The following sources were consulted to summarize aquatic plant control technologies: Gibbons et al. (1999), Madsen (2000), Cooke et al. (2005), Washington Department of Ecology (2008), and Gettys et al. 2009.

Cultural Methods

Cultural control methods typically involve approaches that *prevent* the introduction of invasive species through education and/or legislation (Bellaud 2009). Examples of cultural control methods include boat ramp monitoring programs, boat wash stations, education programs directed to various citizen groups such as volunteer monitoring, and organized waste clean-up activities. Consistent and clear messaging (e.g., "Clean, Drain, and Dry") is a common theme of most prevention programs.

The application of cultural control methods has been highly effective at Lake Tahoe. Specific examples include the Small Watercraft Inspection Program and the Watercraft Inspection Program (see Appendix D). Reports from individual workgroups are provided as attachments on an annual basis.

Physical Methods

Methods to physically control unwanted aquatic plants include: hand-pulling and hand-pulling with diver-assisted suction, deployment of benthic/bottom barriers, water level drawdown, and the use of tools such as cutters, rakes, or hooks. Many of these physical methods, however, typically produce plant fragments capable of sprouting.

Diver-operated suction is used to facilitate the removal of plants and plant fragments following hand-pulling. Similar to vacuuming, the plant material and sediment are suctioned during hand-pulling then transported to the surface. The sediment is sifted through a screen and the vegetation is retained for disposal. This method can allow for selective removal of unwanted vegetation, may be used near boat docks or other areas of lake bottom with large obstacles (e.g., boulders, tree logs), and is generally considered environmentally favorable by the public. Increased turbidity can temporarily result from diver-assisted suction and reduce diver visibility. While an effective means of controlling invasive aquatic plants, vegetative hibernacula such as tubers, turions, and root crowns may remain in the sediment allowing for reinfestation.

Hand-pulling of aquatic plants is most effective in shallow water where the bottom is within reach. In deeper water, tools and/or snorkel or scuba gear will most likely be needed. Physical methods of plant removal are best for smaller areas and for on-going maintenance of treated areas as it is very labor intensive. Because plant fragments may be produced while using many physical methods, it is important to have a system in place to contain the fragments (e.g., suction device, booms around the boat, person to hand net the fragments). To reduce the potential spread

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of aquatic plants, all removed plants must be disposed of at an off-site location away from water sources.

Bottom barriers, also called benthic barriers or benthic screens, control rooted aquatic plants by covering the vegetation with materials such as sand, gravel, burlap, plastic, or woven synthetic fibers, thereby preventing light penetration. These barriers can be used at various depths but typically require divers for applications in deep water or around boat docks and piers. Due to the flexible nature of materials used, bottom barriers require anchoring or ballast and perforations to allow gas from decomposing plant material to escape.

The advantages of bottom barriers are that a variety of rooted plants, particularly new infestations, may be controlled and they are not considered harmful to ecosystems. Disadvantages include maintenance, cost of material, limited to flat areas or those with little change in slope and no obstructions (i.e., logs, boulders, large rocks), and potentially high cost of installation and maintenance if commercial dive services are used. Maintenance is critical as plants can send lateral branches from under the barrier. Also, improper anchoring can lead to ballooning of the material, and sediment deposition over the barrier can exacerbate barrier decomposition (e.g., for burlap). Lastly, barriers may result in temporary impacts to benthic organisms.

In general, the advantages of physical control methods are: they are generally less expensive, allow for selective removal, are simple, and are perceived favorably by the public. As an example of physical application, California State Parks uses a combination of bottom barriers with diver-operated suction with hand pulling. The bottom barriers cover large areas and the diver-operated suction/hand pulling removes the aquatic weeds in areas that cannot be covered by barriers due to large underwater obstacles, lake bottom topography, etc. Disadvantages for physical control methods are: labor intensive effort and plant fragments need to be removed to prevent further spread. Additionally, water may become turbid and limit visibility particularly when pulling plants that have large or deep rhizomes or roots. Operations may require acquisition of permits and water quality monitoring for diver-assisted suction removal and bottom barrier placement and removal. Water quality monitoring is a requirement for projects permitted by the Lahontan Regional Water Quality Control Board (LRWQCB) and monitoring needs are identified in such permits. An effort is currently under way by the TRPA to implement a lake-wide (i.e., not state specific) permit for such activities.

Water level drawdown may be used to expose plants to desiccation, heat, or cold long enough to kill them. Water drawdown may provide opportunities for coordination with bottom barrier installation or maintenance and construction of other structures such as boat docks, fish screens, and dams. Frequent and/or prolonged drawdowns are often required for substantial reduction or elimination of unwanted vegetation. Water drawdown is not a selective plant eradication strategy and may encourage the growth of unwanted vegetation, particularly plants that can survive desiccation (e.g., hydrilla tubers [Doyle and Smart 2001]). This method of plant control is more

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applicable for use in reservoirs, irrigation canals, and other areas where water level control structures are present; it is not considered a viable method for controlling invasive aquatic plants in Lake Tahoe.

Mechanical Methods

Mechanical control devices typically remove or "mow" the upper portions of a plant canopy (up to about 1 to 2 meters below the water surface) using a mechanized cutter. The scale of mechanical controls ranges from portable boat-mounted to barge-like devices. Fragment recovery is critical to prevent further spread and can be accomplished using a net for boat-mounted devices. For larger harvesters, a conveyor belt system may be used to offload harvested vegetation to a barge where plants are deposited on shore or contained for transport off-site.

The advantages of mechanical control are that open water access is immediately provided and it is perceived as less harmful to the environment. The disadvantages are that cost varies greatly between small boat-mounted cutters and large-scale harvesters. The latter have to be either transported from elsewhere, or purchased for use within the same waterbody. The prevailing disadvantages are that plants are allowed to return, there is no selective control, "mowing" can stimulate more dense vegetative growth, and plant fragments can be spread to potentially expand the in-lake population.

Weed cutting and harvesting are not currently regulated in the Region; however, there are concerns about the improper disposal of plant fragments that could spread infestations and release nutrients upon decay. Additionally, the operation and maintenance of weed harvesters should be sufficient to prevent leakage of mechanical fluids. Regulatory agencies (i.e., LRWQCB or TRPA) customarily require that a plant disposal plan and an operations and maintenance plan be in place prior to project commencement. Such agencies often meet this need through the requirement of a Hazard Assessment and Critical Control Points Plan for the project.

Biocontrol Methods

Biocontrol is the use of one organism (generally host-specific) to control another. The control agent works by impacting the reproduction or growth of the host. Because the presence of the host organism is required for the biocontrol agent, this method used alone will provide control, but not eradication. Biocontrol methods may, however, be used as part of an IPM plan to increase efficacy.

The advantage of biocontrol agents is that public perception is generally benign and the perception is further improved when the proposed agent is native. Additionally, while biocontrol agents will not effectively *eradicate* unwanted vegetation, they can control plants to more acceptable levels, allowing for native vegetation to thrive, or leave plants susceptible to other control methods using IPM. Biocontrol agent stocking rates are difficult to predict especially in novel environments.

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The native North American weevil (*Euhrychiopsis lecontei*) has been shown to be an effective biocontrol agent against Eurasian watermilfoil (Newman et al. 1995; Creed 1998; Jester et al. 2000; Sheldon and Creed 2003; Smith 2010). Weevil larvae damage milfoil plants by mining through the stem during their development (Mazzei et al. 1999). The result can be substantial loss in stem and root biomass without the need for mechanical removal. The optimal stocking rate of weevils has been estimated at two to four weevils per stem (Newman and Biesboer 2000); however, damage to the plant depends on factors such as water temperature, disease, and plant health (Newman et al. 1995; Mazzei et al. 1999; Spencer and Ksander 2004). Weevils have been considered for use in Lake Tahoe; however, it is unknown whether viable populations of the insects would establish at Lake Tahoe due to lack of suitable over-wintering habitat and in-lake predation by fish (Newman et al. 2001). Cline et al. (2013) reported *E. lecontei* in Placer County, California, northwest of Lake Tahoe. They also reported larval feeding damage on *M. sibiricum* (northern milfoil) in Spooner Lake, Nevada, east of Lake Tahoe; however, it is unknown whether this was from *E. lecontei* or another weevil commonly associatiated with other *Myriophyllum* species.

Grass carp or white amur (*Ctenopharyngodon idella* Val.) are non-native, plant consuming fish native to large rivers of China and Siberia. Known for their high growth rates and wide range of plant food preference, these fish can control certain nuisance aquatic plants under the right circumstances. Grass carp are most appropriately used for lake-wide, low-intensity control of submersed plants. Stocking rates and effectiveness of grass carp in controlling aquatic weeds depends on feeding preferences, metabolism, temperature, stocking rates, and even fish size (Sanders et al. 1991, Ecology, 1992; Cooke et. al., 1993, Colle 2009). Laboratory and field studies in Washington State have shown that some plant species appear to be highly preferred such as the pondweeds, (e.g. *Potamogeton crispus*, *P. pectinatus* and *P. zosteriformis*); others are variably preferred such as coontail (*Ceratophyllum demersum*) and Brazilian elodea (*Egeria densa*), and some plants are not preferred such as milfoil, watershield (*Brasenia schreberi*) and cattail (*Typha* spp.). In fact, while grass carp will consume almost any plant material (including grass clippings), there is a conspicuous lack of preference for milfoil (Colle 2009). Since sterile grass carp exhibit distinct food preferences, they do not graze all plants equally, limiting their applicability. The fish may avoid areas of the waterbody experiencing heavy recreational use, resulting in less plant removal. Plant reductions may not become evident for several years. Overstocking of grass carp could result in eradication of beneficial plants and have serious impacts on the overall ecology of the waterbody. An escape barrier is required to prevent movement of fish out of the system and avoid impacts on downstream aquatic ecosystems. There may be fish loss due to predation, especially by ospreys and otters.

Chemical Methods

Aquatic herbicides registered by the U.S. Environmental Protection Agency (EPA) may be used to control and, in some cases, eradicate unwanted vegetation. These herbicides must also be

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registered by the California Department of Pesticide Regulation for use in California and by the Nevada Department of Agriculture if used in that state. Herbicide selection is based on factors such as plant species, waterbody function (e.g., drinking water, recreation, aesthetics or irrigation), presence of native and/or federal/state-listed species, public perception, and other considerations. Aquatic herbicides are typically discussed in terms of their mode of action and selectivity. Aquatic herbicides registered for use by the EPA, the state of California, and the state of Nevada to control curlyleaf pondweed and Eurasian watermilfoil are summarized in Table 1.

Disadvantages of chemical control methods include restrictions to swimming, drinking water, and fishing and potential impacts to non-target plants. Additionally, the use of chemical controls may require extensive water quality monitoring that could increase overall program costs. In the Lake Tahoe Basin, water quality objectives for pesticides and related objectives for non-degradation and toxicity create a high standard for protection of waters, with the burden of evidence for water quality protection placed heavily on the project proponent. In California, the LWQCB adopted a prohibition on pesticides (such as aquatic herbicides) in water (pending EPA approval; see Appendix A). The LWQCB may grant an exemption to this prohibition for aquatic pesticides if certain criteria are met by the project proponent. The TRPA has similarly restrictive rules for pesticide use for the protection of water quality (TRPA Water Quality Management Plan for the Tahoe Basin; see Appendix A).

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Table 1. Aquatic Herbicides Registered by California Department of Pesticide Regulation, Nevada Department of Agriculture, and/or the U.S. Environmental Protection Agency

Active Ingredient	Controls	CDPR	NDA	EPA
2, 4-D (butoxy-ethyl-ester [BEE])	Eurasian watermilfoil		✓	✓
2, 4-D (dimethylamine salt [DMA])	Eurasian watermilfoil	✓	✓	✓
Acrolein*	Curlyleaf pondweed	✓	✓	✓
Carfentrazone-ethyl	Eurasian watermilfoil		✓	✓
Copper (elemental)	Eurasian watermilfoil	✓	✓	✓
Copper (chelated)	Curlyleaf pondweed Eurasian watermilfoil	✓	✓	✓
Diquat dibromide	Curlyleaf pondweed	✓	✓	✓
Endothall (dipotassium salt)	Curlyleaf pondweed Eurasian watermilfoil	✓	✓	✓
Flumioxazin	Curlyleaf pondweed Eurasian watermilfoil		✓	✓
Fluridone	Curlyleaf pondweed Eurasian watermilfoil	✓	✓	✓
Imazamox	Curlyleaf pondweed Eurasian watermilfoil	✓	✓	✓
Penoxsulam	Curlyleaf pondweed Eurasian watermilfoil	✓	✓	✓
Triclopyr (triethylamine [TEA])	Curlyleaf pondweed Eurasian watermilfoil	✓	✓	✓
Acid Blue 0 Acid Yellow 23	Curlyleaf pondweed Eurasian watermilfoil	✓	✓	✓

Notes: CDPR = California Department of Pesticide Regulation; NDA = Nevada Department of Agriculture; EPA = U.S. Environmental Protection Agency.
*Registered for use in irrigation canals and irrigation reservoirs.

1.2 WARM WATER FISHES

Beginning in the mid-late 1970s through the late 1980s, a variety of warm water fish species were found in the nearshore environment of Lake Tahoe (Reuter and Miller 2000). These illegal introductions are thought to be the result of anglers eager to catch these fish and releases from local aquariums (e.g., goldfish [*Carassius auratus auratus]*). Prior to the 1970s, native minnows were abundant; however, by the late 1980s largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*) were common to the Tahoe Keys. The change in fish structure was confirmed by fishing guides operating out of the Tahoe Keys and through limited sampling by California Department of Fish and Game (now called California Department of Fish and Wildlife). By the 1990s, the fishing guides could no longer collect minnows, commonly used as bait during fishing charters, on the lake from certain marinas. The quick reduction in native fish

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abundance raised concern, while at the same time suitable habitat for non-native fishes in the nearshore environment increased by the expansion of aquatic weed beds (Kamerath et al. 2008). The expansion of warm water fishes has led to reduced food web efficiency and decreased biodiversity of native fish assemblages in other ecosystems (MacRae and Jackson 2001).

Until 2006, the distribution of warm water fishes beyond the Tahoe Keys was largely unknown, but a survey by Kamerath et al. (2008) found non-native fish species, including bluegill, largemouth bass, brown bullhead (*Ameiurus nebulosus*), black crappie (*Pomoxis nigromaculatus*), and goldfish, at 12 of 21 sites around Lake Tahoe with the highest density and abundance of warm water fish found in the Tahoe Keys (east and west). Subsequent surveys conducted between 2008 and 2010 at other nearshore areas suggest that smaller satellite populations of warm water fish may be found outside of the Tahoe Keys. However, it is unclear the extent to which warm water fishes have established in these areas. It is believed that increased nearshore water temperature is extending the amount of habitat available for warm water fishes to establish and spawn (Chandra et al. 2009; Ngai et al. 2013).

Between 2006 and 2010, University of Nevada - Reno (UNR) researchers investigated the distribution, relative abundance, and diets of warm water fishes within Lake Tahoe and, more specifically, whether they are moving out of the Tahoe Keys (Chandra et al. 2009). Additionally, temperature changes in the nearshore environment were monitored to determine where and when adequate spawning conditions are present. The objectives of their work were to determine whether the Tahoe Keys could serve as a source population of warm water fishes to the rest of the lake, and to identify best management periods to reduce deleterious impacts to native fishes. Nearshore temperature data suggest that all monitored sites are thermally suitable for spawning by largemouth bass, bluegill, and likely other warm water fishes (Kamerath et al. 2008). However, not all monitored sites are currently thermally suitable for over-winter survival of warm water fishes (Ngai 2008). A study suggests and that bass migrate out of the Tahoe Keys in early to mid-summer. Based on the shift in largemouth diet to piscivory at two to four years (8.0 to 12.0 cm), Chandra et al. (2009) recommended largemouth bass and other warm water fish removal, optimally every two years, to minimize predation pressure and competition with native fishes.

Control/Eradication Methods for Invasive Fishes

Examples of non-chemical, mechanical methods to control unwanted warm water fishes include fyke nets, gill nets, minnow traps, seines, electro-fishing, and electric fields. In some cases, these efforts are more efficacious in smaller waterbodies and require repeat visits (Closs et al. 2003). Electro-fishing and seines may be used to control invasive fish. Evidence from Lake Davis, California and Browns Pond, California suggest these methods have limited impact for controlling northern pike (*Esox lucius*) and grass carp (*Ctenopharyngodon idella*), but electro-fishing removal of smallmouth bass (*Micropterus dolomieui*) from an Adirondack lake has shown promising results in reducing non-native fish reproductive success, limiting their

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recruitment, and helping restore native fish communities (Weidel et al. 2007). Unlike chemical methods, most mechanical methods are selective and can be used to target removal of only non-native species. Another method is harvest through recreational fishing, as in Japan where the government is attempting to facilitate the eradication of bluegill from Lake Biwa, Japan, by calling on its citizens to "catch-and-eat" the nuisance non-native species. Interest in evaluating the use of electric fields to block, deter, or guide fish movement has increased recently (Burger et al. 2012), particularly with national attention on the use of electric barriers in the Chicago Sanitary and Ship Canal to deter passage of Asian carp (*Hypophthalmichthys* sp.) to Lake Michigan. Unfortunately, there is mounting evidence, based on environmental DNA (eDNA) that *Hypophthalmichthys* sp. could be present in the Great Lakes (Jerde et al. 2013).

Chemical methods to control warm water fishes include the plant-derived piscicide rotenone. Rotenone acts by inhibiting oxygen uptake through the gills, resulting in suffocation. Rotenone is non-selective, meaning it will kill all fish within the target tolerance level as well as other aquatic organisms such as invertebrates; however, there is usually recovery of benthic organisms over time (Mangum and Madrigal 1999; Melaas et al 2001). Different fish species can tolerate different levels of exposure thus application rates are based on target-species tolerance. Often, applications are made in combination with a significant drawdown or area isolation. Following rotenone application, potassium permanganate may be used to neutralize the effects of rotenone. Typically, a concerted effort is made to salvage as many native fish species as possible prior to the application of a piscicide.

Given the evidence that largemouth bass may migrate out of the Tahoe Keys and that widespread nearshore habitat is available for spawning, a three-year pilot control project was implemented in 2011. The main objective of the pilot project is to determine the feasibility and effectiveness of using mechanical removal methods (mainly electro-fishing) for management of warm water fishes by reducing the reproductive population of warm water fishes to a controllable level and, in turn, examine how warm water fish removal may facilitate native fish restoration in Lake Tahoe. Preliminary observation confirms that the main population of non-native warm water fish remains in the Tahoe Keys. Low numbers and limited distribution of warm water fishes are found outside of the Tahoe Keys. Thus far, approximately 51,000 (approximately 7,000 pounds) warm water fishes have been removed from Lake Tahoe. Changes in population and community dynamics between native and non-native warm water fishes, as well as potential re-colonization of native fishes in treated areas, are currently being analyzed and examined. Given current restricted distribution of these fishes, electro-fishing can be an effective, relatively low cost, and environmentally favorable method used to reduce the reproductive population of warm water fishes in the Tahoe Keys to a manageable level. While the pilot project shows encouraging results, the amount of removal effort necessary to achieve the control objective remains to be determined. Non-native fish control in other systems has demonstrated that continuous control effort is essential and should be encouraged. Management of the source population is critical for preventing further spread and proliferation of these species into other parts of the lake. Rotenone

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use in Lake Tahoe is not currently prohibited per se, but applications must be reviewed on a case by case basis, meet a series of conditions, and are subject to approval by the Executive Officer of the LRWQCB. Simplification of this approval process, or easing of requirements, would require an amendment to the Basin Plan, which is currently being evaluated.

1.3 ASIAN CLAMS

The Asian clam (*Corbicula fluminea*) is a bio-fouling bivalve, which is both a filter-feeder and sediment-feeder. Asian clams have been reported to dominate the benthic community, composing some 97% of the benthic invertebrate community (Karatayev et al. 2003). The Asian clam usually occurs in high densities (thousands per square meter) (Gottfried and Osborne 1982; McMahon 1983; Stites et al. 1995) and accumulation of dead shells in large beds exemplifies this (see Hackley et al. 2008 for images). Asian clam beds increase the nutrient load in the water column through excretion of organic wastes (elevated levels of nitrogen) and by re-suspending silt and fine sediments. These modifications result in decreased water clarity from algal growth in nearshore areas that limit planktonic food to other species (McMahon 1991, Sousa et al. 2008; Chandra and Wittmann unpublished data). In some instances the Asian clam can reduce native biodiversity (Strayer et al. 1999), and in Tahoe, potentially out-competing native benthic invertebrates such as the montane pea clam (*Pisidium* spp.). In addition to concerns about the direct impacts of Asian clams to the Lake Tahoe ecosystem, researchers are concerned that their presence may facilitate a dreissenid mussel invasion by increasing localized calcium concentrations in clam beds (Hackley et al. 2008). Research is under way in Lake Tahoe to test this hypothesis (Chandra and Wittmann, unpublished data).

Known occurrences of Asian clams in or near the Region include Lake Tahoe, Donner Lake, the Lower Truckee River, and shell casings were found at Upper Blue Lake (Alpine County). Asian clams were observed during a 2002 survey of Lake Tahoe's south shore, revealing a small population that could have been present since the late 1990s (survey by Sudeep Chandra, UNR). During a 2008 survey of Lake Tahoe's south shore, beds were found in 4 to 40 meters of water with densities ranging from zero to greater than 100 individuals per m^2 while the densest beds had greater than 2,000 individuals per m^2 (Wittmann et al. 2008). Recently, clam populations have spread to other sections of the lake including Emerald Bay State Park, where significant effort is under way to control the population in this sensitive area of the lake.

Control/Eradication Methods for Asian Clams

In general, limited success has been achieved in controlling Asian clams. Chemical control of Asian clams is difficult and involves the use of chlorine or bromine to control juveniles. In Lake Tahoe, research has been conducted to physically manage Asian clams, involving: 1) field testing of removal options, 2) evaluation of strategies, 3) implementation, and 4) long-term monitoring (Wittmann et al. 2008). Benthic barriers and diver-operated suction plots have both been tested on the south shores of Lake Tahoe, specifically barriers have been deployed in Marla

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Bay, and suction plots have been completed outside of the Lakeside Marina (Wittmann et al. 2011, 2012). Both methods proved effective in eliminating or causing significant mortality in clam populations; however, both also come with undesired consequences as well. For example, both cause significant loss of native benthic macroinvertebrates and biodiversity, while suction plots also removes benthic macroinvertebrates and nearly all substrate material, reducing available habitat (Wittmann et al. 2012a, 2012b). Because of the effectiveness and success of barriers in Marla Bay, 5 acres of barriers have been deployed at the infestation site in Emerald Bay. With the project ongoing, final results are still to be determined. Research to understand the effectiveness of reducing populations of clams during the pilot studies and long-term influence on native taxa is warranted (Wittmann et al. 2012).

1.4 QUAGGA AND ZEBRA MUSSELS

Quagga (*Dreissena rostriformis bugensis)* and zebra mussels (*D. polymorpha*) (hereinafter dreissenid mussels) are two of the biggest threats to North America's freshwater ecosystems, and their presence often results in irrecoverable ecological damage with fiscal impacts of over $1 billion annually for control efforts in the U.S. (Pimentel et al. 2005; Connelly et al. 2007). They grow in dense populations that encrust pipes, impede water movement, and colonize on other organisms (e.g., turtles, native mussels, crayfish, and aquatic plants) and structures (e.g., watercraft, piers, docks, pilings, rope, and anchors). Dreissenid mussels are filter-feeders, commonly found in high flow areas such as pipes, intake structures, and pumps, which can substantially reduce their flow efficiency, forcing expensive maintenance of pipes and other water conveyance structures. Dreissenid mussels are essentially impossible to eradicate once they become established.

Dreissenid mussels can filter about 1 liter of water per day, primarily consuming phytoplankton but also other suspended material including bacteria, silt, and microzooplankton (U.S. Geological Survey 2008). This results in transfer of substantial portions of the phytoplankton biomass from overlying surface water into the benthos, thereby increasing water clarity (Edwards et al. 2005). This can result in increased, and possibly toxic, blue-green algae blooms, which in turn increase odor problems. Increased water clarity can also allow more light for the growth of submersed aquatic plants.

Colonization is common to areas where suspended organics or re-suspension from wave action occurs (e.g., shoreline areas) (Tuchman et al. 2004). These natural disturbances of nutrient rich sediments or aggregation of phytoplankton in higher densities at the shoreline support higher densities of dreissenid mussels. Ultra-oligotrophic waterbodies with non-point source nutrient runoff entering from shoreline development may also support increased mussel populations, resulting in locally dense phytoplankton growth as nutrients are expelled directly from invasive bivalve excrement (Higgins et al. 2008).

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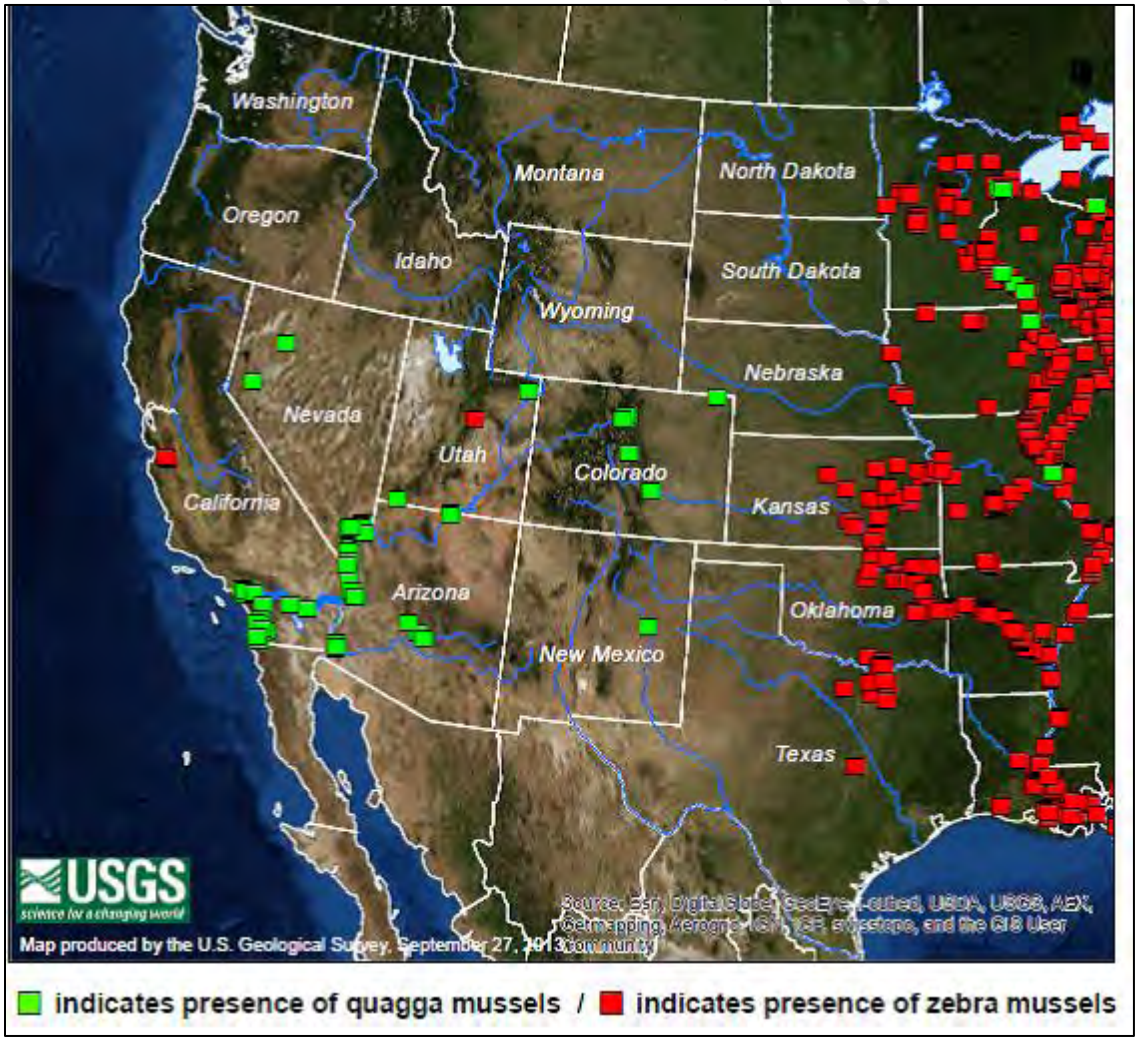
Dreissenid mussels were not found west of the 100th Meridian until January 2007 when quagga mussels were found in Lake Mead, Nevada. Since then, zebra mussels have been found in San Justo Reservoir, San Benito County, California and quagga mussels are present in waters in southern California, Nevada, and Arizona (Figure 2). More specifically, quagga mussels are present in the Lower Colorado River lakes (Lake Mohave, Arizona/Nevada; Lake Havasu, California/Arizona; Copper Basin Reservoir, California). Quagga mussels were also found at the Nevada State Fish Hatchery (Lake Mead), the Willow Beach National Fish Hatchery (Lake Mohave, Arizona), and most recently at Lake Powell. The Nevada State Fish Hatchery has been decontaminated and the Nevada Department of Wildlife is pursuing an alternative water delivery system with the Southern Nevada Water Authority and modifying the water delivery system to provide treated water (quagga mussel free) to the facility. Most recently, dreissenid larvae were found in the Big Thompson Water Project, which serves nearly 800,000 water users in northern Colorado. Within the Big Thompson Water Project, both quagga and zebra mussel larvae are currently established in Grand Lake while only quagga mussel was found in Lake Granby and Shadow Mountain, Pueblo, and Willow Creek Reservoirs.



Source: http://nas.er.usgs.gov/taxgroup/mollusks/zebramussel/maps/southwest_quagga.pdf Accessed October 24, 2013

Figure 2. Distribution of quagga and zebra mussels in the western U.S.

Quagga mussels colonize in higher abundance at greater depths (130 meters) than zebra mussels (110 meters) and, in North American populations, exhibit a lower thermal maximum, suggesting the quagga mussel is better adapted to cold water than the zebra mussel (Mills et al. 1996). Low summer temperature limits for the potential distribution are typically reported in the range of 9 to 15°C; however, minimum temperatures for quagga are not reported (summarized in Cohen 2007). These observations highlight an interrelationship between water depth and level of disturbance where deeper water habitat tends to have largely undisturbed substrate composed of silty-sand, while shallower habitat is frequently affected by wave action (Mills et al. 1996). These differences have resulted in the spatial partitioning of the two species (Cohen 2007) along multiple environmental gradients, underscoring the importance for considering these relationships at all life stages.

Optimal conditions represented by the convergence of multiple environmental gradients determine the success of mussels and distribution in some systems. Based on a maximum colonization depth of 130 meters, potential quagga and zebra mussel habitat in Lake Tahoe is shown in Figure 3.

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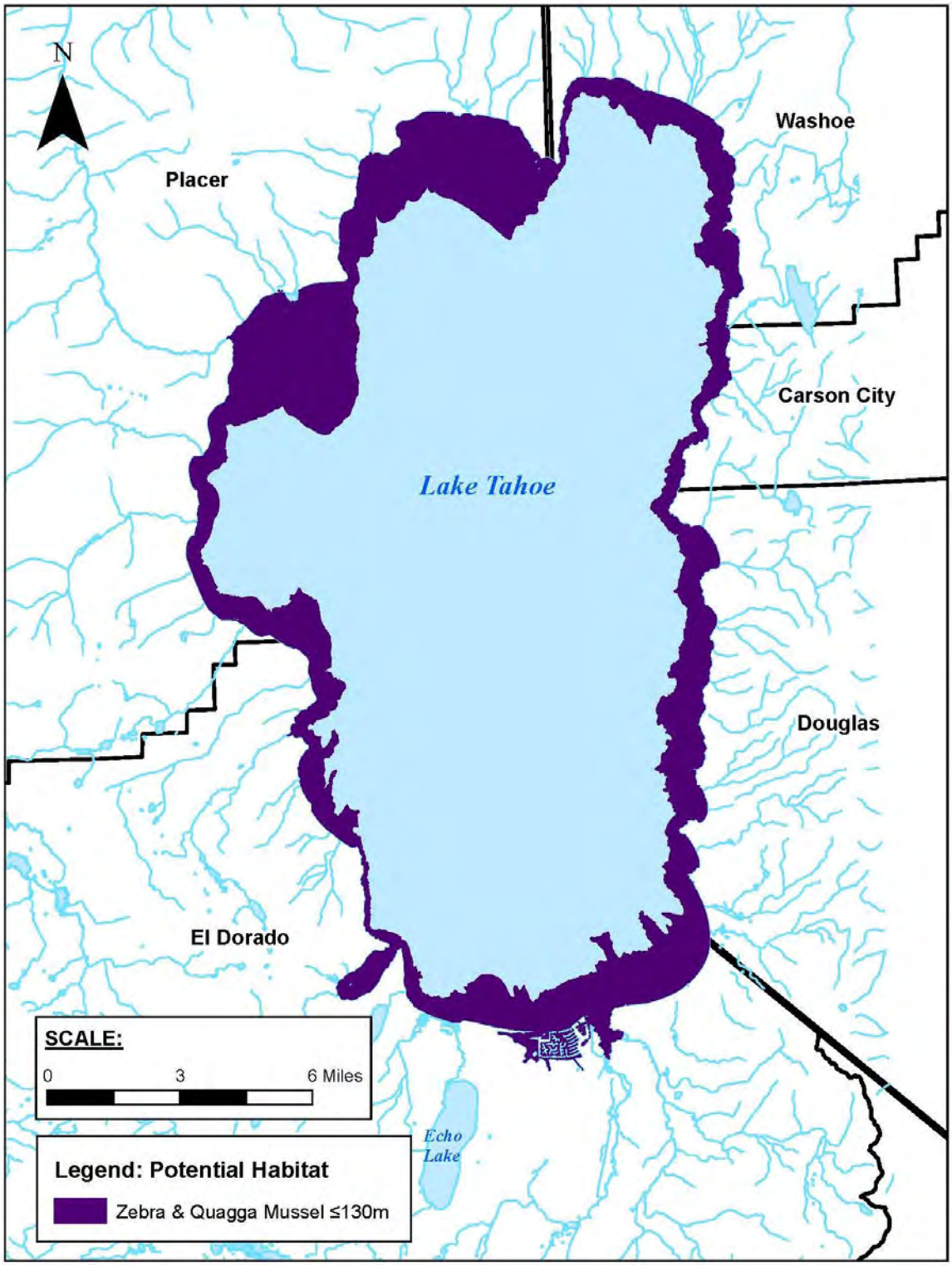

Figure 3. Potential quagga and zebra mussel habitat in Lake Tahoe (survival depth ≤130 m)

Control/Eradication Methods for Dreissenid Mussels

There are no widely accepted physical methods to substantially control or eradicate invasive dreissenids. Physical removal of dreissenid mussels from structures such as intake screens, trash grates, and cooling units may be accomplished by using pressure washing with water or dewatering structures and allowing them to dry (U.S. Army Corps of Engineers 2009). Such physical methods, however, are only practical where water levels can be manipulated such as irrigation canals or hydropower facilities with redundant infrastructure to allow off-line cleaning.

Methods of controlling dreissenid mussels from pipes include: a physical inspection gage or "pigging," manual cleaning, exposure to temperatures that exceed thermal optima, or desiccation of viable life stages. Physical pigging involves use of a tool that is propelled through a pipeline and scrubs the interior with abrasive brushes, removing attached mussels. This method of cleaning is a control action and not a preventive measure. Manual cleaning can include use of pressure washers or abrasive brushes to remove the invading mussels. Manual cleaning is useful when the mussels are visible such as on the outside of boat hulls, docks, and natural surfaces that may be immersed in affected waterways and subsequently removed or exposed for a period of time. Exposure of dreissenid mussels to heated water over 140°F (60°C) or greater is also effective in eradicating the adult life stage (Zook and Phillips 2009). Heated water is introduced into piping and exposes the invading mussels for a period of time. Return of the heated water to a lake is blended with lake water to reduce temperatures and lessen thermal impacts to receiving aquatic biota. This is a non-chemical method to control the mussels and can be used on a periodic basis for maintenance of water conveyance structures and pumping equipment. Enclosed areas colonized by invasive mussels can be exposed to radiation by microwaves that heat surrounding water resulting in the same effect from exposure to pre-heated water.

A microbial pesticide (*Pseudomonas fluorescens* strain CL145A [Pf-CL145A]) was recently formulated (Zequanox®) and approved by the USEPA to control dreissenid mussels (registration number 84059-15). The bacteria resemble food normally filtered by the mussel; however, ingestion of either live or dead cells does not stimulate valves to shut, destroying the mussel's digestive system. Exposure of veliger or adult stages of dreissenid mussels to the biotoxin found in the bacteria results in 70 to 100% mortality. Limitations for use of this biological control method include achieving effective concentrations of bacteria in open water. Use in enclosed piping is less complicated as it provides a controlled environment for application. Non-target tests on *Daphnia magna* (water fleas) indicate non-lethal effects from the bacterium. Successful testing has been done in enclosed pipe systems, indicating high mortality rates in mussels; further testing is in progress to determine the bacteria's effect on non-target species (Molloy et al. 2013).

Natrix® is a chelated copper ethanolamine complex (EPA Reg. No. 67690-9) applied to freshwaters to control invasive/exotic mussels, snails, oysters or clams. EPA Section 24 (c), Special Local Need, registrations have been approved in numerous states that are actively targeting control of one or more of the targeted invasive/exotic species. Natrix is applied at rates

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up to 2.5 mg Cu/L with exposures typically ranging from 12 to 112 hours to achieve control of the target species. Natrix evaluations have demonstrated 80% + mortality of zebra mussels across different concentrations and exposure (CET) scenarios. Project specific conditions (e.g. water quality, spot or partial, large scale and continuous flow) influence treatment prescription design required to achieve the target CET and management objective.

To prevent bio-fouling (undesirable accumulation) of organisms such as dreissenid mussels from attaching to aquatic structures, antifouling building materials and repellents are also available. Antifouling building materials include: copper, galvanized iron, aluminum, acrylic, Teflon, vinyl, pressure-treated wood, black steel, pine, polypropylene, asbestos, stainless steel, and polyvinyl chloride or PVC (Kilgour and Mackie 1993). Antifouling products that can be applied to surfaces include coatings containing cuprous oxide that repel zebra and quagga mussels, foul-release coatings that minimize byssal thread attachment, and thermal spray coatings that work by slowly releasing metal ions (Boelman et al. 1996).

Several methods for chemical control of dreissenid mussels have been used, including use of chlorine, potassium permanganate, bromine, ozone, and molluscicides (Shaw 2004; Maguire and Sykes 2004). These treatments, however, are normally introduced to intake pipes and other colonization locations for zebra and quagga mussels. Otherwise, obtaining effective concentrations in open water proves to be unachievable without harming other biota on a localized basis. The only known zebra mussel eradication using potassium chloride solution occurred in Millbrook Quarry in Virginia. This is currently an unacceptable method in the Tahoe Region.

Physical removal of mussels using underwater scuba has also been investigated at Lake George, New York (Nierzwicki-Bauer 2012). Since 2000, significant reductions in zebra mussels have been achieved and, in fact, only 38 mussels were removed between 2008 and 2011.

The most effective method of controlling dreissenid mussels is prevention (Leung et al. 2002). Although mussels are not currently found in Lake Tahoe, there are many locations in the west that have a dreissenid population and with visitors coming from a variety of locations (Wittmann 2008) there is a risk to the Tahoe Basin. Currently, Lake Tahoe has an effective boat inspection program, where each vessel is sealed after an inspection/decontamination cleaning, which provides an additional line of defense inhibiting the introduction of dreissenids to Lake Tahoe (details provided in Appendix D).

1.5 CRAYFISH

Signal crayfish (*Pacifastacus leniusculus*) were introduced into Lake Tahoe as early as 1885, and a population was established by 1936 (Abrahamsson and Goldman 1970). Crayfish are currently the dominant benthic species in the lake and are conservatively estimated at 8 million pounds (3.6 kg) (Chandra et al., unpublished). Given its longevity in the system and dominance of the

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Lake Tahoe benthic community, the species likely play an important role in ecological function of the lake.

Crayfish production can exceed hundreds of kilograms per hectare; the production of crayfish often exceeds the production of all other benthic invertebrates combined (Momot 1995; Whitledge and Rabeni 1997). Given the amount of biomass (roughly 8 million pounds, Chandra et al., unpublished) crayfish have in Lake Tahoe, they have the potential to play a role in the flow of energy and nutrients throughout the system, often having positive and negative impacts on both algal production and benthic macroinvertebrate production and diversity (Flint and Goldman 1975). At low densities (0.16 individuals/m^2), Flint (1975) showed that crayfish can stimulate periphyton production by removing old senescent cells, while at higher densities (1.05 individuals/m^2) they reduce periphyton, potentially reducing food for benthic invertebrates. Crayfish excretion experiments by Flint (1975) indicate that they are a source of nitrogen to the lake and can result in increased periphyton production. Given the variety of effects grazing can have on periphyton production, along with the species' impact on flow nutrients (Flint 1975; Lodge et al. 1994), the overall role of crayfish in benthic primary production is still not well understood.

Crayfish are also "poly-trophic" feeders (Lodge et al. 1994) and can dominate the benthic environment (Momot 1995; Whitledge and Rabeni 1997), suggesting that their role in lake food webs may be significant (Light 2003). Recent studies suggest there have been drastic declines in all invertebrates (besides crayfish) that inhabit the bottom of the lake (Frantz and Cordone 1996; Caires et al. 2013). Endemic species have been particularly impacted by crayfish include the Tahoe stonefly (*Capnia lacustra*), Tahoe blind amphipod (*Stygobromus* spp.), and Tahoe flatworm (*Phagocata tahoena*), among other species (Caires et al. 2013). Recent investigations of crayfish ecology at the University of Nevada-Reno (Chandra et al., unpublished data), along with increases in their population suggest that they may compete with and prey upon benthic invertebrates. Additionally, data collected by Kamerath et al (2008) suggest that crayfish have subsidized the increasing population of predatory invasive warm water fish in Lake Tahoe. Thus, the effects of crayfish on the benthic community are diverse, but data suggest they likely cause a decrease in benthic invertebrates by both direct and indirect mechanisms in Lake Tahoe.

Crayfish are widely distributed around the periphery of Lake Tahoe and comprise the bulk of the benthic biomass in the littoral zone with seasonal dynamic of movement and migration across depths. For example, Flint (1975) concluded that crayfish occupied shallow water during the summer and fall. Data from Flint (1975), Abrahamsson and Goldman (1970), and UNR (Umek and Chandra, unpublished, 2008-2010) suggest that maximum densities occur at depths from 10 to 20 meters with rapid declines at depths greater than 40 meters, even where the bottom substrate appeared suitable. Not as many crayfish occur in shallower waters (less than 10 meters) possibly due to stronger predation, high light intensity, which inhibits the production of attached algae (a major food source), and wind driven currents. Research has suggested that the decline at depths over 40 meters arose because crayfish eggs do not hatch in the cold temperatures at such

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depths during summer months. Winter minnow trap data supplied by Beauchamp et al. (1992) and by Chandra and Umek (unpublished, 2008-2010) suggest there may be substantial numbers of crayfish at depths less than 90 meters during all seasons.

The populations of crayfish have been generally increasing since their introduction and establishment in the early 1900s. Flint (1975) estimated the population at approximately 2,450,000 pounds. While in 2010, the population is thought to be over 220 million individuals and over 8 million pounds of biomass (Chandra et al., unpublished data). It is likely that the population fluctuates over time, dependent on lake and environmental conditions, but in general has been increasing.

Control/Eradication Methods for Crayfish

Currently there is no specific program to manage crayfish populations in the lake even though their populations have increased substantially since the late 1960s and preliminary information suggests they may be controlling native invertebrate community structure and contributing to nearshore algae growth. In the last 2.5 years, the states of Nevada and California have passed legislation or amended regulations that allow for the commercial harvest of crayfish. It is not clear if commercial harvest can successfully reduce crayfish populations; however, it is recommended that there is a facilitation of activity among the harvesters to reduce populations in different regions of the lake. In addition, monitoring of crayfish populations is important for understanding long term dynamics of the nearshore.

1.6 NEW ZEALAND MUDSNAILS

The New Zealand mudsnail (*Potamopyrgus antipodarum*) is a tiny (4 to 6 mm) freshwater snail that, as its name implies, is native to New Zealand. It is rapidly invading waterbodies in the western U.S., many of which are blue ribbon trout streams in California, Montana, Colorado, Oregon, Idaho, and Wyoming (Figure 4). Because of their association with popular fishing sites, waders and other fishing gear are commonly attributed to facilitating their spread. They are capable of closing their operculum to avoid desiccation, allowing for long transport between waterbodies.

New Zealand mudsnails form dense carpets along stream bottoms, rocks, and vegetation and establish in a range of densities from very few to up to 800,000 individuals/m^2 meter (Lucas 1959 in Dorgelo, 1987). As a nocturnal grazer, they feed on plant material, animal detritus, epiphytic and periphytic algae, sediments, and diatoms (Broekhuizen et al. 2001, James et al. 2000, Kelly and Hawes 2005, Parkyn et al. 2005, Zaranko et al. 1997). Their dense growth can result in significant deleterious impacts to gross primary production and native invertebrate communities. Some fish species are known to consume New Zealand mudsnails; however, studies have shown that the snails pass through the digestive tract alive and intact, thus the fish receives little to no energy gain from their consumption (Haynes et al. 1985; Vinson and Baker 2011). In fact, Vinson and Baker (2011) used ^{15}N-labeled mudsnails to measure the effects of

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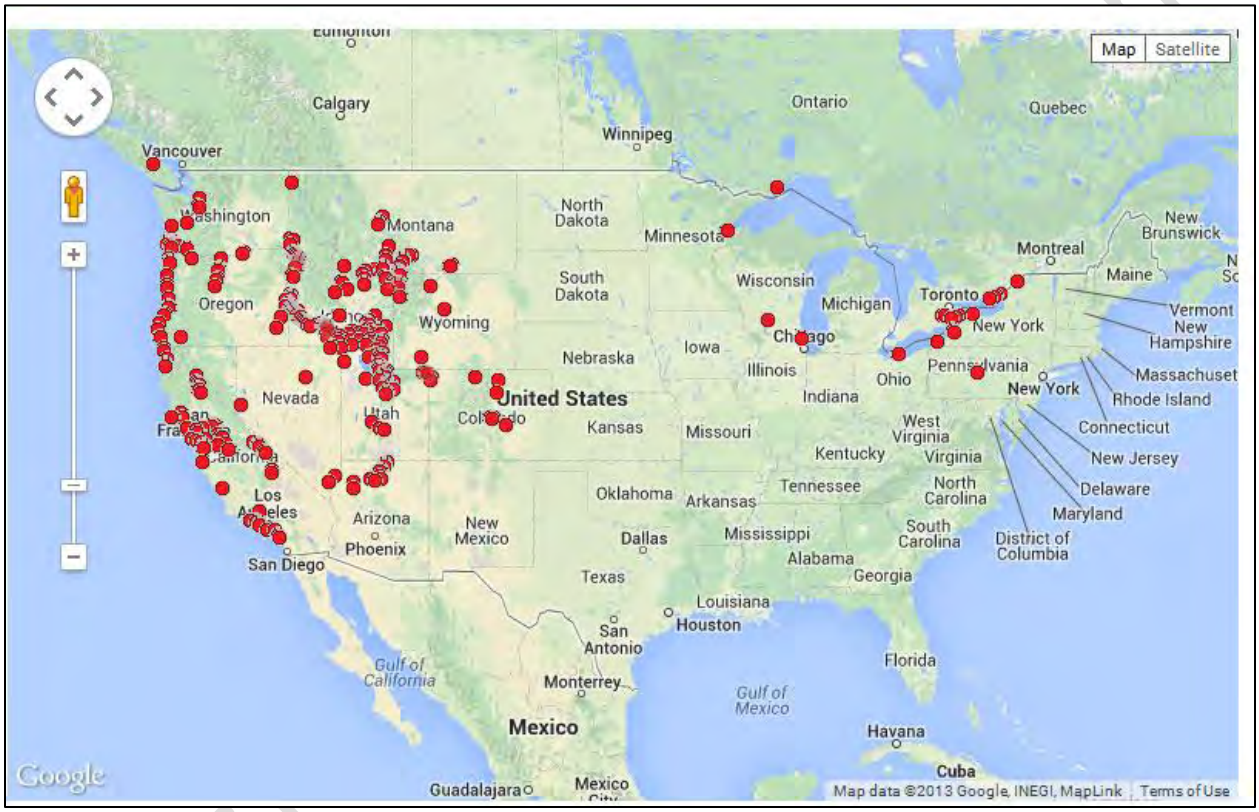
trout that were fed an exclusive and unlimited amount of mudsnails and found a 0.14 to 0.48% loss in initial body weight per day.

Research conducted by Kolosovich et al. (2012) assessed the survivability of and potential impacts to standing crop from New Zealand mudsnails under experimental conditions using substrate and water from the Truckee River and Lake Tahoe. They determined the Truckee River would be more vulnerable to New Zealand mudsnail establishment. Unfortunately, New Zealand mudsnails have since been identified in at least a one mile stretch of the Truckee River in Sparks.



Source: Benson 2013

Figure 4. Distribution of New Zealand mudsnails in the U.S. (red dots)

Control/Eradication Methods for New Zealand Mudsnails

Currently, there is no widely accepted method to control New Zealand mudsnails. Research on a trematode parasite, *Microphallus* spp., as biocontrol agent for New Zealand mudsnails is under way (Fromme and Dybdhal 2006); however, no experimental methods will be considered for immediate implementation in this Plan.

Guidance available on the vectors, pathways, and decontamination procedures that may be applied to control New Zealand mudsnails on waders and other equipment may be found in the following:

- *National Management and Control Plan for the New Zealand Mudsnail (Potamopyrgus antipodarum)* (New Zealand Mudsnail Management and Control Plan Working Group 2007),
- CDFW Aquatic Bioassessment (ABL) protocols, and
- *Controlling the Spread of New Zealand Mudsnails on Wading Gear* (CDFG 2005)

1.7 AMERICAN BULLFROG

The American bullfrog (*Rana catesbeiana*) is native to eastern North America but has become widespread across the country. It is the largest true frog in North America, reaching sexual maturity between three to five years following metamorphosis and living for nearly 13 years. Common to other bullfrogs, *R. catesbeiana* is cannibalistic, frequently consuming newly metamorphosized bullfrogs and larval tadpoles (Stuart 1993). Bullfrogs prefer vegetated areas that allow for places to lay eggs and to hide from predators and wait for prey.

The American bullfrog is considered one of the most destructive invasive species, largely due to its rapid population growth and voracious and unspecialized feeding habits (Lowe et al. 2000; Kraus 2009; CABI 2011; Jancowski and Orchard 2013). Bullfrogs develop nonlethal infections from chytridiomycosis, caused by the chytrid fungus (*Batrachochytrium dendrobatidis*) (Daszak et al. 2004). Chytrid fungus appears capable of infecting most all amphibian species and has been linked to significant populations declines (Fisher et al. 2009). Recent research suggests bullfrogs are also known to transmit the disease to other anuran species (Greenspan et al. 2012).

Control/Eradication Methods for Bullfrogs

To control adult bullfrogs, a variety of methods may be deployed, including shooting, spears/gigs, bow and arrow, clubs, nets, traps, angling, and by hand (Global Invasive Species Database 2008). Recently, methods have been developed to collect and control frogs using a modified electro-fishing shocker. They tend to be extremely shy, but can be caught by use of a strong spotlight at night and collected by hand or alternatively can be shot. Collecting egg masses using a bilge pump can be an effective adjunct control method (Govindarajulu 2004). Targeting egg searches to areas where male bullfrogs are heard calling during the night may improve the probability of detecting egg masses (Govindarajulu 2004). Incomplete removal of eggs or larvae, however, can inadvertently increase the growth and survival of the remaining individuals and cause an increase in the population (Govindarajulu 2004). Bullfrogs can also be controlled by ringing the aquatic areas where they are established with reptile-proof fencing to catch neonates and placing traps in terrestrial areas to catch dispersing adults.

Direct removal of bullfrog is often very difficult and typically unsuccessful due to their high fecundity rate, high dispersal capability, opportunistic diet, and the complex habitats in which they are often associated. Habitat manipulation, in association with direct removal efforts, could prove more successful. Maret et al. (2006) used a method of draining and drying ponds to

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eliminate bullfrogs. Because bullfrogs overwinter as larvae and are dependent on permanent water for growth, this method has shown some success. Doubletree et al. (2003) used models to determine necessary draining intervals to reduce numbers. Their model suggests that direct removal of adults in combination with periodic drying (approximately every two years) could allow native amphibians the opportunity to reestablish. Although this could be successful, it is undetermined how periodic draining would impact other native species that also rely on a permanent water source.

2 Non-Native Species Types

Similar to the California Aquatic Invasive Species Master Plan, species management types/categories were developed by the Lake Tahoe AIS Coordinating Committee to facilitate the prioritization of management objectives (Table 2). This system will be used to categorize non-native species in the Region and those threatening introduction. Table 3 lists the estimated dates of species introduction (if present), known pathway of introduction, and applicable state and federal pest ratings.

Table 2. Non-Native Species Management Types

Species Management Type	Current Management Response
Type 1 Not yet detected in the Region	Prevention Monitoring Education
Type 2 Limited in extent with operational control* options	Monitoring Control/Eradication
Type 3 Established with operational control* options	Prevention Monitoring Control/Eradication Education Research
Type 4 Established but no operational control* options	Monitoring Research
Type 5 Unknown invasion potential	Prevention Research
Type 6 Legal introduction	Education Research

*Operational control refers to legal and permitted control and eradication methods, e.g., hand-removal of aquatic plants, diver-assisted suction for Asian clam removal.

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Table 3. Non-Native Species Presently In or Threatening the Lake Tahoe Region

Group	Common Name	Scientific Name	In Tahoe Region (since)	Pathway	Applicable Pest Rating
Type 1: Not yet detected in the Region					
Aquatic Plants	Brazilian egeria	*Egeria densa*	N	N/A	CDFA "C" NRS 503.597
	Fanwort	*Cabomba caroliniana*	U	N/A	CDFA "Q" NRS 503.597
	Giant salvinia	*Salvinia molesta*	N	N/A	CDFA "A" NDA "A" Federal NRS 503.597
	Hydrilla	*Hydrilla verticillata*	N	N/A	CDFA "A" NDA "A" Federal NRS 503.597
	Oxygen weed	*Lagarosiphon major*	N	N/A	CDFA "Q" Federal NRS 503.597
	Parrot feather	*Myriophyllum aquaticum*	U	N/A	NRS 503.597
	S. American spongeplant	*Limnobium laevigatum*	N	N/A	CDFA "A" NRS 503.597
	Water chestnut	*Trapa natans*	N	N/A	NRS 503.597
	Yellow flag iris	*Iris pseudacorus*	N	N/A	NRS 503.597
	Yellow floating heart	*Nymphoides peltata*	N	N/A	NRS 503.597

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Group	Common Name	Scientific Name	In Tahoe Region (since)	Pathway	Applicable Pest Rating
Fishes	Northern pike	*Esox lucius*	N	N/A	CDFW NRS 503.597 NAC 503.110
	Mosquitofish	*Gambusia affinis*	U	N/A	CDFW NRS 503.597
Other Species	Quagga mussel	*Dreissena bugensis*	N	N/A	CDFW NRS 503.597 NAC 503.110
	Spiny waterflea	*Bythotrephes longimanus*	N	N/A	NRS 503.597
	Zebra mussel	*Dreissena polymorpha*	N	N/A	CDFW US NRS 503.597 NAC 503.110
Type 2: Limited in extent with operational control options					
Aquatic Plants	Curlyleaf pondweed	*Potamogeton crispus*	Y[1] (2003)	AT, RA	NRS 503.597
Fishes	Smallmouth bass	*Micropterus dolomieui*	Y[1] (2011)	RA	NRS 503.597 NAC 503.060
Other Species	-	-	-	-	-
Type 3: Established with operational control options					
Aquatic Plants	Eurasian watermilfoil	*Myriophyllum spicatum*	Y[1] (early-1990s)	AT, RA	CDFA "A" NDA "A" NRS 503.597
Fishes	Black crappie	*Pomoxis nigromaculatus*	Y[1] (late 1980s)	RA	NRS 503.597 NAC 503.060
	Bluegill	*Lepomis macrochirus*	Y[1] (late 1980s)	RA	NRS 503.597 NAC 503.060
	Brown bullhead	*Ameiurus nebulosus*	Y[1] (early 1960s)	RA	NRS 503.597 NAC 503.060

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Group	Common Name	Scientific Name	In Tahoe Region (since)	Pathway	Applicable Pest Rating
Fishes cont'	Common carp	*Cyprinus carpio*	Y[1] (late 1900s)	RA	CDFW NRS 503.597
	Fathead minnow	*Pimephales promelas*	U	RA	CDFW NRS 503.597
	Goldfish	*Carassius auratus auratus*	Y[1] (late 1980s)	AT	NRS 503.597
	Golden shiner	*Notemigonus crysoleucus*	Y[1] (early 1960s)	RA	NRS 503.597
	Green sunfish	*Lepomis cyanellus*	Y[1] (late 1980s)	RA	NRS 503.597
	Largemouth bass	*Micropterus salmoides*	Y[1] (late 1980s)	RA	NRS 503.597 NAC 503.060
	White crappie	*Pomoxis annularis*	N	N/A	NRS 503.597 NAC 503.060
Other Species	Asian clam	*Corbicula fluminea*	Y[1] (early 2000s)	RA	NRS 503.597
	Bullfrog	*Rana catesbeiana*	Y[1] (late 1940s)	AT	NRS 503.597
	Mysid shrimp	*Mysis relicta*	Y[2] (1963-65)	ISI	NRS 503.597
	Signal crayfish	*Pacifastacus leniusculus*	Y[2] (1895 & 1909)	ISI	NRS 503.597
Type 4: Established but no operational control options					
Aquatic Plants	Rock snot	*Didymosphenia geminate*	Y	RA	NRS 503.597
Fishes	-	-	-	-	-
Other Species	Gill maggot	*Salmincola californiensis*	Y[1] (2006)	RA, RM	NRS 503.597

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Group	Common Name	Scientific Name	In Tahoe Region (since)	Pathway	Applicable Pest Rating
Other Species cont.	New Zealand mudsnail	*Potamopyrgus antipodarum*	N**	RA	CDFW NRS 503.597 NAC 503.110
Type 5: Unknown invasion potential					
Aquatic Plants	Water hyacinth	*Eichorrnia crassipes*	N	N/A	CDFA "C" NRS 503.597
	Water lettuce	*Pistia stratiotes*	N	N/A	CDFA "B" NRS 503.597
Fishes	-	-	-	-	-
Other Species	-	-	-	-	-
Type 6: Legal introduction					
Aquatic Plants	-	-	-	-	-
Fishes*	Brook trout	*Salvelinus fontinalis*	Y[2] (1870s)	MF	NAC 503.060 NRS 503.597
	Brown trout	*Salmo trutta*	Y[2] (1896)	MF	NAC 503.060 NRS 503.597
	Golden trout	*Salmo aquabonita*	N (but introduced in 1918)	MF	NRS 503.597
	Kokanee salmon	*Oncorhynchus nerka*	Y[2] (1949)	MF	NRS 503.597
	Lake trout/Mackinaw	*Salvelinus namaycush*	Y[2] (1888)	MF	NAC 503.060 NRS 503.597
	Rainbow trout	*Oncorhynchus mykiss*	Y[2] (1880s)	MF	NAC 503.060 NRS 503.597
Other Species	-	-	-	-	-

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Notes:

Sources of information for this table: Lake Tahoe AIS Working Groups and Coordinating Committee, applicable state or federal regulations, Vander Zanden et al. 2003; Anderson 2007; Kamerath 2008; Hackley et al. 2008; U.S. Geological Survey 2008; Nevada Department of Wildlife; U.S. Forest Service-Lake Tahoe Basin Management Unit

*Desirable non-native, coldwater game fish have been managed in the Region through stocking programs or possession limits by Nevada Department of Wildlife (NAC 503.060) and California Department of Fish and Wildlife (CDFW).

**Found in the Lower Truckee River outside of the Tahoe Region, as defined by the TRPA Compact

Y = Yes; [1] = Detected; [2] = Intentionally Introduced

N = No

U = Unknown; no known surveys have been conducted and no documentation of the presence of this species has been located. This does not constitute verification of presence or absence of this species

RM = Resource Management activities (i.e., fish stocking, vector control)

ISI = Intentionally Stocked Invasive

MF = Managed Fishery

RA = Recreational Activities

AT = Aquarium Trade

N/A = not applicable; however, of concern to resource managers

NDA = Nevada Department of Agriculture

"A" Weeds not found or limited in distribution throughout the state; actively excluded from the state and actively eradicated wherever found; actively eradicated from nursery stock dealer premises; control required by the state in all infestations

"B" Weeds established in scattered populations in some counties of the state; actively excluded where possible, actively eradicated from nursery stock dealer premises; control required by the state in areas where populations are not well established or previously unknown to occur

"C" Weeds currently established and generally widespread in many counties of the state; actively eradicated from nursery stock dealer premises; abatement at the discretion of the state quarantine officer

NAC = Nevada Administrative Code

NRS = Nevada Revised Statue

CDFA = California Department of Food and Agriculture Pest Ratings (Policy Letter #89-2; April 28, 1989)

"A" An organism of known economic importance subject to state (or commissioner when acting as a state agent) enforced action involving: eradication, quarantine, containment, rejection, or other holding action

"B" An organism of known economic importance subject to: eradication, containment, control or other holding action at the discretion of the individual county agricultural commissioner.

"C" An organism subject to no state enforced action outside of nurseries except to retard spread. At the discretion of the county agricultural commissioner.

"Q" An organism requiring a temporary "A" action pending determination of a permanent rating. It is suspected to be of economic importance, but its status is uncertain because of incomplete identification or inadequate information.

"D" Organisms determined to be of little or no economic importance

CDFW = California Department of Fish and Wildlife, Restricted Species, California Code of Regulations Title 14 §671.5

US = U.S. Fish and Wildlife Service, Lacey Act CFR 16.11-16.15

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LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix C: Short- and Long-Term Strategies and Actions

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Acronyms

AIS	Aquatic Invasive Species
ANS	Aquatic Nuisance Species
ANSTF	Aquatic Nuisance Species Task Force
CDFA	California Department of Food and Agriculture
CDFW (CDFG)	California Department of Fish and Wildlife, formerly California Department of Fish and Game
EDRR	Early detection and rapid response
EIP	Environmental Improvement Program
LTAISCC	Lake Tahoe Aquatic Invasive Species Coordination Committee
LTAISWG	Lake Tahoe Aquatic Invasive Species Working Group
NDOW	Nevada Department of Wildlife
TRPA	Tahoe Regional Planning Agency
USFS - LTBMU	United States Forest Service – Lake Tahoe Basin Management Unit
USFWS	United States Fish and Wildlife Service
WIP	Watercraft Inspection Program

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Appendix C
Short- and Long-Term Strategies and Actions

Prior to the development of this Lake Tahoe Aquatic Invasive Species Management Plan (Plan), resource managers, researchers, and many community members recognized the need for organized aquatic invasive species (AIS) prevention, education, control, and research. Partnerships such as the Lake Tahoe Aquatic Invasive Species Coordination Committee (LTAISCC) and Lake Tahoe Aquatic Invasive Species Working Group (LTAISWG) have facilitated development and review of this Plan.

This section identifies current/short-term (i.e., through current fiscal year) and long-term (i.e., five-year) strategies and actions. Additionally, the Implementation Table (Table 1 at the end of this Appendix) identifies the lead working group and entities, previous and current funding, and where applicable, anticipated funding needed to implement actions over the next year and the next five-year period.

Objective A: Oversight and Internal Coordination

As an interstate management plan, strong oversight and coordination is necessary to ensure the Plan objectives and action items continue to meet the goals of the Plan within the existing regulatory framework of both states and the Lake Tahoe Region (the Region). This requires identifying lead organizations to support the Plan development, oversight, coordination, implementation, and adaptive review.

STRATEGY A1: PLAN OVERSIGHT AND COORDINATION

The following action items describe the process of Plan development and implementation and identify the lead fiscal agent to facilitate financial transfer of funds, as needed, to support action items.

Actions

A1a. Lead Organization for Plan Oversight

Numerous regional, state, federal, and non-governmental organizations are involved in protecting and advocating for the environmental, recreational, and economic stability of Lake Tahoe. Implementation of the Plan will require committed oversight by an organization capable of regulation across the boundaries between California and Nevada, federal, and multiple local jurisdictions. The Tahoe Regional Planning Agency (TRPA) was created by California and Nevada as well as the U.S. Congress to have this regulatory power. It follows that TRPA is the one agency most suited for the oversight role.

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A1b. Implementation of the Lake Tahoe Region AIS Management Plan

Implementation of the Plan will largely be conducted by the LTAISCC and associated technical working groups. These groups have representatives from regional, state, and federal agencies and non-profit groups from the Lake Tahoe Region.

A1c. Prioritize AIS Management Efforts

One of the key functions of the LTAISCC is to prioritize the various strategies, actions, and projects implemented as part of the Plan. The LTAISCC will annually review and establish priorities within the Plan.

A1d. Establish Annual Program of Work

The LTAISCC will work with the individual technical working groups to establish an annual program of work and budget to guide actions for that year. This annual program of work will inform changes to Table 1.

STRATEGY A2: PLAN REVIEW

Timely review of the Plan is necessary to ensure strategies and specific action items continue to support the Plan's goals. New AIS threats and pathways of introduction should be evaluated for inclusion in updated Plan versions. Additionally, funding sources and levels should be considered to keep the Plan timely and ensure stakeholders have the support to implement the action items.

Actions

A2a. LTAISCC Review Sub-committee

The LTAISCC is critical to developing and updating the actions described in the Implementation Table (Table 1), including identifying lead Work Groups and organizations. The LTAISCC is tasked with evaluating Plan effectiveness and identifying gaps that limit the Plan's implementation. A sub-committee has been formed to address these issues. Members of the sub-committee:

- Are familiar with AIS issues, regulations, and laws at the regional, state, and federal levels,
- Are familiar with other regional and state AIS plans,
- Are capable of recommending strategies to improve the effectiveness of the Plan, and
- Lead data assessment relative to progress on control and prevention and recommend adaptive management changes.

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A2b. Plan Appendix Review

The appendices of the Plan will be reviewed annually by the LTAISCC review sub-committee described above and presented to the LTAISCC. Should revisions to appendices be needed, changes would then be addressed with Aquatic Nuisance Species Task Force (ANSTF) staff as minor technical revisions. The processes for this review are included in Chapter 6 Plan Review.

A2c. Plan Review

After a minimum of five years following a review of the body of the Plan, or if a revision of the body of the Plan is deemed required based on A2b, the Review sub-committee shall present revisions to the LTAISCC and address changes with the ANSTF. The processes for this review are included in Chapter 6 Plan Review.

STRATEGY A3: FUNDING

Sources of funds that support current AIS prevention, management, and research activities in the Region come from a variety of sources ranging from federal and state programs to private donations (details in Appendix G). Federal funds currently authorized under Section 1204(b) of the Nonindigenous Aquatic Nuisance Prevention and Control Act are limited to $4 million, split among other state AIS management plans. An additional $1.075 million is available from the U.S. Fish and Wildlife Service (USFWS) for ANTSF-approved plans; however, this is similarly split between state and interstate AIS plans. In 2009, the 31 approved plans received only $34,677. Increasing funding for state and interstate management plans to $30 million has been identified as a high priority in the *Quagga-Zebra Mussel Action Plan for Western U.S. Waters* (Western Regional Panel 2009).

Actions

A3a. Fiscal Agent for Plan

The TRPA has the ability to act as a fiscal agency for the implementation of the Plan. The TRPA cooperatively leads and successfully manages the Tahoe Environmental Improvement Program (EIP), and has demonstrated the ability to be nimble when acting as a pass-through agency for funding proposes. For example, TRPA can pass funds from a State of California agency to a State of Nevada agency.

A3b. Funding for Aquatic Nuisance Species (ANS) Coordinator

Southern Nevada Public Land Management Act funds currently support the USFWS ANS Coordinator for the Tahoe Region. Continued funding for this position is critical for coordinating AIS prevention, management, and research efforts in the Region in collaboration with state (e.g., California Department of Fish and Wildlife [CDFW), Nevada Department of Wildlife [NDOW], California Department of Food and Agriculture [CDFA]) and regional agencies (e.g., TRPA, Western Regional Panel) and guidance at the national level (e.g., ANSTF).

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STRATEGY A4: REGIONAL, BI-STATE, NATIONAL, AND INTERNATIONAL COLLABORATION

The following action items describe how regional, bi-state, national, and international coordination and collaboration efforts may be improved to monitor, prevent, and control AIS in the Region.

Actions

A4a. Coordinate with California and Nevada AIS Management Efforts

The CDFW in California and the NDOW in Nevada are the lead agencies for AIS prevention, monitoring and control for their respective states. The bi-state nature of the Plan means that coordination with AIS efforts in both California and Nevada is critical for its success. Coordination between the LTAISCC and the two state agencies on efforts outside the Region may include but are not limited to:

- Coordinated outreach. In 2012 the LTAISCC Outreach Working Group coordinated with NDOW to place joint billboards in northern Nevada promoting the "clean, drain and dry" slogan as well as providing a coordinated information phone number for boaters to call and get more information.
- Information Sharing. The sharing of information on new detections, prevention techniques, and AIS policy is important to ensure that best practices are maintained.
- Sharing of Resources. While it may not always be possible, the LTAISCC should look for ways to share resources with AIS prevention and control efforts outside of the Region and within California and Nevada.

A4b. Coordinate with the Lake Tahoe Environmental Improvement Program

The Lake Tahoe EIP is the overarching program that organizes and provides funding for all environmental improvement efforts in the Lake Tahoe Region. The EIP was formed following the 1997 Presidential Summit and has delivered $1.6 billion in environmental improvements since that time. Coordination between the LTAISCC and the EIP is critical to ensure the success of prevention, control, and monitoring of AIS in the Lake Tahoe Region.

A4c. Annual Plan Reporting

Continue synthesis and distribution of the annual LTAISWG summary of accomplishments and goals.

A4d. Foster Stakeholder Relationships

Foster relationships and partnership development among stakeholder groups that have private property, economic, and environmental interests in the Region.

A4e. Link LTAISCC and Working Groups to State, National, and International AIS Efforts

New AIS and introduction pathways are rapidly emerging due to increased internet trade, world-wide travel, and climate change. Similarly, innovative prevention, monitoring, and control methods are also increasing. To stay abreast of these emerging challenges and resources,

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stakeholders in the Region must be engaged with other state (particularly neighboring western states), national, and even international AIS managers and researchers. Examples of organizations include (links provided in Appendix I):

- Aquatic Nuisance Species Task Force
- National Invasive Species Council
- California Agencies AIS Advisory Team
- Sea Grant
- The 100th Meridian Initiative
- Western Regional Panel

STRATEGY A5: AIS LAWS AND REGULATIONS

In the Lake Tahoe Region, laws and regulations limiting the possession, transportation, introduction, distribution, propagation, and control of AIS are overseen by numerous agencies at the regional (i.e., TRPA), state (e.g., CDFW, CDFA, NDOW, Nevada Department of Agriculture), and federal (e.g., U.S. Department of Agriculture) levels. The diverse legal landscape in the Lake Tahoe Region has led to substantial gaps in AIS laws and regulations, particularly given the bi-state nature of the Region.

Actions

A5a. Maintain AIS Lists

Maintain accurate lists of AIS to alert managers and watercraft inspectors to species either present or threatening introduction to the Lake Tahoe Region.

A5b. Monitor Existing Laws and Regulations

Given the bi-state nature of the Tahoe Region, efforts should be made to ensure that existing AIS laws and regulations are consistent or at least not in conflict among the States of California and Nevada, the federal government, and this Plan.

A5c. Propose Relevant Amendments

Identify gaps and overlap in existing AIS laws, including but not limited to, quarantine, decontamination, possession, transport, and introduction. Provide recommendations to policy makers to bolster existing laws and establish Region-wide consistency.

A5d. Coordinate California and Nevada Law Enforcement

Facilitate the alignment of the TRPA and the States of California and Nevada's rules on AIS transport, possession, and introduction to establish Region-wide rules (summarized in Appendix A).

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Objective B: Prevention

Preventing the introduction of AIS to the Lake Tahoe Region (inter-region) and further spread of existing AIS within the Lake Tahoe Region (intra-region) requires adequate inspection and decontamination procedures coupled with effective and consistent education and outreach. Additionally, targeting prevention efforts to high risk introductory pathways will maximize limited resources.

STRATEGY B1: MOTORIZED INSPECTION AND DECONTAMINATION

The objective of motorized inspection and decontamination is to find and completely eliminate *all* viable AIS life stages to prevent their introduction into and between waters of the Lake Tahoe Region. Decontamination efforts should include *all* AIS (i.e., snails, plants, mussels, and other less conspicuous organisms).

Actions

B1a. Summer Season Inspection and Decontamination Implementation

Implement the summer season Watercraft Inspection Program (WIP) according to the protocol in Appendix D and in compliance with TRPA Chapter 63 of the Code of Ordinances, which provides for vessel inspection, decontamination, and the closure of launch facilities when inspectors are not present as well as a fee to support these efforts. Tahoe Resource Conservation District and TRPA staff have been certified by the 100th Meridian Initiative to provide inspection and decontamination trainings to contractors, launch facility staff, and Washoe Tribe inspectors.

B1b. Winter Season Inspection and Decontamination Implementation

Implement the winter season WIP according to the protocol in Appendix D and in compliance with TRPA Chapter 63 of the Code of Ordinances, which provides for vessel inspection, decontamination, and the closure of launch facilities when inspectors are not present as well as a fee to support these efforts.

STRATEGY B2: NON-MOTORIZED INSPECTION AND DECONTAMINATION

Actions

B2a. Non-motorized Watercraft Inspection

Integrate and implement inspection and decontamination protocols for all non-motorized watercraft, including the small watercraft screening procedures outlined by the U.S. Forest Service – Lake Tahoe Basin Management Unit (USFS – LTBMU; Appendix D).

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STRATEGY B3: PATHWAYS/VECTORS

The physical means or agent by which AIS are transported to a new environment and eventually established is an AIS pathway or vector. These dispersal mechanisms can be natural or human connections that allow movement of species or their reproductive propagules from place to place. Motorized and non-motorized watercraft are addressed above (Actions B1a, B1b, and B2a).

Actions

B3a. Seaplanes

Continue to educate the owners and pilots of seaplanes about the risk of transporting AIS not only to the Region, but outside of the Region.

B3b. Anglers

Expand outreach and education to anglers regarding decontamination of fishing equipment prior to its use in Region waterways.

B3c. Natural Resource Management

Continue to ensure that resource managers are aware of the potential to transport AIS (e.g., New Zealand mudsnails and rock snot on waders and other sampling equipment) and that adequate decontamination measures are taken.

B3d. Wildfire Suppression Activities

Ensure that AIS are not transported between waterbodies by equipment used for wildfire suppression activities by following, where possible, the USFS-LTBMU's *Resource Guidelines for Wildfire Suppression*.

B3e. Construction Activities

Ensure that AIS are not transported between waterbodies by equipment used for construction activities (e.g., culvert placement, dock and pier maintenance).

B3f. Fish Stocking

Continue to provide adequate decontamination of equipment used to transport hatchery-raised fish for stocking.

STRATEGY B4: EDUCATION

Education is key to any effective management program and numerous efforts are currently under way in the Region, including providing clear and consistent messages to various users, boaters, pilots, and paddlers. Maintaining a dialogue with resource managers in other regions of the U.S. and internationally will allow for information sharing and increase message recognition (e.g., *Stop Aquatic Hitchhikers!*).

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Actions

B4a. Motorized Inspection Education

Continue to update education/outreach for motorized boaters and the inspection program. As resources allow, continue the use of billboards, magazine, direct mailers, and radio advertisements (for example, the "clean, drain and dry" slogan) to prepare travelers for boat inspections and potential decontamination procedures, particularly during peak travel seasons. Continue to maintain a regional hotline (888-TAHO-ANS) to provide information on watercraft inspection and to report sightings of AIS.

B4b. Tahoe Keepers

Continue to implement the Tahoe Keepers non-motorized prevention and stewardship program. Tahoe Keepers is based on the ability of non-motorized boaters to substantially reduce the risk of AIS introduction or transport through diligent implementation of the "clean, drain, dry and dispose" method of self-inspections and decontamination. The purpose of the Tahoe Keepers campaign is to educate the target user group on the risks, techniques, and laws or ordinances associated with AIS in the Tahoe Region.

B4c. AIS Public Stewardship

Provide specific recommendations to vendors/suppliers and the general public for using suitable native plants and animals instead of non-native species in aquascaping projects. Also spread the message to the general public to avoid release of pets and aquarium plants, as well as other tips for preventing unintentional or intentional introductions into or between waterbodies in the Region.

B4d. AIS Identification

Train field biologists and boat inspectors to properly identify a range of AIS (and their life stages) including but not limited to dreissenid mussels, Asian clams, Eurasian watermilfoil, curlyleaf pondweed, and other potential invaders such as the spiny water flea and New Zealand mudsnail.

STRATEGY B5: PREVENTION EVALUATION AND UPDATE

Actions

B5a. Evaluate Decontamination Methods to Ensure Decontamination of a Range of AIS

Conduct spot checks to ensure proper watercraft decontamination protocols are followed, and evaluate inspection and decontamination procedures to ensure they address all life stages of targeted and non-targeted AIS. That is, train AIS inspectors to look for a range of organisms (e.g., spiny waterflea) and not just mussels and plants.

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B5b. Update Watercraft Inspection Plan

Update the Watercraft Inspection Plan (Appendix D) at a minimum annually to make sure that the WIP is operating in an efficient and effective manner, ensuring that it addresses all life stages of targeted and non-targeted AIS while providing for recreational boating access.

B5c. Update Watercraft Inspection Fee

Reassess the TRPA Governing Board approved fee in Chapter 63 of the TRPA Code of Ordinances to support the WIP on at least a yearly basis to determine if changes are needed, such as changes to the fee if other funds are found to offset costs.

Objective C: Monitoring, Detection, and Response

Following prevention, early detection, containment, and control/eradication of new AIS introductions are the second most cost-effective measures to reduce the impacts from AIS. This is accomplished through rigorous monitoring followed by the ability to respond efficiently and aggressively. Response is facilitated by a collaborative effort between numerous agencies, non-governmental organizations, researchers, and other stakeholders.

STRATEGY C1: POTENTIAL AIS

Understanding the distribution and impacts of potential AIS (i.e., Species Management Types 1 and 5; see Appendix B, Table 2) may be used as a benchmark for future management assessments and prioritization. Monitoring for potential AIS is the first step in responding rapidly to introductions. The most innovative technologies should be used to detect AIS.

Actions

C1a. AIS-Positive Waterbodies

Maintain a list of rivers and lakes outside of the Region with AIS. This list may be used to determine at-risk vessels so that inspectors can activate appropriate precautionary AIS prevention protocols. These records can be shared with inspectors in nearby watersheds and resource managers from AIS points-of-origin to coordinate an early warning network for potential AIS transport.

C1b. At-risk Waterbodies and Habitats in Region

Identify waterbodies in the Region that could host specific AIS throughout all life stages. For example, if similar water quality conditions exist between Lake Tahoe and Fallen Leaf Lake, then efforts should be made to prevent the transport of aquatic weeds from Lake Tahoe to Fallen Leaf (note: a wash station is currently in operation at Fallen Leaf Lake). Establishment of AIS is not only dependent upon the frequency of introduction but the convergence of optimal physical and chemical factors (e.g., fine substrates, particulate organics, available calcium). Partitioning of optimal habitat can vary temporally and would enable critical life stages to survive and either

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complete a life cycle at the same location or enable migration to other locations that are more suitable for completion of remaining life stages (excluding invasive macrophyte species). Surveys of these optimal habitat zones should be conducted on a routine basis to identify new AIS infestations or areas where they could establish.

C1c. Early Detection Monitoring

Continue to implement early detection monitoring and expand to address all Type 1 species. Prioritize monitoring locations within Lake Tahoe and surrounding streams and lakes based on access, level of use, and suitability of habitat.

STRATEGY C2: EXISTING AIS

Understanding the distribution and impacts of existing AIS (i.e., Species Management Types 2, 3, and 4) may be used as a benchmark for future management assessments and prioritization.

Actions

C2a. Invertebrate Monitoring Plan

Describe invertebrate monitoring protocols and current distributions. Review monitoring protocols as needed. Develop a site selection process that targets at-risk habitats from invasion of invertebrate AIS. Select protocols that measure appropriate habitat features that would be used by invertebrate AIS. Prepare a Quality Assurance Project Plan as part of a long-term monitoring program. Determine associations with other invasive species that provide habitat structure or physical features along the shoreline that would serve as suitable habitat for colonization.

C2b. Aquatic Plant Monitoring Plan

Continue to map the distribution of aquatic plants with regularly scheduled surveys and identify likely locations of infestation within the Region. Determine associations with other invasive species that provide habitat structure or physical features along the shoreline (e.g., sediment types) that would serve as suitable habitat for colonization.

C2c. Warm Water Fish Monitoring Plan

Continue to determine current distribution and identify habitats that currently support and are predicted to support all life stages of non-native warm water fish. Determine associations with other invasive species that provide habitat structure (e.g., Eurasian watermilfoil) or physical features along the shoreline that would serve as suitable habitat for colonization.

C2d. Bullfrog Monitoring Plan

Develop a plan to identify and survey at-risk habitat for bullfrog invasions in the Region. Determine current distribution and associations with other invasive species that provide habitat structure (e.g., Eurasian watermilfoil) or physical features along the shoreline that would serve as suitable habitat for colonization.

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C2e. Volunteer AIS Monitoring

Continue and expand as warranted the volunteer AIS citizen monitoring program called Eyes on the Lake. The Eyes on the Lake program is led by the League to Save Lake Tahoe. The program trains water recreationists (swimmers, snorkelers, paddlers, boaters, divers, etc.) how to identify, survey, and report on the presence and absence of invasive aquatic plants in Lake Tahoe and its surrounding streams and lakes. The training includes a classroom, laboratory, and field component. The League coordinates the data collected by the volunteers and reports the results back to the LTAISCC.

STRATEGY C3: EARLY DETECTION AND RAPID RESPONSE PLANNING

The purpose of developing early detection and rapid response (EDRR) plans is to provide for a coordinated system to monitor, report, and effectively respond to newly discovered and localized invasive species (National Invasive Species Council 2008). Critical to the success of EDRR plans is the ability to establish strategic partnerships and share resources across jurisdictional boundaries, available funds and technical resources, and mutually agreed upon implementation plans. The National Invasive Species Council breaks EDRR into the following three components:

- Early Detection: Where targeted species surveys and localized monitoring efforts are used to construct distribution maps and other ecological/biological data to facilitate planning and response actions.
- Rapid Assessment: Where the appropriate response to the early detection and an overall strategy is formulated, accounting for "transjurisdictional issues."
- Rapid Response: Where localized populations of invasive species are systematically eradicated or contained, including newly discovered as well as expanding populations of existing invasives.

Actions

C3a. Lake Tahoe Region AIS EDRR Plan

Develop a *Lake Tahoe Region AIS EDRR Plan* to address a broad range of potential AIS. The plan may be modeled after the Draft *California Rapid Response Plan* (CDFG 2008) and the *Columbia Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other Dreissenid Species* but tailored to the unique jurisdictional authority of agencies in the Lake Tahoe Region. Adopt National Incident Command System as part of the EDRR framework.

C3b. Lake Tahoe Region Mussel EDRR Plan

Review and update as needed the *Lake Tahoe Region Mussel EDRR Plan* based on the results of the rapid response table top exercise.

C3c. Rapid Response Table Top Exercise

Trigger bi-annual rapid response exercise for AIS using Incident Command System protocols.

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STRATEGY C4: AIS LIFE HISTORIES AND ENVIRONMENTAL REQUIREMENTS

Successful prevention and control efforts are largely dependent upon understanding the life histories and environmental requirements of current or potential AIS. Conducting research or compiling information that facilitates this understanding is considered a high priority in the Region.

Actions

C4a. Water Quality Parameters

Continue monitoring water quality parameters (i.e., calcium and temperature) in Lake Tahoe and other waterbodies in the Region to determine potential habitat for all life stages of existing and potential AIS, including plants, fishes, and invertebrates.

C4b. Survivability

Continue to identify controlling and limiting factors for survival and proliferation for all life stages of existing and potential AIS, including plants, fishes, and invertebrates.

C4c. Risk Matrix

Develop a detailed matrix that identifies at-risk sites for expansion of existing and establishment of potential AIS.

Objective D: Long-Term Control

Control of AIS implies that populations are present and small enough to curtail further increases while eradication means complete removal of all life stages of a species (see Chapter 2 AIS Management Approach). Often the methods to control AIS are the same as those to eradicate an AIS; however, the methods are applied differently or used in a fully integrated eradication regime. That is, the intensity of management may vary greatly from control to eradication. Methods to control or eradicate may overlap between groups of AIS while other methods are specific to a particular AIS.

STRATEGY D1: PROVIDE FOR ALL APPROPRIATE TREATMENT AND CONTROL MEASURES

Discussions among the LTAISCC, researchers, and regulatory agencies should continue in an effort to provide for all available and appropriate technologies to meet the management goals of this Plan.

Actions

D1a. Coordinate with Regulatory Agencies on Requirements for Utilizing Treatment Methods

The application of most treatment methods for the control of existing AIS requires permitting and environmental documentation before they are applied. Continued coordination with the regulatory agencies responsible for permitting these actions is critical for the efficient application

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of treatment resources. When possible, efforts should be made to utilize programmatic permits and environmental documents to create efficiencies at the project level.

STRATEGY D2: AQUATIC PLANT CONTROL

Each action should include an evaluation of effectiveness and ability to measure success in controlling and/or abating the harmful effects of invasive aquatic plants. Options currently available to control or eradicate invasive aquatic plants in the Tahoe Region include physical and mechanical methods; however, continued effort should be made to utilize innovative approaches to invasive aquatic plant control.

Actions

D2a. Aquatic Plant Control Plan

Continue to develop and update as needed an implementation plan that articulates a Region-wide strategy to control or abate the harmful effects of invasive aquatic plants. This plan should articulate how the treatment of specific infestations will be prioritized to make the most efficient use of funds and provide the greatest benefit to the control of invasive aquatic plants.

D2b. Tahoe Keys Aquatic Plant Management Plan

Develop and implement an Aquatic Plant Management Plan specific to the Tahoe Keys. Elements of the plan should include measures to:

- Prevent spread of existing invasive aquatic plant populations beyond the Tahoe Keys.
- Prevent the introduction of additional invasive plant species.
- Determine long-term control or eradication goals for the Tahoe Keys using all available technologies.

D2c. Emerald Bay Aquatic Plant Control

Continue the use of benthic barriers and diver-operated suction along with any future innovative technology to control invasive aquatic vegetation in Emerald Bay.

D2d. Nearshore Aquatic Plant Control

Continue the use of benthic barriers and diver-operated suction along with any future innovative technology to control invasive aquatic vegetation in the nearshore of Lake Tahoe.

STRATEGY D3: ASIAN CLAM CONTROL

Each action should include an evaluation of effectiveness and the ability to measure success in controlling and/or abating the harmful effects of Asian clams. Options currently available to control Asian clams in Lake Tahoe include physical and mechanical methods; however, these methods are under development and not yet operational lake-wide.

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Actions

D3a. Asian Clam Control Plan

Continue to develop and update as needed an implementation plan that articulates a Region-wide strategy to control or abate the harmful effects of Asian clams. This plan should articulate how the treatment of specific infestations will be prioritized to make the most efficient use of funds and provide the greatest benefit to the control of Asian clams.

D3b. Implement Asian clam control

Continue to evaluate the logistics, effectiveness, and environmental impacts of using benthic barriers and other innovative techniques for Asian clam control.

STRATEGY D4: WARM WATER FISH CONTROL

Each action should include an evaluation of effectiveness and ability to measure success in controlling and/or abating the harmful effects warm water fish. Continued information about juvenile, subadult, and adult life stages is essential for adapting various control strategies and methods. Control strategies and methods will need to be consistent with state and federal fisheries management objectives (i.e., threatened and endangered species recovery programs). For warm water fish control projects implemented on the Nevada side of Lake Tahoe, a scientific collection permit may be required as some warm water fish species are considered "game fish" according to NAC 503.060.

Actions

D4a. Warm Water Fish Control Plan

Continue to develop and update as needed an implementation plan that articulates a Region-wide strategy to control or abate the harmful effects of warm water fish. This plan should articulate how the treatment of specific infestations will be prioritized to make the most efficient use of funds and provide the greatest benefit to the control of warm water fish.

D4b. Implement Warm Water Fish control

Continue to evaluate the logistics, effectiveness, and environmental impacts of using electrofishing, nets, and other innovative techniques for warm water fish control.

STRATEGY D5: BULLFROG CONTROL

Each action should include an evaluation of effectiveness and ability to measure success in controlling and/or eradicating bullfrogs. Current efforts to control bullfrogs from the Region are limited and much work is needed to determine the most appropriate methods based on current population sizes and locations.

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Actions

D5a. Bullfrog Control Plan

Develop an implementation plan that articulates a Region-wide strategy to control or abate the harmful effects of bullfrogs. This plan should articulate how the treatment of specific infestations will be prioritized to make the most efficient use of funds and provide the greatest benefit to the control of bullfrogs. It will also evaluate the success of various methods to control bullfrogs.

D4b. Implement Bullfrog Control

Evaluate through pilot projects the logistics, effectiveness, and environmental impacts of using techniques for bullfrog control.

STRATEGY D6: LONG-TERM CONTROL OUTREACH

Education and outreach are key factors in meeting the control objectives of the Plan. Stakeholder groups and the public need to be informed and engaged with regard control efforts for existing AIS species in the Region.

Actions

D6a. AIS Control Stakeholder Outreach

Expand efforts to reach out to stakeholder groups such as fishermen, shoreline businesses, and homeowners to provide information and get input regarding current and future AIS control projects and programs.

Implementation Table

Descriptions of the objectives, strategies, and actions above provide background and justification of each action item. The implementation table identifies the lead working group and entities, previous and current funding, and where applicable, anticipated funding needed to implement actions over the next year and the next five-year period (Table 1).

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Table 1. Lake Tahoe Region AIS Management Plan Implementation Table (Revised 2014)

Objectives/Strategies/Actions		Lead Working Group or Organization*	Previous Year Budget $1K	Current Year Budget $1K	Current funding source $1K	Next Year Anticipated Budget $1K	Anticipated Five-Year Funding Need $1k	Priority
Objective A: Oversight and Internal Coordination								
Strategy A1:Plan Oversight and Coordination								
A1a	Lead Organization for Plan Oversight	TRPA						
A1b	Implementation of the Lake Tahoe Region AIS Management Plan	LTAISCC						
A1c	Prioritize AIS Management Efforts	LTAISCC						
A1d	Establish Annual Program of Work	LTAISCC						
Strategy A2: Plan Review								
A2a	LTAISCC Review Sub-committee	LTAISCC						
A2b	Plan Appendix Review	LTAISCC						
A2c	Plan Review	LTAISCC						
Strategy A3: Funding								
A3a	Fiscal Agent for Plan	TRPA						
A3c	Funding for ANS Coordinator	USFWS						
Strategy A4: Regional, Bi-state, National, and International Coordination								
A4a	Coordinate with California and Nevada AIS Management Plans	LTAISCC						
A4b	Coordinate with Lake Tahoe Environmental Improvement Program	LTAISCC						
A4c	Annual Plan Reporting	LTAISCC						
A4d	Foster Stakeholder Relationships	LTAISCC						
A4e	Link LTAISCC and Working Groups to State, National, and International AIS Efforts	LTAISCC						

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Objectives/Strategies/Actions		Lead Working Group or Organization*	Previous Year Budget $1K	Current Year Budget $1K	Current funding source $1K	Next Year Anticipated Budget $1K	Anticipated Five-Year Funding Need $1k	Priority
Strategy A5: Laws and Regulations								
A5a	Maintain AIS Lists	LTAISCC						
A5b	Monitor Existing Laws and Regulations	LTAISCC						
A5c	Propose Relevant Amendments	LTAISCC						
A5d	Coordinate California and Nevada Law Enforcement	WIPWG						
Objective B: Prevention								
Strategy B1: Motorized Inspection and Decontamination								
B1a	Summer Season Inspection and Decontamination Implementation	WIPWG						
B1b	Winter Season Inspection and Decontamination Implementation	WIPWG						
Strategy B2: Non-motorized Inspection and Decontamination								
B2a	Non-motorized Watercraft Inspection	NMWG						
Strategy B3: Pathways/Vectors								
B3a	Seaplanes	WIPWG						
B3b	Anglers	WWFWG						
B3c	Natural Resource Management	CDFW, NDOW, USFS, TRPA						
B3d	Wildfire Suppression Activities	USFS						
B3e	Construction Activities	TRPA						
B3f	Fish Stocking	CDFW, NDOW, USFWS						

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Objectives/Strategies/Actions		Lead Working Group or Organization*	Previous Year Budget $1K	Current Year Budget $1K	Current funding source $1K	Next Year Anticipated Budget $1K	Anticipated Five-Year Funding Need $1k	Priority
Strategy B4: Education								
B4a	Motorized Inspection Education	WIPWG, OWG						
B4b	Tahoe Keepers	NMWG, OWG						
B4c	AIS Public Stewardship	OWG						
B4d	AIS Identification	OWG						
Strategy B5: Prevention Evaluation and Update								
B5a	Evaluate and Update Decontamination Methods to Ensure Decontamination of a Range of AIS	WIPWG, NMWG						
B5b	Update Watercraft Inspection Plan	WIPWG						
B5c	Update Watercraft Inspection Fee	TRPA						
Objective C: Monitoring, Detection, and Response								
Strategy C1: Potential AIS								
C1a	AIS-Positive Waterbodies	WIPWG						
C1b	At-risk Waterbodies and Habitats in Region	LTAISCC						
C1c	Early Detection Monitoring	LTAISCC						
Strategy C2: Existing AIS								
C2a	Invertebrate Monitoring Plan	ACWG						
C2b	Aquatic Plant Monitoring Plan	NAWWG						
C2c	Warm Water Fish Monitoring Plan	WWFWG						
C2d	Bullfrog Monitoring Plan	USFS						
C2e	Volunteer AIS Monitoring	LTSLT						

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Objectives/Strategies/Actions		Lead Working Group or Organization*	Previous Year Budget $1K	Current Year Budget $1K	Current funding source $1K	Next Year Anticipated Budget $1K	Anticipated Five-Year Funding Need $1k	Priority
Strategy C3: Early Detection and Rapid Response (EDRR) Planning								
C3a	Lake Tahoe Region AIS EDRR Plan	USFWS						
C3b	Lake Tahoe Region Mussel EDRR Plan	USFWS						
C3c	Rapid Response Table Top Exercise	USFWS						
Strategy C4: AIS Life Histories and Environmental Requirements								
C4a	Water Quality Parameters	LTAISCC						
C4b	Survivability	LTAISCC						
C4c	Risk Matrix	LTAISCC						
Objective D: Long-Term Control								
Strategy D1: Provide for all Appropriate Treatment and Control Methods								
D1a	Coordinate with Regulatory Agencies on Requirements for Utilizing Treatment Methods	ACWG, NAWWG, TKWG						
Strategy D2: Aquatic Plant Control								
D1a	Aquatic Plant Control Plan	NAWWG						
D2a	Tahoe Keys Aquatic Plant Management Plan	TKWG						
D2b	Emerald Bay Aquatic Plant Control	NAWWG						
D2c	Nearshore Aquatic Plant Control	NAWWG						
Strategy D3: Asian Clam Control								
D3a	Asian Clam Control Plan	ACWG						
D3b	Implement Asian Clam Control	ACWG						

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Objectives/Strategies/Actions		Lead Working Group or Organization*	Previous Year Budget $1K	Current Year Budget $1K	Current funding source $1K	Next Year Anticipated Budget $1K	Anticipated Five-Year Funding Need $1k	Priority
Strategy D4: Warm Water Fish Control								
D4a	Warm Water Fish Control Plan	WWFWG						
D4b	Implement Warm Water Fish Control	WWFWG						
Strategy D5: Bullfrog Control								
D5a	Bullfrog Control Plan	USFS						
D5b	Implement Bullfrog Control	USFS						
Strategy D6: Long-term Control Outreach								
D6a	AIS Control Stakeholder Outreach	OWG						

*List of abbreviations for Working Group or Organization:

- ACWG: Asian Clam Working Group
- NAWWG: Nearshore Aquatic Weed Working Group
- CDFW: California Department of Fish and Wildlife
- LTAISCC: Lake Tahoe Aquatic Invasive Species Coordination Committee
- NDOW: Nevada Department of Wildlife
- NMWG: Non-Motorized Working Group
- OWG: Outreach Working Group
- TKWG: Tahoe Keys Working Group
- TRPA: Tahoe Regional Planning Agency
- USFS: United States Forest Service
- USFWS: United States Fish and Wildlife Service
- WIPWG: Watercraft Inspection Program Working Group
- WWFWG: Warm Water Fish Working Group

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LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix D: Prevention Planning

This appendix together with Appendices E and F form the framework for planning the objectives, strategies, and actions found in Appendix C. This appendix contains planning documents that describe the individual programs, projects, and protocols that are updated on a regular basis as part of the continual improvement process for the Plan. The last date of revision for any document in this appendix is the most current as not all plans are updated at the same time.

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Appendix D1: Non-motorized Watercraft Inspection

Lake Tahoe Aquatic Invasive Species

Non-Motorized Inspection Implementation Plan

Lake Tahoe Aquatic Invasive Species Integrated Management Strategy

Lake Tahoe Watershed, California & Nevada

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December 2010

This product was prepared by:

California State Parks

California Tahoe Conservancy

Tahoe Resource Conservation District

Tahoe Regional Planning Agency

U.S. Forest Service, Lake Tahoe Basin Management Unit

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Purpose and Objectives:

The purpose of the Non-Motorized Inspection Implementation Plan is to help prevent the introduction of new aquatic invasive species (AIS) populations in the Lake Tahoe Region (Region), to control or prevent populations that already exist in the Region from spreading within or between water bodies, and to prevent degradation of aquatic resources in the Region. This Plan has been developed to 1) define the duties of the watercraft inspector, land owners, and public facility operators and 2) describe the implementation of the inspection process for non-motorized vessels. The program outlined in this Plan is intended to inform partners and stakeholders on the responsibilities and implementation process that will operate in conjunction with other plans and programs, such as trailer-launched/motorized watercraft inspection and AIS outreach.

Background:

> At least 20 non-native species are established in the waters of the Region. These include aquatic plants, fish, invertebrates and amphibians. Other invasive species, such as quagga mussel (*Dreissena bugensis*), zebra mussel (*Dreissena polymorpha*), and New Zealand mudsnail (*Potamopyrgus antipodarum*), have not established populations in the Region but introduction of these species pose a significant threat. The establishment of quagga mussel in Lake Tahoe would cost the local economies an estimated $22.4 million dollars a year in property and infrastructure damage, maintenance costs, and recreational impacts. Both extant and proximate invasive species threaten the ecological stability of the waters of the Region, and put at risk recreational and scenic resources, water quality, socioeconomic conditions, and public safety in the Region.

Recreational activities involving watercraft (including motor boats, personal watercraft, kayaks, canoes, inflatable, etc.) and/or fishing are the most likely vectors for the introduction of AIS to the Region and among water bodies within the region (USACE. 2009. Lake Tahoe Region Aquatic Invasive Species Management Plan, California – Nevada; Page 16.). Although motorized watercraft present the greatest risk for transporting AIS overland for long distances, hand launched watercraft are also capable of transporting aquatic weeds or live invertebrates between water bodies. These risks are magnified due to the many dispersed recreation sites and beaches that are used to launch non-motorized watercraft, which do not typically have a land management or law enforcement presence. Effective implementation of an AIS prevention program in the Region therefore requires an inspection plan and accompanying public education program targeting non-motorized or hand launched watercraft that addresses the various types of hand launched watercraft and the dispersed nature of water body access in the Region.

In 2008 the US Forest Service, Lake Tahoe Basin Management Unit (LTBMU) initiated an AIS screening process (Appendix 2) at developed recreation sites. These sites are staffed at main entry points, which are usually kiosks. The screening form is intended to gage the level of risk hand carried watercraft pose to unwanted AIS transference. Any watercraft which has been in an infected water body within the last 28 days or which has been dry for three days or fewer is considered “High Risk” for AIS transference. Screening forms are completed by recreation site management staff and returned to LTBMU Aquatic Biologists for information storage and synthesis. Of the returned data forms for 2009, a total of 1,536 watercraft were screened at Forest Service develop recreation sites. Of those, 65 were determined to have been in infested waters within the 28 days prior to launching in Lake Tahoe. All of those 65 boats had been dry

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for three days or more. Similarly in 2010, […] Implementation of the LTBMU's AIS screening process will continue at Forest Service developed recreation sites in 2011 with appropriate updates (i.e. moving the three day dry criteria to five days) based on this Plan and direction from the LTBMU Forest Supervisor.

In 2010, the Tahoe Resource Conservation District (Tahoe RCD) initiated a pilot project at Fallen Leaf Lake to assess the effectiveness of roving inspectors. The inspector monitored boater activity at various access points to Fallen Leaf Lake and determined that the majority of boaters used relatively few well-established trails and parking areas. Inspections and outreach/educational interviews were conducted at every opportunity along popular access points, the shoreline, and from the water. The inspector collected information on the use of non-motorized watercraft in the Region including watercraft types, transportation, and knowledge of responsible boating practices. Data…

[Insert information from Water Trail surveys (CTC).]

Regulations:

Preventing the introduction of AIS into the Region is a function of outreach, education, voluntary action by the boating public, and regulation. Interaction with the public during inspections has shown that the vast majority of the boating public is aware and concerned about the spread of AIS. The level of cooperation with inspections by the boating public has been high, which greatly simplifies prevention efforts. The TRPA Code of Ordinances includes several sections relating to AIS efforts that could be applied if needed.

Current Code:

TRPA Code of Ordinances, Chapter 79.3 contains regulations relating to the prevention of invasion by AIS. Invasive species are defined in the TRPA Code as:

> …species, both aquatic and terrestrial, that establish and reproduce rapidly outside of their native range and may threaten the diversity or abundance of native species through competition for resources, predation, parasitism, hybridization with native populations, introduction of pathogens, or physical or chemical alteration of the invaded habitat. Through their impacts on natural ecosystems, agricultural and other developed lands, water delivery and flood protection systems, invasive species may also negatively affect human health and/or the economy.
>
> Aquatic invasive species shall include but not be limited to: zebra mussel (*Dreissena polymorpha*), quagga mussel (D*reissena bugensis*), Eurasian water milfoil (*Myriophyllum spicatum* L.), curlyleaf pond weed (*Potamogeton crispus* L.), and large mouth bass (*Micropterus salmoides*).

TRPA Code of Ordinances, Chapter 79.3.A Relates to the transport, introduction and launching of watercraft that are contaminated with AIS.

> Prohibition: The transport or introduction of aquatic invasive species into the Lake Tahoe Region is prohibited. Further, the launching of any watercraft contaminated with aquatic invasive species into the waters of the Tahoe Region is prohibited

TRPA Code of Ordinances, Chapter 79.3.B Makes it mandatory to submit all watercraft for inspection prior to launching into the lakes of the Region when an inspector is present. This

section also makes decontamination mandatory when the watercraft is judged by an inspector to be contaminated. Finally, TRPA Code requires that boat launching facilities be closed to launching when an AIS inspector is not present.

> (1) An owner operator of a Boat Ramp or other Boat Launch Facility (exclusive of single family residences) shall close the ramp or facility to launching of watercraft at all times when the provisions of subsection (2) have not been or cannot otherwise be provided or met.
>
> (2) All watercraft, motorized and non-motorized, including but not limited to boats, personal watercraft, kayaks, canoes and rafts, shall be subject to an inspection prior to launching into the waters of the Lake Tahoe Region to detect the presence, and prevent the introduction, of Aquatic Invasive Species. An inspection under this section is valid only if performed by a trained inspector pursuant to Tahoe Regional Planning Agency standards and requirements for Aquatic Invasive Species inspections.
>
> (3) All watercraft inspected in subsection (2) shall be subject to decontamination if determined necessary by an inspection under 79.3 B (2). A watercraft shall launch only if the required decontamination is performed and completed by a trained individual pursuant to TRPA standards and requirements for Aquatic Invasive Species decontamination and launch is authorized by a trained inspector pursuant to TRPA's standards and requirements for Aquatic Invasive Species Inspections.
>
> (4) All watercraft inspected in compliance with subsection (2) and decontaminated in compliance with subsection (3) are subject to a fee to pay for the inspection and/or decontamination and other program costs. The TRPA Governing Board will review and approve the fee amount and structure annually (Effective June 1, 2009).

Inspection Protocol:

Training and Designation of Inspectors

All TRPA designated inspectors must be trained to meet TRPA standards prior to conducting any inspections. Tahoe RCD and TRPA staff have completed the Level Two, Watercraft Inspection and Decontamination Interception Training certification provided by the 100th Meridian Initiative, and are qualified as incident responders and Level One trainers. The 100th Meridian Initiative is a cooperative effort between local, state, provincial, regional and federal agencies in western portions of North America, designed to prevent the spread of zebra and quagga mussels and other aquatic nuisance species. Through these certifications, Tahoe RCD and TRPA staff is able to provide the necessary inspection and decontamination trainings to certify contractors and launch facility staff to perform inspections.

Facility Types

Lake Tahoe and its neighboring water bodies offer the public extraordinary boating opportunities, especially where the use of kayaks, canoes, rafts and other hand carried watercraft is desired. The spectrum of boating opportunities within the Region varies from large lakes, such as Lake Tahoe or Fallen Leaf Lake, to small lakes, such as those that occur in alpine areas. Hand carried watercraft provide a non-motorized means of getting to lake destinations for activities such as fishing, camping, wildlife viewing, or sightseeing.

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Facilities in the Region that provide points of access to hand launched watercraft include recreation sites managed by federal, state, local, and private entities. The most common types of public facilities are state parks, USDA Forest Service campgrounds, day use areas, and city parks. Examples of private facilities and access points common to the Region are privately operated marinas and boat launches, private docks and boat houses, and lakefront properties with beach access (including single-family homes, condominiums, and hotels).

Locations that offer hand carried watercraft access to lakes and rivers can be classified as either developed or undeveloped. Developed recreation sites have facilities, such as signage identifying the site and access points, designated parking (paved or unpaved), kiosks (public check-in points), bathrooms, or other amenities that enhances the public's experience. Undeveloped sites (sometimes also termed "dispersed recreation areas") do not have facilities or other amenities as part of the access point as they are not formally managed as recreation areas. Types of developed and undeveloped sites include:

Developed	**Undeveloped**
Day use areas	Un-designated road pull-outs
Campgrounds	Unmanaged trailheads and/or trails
Resorts	
Boat launch facilities	
City parks	
Designated trailheads	

Types of Inspection

Four types of inspections have been developed to address the diversity in access points described above, the various management and administrative roles at developed and undeveloped sites, and the capacity at which the program can fund staff.

All types will incorporate education and outreach materials including signage, brochures, and handouts. Under each inspection type, all watercraft are required to be reliably decontaminated prior to arriving at an access point and will be subject to a certified decontamination process if determined necessary by a designated inspector. The inspector will contact the Tahoe Aquatic Nuisance Species Hotline to coordinate decontamination procedures when necessary. The four types of inspection are:

Type 1: Un-staffed

This type of inspection will include self inspection through an educational "how to" (Appendix 1) available at the most common entry point(s).

Type 2: Rover

This type of inspection is similar to Type 1, but with trained inspectors alternating between sites during periods of peak use to conduct AIS screening surveys (Appendix 2) and providing direct education to the public.

Type 3: Staffed

This type of inspection will occur at locations where there is a single point of entry and staff present. All watercraft owners will be given a screening survey and educational materials from kiosk personnel at boat launching facilities and day use facilities during normal hours of operation. Inspections may also be available at designated boat launching facilities when the boat ramp is open to motorized watercraft. When staffed locations are not in operation, and therefore un-staffed, then Type 1 or Type 2 inspections will be implemented.

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Type 4: Stations

These inspections will occur at existing, established motorized watercraft inspection stations, which are located along major highways are entrances to the Tahoe Basin. Inspections may also be available at designated boat launching facilities, and marinas.

Appendix 3 describes the type of inspection to be conducted at each facility/location.

Procedures

Education and Outreach: Education and outreach materials will be distributed to the public at a wide range of locations which serve the variety of user groups and the various facility and access point types. Signage, self inspection handouts, educational brochures and promotional items will be made available throughout the Region. Outreach to non-motorized watercraft users will also be conducted as part of the Lake Tahoe AIS prevention and control programs, including website ads, brochures, event promotion, viral media, etc.

Education on appropriate inspection and decontamination methods will be provided to the boating public through on-site education and certification courses available at designated inspection stations and through an online education and certification course. Completion of an annual training course will require each certificate holder to declare that he/she will assure decontamination of their boat prior to each launch. This includes launches between different waterways in the Region, such as from Lake Tahoe to Fallen Leaf Lake. Completion of annual training will include a user information survey and certification as described below.

Boater Registration and Watercraft Certification: All non-motorized boat users in the Region will be required to complete training for self-inspection and proper decontamination. The training will consist of background information concerning the AIS threat (updated annually) and detailed inspection and decontamination techniques. Upon completion of the training course, users must pass a brief test in order to receive their certification. Planners expect this training to require approximately 10 minutes. Boaters who have completed the training will receive a certificate and sticker(s) valid for one year. The certificate is valid for the user, meaning that he/she may use any watercraft, provided the certificate is always carried and visibly worn on their upper-body by the certified user. The certified user will be asked to register each hand launched watercraft that will be used in the Region, by providing information, such as the make, model, and color. A certificate of training and a certification sticker for each watercraft will be issued to the user upon satisfactory completion of training. Each user completing the training will also be offered a corresponding certification sticker for their car-top rack to facilitate roving and staffed screening surveys or inspections.

A valid **user certificate** insures that the user has the knowledge, skill, and commitment to inspect and decontaminate any watercraft he/she uses.

A valid **boat sticker** demonstrates each boat has undergone appropriate cleaning and decontamination processes by a knowledgeable boater between each use, as declared under issuance of the user certification.

The boater and watercraft registration program is an integral part of the outreach and education program, will facilitate efficient screening and watercraft inspection at developed and un-developed sites, and will promote resource stewardship. However, possession of a user certificate or boat sticker does not obviate users from complying with TRPA Code of Ordinances 79.3.B. Designated inspectors may order ANY boat that

is determined to pose a risk to be decontaminated; failure to comply with this order shall be a violation of TRPA Code and subject to fines. Certified users who transport a watercraft into a river or lake in the Region without conducting decontamination procedures may be considered in knowing-violation of this Code.

Use of annual stickers, identified by color and year, can assure compliance by dramatically improving enforcement of inspection/decontamination requirements. Roving inspectors or other site staff can easily monitor parking lots to see that car-top kayak or paddleboard racks display a valid sticker. Similarly during on-water patrols conducted by the TRPA Watercraft Team, boats without stickers can be quickly identified and the team can provide education or enforcement as appropriate. In addition, peer-pressure and self-enforcement among boater and paddler groups may serve to encourage greater awareness and help to improve sticker compliance.

Self Inspection (Type 1: Un-staffed): Self inspection consists of the procedures by which a boater can ensure a hand launched watercraft is free of invasive species, or "Clean, Drained, and Dry." Boaters can reliably decontaminate hand launched watercraft by cleaning with pressurized water; removing plant matter, mud/dirt and debris from the hull, cockpit, rudder, and gear; draining water from all hatches, cockpits, pumps, coolers, and gear; and allowing the boat to completely dry for a minimum of three days. Appendix 1 provides an example handout explaining correct clean boating practices for kayaks, canoes, and other hand launched watercraft for preventing the transportation of AIS.

Self inspection will be certified through both the online training course and on-site educational materials. Participation in the self inspection program will promote user-awareness of the AIS program and facilitate efficient screening and inspection. For instance, a certified user that has properly conducted a self inspection and decontamination will not require additional education at a park kiosk and will move quickly through required screening or inspections.

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Roving Inspectors (Type 2): The Rover, or roving inspector, will conduct surveys and inspections at dispersed recreation areas and common “road-side” access points where boaters do not pass through a kiosk or check-in. Roving inspectors will act as a community outreach liaison for the program by providing educational training and inspections to boaters at dispersed recreation sites, where other outreach efforts may be less effective. Rovers will be trained to the same standards as designated Tahoe RCD inspectors and will carry the same authority as described above for all designated inspectors.

Staffed Locations (Type 3): Developed locations that are staffed with state park staff, USDA Forest Service Rangers, or private employees may not always have a designated inspector at the entrance location; however, a designated inspector or roving inspector shall be designated for each facility during operating hours. Employees at staffed location entrances will conduct the AIS screening survey (Appendix 2) to determine risk and inspection or decontamination requirements. If the screening staff member determines that a full inspection and/or decontamination is needed before a watercraft can legally launch, staff will notify the designated inspector for that facility and provide educational information to the user. Staff employees will contact the Tahoe Aquatic Nuisance Species Hotline to coordinate inspection and decontamination procedures when necessary and will coordinate with the hotline in the event a user does not comply with the inspection requirements or decontamination orders.

Inspection and Decontamination Stations (Type 4): Watercraft brought to the Region will pass a roadside watercraft inspection station. These stations are currently planned to be operated in Meyers, Alpine Meadows, Northstar Resort, and Spooner Summit. Full hot-water decontamination services for motorized and non-motorized watercraft are available at each of these roadside inspection locations as well as the TRPA office in Stateline, Nevada. Inspections for non-motorized watercraft may also be available at most motorized watercraft launching facilities at Lake Tahoe, Fallen Leaf Lake, and Echo Lake when launch ramps are in operation. Inspectors at these stations can provide non-motorized watercraft users with the training program described above and can inspect/decontaminate each watercraft. If the watercraft user already has a valid certificate or sticker, the training portion of this inspection may not be necessary, facilitating a faster inspection process. At the conclusion of this visit, users may receive their certificate and each boat and car rack will be provided a sticker if they do not already have one.

Survey and Screening Form: The survey and screening form is used as a tool for evaluating the boater’s knowledge of clean boating practices, the level of risk each type of watercraft presents, and the need for further inspection and/or decontamination. The survey will be used as a basic guideline for the inspector’s interaction with the boat owner/user. Rover, Staffed, and Station Inspections will use a standardized survey form and screening procedure following the methods described in Appendix 2. The information gathered will then be entered into a database for further analysis.

Role of Watercraft Inspection Program and Decontaminations: The Tahoe RCD inspectors and the other Lake Tahoe Watercraft Inspection Program staff will provide training and a framework for guidance and technical assistance to rovers, kiosk staff and other partner agencies. Through training sessions, follow-up refreshers and regular coordination, detailed inspections and decontaminations will be performed by Tahoe RCD staff.

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Role of State and Local Law enforcement:

The role of the AIS inspector is to complement efforts by state agencies with jurisdiction over boating and AIS introduction, including California Department of Fish & Game and Nevada Department of Wildlife. TRPA and the U.S. Fish and Wildlife Service have engaged the local governments in the Region to encourage the passing of local ordinances that address AIS introduction and vessel inspection. Agreements are also being developed with local law enforcement agencies in California to assist when these local laws regarding AIS are being violated. Local law enforcement agencies in Nevada already have the ability to enforce state game law and agreements with these agencies are being pursued. Assistance from local law enforcement will be vital, as the Warden resources of both states are often committed and timely response can be challenging. The Watercraft Inspectors should follow the recommended approach to conducting the surveys and inspections found in the *Tahoe RCD Boater Interaction Protocol*.

Recent experience suggests that the majority of boaters will be cooperative. However, should the boater refuse any part of the inspection, the inspector is to inform the boater that inspections are mandatory and that they will not be permitted to launch unless they complete the inspection. Should the boater continue to refuse the inspection and proceed to launch, the inspector shall inform the boater that if they launch they are subject to significant monetary penalties and the inspector shall contact the ANS Hotline (and/or their supervisor), who will contact Game Wardens and/or the TRPA to follow up and enforce the Code of Ordinances.

***** ***The inspector shall ALWAYS be courteous, shall never use foul or obscene language or gestures under any circumstances, and shall be required to use the utmost professionalism at all times.***

Logistics and Accounting:

Inspection Locations, Type, and Schedule:

Seasonal staffing needs and funds allocation will be determined based on the inspection location, type, and schedule database in Appendix 3. This database can be adapted as needed based on program implementation, boater use patterns, and effectiveness review.

The type of site (developed and undeveloped) and expected frequency of use for non-motorized watercraft will be used to prioritize and determine the locations, staffing, seasonal schedule, and maintenance of inspection locations, as well as the type of inspection to be conducted at each site (Appendix 3).

***Equipment*:**

It is recommended that the inspectors be supplied with the following equipment:

- Cellular phone or two-way radio
- Small flashlight or pen light
- Telescoping mirror
- Magnifying lens
- Clipboard
- Survey and Screening Forms
- Pen
- Digital camera
- AIS Incident and Emergency Contact information

Fee Structure:

Insert new fee structure text…

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[REVISE BASED ON 2009-2010 DATA AND 2010 FEE STRUCTURE]

Table 1: 2009 Fee structure with sliding scale based on vessel length, no charge for sealed vessels and extra charge for live-wells and ballast tanks at centralized inspection stations.

Vessel Category	Inspection fee	Estimated number of inspections in each category*
Non-motorized vessels	**$0**	**N/A**
Vessels with intact inspection seal	$0	N/A
Vessels up to and including 16 feet	$10	1,620
Vessels over 16 feet to 25 feet	$30	16,605
Vessels over 25 feet to 39 feet	$40	1,620
Vessels over 39 feet	$60	405
Vessels containing ballast tanks/ bladders/livewells	$10 additional fee	4,151
Total Funding:	**$654,000**	

* Based on estimated 24,401 inspections of vessels that did not last launch in Tahoe, and using percentages of boats in each category from 2006 Tahoe Boat Survey

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Program Evaluation

The non-motorized vessel inspection program will require the following forms of evaluation to ensure that it is operating efficiently and effectually.

Program Implementation

The first evaluation is that of program implementation. This evaluation will rely on both queries of the database to look for anomalies and review of on the ground implementation by TRPA staff. Examples of questions that will be asked as part of the evaluation are:

- Have inspection sites been identified and staffed?
- Are sites effectively screening users before they have launched?
- Are self inspection forms being filled out and returned?
- Are non-motorized vessel owners aware of the issue and prevention measures?
- More…

Program Effectiveness

To be effective, the Lake Tahoe Aquatic Invasive Species Non-Motorized Inspection Implementation Plan must 1) demonstrate compliance with local, state, and federal law, and 2) prevent the introduction and/or spread of AIS in the Region.

Site-based and roving inspectors will inspect and order watercraft decontamination as necessary. Due to the portability of hand launched watercraft and the dispersed nature of launch opportunities in the Region, this program also includes a procedure to train and certify boat users for self-inspection and decontamination prior to each launch. A combination of education, certification, and various inspection opportunities will be necessary to achieve effective prevention and control under this plan.

The methods to evaluate the effectiveness of the program still need to be developed in cooperation with our partners.

Secret Shopper/ Inspector Review

Boater Interviews/ Outreach Review

Online Training Survey w Annual Review

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APPENDIX 1: How to Inspect and Decontaminate your Vessel

Clean, Drain, Dry--Everytime

To stop aquatic hitchhikers please CLEAN, DRAIN, AND DRY your Kayak/Canoe/Inflatable/etc, in between every body of water—EVERYTIME. Please DISPOSE of all plants and debris in a trash can. Here's how:

1. DRAIN your canoe/kayak of WATER before leaving the launch site.

2. HOSE OFF the following items and make sure they are free of VEGITATION, MUD, and other DEBRIS.

Kayak/ Canoe (inside and out)	Hatches and Tanks
Rudders	Coolers
Lifejackets	Dry Bags
Seat Cushions	Bailing Pumps and Sponges
Paddles	Water shoes

3. Using a spray bottle filled with bleach solution (about 3 oz bleach per 32 oz water) spray all inner compartments and bilges of your kayak, canoe, or watercraft.[Discuss…]

4. Keep your kayak, canoe, or watercraft DRY with PLUGS PULLED for at least 3 DAYS before launching at another body of water. In addition, make sure all boating accessories and parts are dry.

For more information or a clean boat guide:

● www.tahoeboatinspections.com ● www.dbw.ca.gov/PDF/BoatingQuaggaGuide.pdf ●

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APPENDIX 2: Hand-Launched Watercraft Inspection Survey and Screening Form

Ask the following questions of all visitors with non-motorized or hand-launched watercraft.

Record all information on screening data form.

1. **Visually Inspect and Assess** – Record the following:
    a. Zip Code
    b. Vehicle make/model/color/ and license plate number
    c. Type of Vessel (inflatable, kayak, canoe, zodiac, etc.)
    d. Tahoe Inspection Sticker number?
    e. Decontaminated to Clean Drain and Dry standards?

2. **Ask** – Where has your vessel been within the last 28 days?
    a. Record waterbody name, state, and location (nearest city, landmark, launch site);
    b. Compare to list of infested waterbodies;
    c. If vessel has been in one of these waterbodies, go to number 3.

3. **Ask** – Has the vessel been completely dry for the last 3 days?
    a. If YES – Provide outreach information and complete survey.
    b. If NO – Advise individual(s) not to launch until boat has been decontaminated;
        i. Refer boat owner to appropriate inspector or decontamination station,
        ii. Notify site or roving inspector, and
        iii. Call AIS inspection hotline (530-545-3546 or 888-824-6268) to report vehicle and boat information.

→ If a watercraft needs inspection, refer boat owner to the following:

- Designated Site Inspector – Notify to conduct inspection
- Roving Inspector – Mobilize to conduct inspection
- Inspection Stations – Direct boat owner to closest available locations

→ If a watercraft needs decontamination, report vehicle/boat information to hotline and refer boat owner to the closest available stations:

- TRPA office in Stateline, Nevada
- Spooner Summit, Nevada – Junction of Highway 50 and Highway 28
- Northstar at Tahoe Resort, California – in parking lot
- Alpine Meadows Resort, California – in parking lot
- Meyers, California – on Pole Road near junction of Highway 50 and Highway 89
- Incline Village, Nevada – Sand Harbor Marina
- Tahoe City, California – Lake Forest Boat Launch
- Meeks Bay, California – Meeks Bay Resort

4. **Ask** – Were you previously aware of invasive species? Did you know it is possible to transport aquatic invasive species on non-motorized boats (canoes and kayaks), even between lakes in the same area, such as between Lake Tahoe and Fallen Leaf Lake? Do you now know how to prevent this problem from happening?

5. **Ask** – How do you store your vessel?

6. **Ask** – How do you typically transport and launch your vessel?

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Information Recorded on Data Form

Visual Inspection and Registration
Zip Code
Vehicle make/model/color and license # of towing/holding vehicle
Type of vessel (inflatable, kayak, canoe, zodiac, etc)
Tahoe Inspection Sticker Number
Decontaminated to Clean, Drain, Dry Standards

Questionnaire
Previous Waterbodies
Aware of AIS
How long out of water
Storage
Transportation
Email address

Decontamination needed?

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Appendix D2: Watercraft Inspection

Lake Tahoe Aquatic Invasive Species Watercraft Inspection Implementation Plan

Revised 2013

Lake Tahoe Aquatic Invasive Species Integrated Management Strategy
Lake Tahoe Watershed, California & Nevada

March 2013

This product was prepared by:

TAHOE
REGIONAL
PLANNING
AGENCY

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Introduction:

This plan is a revision of the previous Watercraft Inspection Implementation Plan (the Plan) that was developed in 2009 and adopted as part of the Lake Tahoe Region Aquatic Invasive Species Management Plan. The Plan is designed to help prevent the introduction of new aquatic invasive species (AIS) populations in the Tahoe Region, to control the spread of those populations that already exist and to prevent insure that watercraft follow general clean boating practices. This Plan is being developed to define the duties of the boat inspector and describe the implementation of the inspection process. The program outlined in this document is intended to work with other plans and programs to prevent the degradation of the waters of the Lake Tahoe Region.

Background:

Zebra mussels were first discovered in the U.S. in Lake St. Clair, near Detroit, in 1988. Since that time zebra mussels have spread at an alarming rate through much of the Eastern United States. Quagga mussels were until recently thought to be a type of zebra mussel and have spread from the Great Lakes to Arizona, Nevada and California. The New Zealand mud snail was first found in the Snake River Drainage, Idaho and Washington, in the 1980's. Since that time this snail has spread too many areas of the west, including California's central valley and the Owens River. Billions of dollars have been spent nationwide dealing with the maintenance issues, AIS infestations present, and countless dollars have been lost due to the economic impacts on tourism and recreation.

On January 6, 2007, quagga mussels were discovered in Lake Mead, Nevada and Arizona. Since that time, quagga and/or zebra mussel have been discovered in multiple waterbodies around the west. Currently, Lake Tahoe and other lakes of the Tahoe Region are believed to be free of quagga and zebra mussels, based on ongoing monitoring for the presence of these species. However, zebra and quagga mussels and New Zealand mud snail pose a major threat to Lake Tahoe and other lakes of the Tahoe Region if they were to become established. Experts fear that these invertebrates could spread quickly through the Truckee River watershed and become a downstream threat to the City of Reno and Pyramid Lake. If zebra or quagga mussels or the New Zealand mud snail were to infest Lake Tahoe, they could:

- Have severe impacts on aquatic biologic communities, fishing and recreation.
- Foul facilities such as docks and ramps.
- Encrust boats and clog engines.
- Litter beaches with sharp odiferous shells.
- Cause impacts to water quality that would increase costs for drinking water treatment.
- Clog drinking water and other intake pipes, increasing maintenance costs to these systems.
- Negatively impact property values.

In addition, other AIS such as Eurasian watermilfoil, curlyleaf pondweed, largemouth bass smallmouth Bass and other warm water fish species currently exist in Lake Tahoe. The existence of these species in the Lake has started to disrupt the food web, has impacted water clarity and has had a deleterious effect on native fish populations such as the Lahontan redside shiner and speckled dace. Eurasian watermilfoil also creates a habitat that the New Zealand

mud snail and warm water fishes can thrive in. The control of AIS that are present in the Lake Tahoe Region is not dealt with further in this plan, but is covered in the Lake Tahoe Regional AIS Management Plan and other documents.

AIS present a growing worldwide problem. New invasive species are continually being identified. Impacts from AIS can be extreme and affect ecosystems, recreation, and economics. AIS infestations are generally permanent, and where control and/or eradication is possible it is very costly; prevention is the only good strategy to combat them. Education is critical because aquatic invasive species generally need humans to move anywhere but downstream. As a result the TRPA Governing Board unanimously passed a resolution adopting the need for emergency action for AIS control in May of 2007.

Regulations:

Preventing the introduction of aquatic invasive species into the Lake Tahoe Region is a function of outreach, education, voluntary action by the boating public, and regulation. Interaction with the public during inspections has shown that the vast majority of the boating public is aware and concerned about the spread of AIS. The level of cooperation with inspections by the boating public has been high and this greatly simplifies prevention efforts. The TRPA Code of Ordinances includes several sections relating to AIS efforts that could be applied if needed.

Current Code:

TRPA Code of Ordinances, Chapter 63.4 contains regulations relating to the prevention of invasion by aquatic invasive species. Invasive species are defined in Chapter 90 of the TRPA Code as:

A nonindigenous species that threatens the diversity or abundance of the native species or the ecological stability of infested waters, or the commercial, agricultural, aquacultural, or recreational activities dependent on such waters, as identified in the Lake Tahoe Region Aquatic Invasive Species Management Plan. Aquatic Invasive Species include but are not limited to: zebra mussel (*Dreissena polymorpha*), quagga mussel (*Dreissena bugensis*), Eurasion water milfoil (*Myriophyllum spicatum* L.), curly leaf pond weed (*Potamogeton crispus* L.), and largemouth bass (*Micropterus salmoides*).

TRPA Code of Ordinances, Chapter 63.4.1 lists the actions prohibited related to AIS.

63.4.1. Prohibition

A. The transport or introduction of aquatic invasive species into the Lake Tahoe region.

B. The launching of any watercraft or landing of any seaplane contaminated with aquatic invasive species into the waters of the Tahoe region.

C. The provision of inaccurate or false information to the TRPA or persons designated to conduct inspections pursuant to subsection 63.4.2.

D. The alteration or modification of any inspection seal or other device used by TRPA or its designee to indicate that a watercraft or seaplane last entered the waters of the Lake Tahoe region.

TRPA Code of Ordinances, Chapter 63.4.2 makes it mandatory to submit to the inspection of watercraft prior to launching and have an intact seal in order to launch, makes decontamination mandatory when the watercraft is judged by an inspector to be contaminated, and closes boat launching facilities when an AIS seal inspector is not present.

63.4.2. Watercraft Inspections and Decontamination

A. All motorized watercraft shall be inspected by TRPA or its designee prior to launching into the waters of the Lake Tahoe region to detect the presence, and prevent the introduction of, aquatic invasive species. Non-motorized watercraft and seaplanes may be subject to an inspection prior to entering the waters of the Lake Tahoe region if determined necessary by the TRPA or its designee.

B. All Watercraft and seaplanes inspected pursuant to subparagraph 63.4.2.A shall be subject to decontamination if determined necessary by the TRPA or its designee.

C. All Watercraft and seaplanes subject to decontamination pursuant to subparagraph 63.3.2.B shall be permitted to enter the waters of the Lake Tahoe region only if: (a) the decontamination is performed and completed by an individual trained and certified pursuant to TRPA standards and requirements for aquatic invasive species decontamination, and (b) following decontamination, the launch or landing, as appropriate, is authorized by an inspector trained and certified pursuant to TRPA's standards and requirements for aquatic invasive species inspections.

Inspection Locations and Schedule

This part of the implementation plan was developed following meetings with both the Private and Public owned launches on Lake Tahoe. It is designed to meet the needs of the boating public while preventing the introduction of aquatic invasive species. Starting with the 2011 boating season, inspections and decontaminations were only conducted at Off Ramp Locations. This decision was made with the input from the private launch facilities to relieve the congestion at the ramps and to increase quality control of the inspection process.

Inspections at Off Ramp Facilities:

As mentioned above, inspections no longer take place at Launch Facilities on Lake Tahoe, as a matter of practice (except as noted below for winter operations). While there may be a few exceptions in order to accommodate some large, commercially hauled vessels, the inspection and decontamination process will only be performed at the Off Ramp Facilities. However, inspections will still occur at Echo Lakes. In addition to the four previously existing Off Ramp Facilities, a fifth location was added in 2011at the Homewood Ski resort. These inspection and decontamination stations are located along the major routes into the Lake Tahoe Basin to better serve the boating public. Days and hours of operations are subject to change based on special events in the Tahoe Region and budgetary constraints. The public is encouraged to access www.TahoeBoatInspections.com for up to date information regarding operations.

Locations and schedule for off ramp inspection

The following Off Ramp Inspection Facilities will be open for the inspection and decontamination of watercraft during the boating season, typically May 1st through September 30th. Please note that changes to hours and days of operation may occur to maintain efficiency and customer service. Inspections will be provided by TRCD staff:

- Highways 89 and 50 in Meyers
- Alpine Meadows adjacent to highway 89 in Placer County
- Northstar at Tahoe adjacent to highway 267 in Placer County
- Highway 50 at NV 28 intersection (Snow Play area)
- Highway 89 at the Homewood Ski Resort

Please visit www.TahoeBoatInspections.com for detailed directions and days and hours of operations.

Seal Inspections at launch facilities

Inspection Seals

The Watercraft Inspection Program utilizes inspection seals to determine at a launch facility if a watercraft has been inspected, or last launched on the same waterbody and is permitted to launch. The presence of an intact inspection seal from the watercraft to the trailer or other location such that the seal must be broken to operate the watercraft, is required for launch. Inspection seals are installed at off ramp inspection stations following inspection and/or decontamination and at launch facilities following haul out from Lake Tahoe, Fallen Leaf Lake and Echo Lake. A complete description of the sealing process can be found in the section *Inspection sealing of watercraft*, below.

Seal Inspectors

In order for launch ramps to be open, trained Seal Inspectors must be present. Seal Inspectors verify whether or not a boat has an intact inspection seal prior to launching. Assuming an intact seal is in place, the boater may launch. If an intact seal is not present, then the Seal inspector will direct the boater to one of the Off Ramp Locations. Seal inspectors also provide a new seal for the boat upon haul out from the Lake. Seal Inspectors are employees of the individual launch facilities.

Launch Facilities

Public and Private Launch Facilities are free to set and maintain their own operating hours and may be open as long as Seal Inspectors are present. Since conditions can change frequently, interested parties are encouraged to utilize the www.TahoeBoatInspections.com website to find up to date lists of launch facilities and their operating conditions.

Launch facility gates

Launch facilities are required to have gates or other infrastructure that prohibit launching when seal inspectors are not present, or when other measures are not in place to meet TRPA code requirements. In addition to the infrastructure required to limit uninspected launching, updated signage is at all launch facilities to explain that it is illegal to launch without having received an inspection and/or knowingly launching without an inspection or inspection seal. Grant funding has been provided to install infrastructure at ramps.

Late haul-out option

Operators have coordinated with emergency responders in their respective locations to allow emergency access. In addition, launch operators may choose to also have a non-emergency late haul-out option that would be reviewed for approval by TRPA. One example of a late haul out option is a gate code that would be good only for that day would be given out to boaters when they launch. The code would be entered into the gate lock when the inspector leaves for the day and changed the following day. This gives boaters that cannot get back to the ramp on time the ability to haul-out, however as no inspector will be there when the boat is hauled out, these boats will not be sealed with an inspection seal (see below) and will need to be re-inspected prior to the next launch. An alternate methodology for late haul-out is currently being implemented at some facilities that would use one-way "tire rippers" and gates at the entrance to allow watercraft to leave but not enter after normal operating hours.

Winter Operations:

During the winter, or boating off-season, typically October 1, inspections will not take place at the Off Ramp Locations. During this time, inspections will be conducted a Cave Rock State Park Boat Ramp and Lake Forest Boat Ramp. Decontaminations can also be performed at these launch facilities. For boats that require a more thorough or complex decontamination, appointments may be made for the Meyers Station. Winter Operations will last at least until May 1 of the following year. Decontaminations during the winter may be impacted by weather and will not always be available due to cold temperatures.

Again, up to date information regarding delays or closures due to weather and the start of summer operations can be found at www.TahoeBoatInspections.com .

Changes in Schedule at public launches

All scheduled hours for operation and inspection at public launches during the winter season are subject to change due to inclement weather and water level. The determination to open public ramps will come from the ramp operator (i.e. Nevada State Parks for Cave Rock). The ramp operator will call the TRCD on call inspector or other designated staff who will then inform the scheduled inspector of the closure, post the announcement on the AIS hotline and inform TRPA staff who will update the website to reflect the decision to change operating hours. This last step is critical as it will inform the boating public of any changes. The hours and locations at launch facilities represent full implementation at high water and are subject to change based on lake level.

Inspection Procedures

Training and Designation of Inspectors:

All TRPA designated watercraft and seal inspectors will be trained to meet TRPA standards prior to conducting any inspections. Tahoe Resource Conservation District (Tahoe RCD) and TRPA staff are currently certified by the 100th Meridian Initiative to provide inspection and decontamination trainings. Tahoe RCD and TRPA staff will provide the needed trainings to certify contractors and launch facility staff have the necessary Seal Inspectors required in order to maintain operations.

Procedures at Off Ramp Inspection Facilities:

This section describes general procedures for the inspection program. Detailed inspection protocols are subject to a continual improvement process, and as such are not included as part of this document.

Inspection:

The following section gives details about various aspects of the inspection of watercraft. Please see the flowchart at the end of this section for the step by step process for inspection.

One of the purposes of the inspection is to educate the watercraft operator of the adverse impacts of AIS and steps that they can take to reduce the risk not just to Tahoe, but to other lakes that they use as well. To accomplish this outreach, inspectors will begin the inspection by educating the boater about AIS issues then follow with a brief survey designed to asses the risk a particular watercraft presents.

Inspectors will survey every watercraft operator entering the inspection station at which they are stationed, while they are on duty; unless the watercraft is sealed on the trailer (see inspection sealing section below). The survey includes questions such as: where are the boaters from, what is the last body of water the boat was in, how long has their boat been out of the water and did they clean, drain and dry their boat. In addition to collecting this basic information to evaluate risk, a thorough examination of the boat is performed. The survey also includes other information that will inform TRPA as to how adjustments/improvements can be made. In addition, the surveys include watercraft usage information. Inspectors also need to be observant and compare the answers with visual clues. For example, the boater states they are local, but their license plate is from Arizona.

The inspector will then proceed with the inspection as described in Appendix XX, and conduct a decontamination as necessary. Once the inspection/decontamination process is complete, a wire seal will be placed between the boat and the trailer to indicate that the boat is cleared to launch in Lake Tahoe.

Any attempt to launch, give false information and/or tamper with the wire seal can be considered a violation of the TRPA Code of Ordinances and the individual may be subject to a minimum $5,000 penalty as stated in Article VI (1) of the Tahoe Regional Planning Compact.

Role of State and Local Law enforcement

The role of the AIS inspector is to complement efforts by state agencies with the jurisdiction over boating and AIS introduction, California Department of Fish & Game or Nevada Department of Wildlife. TRPA and USFWS have engaged the local governments in the Lake Tahoe Basin to encourage the passing of local ordinances that address AIS introduction and watercraft inspection. Agreements are also being developed with local law enforcement agencies in California to assist when these local laws regarding AIS are being violated. Local law enforcement agencies in Nevada already have the ability to enforce state game law and agreements with these agencies are being pursued. This assistance by local law enforcement will be needed as the Warden resources of both states are stretched thin. The Boat Inspectors should follow the recommended approach to conducting the surveys and inspections:

- Approach watercraft operator from the front and on the driver side of their vehicle whenever possible.
- Identify themselves as an aquatic invasive species boat inspector.
- The inspector shall present the boater their Boat Inspector Identification if requested (the inspector's id badge should be worn and visible).
- Ask the boater if they are aware of AIS issues.
    - If not, provide outreach material and explain the threats AIS pose and the importance of the inspection
    - If they are aware, ask them what they know and from where their information came.
- Conduct survey and fill out the Watercraft Inspection Form.
    - Collecting boaters address is not necessary, the city they are from is sufficient. We are only collecting this information in order to determine what area they are from and if they live near an AIS infested waterway. However, collection of the boat registration is essential to allow for follow up investigation if needed.
- Perform thorough inspection, and decontamination if warranted.
    - Ask the owner to accompany you while you are inspecting the watercraft.
    - Always ask permission to board the watercraft to inspect the bilge, live/bait wells, anchor locker, etc.
    - If to inspect the watercraft any component needs to be removed or opened (hatches, panels, cushions, bilge plug, etc.) the inspector is to request that the owner perform the removal or opening. Under no circumstances is the inspector to perform these operations for an owner due to the liability that may be incurred if the boat is damaged.
- Inform boater of the recommended decontamination, if necessary
- Install the wire security seal if they are approved to launch.
- Always thank them for their cooperation.

The majority of boaters will be cooperative. However, should the boater refuse any part of the inspection, the inspector is to inform the boater that inspections are mandatory and that they will not be permitted to launch unless they complete the inspection.

********* ***The inspector shall never use foul or obscene language or gestures under any circumstances. The utmost professionalism is required at all times. Always be courteous and professional.***

Procedures specific to Launch Facilities:

Seal Inspectors will be employed by the launch facility directly and trained by TRPA or Tahoe RCD staff. They should position themselves in such a manner as to insure that watercraft are inspected for intact inspection seals efficiently; this may require that seal inspectors move along any queue that forms at the facility to inspect, rather than waiting for the watercraft to come to the launch ramp. The exact position of the inspector will be site and season specific. Arrangements with the facility superintendents have been made in order to facilitate this effort. Launch facilities should provide seal inspectors with protection from the elements both winter and summer.

Inspection sealing of watercraft

Upon haul out from any launch facility, or after an off ramp inspection has been performed, a designated inspector will provide at the operators request, an inspection seal that designates the watercraft as having been inspected at Lake Tahoe. The purpose of this seal is to indicate that the boat received an inspection prior to launching into Lake Tahoe. This will allow boats that last launched into Lake Tahoe to bypass the Off Ramp Inspection locations and proceed directly to the launch facility of their choice, thus reducing the lines at the launch facilities. The rational for this seal is that boats that have been inspected and launched in Lake Tahoe pose no threat to Lake Tahoe and do not require further inspection.

The seal will consist of a numbered seal unique to Lake Tahoe that is placed between the boat and trailer at haul out, or off ramp inspection station, such that it will be broken on launching, but not so tight as to break during transport. The seal should be attached by the inspector. The inspector should also verify the bilge plug is pulled and there are no weeds or other attached matter that could spread the AIS currently in Tahoe (i.e. Asian clams and curly-leaf pond weed) to other lakes.

If a boat appears at a launch facility with an intact seal from Lake Tahoe, the designated seal inspectors may allow that boat to launch after confirming that the seal is unbroken. This same procedure applies at the two other boating lakes in the Region, Fallen Leaf Lake and Echo Lake. In addition, boats that have intact seals from Fallen Leaf Lake or Echo Lake may launch in Tahoe once the seal is confirmed, however boats with an intact Lake Tahoe seal still are required to have further inspection before entering Fallen Leaf Lake and Echo Lake as Lake Tahoe contains AIS not found in these other two lakes. This complies with TRPA Code of Ordinances 73.B (2), which requires that a launch facility can only be operated when boats can be inspected by a designated inspector. As agreements can be reached with other operators of other non-contaminated water bodies, sealed boats from those water bodies may also be included.

Watercraft Stickers:

Two types of stickers can be issued based on whether or not a boat has an intact inspection seal. New stickers will be used starting in February of each year, all stickers will be good for the calendar year they were issued. All boaters that will launch their vessel will be required to purchase a new sticker (in addition to any necessary inspection or decontamination) prior to launching. In addition to these stickers a boater may also purchase a 7 Day Launch Pass (described below). While it is preferred that boaters display their sticker on their boat (port side), it is not required. However, boaters are asked to maintain the sticker on their boat and present it to an inspector when asked, as a proof of purchase. The stickers and launch pass are issued as follows:

- **Tahoe Only**: This sticker can be purchased by boaters whose vessel has an intact inspection seal. These boats are not required to go through an additional inspection as the seal indicates the last body of water they were in was Lake Tahoe. Tahoe Only stickers can be purchased at all Launch Ramps and also at the Off Ramp Inspection Stations. The fee for this sticker is a set fee for all size and types of boats. The majority of this fee is used to ensure that launch ramps have adequate seal inspectors present.

- **Tahoe In & Out**: This sticker will be provided to those vessels which do not have an intact inspection seal, and therefore require an inspection. Tahoe In & out stickers can only be purchased at the Off Ramp Inspection Stations. The fees for these stickers are based on the length of the vessel. Vessels with Tahoe In & Out stickers are entitled to unlimited watercraft inspections and decontaminations each year.

- **7 Day Launch Pass**: This is a third option for boaters who plan on making only one trip to boat in Lake Tahoe. The fee for this option is less than that of a Tahoe In & Out sticker. This option is available to unsealed boats and affords them one inspection and basic decontamination and ability to launch over a continuous 7 day period. After that period expires, the boat is eligible to receive, by purchase, a Tahoe Only sticker (if the inspection seal is intact), a Tahoe In & Out sticker or another 7 Day Pass.

Should a boater with a Tahoe Only sticker decide that they want to boat in another water body, they would no longer have an intact inspection seal. In order for that boat to launch in Lake Tahoe, and inspection and possible decontamination would be required. The boater can then purchase a Tahoe In & Out sticker for the difference in the total of the Tahoe Only sticker to the appropriate fee level of the Tahoe In & Out sticker.

Watercraft Inspection Fee:

This section of the inspection plan was produced to explain the collection of fees to provide long term funding to support AIS inspections. The goal of this proposal is to create a long term source of funding for the inspection program that is effective, equitable, and has the most limited effect on boating in Lake Tahoe.

Inspection Fee Structure:

Budget needs for watercraft inspection program

As mentioned previously, inspections of watercraft are only conducted at the Off Ramp locations (during the boating season); however both privately and publicly run facilities are able to collect fees for previously sealed boats that need the current Tahoe Only sticker. The collected fees are used to support both the inspection and seal inspections of watercraft.

The budget needs for the inspection program are currently calculated based on the off-ramp implementation strategy. This strategy is to centralize inspections at 4 to 6 locations within the Tahoe area and augment the personnel at public ramps to monitor and install inspection seals.

Partner Agency and Stakeholder Input

The TRPA develops the annual fee structure with the input of our partner agencies and public stakeholder groups. Meetings are held with partner agencies and boat facility operators prior to any decision on the approval or denial of this fee schedule by the TRPA Governing Board.

Methods for Calculating Fee Structures

To create the annual fee structure, the number of boats that were inspected and decontaminated on Lake Tahoe in the previous year is used. In addition, the percentages of watercraft that fall into each given length category are determined. These data are used together with the budget needs of the program to develop the annual fee structure that is proposed to the TRPA Governing Board for review. The current annual fee structure is available online at www.TahoeBoatInspections.com

Logistics and Accounting:

The infrastructure and accounting portions of the fee implementation plan are developed following meetings with both the Private and Public owned launches on Lake Tahoe. It is designed to meet the needs of the boating public while preventing the introduction of aquatic invasive species while ensuring that appropriate control and accounting measures are in place.

Database and Fees

As part of the AIS inspection program TRPA has developed an online database to track numbers and patterns of watercrafts using Lake Tahoe. This database is also used to track inspection seals, and other watercraft related data. This database is available to both AIS inspectors and launch operators for data entry and tracking.

Fee Collection

Currently there are two fee collection infrastructure methods that have been incorporated into this plan. The overall goal is to have fee collection methods that are the most efficient possible for the boating public.

The first method involves collection of fees by the private and public launch facility operators. Under this method, the operator only collects fees from boaters with an intact inspection seal on their vessel, and provides them with a Tahoe Only sticker. Boaters arriving at the ramp without an intact inspection seal will be directed to one of the Off Ramp Locations. The launch facility operator also records the boat information on the inspection form, and if described in their contract, enters the information into the database. Launch facilities may collect the fee in any form they choose (cash, check, or credit card), however they must all charge the same amount, which is the approved fee for a Tahoe Only vessel.

The second method involves collection of fees by the Off Ramp Inspection staff. Under this method, inspections may only be paid for with a credit or debit card. Off Ramp locations do not accept cash for the safety of the inspectors.

Program Evaluation

The inspection program requires three forms of evaluation to ensure that it is operating efficiently and effectually.

Program Implementation:

The first evaluation is that of program implementation. This evaluation relies on both queries of the database to look for anomalies, and review of on the ground implementation by TRPA staff. Examples of questions that are asked to evaluate implementation are:

- Are inspectors and related support staff entering data in a timely manner?
- Are inspection seal numbers duplicated or used with more than once?
- Are inspections being conducted in accordance with established protocols?
- Are inspections being conducted on every boat that is not sealed?

Program Effectiveness

The effectiveness of an AIS inspection program is not a simple thing to address. The program is effective only if it prevents the introduction of AIS by watercraft that pass though inspections. This is not to say that should new AIS become established in Lake Tahoe that this program was not effective, for many species there are other vectors for introduction, though trailered boats are the primary vector for most. The methods to evaluate the effectiveness of the program still need to be developed in cooperation with our partners. Currently, a Request for Proposal is being drafted for acquiring services of a “Secret Shopper” that will help evaluate program effectiveness.

Fee Evaluation

The inspection fee is evaluated on annual basis to ensure that it meets the needs of the program without unduly burdening the boating public. TRPA staff brings a progress report annually to the Governing Board, prior to the next boating season. This progress report for the program includes a year to date number of inspections performed, and the results of implementation; effectiveness evaluations and current financial status of the program are also be included. In addition, TRPA staff will request of Governing Board to adjust the inspection fee as needed.

LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix E: Control and Eradication Planning

This appendix together with Appendices D and F form the framework for planning the objectives, strategies, and actions found in Appendix C. This appendix contains planning documents that describe the individual programs, projects, and protocols that are updated on a regular basis as part of the continual improvement process for the Plan. The last date of revision for any document in this appendix is the most current as not all plans are updated at the same time.

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Appendix E1: Aquatic Plant Control

Draft Project Description for Lake-Wide Aquatic Plant Control in Lake Tahoe, California and Nevada

Tahoe Resource Conservation District
Contact: Kimberly Boyd, Invasive Species Program

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November 2011

Outline

1. Introduction
    a. Background
    b. History of Aquatic Plant Control in Lake Tahoe
2. Purpose and Objectives
3. Location
    a. Project Area
    b. Treatment Sites
4. Methods
    a. Benthic Bottom Barriers
    b. Hand Removal and Diver-Assisted Hand Removal
    c. Water Quality Monitoring
    d. Effectiveness Monitoring and Evaluation
5. Duration
    a. Annual Schedule
    b. Project Timeline
6. Purpose of Initial Study/Environmental Assessment

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Introduction

The Tahoe Resource Conservation District (Tahoe RCD), on behalf of the Tahoe Aquatic Invasive Species Coordination Committee (AISCC), is proposing to conduct aquatic plant control and management throughout suitable habitat areas in Lake Tahoe, California and Nevada. The AISCC implements the Lake Tahoe Aquatic Invasive Species Management Plan and is composed of a partnership between more than 40 public, private, and tribal stakeholders. Aquatic plant control efforts in Lake Tahoe were initiated in 2005; the proposed project described is intended to continue control efforts in locations where previous efforts have been successful, expand control efforts to include all known infestation areas, and to allow for rapid response to detections of knew aquatic plant infestations.

Background

There are many threats to the world famous clarity and water quality of Lake Tahoe, and only recently has attention turned to addressing the threat of invasive aquatic plants, particularly Eurasian watermilfoil (*Myriophyllum spicatum*) and more recently, curly-leaf pondweed (*Potamogeton crispus*). Significant habitat disruption, loss of native plant and animal communities, loss of property values, reduced fishing and water recreation opportunities, and large public/private expenditures have accompanied invasive plant introduction in all of the lower 48 states. The occurrence of aquatic invasive plants has spread rapidly across the country with the help of boaters who unintentionally transport and spread plant fragments that adhere to boats and trailers.

Eurasian watermilfoil and other invasive aquatic plants grow prolifically and aggressively invade native aquatic plant communities. Native aquatic plant communities provide many ecological benefits such as food and habitat for waterfowl, fish, and other aquatic organisms. They also help maintain water quality by absorbing nutrients, providing oxygen, and reducing shoreline erosion. However, when Eurasian watermilfoil is introduced it is able to dominate fresh water ecosystems quickly and can enhance its own habitat by trapping sediment and initiating a favorable environment for further establishment and for other invasive species, such as warm-water fish. Eurasian watermilfoil is capable of spreading over long distances when fragmented by boat propellers and by way of buds, surface runners, and seed. New Eurasian watermilfoil plants are capable of growing from tiny fragments as small as one inch long. Equally aggressive curly-leaf pondweed spreads primarily by rhizomes and turions, which are small, hardened stem tips capable of rooting and germinating in the fall and winter. Both of these aggressive invaders also tolerate a wide range of environmental conditions including low light levels, high or low nutrient water, and freezing water temperatures.

History of Aquatic Plant Control in Lake Tahoe

Aquatic invasive plant infestations have dramatically increased in Lake Tahoe in the past 10 – 15 years. Early detection, prevention, and constant maintenance are the best defense and offer the best hope for control, eradication, and successful management of any invasive plant infestation. Once widespread establishment has occurred, aquatic invasive plants are difficult and costly to control. The development of a Lake-wide Aquatic Plant Management Plan in Lake Tahoe is clearly needed and members of the Nearshore Aquatic Weed Working Group (NAWWG) are developing this plan. The document is intended to guide the prioritization of site selection based on risk of spread, infestation size and location, public benefit, cost and feasibility and impacts to the environment. The document will also describe a variety of methods and techniques, which could be deployed in different combinations spatially and over time. Another component of the plan is to develop Oversight Strategies that provide suggested approaches for outside review of program actions and results. Without a formal management plan for aquatic invasive

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plant control, historic efforts to control aquatic plants have been addressed as small scale, site-specific projects.

From 2005 to 2009, a cooperative effort among management and regulatory agencies, scientists, and professional divers was initiated to combat the invasive aquatic plant infestation in Emerald Bay after the dramatic expansion was discovered in 2003. A series of small-scale treatments were deployed in Emerald Bay between 2005 and 2009, but the infestation continued to persist. The recognition of persistence was documented by the California Department of Parks and Recreation through transect monitoring beginning in 2008. By the end of 2009 three separate patches of Eurasian watermilfoil were established at the western end of Emerald Bay, covering a combined area of over 3 acres. One small infestation of curly-leaf pond weed was detected in 2009 near Vikingsholm Pier; the infestation was immediately removed and the species has not been detected in Emerald Bay since. Also in 2009, the cooperative effort tested available control methods at the Ski Run infestation area.

In 2010, aquatic plant control was conducted in Emerald Bay and Lakeside Marina. The NAWWG sought to use a combination of treatment methods over a larger proportion of one infestation site in a strategic attempt toward eventual complete removal of a discrete infestation area. The Vikingsholm Pier site in Emerald Bay was chosen and California State Parks and Recreation deployed a combination of both benthic barrier and diver-assisted hand removal methods in an attempt to treat the entire infestation. Transect monitoring data collected prior to the 2010 efforts in Emerald Bay indicated that Eurasian watermilfoil will begin to re-colonize treatment sites within 15 months post-treatment and that the use of barriers alone is unlikely to provide an effective strategy for controlling this species in Emerald Bay.

The NAWWG also identified an opportunity in 2010 to partner with the private operator of Lakeside Marina in a cooperative effort to dredge the marina bottom and remove all aquatic vegetation. The Lakeside Marina dredging was an attempt to evaluate the effectiveness of standard maintenance dredging in removing aquatic plant populations. Approximately 8-12 inches of benthic material was removed, including aquatic weed biomass. However, rapid and nearly complete recovery of plants from 2010 to 2011 suggests that dredging alone, even with removal of the plant biomass, does not effectively eradicate the population.

In 2011, the Tahoe RCD conducted comprehensive weed control and removal treatments in two separate areas of Emerald Bay: Parsons Rock and Vikingsholm Pier/Swim Beach. In addition to these two comprehensive treatments, preliminary work was begun in a third area: Avalanche Beach. Synthetic bottom barriers were deployed From May to late October and divers assisted in substantial hand removal efforts from late September through late October. All known infestations in Emerald Bay were treated with both barriers and diver-assisted hand removal. Reusable, synthetic barriers were the only type of material used in Emerald Bay in 2011, with both 10’ x 10’ and 10’ x 40’ barriers deployed. Several barriers will be left in place throughout the winter to ensure plant mortality. A summary of barriers deployed and hand removal conducted in Emerald Bay is provided here in Table 2:

Table 1. Summary of Plant Control Methods Used in Emerald Bay, 2011

Location	Barrier Size	Number of Barriers	Total Barrier Coverage	Hand Removal Area
Parsons Rock	10’ x 10’	22	2,200 (0.05 acres)	0.78 acres
Parsons Rock	10’ x 40’	12	4,800 (0.11 acres)	
Vikingsholm Pier / Swim Beach	10’ x 40’	3	1,200 (0.03 acres)	2.21 acres
Avalanche Beach	10’ x 40’	33	13,200 (0.30 acres)	3.03 acres

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A total area of 21,400 square feet of lake bottom was treated with barriers in Emerald Bay. Barriers were not deployed in areas where diver-assisted removal was deemed to be more effective, particularly where plant density was low. Divers removed an approximate total of 22 cubic yards of plant material in 2011.

The combination of barriers and diver-assisted hand removal was estimated to have removed over 99% of the invasive plants in the Vikingsholm Pier and Parsons Rock infestations.. Plant density at the perimeters of the infestations was very low and the plants were very small. 2011 was the first time that the Avalanche Beach infestation in Emerald Bay had been treated since minor diver-assisted removal was conducted in 2005, and diver-assisted hand removal at the Avalanche Beach infestation in 2011 was estimated to have removed 75-80% of the plants that were not covered by barriers. Due to high recolonization potential, this infestation should be revisited in 2012 for comprehensive treatment.

Transect monitoring was conducted throughout the project and the three-year transect monitoring trend for the three Emerald Bay sites is shown in Figure 1. It is important to note that no curly-leaf pondweed was detected anywhere in Emerald Bay in 2011.

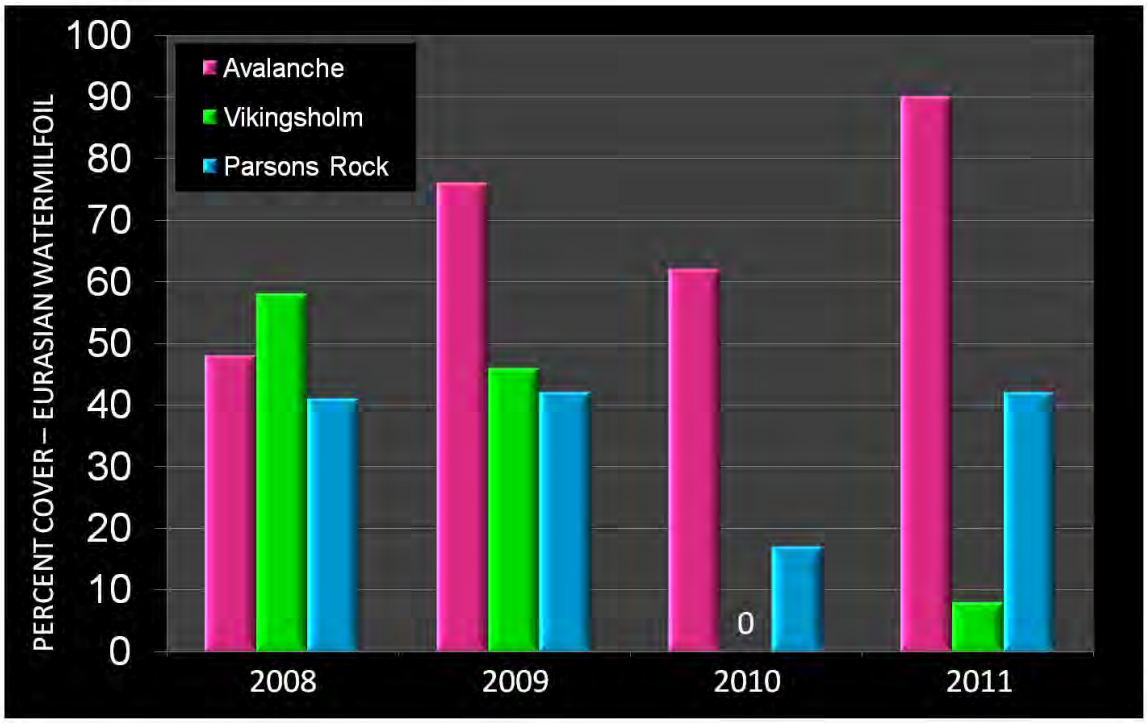

Figure 1. Results of Aquatic Plant Monitoring in Emerald Bay, 2008-2011

Purpose and Objectives

The purpose of the proposed project is to control or eradicate all aquatic invasive plant populations in Lake Tahoe. This project will complement previous efforts throughout Lake Tahoe that have tested the efficiency of different aquatic plant removal methods. When deployed effectively and strategically, successful control efforts will increase public safety, improve water quality, and protect Lake Tahoe's biodiversity. Dense growth of invasive aquatic plants can impede water flow, disrupt navigation, discourage recreation, negatively affect water quality, and reduce plant diversity. Non-native plants can "pump" nutrients from the sediment to the overlying water column during growth and may be contributing to increased phytoplankton and reductions in water clarity. Control of invasive aquatic plants will support other control efforts like warm-water fish removal and suppression.

Consistent with the Lake Tahoe Region Aquatic Invasive Species Management Plan, the annual objectives of the project include:

- prevent the spread of existing invasive plants,
- ensure early detection of new invasive plant infestations, and
- monitor existing invasive plant populations.

Plant treatment projects will utilize the most effective methods at high-priority Treatment Sites and will include maintenance activities at sites that have been treated previously.

Location

The proposed project location includes all suitable habitat areas within Lake Tahoe and several project staging areas. Suitable habitat is present in Lake Tahoe within the City of South Lake Tahoe and El Dorado and Placer counties in California and within Douglas and Washoe counties in Nevada. The *Project Area* will include suitable habitat areas infested with submerged aquatic plants. Within this large project area, several sites have been identified for potential control treatments based on existing knowledge of invasive plant presence. These *Treatment Sites* are project locations where control efforts will be conducted. Although Treatment Sites have been identified for the first year of project implementation, these sites are expected to change annually if new infestations are detected.

Project Area

The Project Area includes all areas within Lake Tahoe that provide suitable conditions for submerged aquatic plants to establish. In order to quantify potential aquatic plant treatment requirements within Lake Tahoe, the Lake Tahoe Aquatic Invasive Species Management Plan identifies areas of suitable habitat based on the best available bathymetry data. Figure 2 depicts suitable habitat within Lake Tahoe for aquatic invasive plant establishment, which represents the Project Area. The total Project Area encompasses greater than 11,300 acres. add survey data

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Figure 2. Project Area: Potential Habitat for Submerged Aquatic Plants

Treatment Sites

Within the Project Area, aquatic plant surveys conducted from 1997 through 2011 have documented plant infestations at approximately twenty locations around the lake. Treatment Sites that have been identified as known infestations to be treated using proposed project methods are shown in Figure 3 and listed in Table 2.

Figure 3. Potential AIS Weed Treatment Sites

Infestation Location	Date Last Documented	Area (sf)	Area (acres)	Treatment/Notes
Crystal Shores	September, 2009	1,500	0.03	Untreated
Timber Cove	August, 2011		0.00	No plants seen in 2011 survey
Ski Run	September, 2009	101,600	2.33	Untreated
Commons Beach, Tahoe City	September, 2009	425	0.01	Untreated
Truckee River Dam Area	September, 2009	60,000	1.38	Untreated
Tahoe Tavern	September, 2009	237,800	5.46	Untreated
Sunnyside Marina	2008	10,000	0.23	Minor evaluation treatment in 2008. No subsequent survey.
Homewood	September, 2009	525	0.01	Untreated
Lakeside Marina	August, 2011	21,700	0.50	Dredged in 2010. Plants re-colonized 100% by 2011
Lakeside Beach	August, 2011	21,600	0.50	Untreated
Edgewood	2009		0.00	No plants seen in 2011 survey
Nevada Beach	September, 2009		0.00	No plants seen in 2011 survey
Elk Point	September, 2009	18,000	0.41	Untreated
Zephyr Cove	September, 2009		0.00	No plants seen in 2011 survey
Logan Shoals	September, 2009	20,100	0.46	Untreated
Glenbrook	September, 2009		0.00	No plants seen in 2011 survey
Meeks Bay	September, 2009	40,100	0.92	Untreated
Taylor Creek	September, 2009	1,200	0.03	Untreated
Camp Richardson	September, 2009	400	0.01	Untreated
Baldwin Beach	August, 2011	260,000	5.97	Untreated
Tahoe Keys	August, 2011	872,000	20.02	Untreated
Regan Beach	2009	1,500	0.03	Untreated
Emerald Bay, Parson's Rock	August, 2011	41,000	0.94	Treatments from 2005-2011. Estimate 99% mortality. Maintenance planned in 2012.
Emerald Bay, Vikingsholm Pier and Swim Beach	August, 2011	97,500	2.24	Treatments from 2005-2011. Estimate 99% mortality. Maintenance planned in 2012.
Emerald Bay, Avalanche Beach	August, 2011	145,000	3.33	Treated in 2005 and 2011. Estimate 75% mortality. Comprehensive treatment planned in 2012.
Total		1,951,950	44.81	

Table 2: Known Aquatic Plant Infestations and Treatments

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Prior work has shown that for successful management, known and new infestations of aquatic invasive plants must be treated comprehensively and repeatedly. This project will establish annual prioritization criteria for plant infestation treatments as described in the Lake-wide Aquatic Plant Management Plan and could include locations not explicitly listed above

Methods

The project proposes to emphasize two mechanical removal methods for implementation in Tahoe: benthic bottom barriers and diver-assisted hand removal. Given that each infestation will vary in size and density, and will have site-specific substrate and lake bottom conditions, these methods will be employed at each site as deemed appropriate, independently or in combination. In addition to removal methods, control efforts at each site will include water quality monitoring and effectiveness monitoring.

Benthic Bottom Barriers

Benthic or bottom barrier treatment consists of placing sections of gas permeable, black landscape cloth, plastic or other material, over the top of the plants to exclude all light. The barriers can range in size from 10' x 10' squares to strips of 10' x 40' or more. The size of the barrier is dependent on the logistics of deploying, retrieving and maneuvering in and out of the water. The barriers remain in place for at least 2-4 months and are either removed from the lake or moved to a new location, typically immediately adjacent to the site just treated.

Barriers will be deployed to high priority areas of dense plant growth. Following barrier placement, diver-assisted hand removal will be conducted to achieve 99%-100% plant removal at the perimeter of the barriers. Where plant density is low, diver-assisted hand removal may be the primary method of control. Depending on site characteristics, plant composition, water temperature, and placement timing, barriers may need to be left in the water over the winter. Any barriers left in the water over the winter will be monitored on a regular basis and be prioritized for removal or relocation in the subsequent year.

Hand Removal and Diver-Assisted Hand Removal

Diver-assisted hand removal of aquatic weeds is accomplished through the use of a small suction hose that is mounted on a floating work platform. The suction is produced by a water injection system that uses a small 4-stroke gas powered engine. Attached to the engine is a water pump that pumps water from the lake into a water injector. The injector is a pump-like device that uses the Venturi effect of a converging-diverging nozzle to convert the pressure energy of a motive fluid to velocity energy which creates a low pressure zone that draws in and entrains a suction fluid. A suction hose from the injector, usually between 3 and 6 inches in diameter is used at the lake bottom to capture and transfer biomass to a catch basket on the work platform.

Qualified dive crews will remove aquatic invasive plants by pulling the plant by the roots and feeding it into the suction hose and transfer the plant matter and associated water up to a conveyor system or collection box mounted on a boat. Screen material separates the plant material from the associated water, which passes through the screen and returns to the water column. The collected plant material is conveyed to an approved staging area. Hand pulled fragments escaping the diver-assisted collection method will be removed by hand, net, or vacuum hose as reasonably practical before the close of each day. The plants that are captured in the screened-in container are transferred into garbage cans for removal and disposal off-shore. Specifically, the material is transported to the Tahoe Keys corporate yard and then taken to Full Circle Compost in Carson City, NV where it is composted.

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In addition to diver-assisted hand removal, when the water level is low enough, hand removal from the shore or canoe or kayak is possible. Vegetation is simply removed from the water and transferred to garbage cans for disposal.

Water Quality Monitoring

Turbidity monitoring is an integral part of aquatic plant treatment because in Lake Tahoe turbidity levels provide an indication of potential risks to water quality. A Water Quality Monitoring Plan is included as Appendix 1. Most of the turbidity observed during barrier installation or hand removal is due to diver or worker movements that disturb bottom sediments. The disturbance is easily noticed on continuous turbidity readings and returns to background levels quickly once the barriers are placed or the divers retreat.

Turbidity levels have been monitoring throughout previous control work efforts in Lake Tahoe. Previous work in Emerald Bay (2005-6, 2009-2011) has recorded higher background and project turbidity levels (often above 0.50 NTU) compared to Lake Tahoe proper (about 0.25-0.35 NTU). Turbidity in marina environments is typically between 1.5 and 2.5 NTU and can rise rapidly depending on substrate composition. While the turbidity levels during bottom barrier installation and removal are generally much less than during diver-assisted hand removal, results from previous diver-assisted hand removal efforts have shown a discrete, short-term disturbance with turbidity levels dropping to background generally within 10-15 minutes.

Effectiveness Monitoring and Evaluation

As described above with respect to aquatic weed removal efforts in Emerald Bay, annual monitoring of plant populations is imperative in effective management. While post-treatment observations may indicate that all plants have been removed, recolonization from roots, fragments, and buried plants is likely in all infestations. Experience has shown that annual treatment cycles in excess of three years are expected for effective management of invasive aquatic plants. This suggests that the same areas will be treated year after year. Following comprehensive treatment however, it has been shown that re-treatment in subsequent years is easier due to reduced plant density. To be useful in effectiveness analysis, pre-treatment infestation evaluations must record plant density as well as spatial coverage information. Pre- and post-treatment evaluation will be conducted for all plant control treatments and year-over-year comparisons will assist in subsequent treatment site prioritization.

Duration

This project proposes to treat areas of aquatic plant infestation deemed to be the highest priority by the Lake-wide Aquatic Plant Management Plan and within resource availability for any given year. The total area of plant removal will vary, dependent on the control method(s) employed, plant density, weather, and resource availability. This project is anticipated to begin May 1, 2012 and continue through November 15, 2017.

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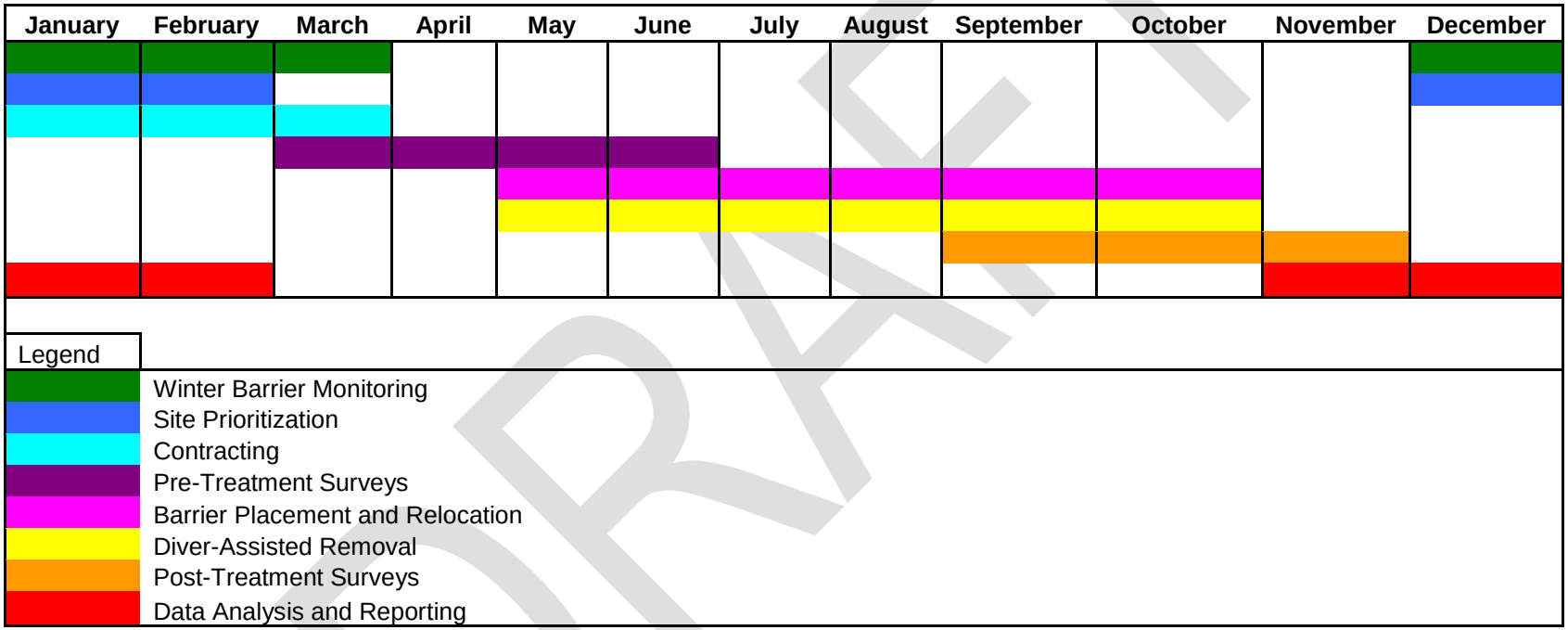
Annual Schedule

Depending on the sites selected for treatment, previous treatments performed, and resources available, the specific activities during any given year will vary. However, experience has shown that any plant control treatment year will roughly follow the timeline shown below.

Typical Annual Aquatic Weed Control Year



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Project Timeline

This lake-wide project will continue the ongoing aquatic plant control efforts that are currently underway. Specifically, the work in Emerald Bay will continue with a goal of total eradication. It is expected that another two years of comprehensive treatment will be required in Emerald Bay, after which annual maintenance will be all that is required. Newly selected Treatment Sites will likely be very similar, requiring two to three years of comprehensive treatment, followed by annual maintenance. The spatial extent and duration of annual maintenance at any given infestation site will vary depending on the site size and the annual recolonization of plants. Experience has shown that repeated and rigorous follow-up is required at Treatment Sites to ensure minimal recolonization. At any given Treatment Site, a typical infestation treatment timeline will be roughly:

Year 1	Comprehensive treatment with bottom barriers and diver-assisted removal. Highest density areas treated with bottom barriers laid early in the growing season, removed at the end of the growing season. If complete plant mortality is not achieved, the barriers will remain in place over winter. Aggressive diver-assisted removal.
Year 2	Comprehensive treatment with fewer barriers and aggressive diver-assisted removal.
Year 3	Diver-assisted removal with possible need of barriers.
Year 4	Maintenance surveys and diver-assisted removal as required.
Year 5	Maintenance surveys and diver-assisted removal as required.

For the duration of this project, each Treatment Site may be in a phase of treatment different from other sites.

Purpose of Environmental Assessment/Initial Study

An Environmental Assessment and Initial Study of this project description will be conducted to determine the appropriate environmental review and analysis needed to comply with the National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA), and the Tahoe Regional Planning Agency (TRPA) Code of Ordinances. No significant or unavoidable impacts are expected to occur as a result of the proposed project activities. For this reason, Tahoe RCD anticipates that preparation of a Finding of No Significant Impact and a Mitigated Negative Declaration will provide adequate review and analysis of potential environmental impacts.

Regulatory agencies with authority over project activities and/or the project area include the United States Army Corps of Engineers, California State Lands Commission, Lahontan Regional Water Quality Control Board, California Department of Fish and Game (CDFG), , Nevada Division of State Lands, Nevada Division of Environmental Protection, and TRPA. In addition, formal or informal consultation with the United States Fish and Wildlife Service, CDFG, and Nevada Department of Wildlife may be required if project activities may affect rare, threatened, or endangered species.

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Appendix E2: Tahoe Keys Aquatic Plant Management

Appendix E2
Tahoe Keys Aquatic Plant Management

Anticipated completion spring 2014.

Appendix E3: Asian Clam Control

DEVELOPMENT OF ASIAN CLAM CONTROL AND MONITORING PLAN STRATEGIES FOR LAKE TAHOE

Report submitted to

Tahoe Regional Planning Agency

and the

Lake Tahoe Aquatic Invasive Species Working Group

from

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[10]California State Parks

A. INTRODUCTION

Asian clam (*Corbicula fluminea*) is a non-native freshwater bivalve that has established in Lake Tahoe and is causing apparent associated environmental impacts. It has been observed in Lake Tahoe at very low densities since 2002, but recently (April 2008) populations have been discovered in much higher (50-3000 clams m^{-2}) but patchy densities in the southern (CA-NV) portion of the lake. Members from Universities of California- Davis and Nevada- Reno (UCD and UNR respectively) conducted exploratory research since the discovery of the increased Asian clam populations in April 2008. University researchers and agency staff from the Tahoe Regional Planning Agency (TRPA), Tahoe Resource Conservation District TRCD, U.S. Fish and Wildlife Service (USFWS) and the Lahontan Regional Water Quality Control Board (LRWQCB) recently formed a working group to prioritize research, monitoring, and control projects of Asian clam populations in Lake Tahoe. The objective of this document is to provide **the full suite of research needs as called for by a complete science plan** with regard to Asian clam management. In this context, research includes scientific information related to Asian clams as well as information related to the logistics of the *in situ* field removal operations. The amount of funding available will determine the prioritization of the proposed research below. To date, we have $100,000 committed from U.S. Fish and Wildlife Service, $100,000 from the emergency clean up and abatement funds from Lahontan Regional Water Quality Control Board, and $125,000 from the Nevada Division of State Lands. This sum allows us to immediately begin project work as enumerated below in Part 1a only—which includes pilot testing and research of removal and abatement techniques. This work is scheduled to begin in February 2009. Additional funds are needed to complete remaining tasks in 2009, and also into 2010.

B. PROBLEM STATEMENT

Asian clam are known aggressive invaders that have significant environmental impacts. Through Lake Tahoe field surveys, laboratory experiments, and literature reviews conducted since April 2008, UCD and UNR researchers have found that Asian clam 1) excretes elevated levels of nitrogen and phosphorus into the water column and sediment substrate 2) filters high volumes

of water, and 3) have a strong correlation to the growth of large, nuisance blooms of bottom-dwelling, filamentous algae in the shorezone. Potential impacts of exponential increases of this species include degraded water quality, decline of pelagic phytoplankton and zooplankton communities, disruption to Lake Tahoe sports fisheries, increased levels of calcium through the concentration of dead shell matter with a promotion of other regional exotic species (Quagga), and out-competing Tahoe's native benthic species such as the Montane Pea clam (*Pisidium* spp.) and the Ramshorn snail (Planorbidae). Given these potential impacts, there is increasing recognition to develop an effective control strategy of Asian clam populations, predicting their spread, as well as the prevention of future invasive species (e.g. quagga and zebra mussel, the spiny water flea, etc.) introduction and establishment.

It is important to note that there is no obvious, simple option that has been proven to control Asian clam at other locations, therefore, eradication of Asian clam in Lake Tahoe is unlikely. However, management aimed at minimizing Asian clam population growth and impact to Lake Tahoe may be feasible. Consequently, the strategy at Lake Tahoe must be undertaken within an adaptive management framework, wherein new knowledge is used to inform and update management decisions.

C. Asian Clam Management Phases

The framework that we have identified to design and implement a research-based, lake wide Asian clam management plan involves a four part program. This program includes the use of pilot project testing and re-testing in small isolated Asian clam infestations, observation and monitoring, and the use of this information to develop an informed long-term management strategy for Asian clam in Lake Tahoe. The four parts are: I) Field testing of removal options and identification of science needs, II) Evaluation of a recommended strategy for Asian clam control, III) Implementation of the control strategy, and IV) Long-term monitoring to evaluate success. **Actions taken in part III and part IV of this plan are contingent on findings from parts I and II given efficacy, timing and costs associated with pilot projects and internal and external reviews.** The steps with each part are outlined below.

There are currently three mechanical management operations under consideration for pilot testing: 1) diver assisted suction removal (to physically remove clams from lake sediments), 2) bottom barriers, or large impermeable sheets to cover and kill Asian clam populations by reducing oxygen and food availability—and 3) some combination of the two treatments. These management options were selected because of their non-chemical nature, their previous use in Lake Tahoe to treat Eurasian watermilfoil and Curly leaf pondweed. Diver assisted suction removal is not practical for removal of clams from extensive areas, as the depth of clam habitat (4 inches) will require the removal of too much material from the lake bed. This technique may, however, be useful for removing small patches of clams. Diver assisted suction may have greater use in removing surface deposits of dead clam shells. Pilot testing of diver assisted suction will therefore focus on removal of small patches and removal of surface deposits. Barriers are currently believed to hold the greatest potential for controlling clams in areas where they are present over large areas (acres). The focus of the pilot testing will be to determine the minimum length of time for which barriers need to be in place to kill clams by depletion of oxygen and/or food supply, and methods for efficiently installing large areas of barrier material (hundreds of square meters).

There are five points of evaluation related to efficacy of the field pilot tests: 1) Does the use of diver assisted suction removal and/or bottom barrier installation and removal cause nearshore turbidity requirement to exceed minimum levels as defined by the regulatory agencies?, 2) What are the impact of the respective management strategies on the physical removal or mortality rates of live clam beds? 3) Does diver assisted suction dredging effectively remove surficial shell matter, thus reducing localized calcium sinks? 4) What is the logistical capability of the action, i.e., what is the rate of removal per unit area per unit effort? And 5) What are the long term consequences of the management action? Once the efficacy of the small scale pilot removal efforts has been evaluated, these or other management options will be assessed for the possible implementation at a larger scale (i.e., multi-acre and/or whole lake treatment). A detailed work plan for Part I will be developed prior to the commencement of pilot operations as part of the permitting process. This work plan will, however, be adaptive in nature and designed to be modified as the testing proceeds.

Additionally, the use of natural, mild molluscicides (e.g. potassium) will be explored as a non-mechanical option **in the laboratory** as a possible long-term control option. These experiments are to test the concentrations required for effective yet environmentally safe use in the field, as well as to collect information that will be critical to inform the approval process for use in Lake Tahoe.

Part I – <u>Field Testing of Removal Options and Identification of Science Needs</u>

Part I of the Lake Tahoe Asian clam management plan is to 1) evaluate the technical feasibility, application logistics and cost for the various control options, 2) determine specific monitoring and management needs, 3) assess the feasibility for Asian clam control using pilot test plots (<1 acre), and 4) perform a quantitative analysis of efficacy of control methods. Part I is designed to inform the management and research team for longer term control and monitoring options. These actions are an assessment necessary to determine likelihood of success and strategy before whole-lake implementation occurs. At this time we anticipate actions to include:

a. Design and implementation of pilot removal operations

- Selection and implementation of areas to test diver assisted suction removal and bottom barriers. This includes the installation of silt curtains to minimize the impacts of increased sediment resuspension as well as the possibility for juvenile spread during the pilot stage
- Evaluate the ability of screens/sieves within the waste collection system to remove small (young) clams
- Determination of proper suction removal equipment required to operate effectively at Lake Tahoe
- Determination of most effective means of providing diver air (compressed air tanks or surface diver air compressor)
- Development of diver safety procedures including back-up diver(s), safety officer and emergency equipment
- Establish minimum equipment (boat, barge, hoist, clam/vegetation disposal) requirements for winter operation

- Establish minimum weather conditions for safe and effective removal operation
- Determine waste (clams etc.) disposal site
- Determine most efficient bottom barrier size, handling and material
- Establish maximum water depth for diver operations

b. Monitoring program to assess:

- Efficacy of the control technique in pilot areas– includes immediate monitoring of clam populations to quantify the removal effort by suction removal, barriers, etc. This will be based on number of clams removed, number remaining, dredge size selectivity, assessment of clam mortality.
- Impacts to lake water during operations (including the fate of dredge return water), changes to bottom substrate
- Recolonization of sites, colonization of new sites, and release of juveniles during treatment
- Asian clam population changes--Areal expansion, biomass growth and changing population densities in existing (non-treatment area) beds, includes impacts or suction removal on reproductive biology (release of juveniles into water)
- Environmental impacts as a result of Asian clam control—includes changes in nutrient flux, turbidity, dissolved oxygen, and benthic disturbance
- Efficacy of large scale removal, including water depth, acreage, disposal of large amounts (weight and mass) and personnel

c. Clam bed expansion from existing beds, lake wide distribution, development of novel technology

- We currently have an incomplete understanding of the rate of expansion of existing beds and their lake wide distribution (only aware of populations from Zephyr Cove to Pope Beach—west, north shores have not been surveyed). An understanding of lake wide distribution and their growth is critical to determine strategies for lake-wide control.

- Field testing of remote sensing technologies (such as sonar, high resolution photographic surveys by autonomous underwater vehicles, airborne lidar etc.) as a tool to rapidly assess large areas of the lake for the presence of clams. Such technologies are used elsewhere to detect fish egg masses and other biota in sediments; could provide a rapid and effective means to survey for Asian clam presence on a large scale. If initial field tests determine that this survey method is effective, then a lake wide survey would be conducted. This will inform (f) below.

d. Clam population growth rate, food utilization, development of a growth model

- Understanding basic life history and clam energetics will be critical to determine the variability in their growth rates around the lake. We will quantify growth in existing patches and determine constraints (food, temperature, light, etc.) that may or may not be limiting their growth.

e. Habitat suitability of lake wide area

- A comprehensive, bottom sediment survey of environmental conditions has never been completed for the lake. This will be needed in order to assess which locations may establish clam populations.

f. Lake wide impacts at current or enhanced levels

- Impacts to the lake's ecology are unknown and likely vary based on the density of clams in a given locations. Changes to the open water (phytoplankton, clarity) and benthic communities are expected and could alter native fisheries. We will assess the potential for changes in clams of varying patch size.

- Impacts to drinking water systems--evaluation of nutrient or particle additions as a result of biofouling at intake pipes, possible impacts to non-filtration status (communications via Tahoe Water Suppliers Association (TWSA))

g. Facilitation by clams of other invasive species (e.g. quagga mussel) via the release of calcium from dead clam matter.

h. Laboratory testing of molluscicide treatments (effective dosages, impacts to clams, water quality, etc.)

i. Permitting, RFPs and funding (to be done by AIS)

- Permits will need to be written for the project by TRPA. TRPA staff within the Environmental Improvement Branch would be the lead planner for this permitting effort[1].

j. Outreach and education (see Section V)

Part II – <u>Evaluation of a Management Strategy for Asian Clam Control</u>

Once the pilot testing has been completed and efficacy and environmental impact have been reviewed, a preferred management strategy for Asian clam control can be selected. This process can include multiple (2-3) pilot test periods. This selection process includes input from the Lake Tahoe Asian clam management and research team, project stakeholders, and external reviewers:

a. Economic evaluation of lake wide management strategy

b. Report on the efficacy of pilot testing

c. Summary of all scientific findings to date

d. Lake Tahoe Asian clam work group and an external review panel will be convened to evaluate the potential based on the latest scientific information to determine the efficacy of removal strategies and effort. Information will be based on pilot test plot information, lake wide distribution, and information gathered to date.

e. Report on recommendation strategy and timetable for clam control

f. Evaluation of funding sources

g. Public and agency outreach

[1] The Asian clam management working group is currently working on permit issues. In addition to the members represented on this document, we will invite representatives from the CA State Lands Commission as well as California State Parks to ensure proper permitting.

Part III – Implementation of expanded demonstration and/or lake-wide control actions

Upon completion of Parts I & II, the Asian clam control and monitoring project could progress in one of two directions: a) the implementation of an expanded demonstration (larger than pilot test plots but at a smaller scale than whole-lake effort) of possible control strategies, or b) the implementation of the large scale, lake wide control plan. The selection of option a or b will be determined by the evaluation of economic and environmental cost in the pilot testing periods of phase 1 and 2, assessment by the external and internal review panels, and feasibility of implementation given timing (i.e., winter periods to minimize impact of Asian clam reproductive cycle, high frequency recreational boating periods, etc.). Phase 3a or phase 3b should occur at a time to minimize the impact of Asian clam reproductive biology on the success of the management strategy, and should include an important public and agency outreach and communication scheme. This cannot be implemented until feasibility of management strategy and lake-wide distributional data have been determined.

a. Implementation of recommended control strategies

b. Onsite monitoring of existing locations

c. Continued monitoring of control patches to determine recolonization, new colonization, benthic conditions, and water quality initiated in Part I.

d. Finalize research recommended from peer review panel.

e. Evaluation of efficacy of expanded demonstration/ lake wide control

f. External peer review panel to evaluate progress and recommendations

Part IV – *Long-term Monitoring to evaluate success*

To understand the impact of control strategies, a long term monitoring plan must be employed. This will include the observation and evaluation of:

a. Recolonization of Asian clam in areas where control strategies have been implemented

- Growth and population level changes both within and without management areas
- Includes both localized and lake wide survey

b. Sediment characteristics

- Changes to benthic areas as a result of Asian clam presence or removal (nutrient content, anoxia, calcium levels, etc.)

c. Colonization in novel, uncolonized areas

Water quality conditions including benthic and pelagic habitats, ties to stormwater, Asian clam related algal blooms

D. Timeline and Related Costs

The following section outlines a timeline related to cost estimates and detailed actions, as well as a public outreach and interagency communication plan for the four phase Asian clam management plan. It is important to recognize that funding availability can affect the priority of needs outlined in Parts I-IV above, and detailed in the table below. Our intent was to provide **the full suite of research needs as called for by a complete science plan**. The table in this section shows the phase schedule with details related to actions, items, and where funds have been applied from (SNPLMA and Nevada Division of State Lands Tahoe License Plate Round 12), and suggestions for where needed funding may come from (SNPLMA capital funds (Capital) and LRWQCB request for urgency funds from the State Water Resources Control Board Clean up and Abatement Account (Abatement)). This table does not include funds already spent or research actions already completed.

TABLE 1. COST BREAKDOWN FOR FIVE YEAR PROJECT (PART 1, 2 AND 3 ARE TWO YEARS, PART 4 IS APPROXIMATELY 5 YEARS)

(Yellow highlighting indicates PART total with breakdown following)

ITEM	TIME SCHEDULE	COST
PART 1. Initial Management Response and Related Science and Monitoring Needs	**November 2008-November 2010**	**$1,398,400**
a. Initial Management Response	**November 2008-December 2009**	**$382,000**
i. Design pilot removal operations		$19,700[2]
• Suction removal		
• Bottom barriers		
ii. Conduct pilot removal operations		
• Operation costs		$90,000
• Equipment costs		$35,000
• Project management		$20,000
iii. Monitoring		
• Success of field removal operations		$18,200
• Immediate removal effectiveness		$21,800
• Impacts to lake water during operations		$20,000
• Change in bottom substrate condition following treatment		$18,200
• Survey for recolonization of *Corbicula*, other invasive species and/or native species following treatment		$48,000
• Release/survivorship of juveniles during treatment		$9,000
Operation costs (LAB CHEM COSTS 125 SAMPLES @ $150 each, boat time 50 hours@200,3000, supplies, computing, etc.)		$31,800
LAB OPERATIONS (UCD AND UNR)		$20,000
iv. Public outreach		$2,600
v. Agency coordination		$2,600
vi. Project administration		$11,200
vii. Reporting		$13,900

[2] These funds to come from remaining Bureau of Reclamation funding, granted to UC Davis and UNR May 2008

b. Science Needs for Decision-Making and to Develop an Informed Management Plan[3]	**November 2008 – November 2010**	**$1,016,400**
i. Distribution and location		
• Development/field testing of remote sensing techniques		$14,800
• Completion of distribution analysis for the southeast/south shores		$47,600
• Depth of clam burial in sediment		$11,100
• Lake-wide survey		$75,800
Operating costs including boat time (120 hours at $200 per hour), travel costs, bottles, etc., lab house in Incline (7.5 month at $1500 per month)		$38,300
Lake-wide survey remote sensing costs (Subject to field testing (side scan sonar, AUV, alternative technologies.: includes instrument field survey time, post-processing data analysis)		$130,000
ii. Characterization of *Corbicula* population growth		
• Clam bed range expansion monitoring		$16,300
• *Corbicula* fecundity/reproductive cycles and growth study		$19,700
• Determine rates of food usage (from both open water and sediment sources) and quantify how food available regulates growth and reproduction		$25,400
• Development of growth model based on food resources, water temperature, calcium concentrations, UV light conditions, etc.		$21,000
iii. Habitat suitability of lake wide area		
• Bottom substrate characterization (e.g. organic content, pore water chemistry, particle size distribution, macro-topography)		$24,200
• Surface current transport and wave action modeling		$96,000
• Environmental parameters related to establishment and growth (e.g. UV light, temperature, wave action)		$45,200
Funds for Jim Oris for UV Project		$50,000
Operating costs (includes boat time (45 hours at $200/hour), car travel, supplies @$8000)		$19,000

[3] Scientific understanding of the Asian clam (*Corbicula*) in Lake Tahoe is currently inadequate to inform resource agencies and decision-makers in the Lake Tahoe Basin with a management plan for this invader that contains a reliable risk assessment for the various levels of treatment available. Since the time scale for the growth and development of these biological populations is on the order of many months to years, it is only reasonable that the important science needs be initiated as early in this program as possible to ensure that future management actions is guided by more a more complete understanding. The results of the recommended research and monitoring will be used throughout all parts of the management effort including immediate (year 1 – development of control approach), intermediate (years 2-3–implementation of control actions), and future (years four and beyond –evaluation of success and adaptive management).

iv. Lake-wide impacts from current or enhanced levels of *Corbicula*		
• Localized stimulation of nuisance blooms of benthic algae		$34,500
• Impacts to in-lake phytoplankton, zooplankton, nutrients and lake clarity		$42,800
• Impacts on native benthic organisms		$20,400
Operating costs (bottles, 1 freezer, 1 incubation chamber, beakers, bags, sugar, boat time 50 hours @ $200/hour)		$17,000
v. Facilitated invasion of quagga mussels via calcium release from dead clam shells		
• Laboratory testing of survival, growth and reproduction using quagga mussels		$13,900
• Clam shell leaching experiments		$16,100
• Field sampling of lake water in direct contact with *Corbicula*		$17,100
• Assess need for shell removal following bottom barrier		$28,200
Operating costs includes boat time (36 hours at $200/hour), car travel, and supplies		$16,000
LAB OPERATIONS (UCD AND UNR)		$20,000
vi. Laboratory molluscicide testing and evaluation		$20,000
vii. Science coordination		$5,000
viii. Public outreach		$2,600
ix. Agency coordination		$2,600
x. Scientific project administration		$44,000
xi. Reporting		$81,800
PART 2. Evaluation of Strategy for Asian Clam Control[4]	**July 2009 – October 2009**	**$172,400**
i. Economic evaluation for lake-wide management strategy		$30,000
ii. Preparation/participation and technical assessment by external peer review panel		$55,400
Panel costs		$40,000

[4] During this part of the management plan basin agencies, together with the in-basin science team and an external peer panel, selected because of their knowledge of *Corbicula* ecology and management, will use the existing information and risk assessment to determine the extent to which removal/control actions will be taken during the winter of 2009-2010. Tasks listed under Part 2 require the full completion of Part 1a and Part 1b to the extent possible.

iii. Report on Recommended Strategy and Timetable for *Corbicula* Control in Lake Tahoe[5]		$33,800
iv. Public Outreach		$2,600
v. Agency coordination		$2,600
vi. Project administration		$10,600
PART 3. Implementation of Expanded Demonstration and/or Lake-wide Control Actions	**November 2009 – October 2011**	**TBD**
i. Implementation of recommended control strategy either at an expanded demonstration scale in the beds located in the southeast portion of the Lake, or lake-wide as determined in Part 2		Cost estimate comes from economic report in part 2
ii. On-site monitoring during removal operations		$74,800
LAB CHEMISTRY COST: 200 SAMPLES@$150 each		$30,000
iii. Continued monitoring of recolonization, new colonization, benthic condition, and water quality status initiated in Part 1		$141,600
iv. Finalize research as recommended in Part 1b		No Budget Associated (Part 1b)
v. Evaluation of efficacy of expanded demonstration/lake-wide control each year		$44,200
vi. Annually, assemble external peer review panel to evaluate progress and discuss future actions		$14,500
Panel costs		$50,000
vi. Public outreach		$2,600
vii. Agency coordination		$2,600
viii. Project administration		$24,700
ix. Reporting		$49,000

[5] Produced cooperatively by the LTAISWG (and associated agencies), in-basin science team and external peer review panel.

PART 4. Long-term Monitoring to Evaluate Success	November 2011 – annually into the future[6]	$103,400
i. Survey for recolonization of *Corbicula*, other invasive species and/or native species in and adjacent to the treated areas		$25,700
ii. Change in bottom substrate condition in treated areas		$27,300
iii. Lake-wide survey for *Corbicula* in previously un-colonized areas		$25,700
iv. Water quality conditions including pelagic and benthic habitats		$10,000
vi. Public outreach		$2,600
vii. Project administration		$2,600
viii. Reporting		$9,500

Table 2. Total amount requested from executive committee less other available funds **for initial two year period of proposed project (This includes Parts 1 and 2 ONLY)**

Amount requested and funding sources	Value
Total	$1,398,400
Total minus in kind matching (UCD and UNR)	$1,204,770
Total minus in kind matching and SNPLMA, NDSL funds (if granted)	$803,196
Total minus in kind matching and SNPLMA, NDSL funds (if granted), and remainder BOR funds ($23K)	$780,196
Total minus in kind matching and SNPLMA, NDSL funds (if granted), and remainder BOR funds ($23K) and Emergency funds ($25K)	$755,196
Total minus in kind matching and SNPLMA, NDSL funds (if granted), and remainder BOR funds ($23K), Emergency funds ($25K) and LRWQCB urgency requests from the State Water Board's Cleanup and Abatement Account ($100K for urgent suction removal and up to $100K additional urgent funds for research and monitoring). Requests >$100K from Cleanup and Abatement Account require State Water Board approval and could take several months to approve.	$655,196
Ibid minus NDSL contributed funds ($125,000)	$530,196
Ibid minus U.S. Fish and Wildlife SNPLMA Round 9 funds ($100,000)	$430,196

[6] It is expected that long-term monitoring for i-iii will be needed on an annual basis for at least five years following treatment.

E. Define Working Group and Partner Roles

The Asian clam working group combines a research team from UC Davis Tahoe Environmental Research Center (J. Reuter, G. Schladow, M. Wittmann) and University of Nevada Reno (S. Chandra) with a management team represented by members from the Tahoe Resource Conservation District (N. Cartwright and D. Roberts), the U.S. Fish and Wildlife Service (S. Chilton), the Lahontan Regional Water Quality Control Board (D. Smith), Tahoe Regional Planning Agency (T. Thayer, D. Oliver), Nevada Department of Wildlife (D. Catalano and K. Tisdale), Nevada Division of State Lands (E. Harrison). In the future, representatives from the California State Lands Commission and California State Parks will be involved in this project.

The research team (UNR & UCD) will provide scientific guidance and technical expertise regarding Asian clam biology, control and its relationship to the physical, chemical, and ecological properties of Lake Tahoe. UCD and UNR will conduct onsite monitoring and analysis of short and long term control treatments, field work including Asian clam presence/absence surveys, physical habitat characterizations, laboratory experimentation, and analysis of ecological data. As well as conducting the research described above, the research team may choose to collaborate with other research institutions when additional expertise is warranted.

The operations plan for Asian clam removal will be carried out cooperatively by U.S. FWS, TRPA, TRCD, and UCD and UNR. Initially TRPA will procure a diver-assisted suction removal unit and the TRCD will contract for the personnel and additional equipment required to facilitate the project. TRCD will also develop and implement a media and outreach plan. Specific locations in California and Nevada for the removal coinciding with research conducted by UCD and UNR will be determined and logistical considerations will be evaluated. Weather and contractor availability will determine the operational windows, but the project will most likely proceed in January 2009 and continue for ten to twenty working days. Personnel will be contracted by the TRCD and will be under their contractual control. Suction removal equipment will be purchased and retained by TRPA and TRPA watercraft will be utilized during the operation. Project coordination will be facilitated by U.S. Fish and Wildlife Service (FWS).

Additionally, TRPA, in its role as the bi-state regulatory agency, will provide permitting for the project. The TRPA will also provide logistical support for the removal and monitoring effort, as

well as assistance with public outreach and agency coordination. Lastly, the TRPA will work with state and federal agencies to provide funds for the project.

The role of the Nevada Division of State Lands (NDSL) in the Asian Clam Control and Monitoring Plan are several. The State of NV owns the lake bottom lakeward of elevation 6223.0 feet and therefore NDSL will need to provide temporary authorization for any work planned for pilot projects associated with Asian Clam control. The State of Nevada has a vested interest in assisting with Asian Clam control and therefore some financial assistance from NDSL will be provided for the pilot program. NDSL will assist in providing public outreach on these efforts where feasible and where resources are available. NDSL intends to provide authorization to another party to submit an application on behalf of NDSL to complete the clam removal work. It is expected that this party will be issued the TRPA permit rather than NDSL. NDSL will provide authorization for another party to complete the actual pilot activities on NDSL property.

NDOW will be able to provide limited on the ground assistance due to budget constraints and resources. NDOW can provide a barge (diver staging, material collection, etc.) if needed but will not have anyone available to man the vessel. In addition, the State of NV has a vested interest in assisting with the control of Asian Clam species and therefore will provide assistance when possible. NDOW may be able to provide some outreach through the department webpage and conservation education program.

TRCD will manage outreach coordination with HOA's, presentations, development, etc. as specified in the table in section F. The TRCD will manage possible contracts, grants, and possibly permits. Finally, TRCD will assist in the coordination with agencies, CCC members, removal crews and scheduling related to removal pilot and demonstration projects.

LRWQCB will provide support for the project and request up to $100K from the State Water Board Cleanup and Abatement Account funds for the urgent suction removal and bottom barrier pilot projects. Additionally, LRWQCB will review, comment, and provide active involvement if the group pursues basin plan amendment to use molluscicides in Lake Tahoe[7].

[7] Molluscicides tested herein falls under the California Agricultural Code § 12753 definition of a pesticide. All laboratory testing of molluscicides will be directed toward assessing the application of these pesticides so as to not

F. COMMUNICATION SYSTEM

The management of Asian clam in Lake Tahoe will require a communication system whose goal to increase awareness of Asian clam presence, control and removal. The general objective is to reduce the public's negative response to clam removal and to keep agency representatives and other stakeholders informed of all actions taken. The table below summarizes means of communication and associated costs.

Objective	Target Audience	Message	Format	Distribution	Cost Estimate
Alert and increase awarenes s of removal plans to reduce negative response	Nearby property owners	• Clam removal will occur on dates: XX • Reasons for and possible impacts	Printed mailer	US Postal Service	10 hrs TRCD= $340 30 hrs AC= $0 3 hours review TRPA= $87.06
	Basin residents	" "	Press release	Newspaper	4 hrs TRCD= $136 12 hrs AC 3 hrs TRPA=$87.06
	Boaters	" " • Check equipment for AIS	• Brochures • Notifications at marinas and launch sites	Hand out by watercraft inspectors, marina staff, postings at launches	4 hrs TRCD= $136 12 hrs AC 3 hrs TRPA=$87.06
	Visitors	AIS impact Lake Tahoe	Exhibits, posters	• UC Davis Thomas J. Long Foundation Education Center • Tahoe	20 hrs TRCD= $680 30 hrs AC 5 hrs TRPA=$145.10

exceed the lowest detectable levels, using the most recent detection procedures available, no increases in pesticide concentrations in bottom sediments or aquatic life. Waters designated as MUN shall not contain concentrations of pesticides or herbicides in excess of the limiting concentrations specified in Table 64444-A of Section 64444 (Organic Chemicals) of Title 22 of the California Code of Regulations which is incorporated by reference into this plan. This incorporation-by-reference is prospective including future changes to the incorporated provisions as the changes take effect.

Objective	Target Audience	Message	Format	Distribution	Cost Estimate
				Maritime Museum • Explore Tahoe	
Information sharing regarding control implementation	Agency staff	Removal updates	• PDF memo • Meetings	• List serve (e.g. clamlist@ucdavis.edu) • Monthly meetings with agency participants to disseminate information	25 hrs TRCD= $850 10 hrs TRPA=$290.20
	Tahoe Water Suppliers Association (TWSA)	Communication and meetings regarding water intakes, monitoring plans, biofouling, etc.	• Meetings, emails	• Meetings with TWSA participants to disseminate information	

Appendix E4: Warm Water Fish Control

Appendix E4
Warm Water Fish Control

To be inserted prior to final submission to the ANSTF.

Appendix E5: Bullfrog Control

Appendix E5
Bullfrog Control

To be inserted prior to final submission to the ANSTF.

LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix F: Monitoring and Response Planning

This appendix together with Appendices D and E form the framework for planning the objectives, strategies, and actions found in Appendix C. This appendix contains planning documents that describe the individual programs, projects, and protocols that are updated on a regular basis as part of the continual improvement process for the Plan. The last date of revision for any document in this appendix is the most current as not all plans are updated at the same time.

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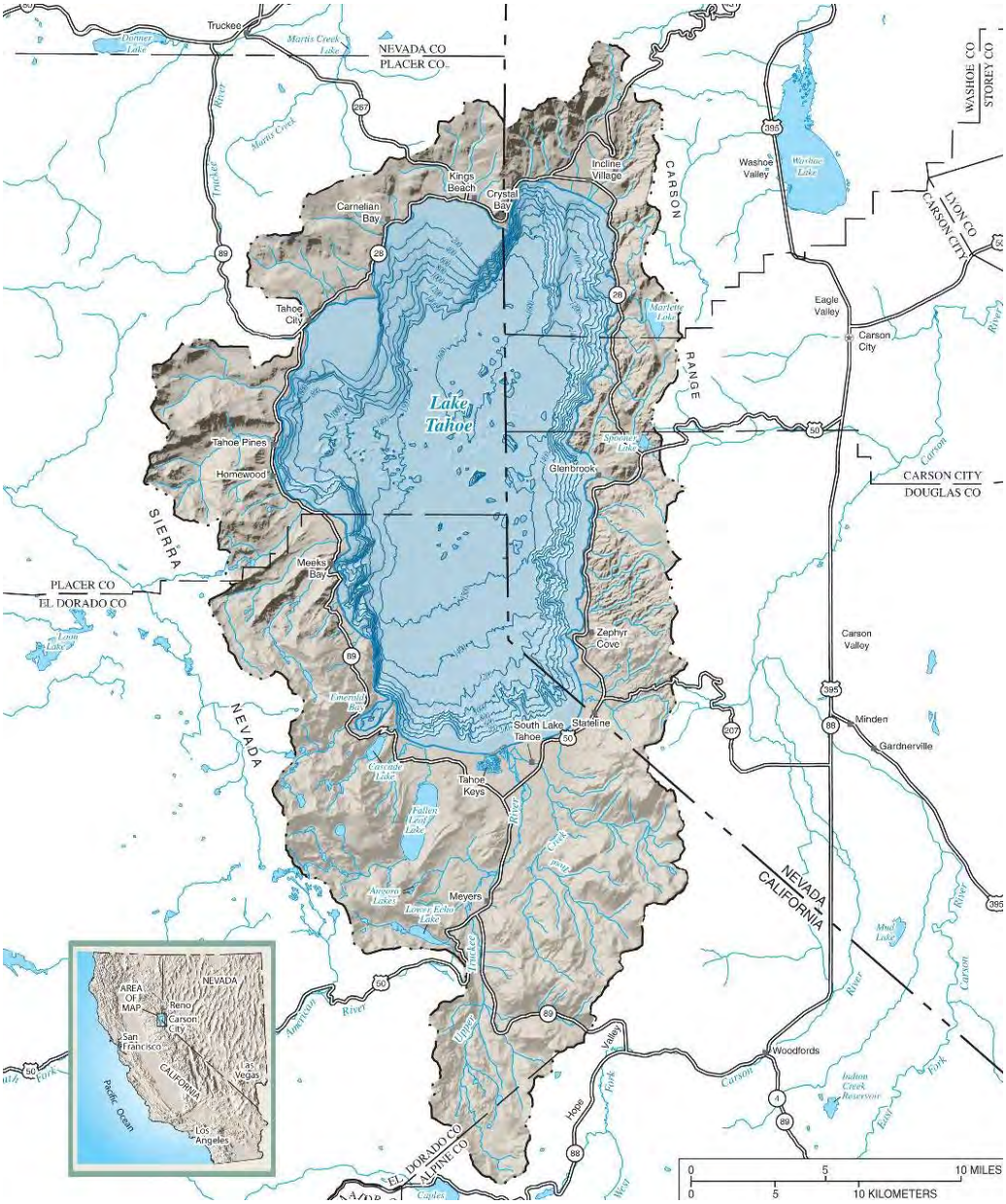
Appendix F1: Lake Tahoe Basin Interagency Dreissenid Mussel Rapid Response Plan

Lake Tahoe Basin Interagency Dreissenid Mussel Rapid Response Plan



Lake Tahoe Basin Interagency Dreissenid Mussel Rapid Response Plan

July 15, 2009
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Prepared for the Lake Tahoe Aquatic Invasive Species Coordination Committee by:
U.S. Fish and Wildlife Service

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For further information about this Interagency Dreissenid Mussel Rapid Response Plan for the Lake Tahoe Basin, please contact Steve Chilton, U.S. Fish and Wildlife Service (775-589-5265; steve_chilton@fws.gov). An electronic version of this Plan and information about the LTAISCC is available

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I. INTRODUCTION

Goal: The purpose of this plan is to provide a framework for an effective rapid response to the discovery of any Dreissenid mussel (mussel) aquatic invasive species (AIS) in Lake Tahoe.

In this document, "rapid response" means that soon after a detection of a dreissenid mussel (veliger or adult) in Lake Tahoe is discovered, 1) the responsible agency will make a determination of whether it is potentially significant and/or detrimental and 2) if that is the case, the responsible agency will develop and implement a course of action. This also would apply to mussels that are discovered in an adjacent waterway or lake that ultimately enters Lake Tahoe.

Possible courses of action for newly discovered mussels may include an effort to eradicate the species, control its spread, prevent future introductions, minimize or mitigate the damage it causes, or study it further before any other action is taken. Rapid response is the second line of defense after prevention to minimize the negative impacts of AIS on the environment and economy of Lake Tahoe. Once non-native invasive species become widespread, efforts to control them are typically more expensive and less successful than rapid response measures. The damage caused by an AIS that becomes widespread, and the actions that are taken to control it, may be more harmful to the environment than a successful rapid response.

To effectively protect aquatic habitats from the impacts of mussels, Lake Tahoe needs to develop and implement a comprehensive early detection and reporting plan. This document does not attempt to address the issue of early detection, nor provide a detailed discussion of mechanisms for reporting mussels. It focuses on what happens after detection of a suspect mussel individual or population. Since a limited early detection and reporting process for mussels (traps and diver monitoring) already occurs, a rapid response procedure is considered the most immediate need.

The Lake Tahoe AIS Coordination Committee (LTAISCC) has been established to address the unique and continuing threats of AIS to the Lake Tahoe Basin. The LTAISCC includes state, federal, Tribal, and university AIS managers and researchers. This Dreissenid Mussel Interagency Rapid Response Plan for the Lake Tahoe Basin reflects strategies, models, and activities gleaned from a variety of other contingency plans. In particular, it draws from the Columbia River Basin Interagency Invasive Species Response Plan: Zebra Mussels and Other *Dreissenid* Species created in 2008 by the Columbia River Basin Team, 100th Meridian Initiative and the Rapid Response Plan for Aquatic Invasive

Species in California created in 2007 by the California Department of Fish & Game, Habitat Conservation Branch, Invasive Species Program.
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Rapid Response Procedure

The initial steps in this procedure result in the determination of whether an active response is immediately necessary after a potential mussel detection is reported. If immediate action is necessary, and requires more than simple, highly localized measures, resource management staff may decide to implement an incident command system (ICS) response. A set of criteria will be developed to help in this decision making process. Many of the steps listed below are likely to take place simultaneously or overlap to some degree. Examples of these include outreach, rapid assessment, and containment activities. A flow chart showing the general steps of this rapid response procedure is provided as Chart 1.

In an ICS response, participants are assigned specific roles in a well-defined hierarchical system that can be expanded or collapsed based on the size and complexity of the incident. The ICS was developed to allow staff from different government agencies and organizations to work effectively and efficiently together to respond to a natural disaster. Participants essentially check their individual agency identities at the door and participate as members of the ICS organization, dedicated to responding to a particular incident. The system's success relies on participants understanding their role, a clear chain of command and communication, managers having an appropriate span of control, and a standardized process for identifying and communicating objectives, strategies, tasks and deadlines. Because of its proven effectiveness, the ICS has recently been integrated into the National Incident Management System (NIMS). For more information about the principles and features of the ICS go to Lessons 2 and 3 at http://emilms.fema.gov/ICS100G/index.htm. To learn more about the integration of ICS into NIMS, please visit www.fema.gov/emergency/nims. An example of how the ICS staff organization scheme has been applied to an AIS rapid response in Lake Tahoe is provided in Chart 2.

Optimal use of this system requires that participants be trained in advance per Section IV (Planning) of this document. The Planning Section also discusses the need to develop the finer details of the procedure, the lists and directories that are referred to in the procedure, and the designation of alternates. This last item ensures that none of the positions described in the procedure are ever vacant.

The procedure that will be followed for a given incident will follow the species-specific rapid response plan below. As additional species-specific plans are developed and approved, staff that have been identified as potential responders will be notified of their approval and location on the Internet. Basic information about each species specific plan will be incorporated into AIS rapid response training.

II. LEGAL AUTHORITY FOR RAPID RESPONSE

Appendices B and C in the CAISMP provide general information on the federal and state government agencies and regulations involved in the management of AIS. Rapid response activities could potentially require state and/or federal permits, consultations or agreements related to the placement of fill or structures into state and/or federal waters, protection of state or federally listed species, or the protection of other special status plant or animal species. The normal timeline for obtaining permits issued under these laws may critically delay rapid response efforts. A streamlined regulatory permitting process for implementing the Rapid Response Plan will need to be developed and approved by participating agencies. Additionally, permission is necessary to work on private and public properties. Clear protocols need to be developed to avoid misunderstandings or illegal trespassing, while making the process of obtaining access as efficient as possible.

In addition to the laws relevant to mussels discussed in the CAISMP, there are laws that specifically address taking action during an emergency or under special circumstances. These laws can facilitate the implementation of a rapid response procedure. Examples include:

Creation of Emergency Regulations

Under California Government Code Section 11346.1, rulemaking state agencies, departments, commissions, offices and boards can adopt emergency regulations, which can remain in effect for up to 120 days. These are regulations that must take effect immediately for "preservation of the public peace, health and safety or general welfare" and must meet other requirements of that code section. The process for adoption of emergency regulations can be found at the Office of Administrative Law's web site (www.oal.ca.gov/emer_reg.htm).

The California Department of Food and Agriculture (DFA) has specific statutory authority to establish quarantines to protect the state's agricultural industry from pests (Food and Agriculture Code Section 5301). If mussels are discovered that have the potential to severely damage crops, water delivery, or flood control systems that support agriculture, DFA can invoke their authority to establish a quarantine area.

According to Section 660 of the Harbor and Navigation Code, any entity, local or state, authorized by law to adopt rules or regulations that govern matters relating to boats or vessels may adopt emergency measures within their jurisdiction as long as they are not in conflict with the general laws of the state relating to those matters. The emergency rules or regulations can be effective for up to 60 days and must be submitted to the Department of Boating and Waterways (DBW) on or before their adoption. DBW can authorize these emergency rules or regulations to be in effect for over 60 days if it is deemed necessary.

Use of a Pesticide Outside of its Registered Use

When dealing with species that are new to Lake Tahoe, the technical experts participating in a rapid response incident may determine that the best solution is to use a pesticide outside of its registered use or to deploy a new end use product. Section 18 of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) allows states to apply to use a pesticide for an unregistered use for a limited amount of time if the EPA determines that emergency conditions exist (http://www.epa.gov/opprd001/section18). Under Section 6206 of Title 3 of the California Code of Regulations (CCR), the DFA Director is permitted to apply for a Section 18 exemption when emergency conditions exist. Section 24 of FIFRA authorizes states to register an additional use of a federally registered pesticide or a new end use product to meet a special local need (www.epa.gov/opprd001/24c).

Experimental Unregistered Use of a Pesticide

Section 6260 of Title 3 of the CCR provides the conditions for obtaining a Research Authorization for the experimental use of a pesticide outside of its registered uses. Research Authorizations are administered by the California Department of Pesticide Regulation (DPR).

III. Scope and Purpose

The purpose of the Plan is to coordinate a rapid, effective, and efficient interagency response in order to delineate, contain, and when feasible, eradicate zebra, quagga, and other dreissenid mussel populations if they are introduced in Lake Tahoe waters. Recognizing that dreissenid mussels typically establish firmly in a watershed prior to detection, this plan assumes that a detected population has not dispersed widely or reproduced (i.e., eradication is still reasonable to consider) until further analysis reveals otherwise.

A. Planning Assumptions:

Prevention is the first priority for addressing the risk of zebra and quagga mussels in the Lake Tahoe Region. This includes preventing contaminated watercraft from entering uncontaminated water bodies. This Plan is not intended to guide interception of contaminated watercraft prior to launching.

The provisions of this Plan are intended to enhance interagency coordination beginning with the discovery of an infestation through containment and initial control efforts. Long-term monitoring and control of a permanent infestation will require a separate management plan developed and implemented by the individuals or organizations with authority and responsibility for managing the infested site(s).

Finally, this Plan focuses on actions that would **follow** a reported dreissenid introduction. It does not address strategic actions needed to enhance preparedness prior to an infestation. Those strategies are covered in a separate document.

B. Responsibilities

The specific agencies and entities required to respond to the discovery of dreissenid species depends on where the infestation is discovered. However, regardless of location, implementation of this Plan depends upon the cooperation of a broad variety of public and private sector organizations, including, but not limited to the agencies that are signatories to this Plan, and those included in Table 1.

Table 1: Agencies and Organizations with Invasive Species Management/Coordination Responsibilities in the Lake Tahoe Basin	
• Nevada Department of Wildlife	• Nevada Department of Environmental Protection
• California Department of Fish and Game	• California Department of Food and Agriculture
• California Environmental Protection Agency	• California State Parks
• El Dorado County Sheriffs Department	• Nevada State Parks
• Placer County Sheriffs Department	• California Highway Patrol
• University of Nevada Reno	• Washoe Tribe
• University of California Davis	• Lake Tahoe Basin Public Utility Districts
• U.S. Army Corps of Engineers	• U.S. Fish and Wildlife Service
• Washoe County Sheriffs Department	• U.S. Geological Survey
• U.S. Bureau of Reclamation	• U.S. Forest Service, LTBMU
• Douglas County Sheriffs Department	• City of South Lake Tahoe Police Department
• U.S. Environmental Protection Agency	• Tahoe Resource Conservation District
• Lahontan Regional Water Quality Control Board	• Tahoe Regional Planning Agency
• State aquatic/general invasive species committees and councils	• City and County Governments
• General Improvement Districts	• Western Regional Panel on Aquatic Nuisance Species
	• State and Local Emergency Management Offices

Each entity is responsible for:

- Participating in such meetings, conferences, and working groups necessary to develop, test, and maintain the Plan;
- Participating in the development and review of this Plan and associated documents and procedures;
- Identifying staff to participate in the organizational elements of this Plan;
- Ensuring that relevant individuals have access to the Plan.
- Establishing and maintaining inventories of resources that may be available in the event this Plan is activated;
- Ensuring that its employees are familiar with the Plan and trained in their duties and responsibilities;
- Implementing the Plan according to its internal authorities and guidelines, and the provisions of this plan; and for
- Participating in evaluations of exercises and activations of the Plan.

This Plan does not stand alone; it relates to a set of Interagency Response documents that in some cases are more general (e.g., State and local Emergency Operations Plans, ANS/AIS early detection/interagency response plans, etc.) and in other cases are more specific (e.g., individual agency AIS response plans).

IV. Concept of Operations

The LTAISCC is responsible for activating and implementing the management structures necessary to respond to and support efforts to contain and control an infestation. Because LTAISCC member agencies do not share a standard organizational structure on a day-to-day basis, the Committee has adopted the organizational structure described in this Plan as its emergency response structure. The organizational elements are divided into two groups: coordination (policy and communication) and incident management (tactical). The structure is designed to be flexible. Only those elements needed to respond to and support a given infestation will be activated. Note that personnel of LTAISCC member agencies may be assigned to any or all of the described organizational elements, depending on their organizational role, expertise, and management requirements of the specific infestation.

Activation of the organizational structure typically is made through State invasive species coordinators to the national US Fish and Wildlife STOP-ANS reporting system and to the LTAISCC Notification Coordinator (Figure 3). The Notification Coordinator has the authority and responsibility to convene the rest of the MAC Coordination and Support Staff, the MAC Group Chair, and the standing members of the LTAISCC MAC Group, and to ensure all organizations on the Priority One notification list (see Appendix C) have been notified.

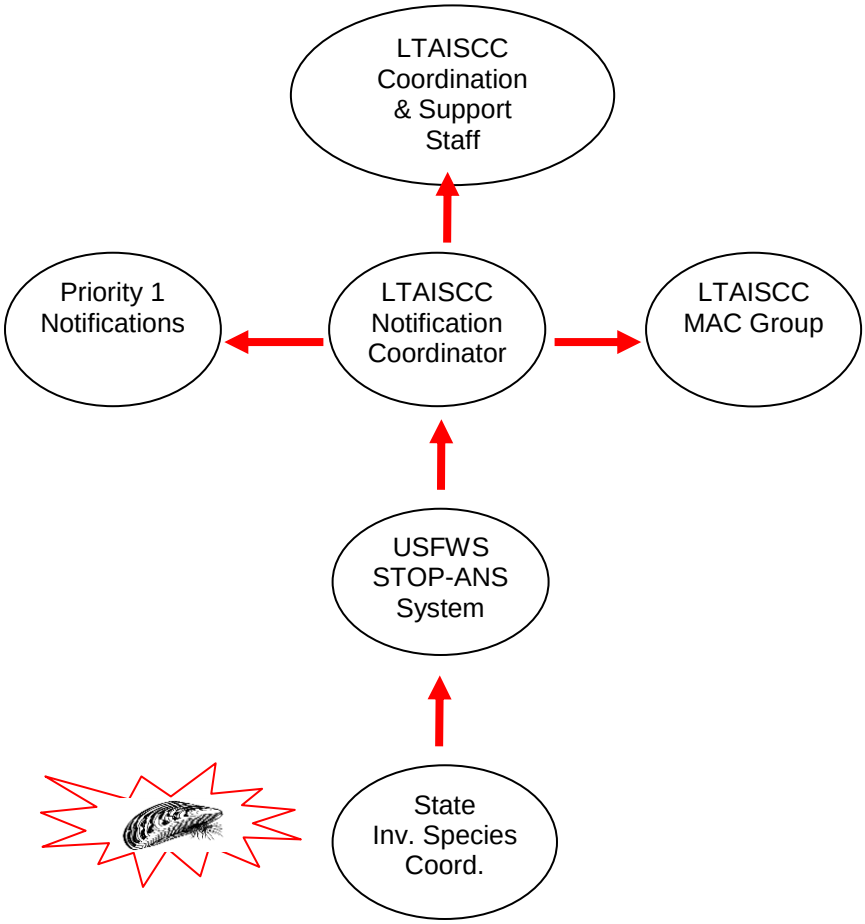

Figure 3: Diagram showing dissemination of a dreissenid report from initial call into state agency to LTAISCC Notification coordinator to LTAISCC MAC Group, Priority 1 contacts and support staff.

A. Coordination Structure

The coordination structure described in this Plan is designed to comply with the requirements of the National Incident Management System (NIMS). This structure focuses on interagency decision-making and communication, rather than on the ground tactics.

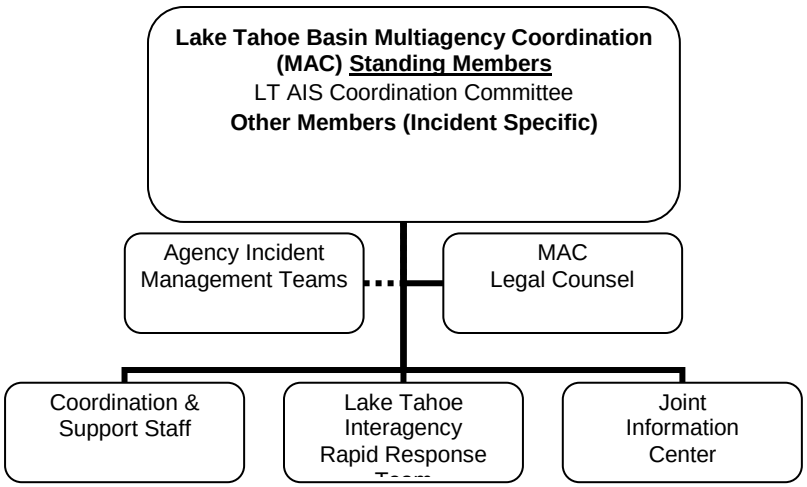

Figure 4: Multiagency Coordination (MAC) structure and organizational elements.

The coordination structure includes four organizational elements (see Figure 4) with the following general responsibilities (also see Appendix B for checklists):

- **Lake Tahoe Basin Multiagency Coordination (MAC) Group**: Policy decisions, including approval of management plans, assignment of resources, and interagency media coordination.

  The MAC Group includes "standing" or permanent members, who are representatives of those LTAISCC member agencies that can be expected always to participate in the activation of this Plan. Standing members are included because they have authorities and responsibilities that are not limited by geography within the Lake Tahoe Basin. Standing members of the Lake Tahoe MAC Group include the Tahoe Regional Planning Agency, US Fish and Wildlife Service, U.S. Forest Service, U.S. Bureau of Reclamation and the states of Nevada and California. The second tier of MAC Group Members includes agencies or organizations who may participate depending upon their responsibilities where the infestation is found.

  It is the responsibility of the standing members of the Lake Tahoe MAC Group to identify, notify, and include representatives of other organizations who should join the MAC Group depending on the location of the infestation.

  The Lake Tahoe MAC Group may be supported by Legal Counsel. The Lake Tahoe MAC Group will annually select one of its members to serve as the Lake Tahoe MAC Group Chair.

- **Lake Tahoe Basin Coordination and Support Staff**: This group provides technical, scientific, and logistical support to the Lake Tahoe MAC Group, the Interagency Rapid Response Team (IRRT), and local affected agencies/entities, including positive confirmation of extent and scope of the infestation. They assist in identifying appropriate containment, control, and eradication efforts. The Lake Tahoe Coordination and Support Staff is made up of subject matter experts activated in response to the specific needs of the reported infestation. Subject matter experts may be employees of any or all entities participating in this Plan, or from organizations outside the Lake Tahoe Region Team.

- **Lake Tahoe Joint Information Center (JIC)**: As part of its external communications system, the Lake Tahoe MAC Group may activate a Joint Information Center (JIC) to support its efforts to develop and implement effective interagency development and dissemination of information to the public and other interest groups.

- **Interagency Rapid Response Team (IRRT)**: This team includes interagency personnel that may be assigned to provide on-scene technical support to the Lake Tahoe Coordination and Support Staff, the Lake Tahoe MAC Group, or incident management support at the request of the impacted jurisdiction/entity and the approval of the Lake Tahoe MAC Group. They also assist in confirming the presence and determining the scope of the infestation, as well as identifying and implementing appropriate containment, control, and eradication efforts. Team members will be selected based on the technical and management needs of the specific infestation.

B. Management Structure

The management structure described in this Plan is designed to comply with the requirements of the National Incident Management System (NIMS). This structure focuses on tactical implementation.

- **Agency Incident Management Teams**: ICS-based organizations responsible for the on-scene implementation of agency and Lake Tahoe MAC Group management decisions. The Incident Management Team reports to the Agency Administrator(s) of the responsible entity or entities. Note: The Lake Tahoe IRRT may be deployed as an Incident Management Team. In such assignments, the IRRT will operate in the place of the Agency Incident Management Team, under a written delegation of authority from the Agency Administrator.

V. Interagency Response Procedures

A. Response Objectives

Ten response objectives support the Plan's goal to delineate and control zebra, quagga, and other dreissenid mussel populations if they are detected in Lake Tahoe waters. **Note that tasks associated with these objectives are not necessarily sequential; many may be implemented simultaneously**.

Table 2 below lists the ten objectives, and indicates which part of the Plan addresses the objective. Table 2 also indicates which element of the Lake Tahoe Coordination organization is responsible.

Table 2: Response objectives that support the Plan's goal to delineate and control zebra, quagga, and other dreissenid mussel populations if they are detected in Lake Tahoe waters

Rapid Response Objective	Plan Location	Responsible Coordination Element
1. Make Initial Notifications	Section IV-A Pages 13-14; Appendix C	State invasive species coordinators; 877-STOP-ANS System
2. Activate appropriate organizational elements of the Lake Tahoe Interagency Response Plan	Section IV-A pages 14-15	Lake Tahoe Notification Coordinator; MAC Group Chair
3. Verify Reported Introduction	Section IV-A, page 15	Responsible Agency/State ANS Coordinator
4. Define Extent of Colonization	Section IV-A page 15 Appendix B Field Operations Page B-52	Responsible Agency or Lake Tahoe Coordination and Support Staff and IRRT/IMT
5. Establish External Communications System	Section III, page 10; Section IV,-A page 16 Appendix B- Joint Information Center. Page B-41	Lake Tahoe MAC Group
6. Obtain and Organize Resources	Section IV-A, page 16	Lake Tahoe MAC Group & Lake Tahoe Coordination & Support Staff
7. Prevent Further Spread Via Quarantine and Pathway Management	Section IV-A, page 16 Appendix B Field Operations page B-53	Responsible Agency or Lake Tahoe IRRT/IMT
8. Initiate Available/Relevant Control Actions	Section IV-A, page 16 Appendix B Field Operations Page B-54 Appendix D-Control Options	Responsible Agency or Lake Tahoe IRRT/IMT
9. Institute Long-Term Monitoring	Section IV-A, page 16 Appendix B Field Operations Page B-56	Responsible Agency
10. Evaluate the Response and the Plan	Section IV-A, page 17	Lake Tahoe MAC Group Lake Tahoe Team/all responding elements.

Objective 1: Make Initial Notifications

Purpose: Ensure that all parties that have jurisdiction in response decisions or can provide technical support are quickly engaged, and also rapidly inform all other interested parties.

Lead entity: The agency that initially receives confirmation of zebra/quagga mussel identification, State ANS coordination contacts and US Fish and Wildlife 1-877-STOPANS hotline staff.

Notification of a possible infestation of dreissenid species may come from any number of sources. All states within the Lake Tahoe Region have established reporting contact points for invasive species. These numbers have been widely disseminated and are supported with internal notification and confirmation procedures. This Plan assumes that reports of *Dreissena* will follow those established processes.

1. The first participating agency to discover or receive a report of a potential infestation will notify the appropriate State Invasive Species contact point (see Appendix C). The initial recipient should collect as much of the following information as possible:
   - Date and time of the report.
   - Date and time of the sighting(s).
   - Name, agency and contact information for the person making the report.
   - Name, agency/entity and contact information of identifying biologist (if positive identification has been made).
   - Details of the location of the infestation, such as name of the affected water body, landmarks, highway mile, and other (GPS if possible) where the suspect mussels were found or introduced.
   - An estimate of the number, density, and extent of the mussel colonies found or introduced.
   - A digital or other photograph (with scale indicator), if possible.
   - A sample of the mussels if possible (in compliance with relevant state/federal regulations regarding movement of live prohibited species).
   - Other relevant conditions (access limitations, etc.)
2. After confirming that the report appears to be credible, the Lake Tahoe Aquatic Invasive Species Coordinator will notify the US Fish and Wildlife Service's national 877-STOPANS system. The Lake Tahoe Aquatic Invasive Species Coordinator will also notify all impacted local agencies and organizations.
3. The US Fish and Wildlife Service 877-STOPANS staff will notify the Lake Tahoe Notification Coordinator that they have initiated their notification process.
4. The following statement can be used as a template for disseminating

initial alerts (see text box below) while verification is in progress:

"A preliminary report suggests that dreissenid mussels have been found in [*insert name of water body or other location*]. We are still investigating the veracity of this report, and will communicate updates via [*insert name of listserv, website, etc*.]. Until then, we encourage other jurisdictions to treat this location as an elevated risk. In order to expedite the local response, we also request that you keep this information internal and wait for us to release further information to interested parties. "

SHARING PRELIMINARY REPORTS

Given the potential for regional spread, agencies handling preliminary reports of dreissenid introductions need to consider the importance of alerting all vulnerable jurisdictions – including those outside of the Lake Tahoe Basin (e.g., other Western states). At the same time, disseminating inaccurate information rapidly and broadly can compromise response effectiveness. Unless unique law enforcement or other conditions warrant extreme caution, this plan recommends that the above initial alert message be communicated via email (and phone if possible) as soon as possible to all state invasive species coordinators in the West, even if positive identification is still pending.

Objective 2: Activate Appropriate Organizational Elements of the Interagency Response Plan

Purpose: Activate a response management system that expedites interagency decision-making, promotes information sharing, ensures efficient resource management, and supports on-scene management of the infestation.

Lead entity: Lake Tahoe Notification Coordinator and Lake Tahoe MAC Group.

Activation of the coordination structure described in this Plan begins with the notification of the Lake Tahoe Notification Coordinator. The Coordinator will discuss the appropriate level of response with the MAC Group Coordinator during the Priority 1 notification. The level of activation is flexible, depending on the size, location, and life-cycle of the infestation, and the support requirements of the responsible agency.

The Lake Tahoe Notification Coordinator will notify the standing members of the Lake Tahoe MAC Group as part of the Priority 1 notifications (see Appendix C for notification contact information). The MAC Group Chair may elect to request a preliminary meeting of the Lake Tahoe MAC Group

in person or via conference call in advance of positive identification (see Objective 3 below), or wait until positive identification has been confirmed, depending on the nature and credibility of the report.

The Notification Coordinator will notify the standing members of the Lake Tahoe Coordination and Support Staff as part of the Priority 1 notifications. The standing members will report at the time and location indicated by the Notification Coordinator.

The Notification Coordinator will notify the standing members of the Lake Tahoe Interagency Rapid Response Team (IRRT) as part of the Priority 1 Notifications.

All primary contacts listed in this Plan will be responsible for further notifications internal to their agency/entity or jurisdiction. Additional contacts may be required depending on the location of the infestation and the affected jurisdictions.

Objective 3: Verify Reported Introduction

Purpose: Confirm positive identification of the mussels as a species within the genus *Dreissena.* Confirmation may include one or both of the following methods:

- Visual identification at the infested site by one or more qualified subject matter experts (Appendix C).
- Visual and genetic identification of a sample sent to a qualified subject matter expert (and handled based on directions given by that qualified subject matter expert in compliance with relevant state/federal regulations regarding movement of live prohibited species).

Until further analysis reveals otherwise, the Lake Tahoe response organization will assume that the reported mussels might be both zebra or quagga mussels and that the detected population has not dispersed widely or reproduced (i.e., eradication is still reasonable to consider).

Lead entity: The agency that receives and accepts responsibility for handling the initial report in coordination with subject matter experts.

Objective 4: Define Extent of Colonization

Purpose: Establish physical range of infestation, and identify life-cycle phase of mussels in order to inform policy and tactical response to the infestation.

Lead entity: The responsible agency where the initial sighting(s) of mussels occurs in partnership with other Lake Tahoe agencies and organizations.

Additional procedures are described in Appendix B, Field Operations

Objective 5: Establish External Communications System

Purpose: Activate and staff the Lake Tahoe Joint Information Center to ensure consistent and effective communication to interested external stakeholders, including the media and public.

Lead Entity: Lake Tahoe MAC Group.

Additional procedures are described in Appendix B - Joint Information Center

Objective 6: Obtain and Organize Resources

Purpose: Provide sufficient resources to implement response objectives.

Lead Entity: Lake Tahoe MAC Group and Coordination and Support Staff with resource support from Lake Tahoe agencies and organizations.

Additional procedures are described in Appendix B

Objective 7: Prevent Further Spread via Quarantine and Pathway Management

Purpose: Minimize all vectors that might further spread the original infestation.

Lead Entity: Agency with jurisdiction with technical assistance from Lake Tahoe agencies and organizations.

Additional procedures are described in Appendix B - Field Operations

Objective 8: Initiate Available/Relevant Control Measures

Purpose: Evaluate management options, and then proceed with either eradication efforts or containment/mitigation activities.

Lead Entity: Agency with jurisdiction with technical assistance from Lake Tahoe agencies and organizations.

Additional procedures are described in Appendix B - Field Operations

Rapid Response Objective 9: Institute Long-Term Monitoring

Purpose: Provide for data for adaptive management and long-term evaluation efforts.

Lead Entity: Agency with jurisdiction.

Additional procedures are described in Appendix B - Field Operations

Rapid Response Objective 10: Evaluate the Response and the Plan

Purpose: Capture and implement lessons learned during exercises and activations of the Interagency Response Plan in order to enhance preparedness and response.

Lead Entity: Lake Tahoe MAC Group.

Additional procedures are described in Appendix B.

B. 17 STEP RAPID RESPONSE PROCEDURES (California Plan Example)

Step 1. Identify species and notify authorities

a. Sighting Report: There are three ways in which CADF&G (DFG) is likely to receive a report of a mussel sighting.

1. Either a detection is reported to DFG via a hotline phone number or e-mail address (Invasives@dfg.ca.gov), and catalogued on *RR Form 1: Suspect AIS Sighting Report* (see Section V).

2. Staff from another agency or cooperator detects the mussel and submits the collected information directly to DFG's Invasive Species Program staff.

3. The initial report is made to one of the federal invasive species reporting systems (e.g. "United States Geological Survey Nonindigenous Aquatic Species Alert System" or the "100th Meridian Initiative") which in turn will alert DFG.

b. Sighting Transmittal: This initial information is transmitted to the DFG Invasive Species Coordinator (ISC). If there is uncertainty about the identification of the species, the Invasive Species Program staff will work with taxonomic experts to resolve the issue.

c. For the purpose of documentation, and to assist making a determination of how to proceed following the initial report, the more detailed *RR Form 2: AIS Alert Report* (see Section V) should be completed.

d. Negative ID: If the identification is negative for AIS no further action is necessary.

e. Indefinite ID and/or level of threat: If uncertainty remains after initial fact-finding, the DFG Invasive Species staff should continue to work with experts from cooperating agencies and research institutions to determine the status of the species reported and the level of threat.

f. Positive ID with a high level of threat: If the discovered mussel is invasive and in the presence of vectors that could cause its spread to uninfested areas, DFG Invasive Species Coordinator will consult with DFG executive level staff to determine if an ICS response is appropriate.

1. If the identification is positive, the DFG Invasive Species staff will ensure that a report is sent to the United States Geological Survey Nonindigenous Aquatic Species Alert System (http://nas.er.usgs.gov/SightingReport.asp). During the

response, the alert system should receive updates on any additional locations of the AIS that are found.
2. Fill out an Incident Brief Form (ICS Form 201).
3. ICS forms are available at:
http://training.fema.gov/EMIWeb/IS/ICSResource/ICSResCntr_Forms.htm

Step 2. Activate command-level participants

a. Incident Command Staff: The executive level DFG staff will work with the Invasive Species Coordinator and executive level staff of cooperating agencies to identify the Incident Command staff. They can utilize the Rapid Response Personnel Directory discussed in the Planning Section of this document.

1. The Incident Commander is the overall supervisor and coordinator for the incident. A detailed description of the responsibilities of an Incident Commander and the other Incident Command officers and General Staff positions, can be found in Lessons 3 and 4 at http://emilms.fema.gov/ICS100G/index.htm.

2. Executive level staff and the ISC will decide to pursue a single command response, with one Incident Commander, or a unified command response, with multiple Incident Commanders working as a team. A Unified Command approach is designed to be used in multi-agency or multi-jurisdiction responses.

b. Initial Unified Command Meeting: If a unified command approach is used the Incident Commanders in the Unified Command should meet to discuss and concur on important issues prior to starting the first operational period planning meetings.

Step 3. Implement the ICS Planning Cycle

a. Begin to utilize the ICS planning cycle to document the current status of the response, identify objectives, strategies, specific task assignments and operational period. See http://www.uscg.mil/hq/g-m/mor/media/Chapter_3.pdf for a description of the ICS Planning Cycle.

1. During every ICS planning cycle, an Incident Action Plan is developed for the following operational period. It contains objectives, safety measures, staff contact information, status of the incident and assignments for each organizational element that will be active during the next operational period. The plan must be approved by the Incident Commander(s).

a) The plan is comprised of standard ICS forms that are available in electronic form. Once the initial set of forms is completed, the Incident Action Plan can rapidly be revised and updated.

Step 4. Develop the Organization

a. Command Post: Establish a command post capable of supporting the space, logistic, communication and other technology needs for managing the operation. It may or may not be a high priority to have the command post located close to the infested site, based on the characteristics of a particular incident. Potential command posts will be listed in the Mussel Rapid Response Resource Directory discussed in the Planning Section of this document.

b. Logistics and Finance: The Logistic and Finance Section Chiefs will establish the fundamental tools and means to run the organization, such as setting up the check-in routine, necessary ICS forms, communication services, spending authorizations, and tracking of resources.

c. Assemble Organizational Elements: Using the ICS system, develop an organization that is suitable for the size and complexity of the incident.

1. Directory of Approved Staff: To staff the organizational elements (e.g. sections, branches, units) the Incident Command and upper level General Staff will utilize (but are not limited to) staff directories of people approved to be assigned to rapid response efforts.

2. ICS training materials suggest that "it is better to initially overestimate the need for a larger organization than to underestimate it, as it is always possible to downsize the organization." (National Wildfire Coordinating Group, 1994, p.3-19).

3. Logistics Section staff will utilize the Resource Directory discussed in the Planning Section of this document in their effort to procure the necessary equipment and supplies among cooperating agencies and organizations during a rapid response procedure.

d. Consider the need to assemble a science advisory panel that may include experts outside of the ICS organization to provide input on such topics as AIS biology, sampling techniques, eradication or control measures.

Step 5. Safety Plan

a. The standard ICS organization includes a Safety Officer who reports to the Incident Commander/Unified Command. One of the duties of the Safety Officer is to develop a Safety and Health Plan that assesses potentially hazardous situations that could exist throughout the operation for responders and the public, and outlines the safety measures that should be taken.

Step 6. Outreach

a. Outreach Plan: The incident's Information Officer develops an Outreach Plan for the incident that addresses short and long-term proactive communication objectives and strategies to be employed with relevant groups such as the media, government agency representatives outside of the ICS response, stakeholders, interest and community groups and the general public.

1. Develop policy with the Incident Commander(s) and the Liaison Officer regarding protocols for disseminating information.

2. Besides disseminating information the outreach plan should address obtaining input from stakeholder groups and other interested individuals.

b. The Media: Typically, the Information Officer is assigned to be the contact person for inquiries from the media.

1. Typical tasks include preparation of press releases, briefings, public meetings, etc.

2. The Information Officer reports to the Incident Commander.

c. Government Agencies: Typically, a Liaison Officer is assigned to be the point of contact for inquiries from government agencies that have an interest in the response.

1. The Liaison Officer provides relevant updates on the response to representatives from these agencies.

2. The Liaison Officer reports to the Incident Commander.

d. Stakeholder and Interest Groups: Outreach to these groups can be crucial, especially if their activities can result in spread of the mussel population. Outreach to non-governmental groups needs to be assigned to the Information Officer or the Liaison Officer. A large stakeholder group for a large incident may warrant their own Assistant Liaison Officer or Assistant Information Officer to maximize cooperation from this group and be aware of concerns they may have.

e. General Public: Assign who will be responsible for responding to inquiries from individual members of the public. Determine whether it is advisable to establish and publicize a toll-free call-in number for the incident.

Step 7. Training

a. Develop a Training Plan: There is often a need to establish a training branch within the ICS. As the incident begins to unfold, the Training Director will be responsible for working with managerial level staff to assess and find appropriate means to provide the

types of training that are needed, both for staff within the ICS and for cooperating agencies, organizations and volunteers.

1. A training manual should be developed that contains any specialized protocols and associated training materials (e.g. survey or decontamination protocols).

Step 8. Regulatory Compliance

a. The Planning Section is typically responsible for addressing regulatory compliance with environmental laws, with input from the Legal Specialist assigned to the incident. The issues that are most likely to arise are related to water quality and effects on state or federally listed species during survey or control activities.

Step 9. Containment Actions

a. Take action to prevent the spread of the mussel population. Examples of containment actions that might be taken include:

1. Inspections: Working with public and private managers of infested and potentially infested waterbodies and waterways, locate and inspect potentially contaminated facilities, shorelines, boats, vehicles and equipment to the extent possible. Prioritize a list of potential sites that should be inspected. Some of this work is part of the rapid assessment described below.

   a) Survey boaters about previous and subsequent waterways visited and provide them with information about the AIS problem.

   b) If regulations allow, require, or otherwise, request that aquatic plant and animal material be removed from the watercraft, motor and trailer and for any remaining water to be drained.

   c) Request that boats and equipment be rinsed with high pressure or hot water and dried before launching. The time needed for drying is species specific.

   d) Boats that are found to be contaminated with a legally restricted species per F&G Code Sec. 671 cannot be launched until they are certified by DFG to be decontaminated.

b. Introductions from Out-of-State: Coordinate with California Department of Food and Agriculture's Border Protection Station Program, federal, and other state and national agencies if the introduction is known to have come from out of state or has potential to have come from out of state.

c. Prevent Spread from Lake Tahoe: Coordinate with federal and state agencies on preventing spread from Lake Tahoe into other states (especially states that border CA), Canada or Mexico.

d. Temporarily quarantine body(ies) of water that contain subject AIS.

1. Establish a quarantine utilizing one of the methods discussed in legal authority section.

2. In addition to sites known to contain the subject AIS, consider whether it is appropriate to quarantine areas where the AIS may have been introduced.

Step 10. Rapid Assessment

a. Extent of the Infestation: Get a qualitative "snapshot" of the extent of the infestation and identify potential vectors for spreading the AIS.

1. Planning and Operations Section staff can work together to identify short vs. longer-term information needs and plan how various types of information should be gathered.

a) Samples may need to be collected for gathering basic demographic information or more in-depth taxonomic work. Establish protocol for collecting, transporting, and storing samples. Develop appropriate permits for possession and transportation of specimens.

b) In addition to noting the presence or absence of the AIS, consider whether it's appropriate to systematically get some basic information about the habitat at this point, collect samples of substrate or water, etc.

c) Determine whether there are known occurrences of, or potential habitat for, state or federally listed species in the area that needs to be surveyed, and whether surveys may require consultation with DFG, the U.S. Fish and Wildlife Service or NOAA Fisheries.

b. Data collection is typically done by the Operations Section of the ICS, with the Logistics and Finance Sections providing assistance with the procurement of equipment, vehicles, travel, etc.

c. Impacted Parties: Obtain contact information for pertinent landowners, land managers, holders of water rights, water users and jurisdiction over the body(ies) of water involved. If it is necessary to enter private property to conduct rapid response work, assign an ICS member to obtain permission to enter.

Step 11. Plan Eradication or Control Measures

a. If appropriate, develop a plan to eradicate the AIS from Lake Tahoe or a control plan to prevent the spread of the AIS. It may not be feasible to finalize the plan during the rapid or ICS phase of the response. Some planning may occur after the ICS is demobilized.

1. During the assessment phase of the response, the Planning Section can gather and review information on potential eradication or control techniques and confer with experts (Step 4D).

2. As information is gained from the rapid assessment, and possibly from subsequent detailed sampling, a more refined version of an eradication or control plan can be prepared, discussing the specific measurable objectives, locations and methods for eradication or control, methods for evaluating the effectiveness of the plan, and the potential costs, benefits and impacts.

3. Conduct any regulatory processes and obtain any regulatory permits that may be necessary prior to implementation of the plan.

Step 12. Implement the Eradication or Control Plan

a. Implementation of the eradication or control plan may place during the “rapid” part of a response; however, if this is not the case, eradication or control measures might be implemented during a later “post –ICS” phase of the response.

b. Document implementation of the eradication or control plan. Note any deviations from the plan and why those occurred.

Step 13. Prevent Reinfestation

a. Develop specific recommendations for actions that can be recommended to prevent reinfestation such as:

1. Long-term monitoring
2. Continued outreach and education
3. Partnerships with business and interest groups
4. Strengthening relevant regulations
5. Identify staffing needs
6. Identify research needs

b. Ensure the potential for introduction from nearby commercial operations (shipping, bait shops, aquaculture, and aquarium shops) is removed or minimized to the extent possible.

Step 14. Prepare Demobilization Plan

a. During the response, the Planning Section is responsible for preparation of a Demobilization Plan and having it approved by the Incident Commander(s). The purpose of the Demobilization Plan is to assure that all participants understand their role in an orderly, safe and efficient demobilization of incident resources as rapid response procedures are completed. Equipment and supplies must be returned to appropriate locations, time and cost accounting reports must be completed within required timeframes, and any other required progress and final reports must be prepared and submitted.

Step 15. Monitor the outcome of the Rapid Response

a. Evaluate Eradication or Control Efficacy: If eradication or control actions were taken during the response, monitor and evaluate the efficacy of the treatment(s) used and conduct environmental monitoring that may be necessary to meet regulatory compliance requirements. Prepare a monitoring report and submit a copy to the ISC. If the control or eradication measures require months or years implementing, these evaluation reports may take the form of periodic progress reports.

1. If the treatments were not successful or an acceptable level of progress is not being achieved, evaluate the potential for remedial measures to improve the results. If there is a strong possibility for improvement, propose possible remedial actions as part of the monitoring report.

b. If eradication or control measures were not taken, there may be a decision to conduct monitoring of the AIS population and provide monitoring reports to the LTAISWG and LTAISCC.

Step 16. Undertake remedial actions and long-term follow up

a. Remedial Action Approval: If there is efficacy monitoring prior to the demobilization of the incident and remedial actions are recommended, the Incident Commander(s) can approve the implementation of a remedial action plan and utilize the assembled rapid response personnel, assuming any environmental regulatory and/or fiscal issues are addressed.

b. Remedial Action Monitoring: Remedial actions and their results will require subsequent monitoring.

c. Follow-Up Actions: If longer-term actions are necessary, the Planning Section, with input from other rapid response personnel and outside expert input as necessary, will develop a follow-up plan that will be submitted to the LTAISCC.

Step 17. Implement the Demobilization Plan

a. Implement the demobilization plan described in Step 14. The work will be carried out by the Incident Teams and Specialists with oversight and coordination from the Incident Command Staff. Reports will be submitted to the ISC for approval and appropriate distribution.

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APPENDIX A- DREISSENID BIOLOGY

Appendix A: Dreissenid Biology

Density and Food Availability

Zebra or Quagga mussel densities within the Lake Tahoe Region could vary widely depending on water chemistry, food availability, and breeding population. After their initial introduction, mussel populations can rapidly increase by orders of magnitude, and then similarly decrease. Eurasian zebra mussel population densities range up to 40,000 mussels per square meter (Neumann et al. 1993). Under ideal conditions in the Laurentian Great Lakes, zebra mussel densities reach 700,000 – 800,000 per square meter (Kovalak et al. 1993). In the lower Mississippi River, where the zebra mussel has been introduced, densities of 400,000 per square meter have been reported (Kraft 1995). The Mississippi has an ideal environment for zebra mussels, in part because food resources are abundant (Kraft 1995). The Lake Tahoe's lower plankton densities in comparison to the Mississippi or Great Lakes, may limit zebra mussel population densities, though this has yet to be quantified.

Water Temperatures

Dreissenids can tolerate a wide range of water temperatures from roughly 32^0 to 86^0F (0 ^{0}F to 30^0 C) (Ohio Sea Grant 1997). North American zebra mussel spawning (release of gametes into the water column) will not generally occur at temperatures below about 12 °C (Claudi and Mackie 1994). There is evidence, however, that quagga mussels in deep waters of the Great Lakes are capable of spawning at temperatures near 5 °C (Roe and MacIsaac 1997) and 9 °C (Claxton and Mackie 1998).

Calcium Requirements

North American zebra mussel populations require 10 mg Ca^{2+}/l to initiate shell growth and 25 mg Ca^{2+}/l to maintain shell growth. Larval development is inhibited at pH of 7.4. Higher rates of adult survival occur at a pH of 7.0-7.5, but populations have been found in the hypolimnetic zone of lakes with a pH of 6.6-8.0, and in the epilimnetic zone with a pH of 7.7-8.5. Optimal larval survival occurs at a pH of 8.4, and optimal adult growth occurs at pH 7.4-8.0. (Benson and Raikow 2007).

Calcium concentrations could be a factor limiting dreissenid densities in the Lake Tahoe Region. Large populations of zebra mussels are not expected where calcium levels are less than 25 mg/l (Hincks and Mackie). Cohen and Weinstein (2001) found little evidence that zebra mussels can become established at ambient calcium concentrations below about 20mg/l. Calcium thresholds in the Lake Tahoe Region may be suboptimal for establishment of dreissenid populations (Whittier et al. 2008).

It should be noted that calcium may be elevated near concrete structures (Cohen and Weinstein 2001). This needs to be studied further in relation to the Lake Tahoe Region with its concrete marina infrastructures. In addition high calcium

concentrations have been found within Asian clam beds. Asian clams have been in Lake Tahoe since approximately 2001 and have established additional populations in relation to littoral lake currents.

History of Control Efforts

Although an attempt to eradicate a new dreissenid mussel infestation presents significant challenges, there is at least one documented success story. In 2002, the first introduction of zebra mussels in Virginia was confirmed in Millbrook Quarry. The 12-acre quarry is located on property under private ownership. The Virginia Department of Game and Inland Fisheries led an effort to eradicate this population. Over a three-week period in early 2006, the water body was treated with 174,000 gallons of potassium chloride solution over a 3-week period from January 31 to February 17, 2006. Potassium concentrations were measured weekly throughout the quarry and in adjacent surface waters to ensure a target concentration of 100 milligrams of potassium per liter of water (below the level that would have human health or significant ecological impacts, but over twice the minimum concentration needed to kill zebra mussels). No potassium leakage from the quarry into adjacent waters was detected.

Monitoring results demonstrated that lethal potassium concentrations were achieved at various depths. Several weeks after treatment ended, four independent methods were also used to confirm zebra mussel eradication. First, more than 1,000 mussels were sampled from rocks at numerous sites around the quarry; none were alive. Divers also visually inspected the quarry and could not find live zebra mussels. Next, an extensive video survey also was conducted using a robotic camera system, documenting dead zebra mussels. Finally, 80 sets of live zebra mussels (100 per set) were placed at various locations and depths within the quarry. After one month of exposure to the treated quarry water, mortality of these test mussels was 100% (as opposed to zero mortality of a control set placed in untreated water). Other aquatic life in the quarry (including turtles, fish, and aquatic insects) appear to be thriving after the treatment. As of the date of this Plan, no additional zebra mussels have been found in the quarry. It is important to note that this case involved infestation in a small, contained water body. Attempting to eradicate zebra or quagga mussels in a large lake system presents a very different set of challenges.

References

References for Appendix A are incorporated in the main document.

APPENDIX B

RAPID RESPONSE CHECKLISTS

APPENDIX B-Rapid Response Checklists

I.	Position Descriptions and Rapid Response Checklists	B-3
	MAC Group Chair	B-3
	MAC Group Members	B-7
	MAC Group Legal Counsel	B-10
	Coordination and Support Staff Manager	B-12
	Coordination and Support Staff Planning Coordinator	B-14
	Situation Analyst	B-19
	Resource Analyst	B-22
	Compliance Technical Specialist	B-24
	Technical Specialist	B-26
	Coordination and Support Staff Logistics Coordinator	B-28
	Communications Specialist	B-31
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	Joint Information Center Internal Information Officer	B-46
	Interagency Rapid Response Team Leader	B-48
II.	Field Operations Checklists	B-52

Appendix B: Rapid Response Checklists

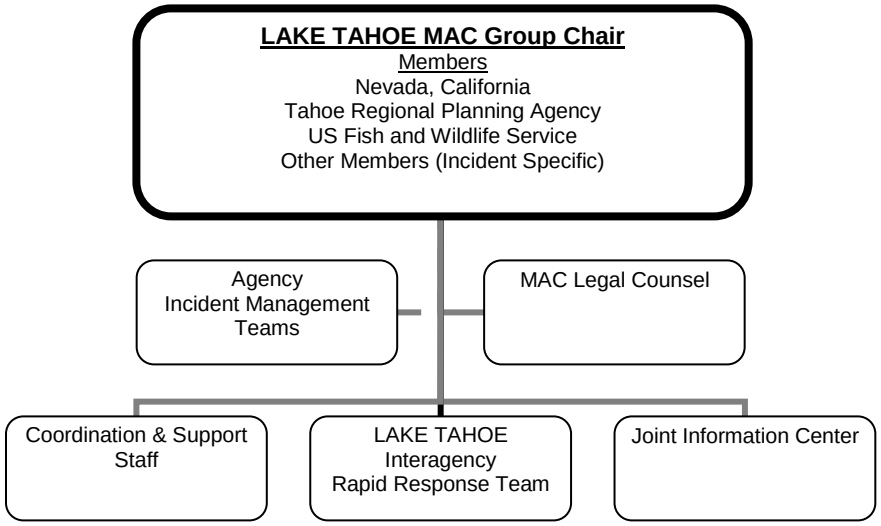
This appendix includes a review of rapid response objectives, and the Lake Tahoe Plan organizational structure. These discussions are followed by detailed position descriptions and rapid response checklists for coordination and field operations.

Note: The nature and scope of the invasive species threat in the Lake Tahoe Region as well as the deliberate flexibility of the NIMS organizational structure make it impossible to develop definitive position descriptions and checklists. Some incidents will not require activation of all elements, or completion of all tasks. Others may require that all elements of the organization be activated, and that additional tasks developed on a case-by-case basis. The organizational structure and information in this annex should be used as a guide to establish the response framework appropriate to the specific infestation.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***

Position:	**Reporting Relationships**:
MAC Group Chair	Reports to: Reports to this Position: ▪ Lake Tahoe Coordination and Support Staff Manager ▪ Lake Tahoe MAC Group Legal Counsel ▪ Interagency Rapid Response Team (IRRT) Leader ▪ Lake Tahoe Joint Information Center Manager

Location in Organization:



General Responsibilities:

The MAC Group Chair is selected by the standing members for a term of one year, and has responsibilities in all phases of the Lake Tahoe Invasive Species Planning Process.

- Mitigation: The Chair of the MAC Group will ensure that the signatories to the Plan pursue a coordinated and consistent approach to invasive species mitigation.
- Preparedness: The Chair of the MAC Group will ensure that the Lake Tahoe Rapid Response Plan is reviewed, exercised and revised to ensure currency.
- Response: The Chair of the MAC Group will serve as the facilitator for the MAC Group, and the liaison to the Coordination and Support Staff, MAC Legal Counsel, Joint Information Center and IRRT.
- Recovery: The Lake Tahoe MAC Chair will ensure that response activities are evaluated for lessons learned, and that these are incorporated into the Lake Tahoe

Plan as appropriate.

Lake Tahoe MAC Chair Response Checklist (page 1 of 3)

The following checklist is a guideline for the Chair of the Lake Tahoe MAC Group. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Activate appropriate members of the Lake Tahoe MAC Group.

____ Obtain initial briefing from Lake Tahoe Notification Coordinator.

____ Assess infestation situation.

- Review the current situation status. Ensure that all County, State and Federal agencies impacted by the infestation are notified.
- Determine probable scope and impact of infestation.
- Determine the need for/status of disaster declarations.
- Determine impact on commercial and recreational activities.
- Determine current priorities

____ Review current status of Lake Tahoe Coordination and Support Staff. Ensure appropriate staffing pattern has been established.

____ Brief Lake Tahoe MAC Group and Coordination and Support Staff

- Identify priorities, strategic considerations, and fiscal and policy directives for the management of the infestation.
- Determine the time and location of first Lake Tahoe MAC Group meeting.
- Define what agency contacts will be delegated to the Lake Tahoe Coordination and Support Staff and which will be retained by the Lake Tahoe MAC Group (for example, routine updates may be assigned to the Coordination and Support Staff, but policy-level communication may be retained by the MAC Group).

____ Establish External Communications System:

- Notify impacted County Commissioners and other elected officials of infestation, and keep them informed as to incident status and activities. Include in MAC Group meetings as appropriate.
- Authorize release of information to the media. Activate Joint Information Center as required.

____ Direct the call back of off-duty personnel as needed (keep in mind the possible need to staff additional shifts). Assess staffing needs for:

- IRRT
- Lake Tahoe Joint Information Center

- Establish what resources will be procured, managed and allocated through the Lake Tahoe MAC Group.

____ Determine information needs and inform staff of requirements.

<u>Lake Tahoe MAC Chair Response Checklist (page 2 of 3)</u>

____ Prioritize incidents daily, when new incidents occur, or if there is a major change in existing incidents. The following rankings may be used to prioritize incidents:

- 1st Priority-Infestations which can be contained and eradicated.
- 2nd Priority-Infestations which present a threat to essential infrastructure.
- 3rd Priority-Infestations which present a threat to commercial or subsistence activity.
- 4th Priority-Infestations which present a threat to recreational activity.
- 5th Priority-Infestations that present a threat to imperiled species or another significant ecological value.

____ Obtain and organize resources.

- Allocate scarce/limited resource to incidents based on priorities.
- Establish parameters for resource requests and releases.
  - Review requests for critical resources.
  - Approve assignment of IRRT upon request from impacted jurisdiction.
  - Confirm who has ordering authority within the organization and in impacted jurisdictions.
  - Define those orders which require Lake Tahoe MAC Group authorization.

____ Establish level of planning to be accomplished.

- Contingency Planning
- Formal Lake Tahoe MAC Group Meetings

____ Establish parameters for tactical response.

- Define those management plans which require Lake Tahoe MAC Group authorization. Coordinate authorization with responsible agency administrator and on-scene IMT(s).
- Review and approve proposed management plan(s).
- Authorize implementation of approved management plan(s).

____ Ensure Lake Tahoe MAC Group and Lake Tahoe Coordination and Support Staff coordination.

- Periodically check progress on assigned tasks of MAC and Coordination and Support Staff personnel.
- Approve necessary changes to strategic goals and action plans.

____ Ensure Inter-jurisdictional coordination.

- Ensure that all press releases are coordinated with other impacted jurisdictions and agencies.

<u>Lake Tahoe MAC Chair Response Checklist (page 3 of 3)</u>

- Ensure that agency Incident Management Teams are sharing information and coordinating activities as appropriate.
- Ensure that situation status is being shared with cooperating and assisting agencies.
- Ensure that logistical support requests are being handled efficiently.

____ Request emergency declaration as necessary. Ensure declaration is forwarded to impacted County Emergency Manager(s) (Counties must process request for disaster declaration from the Governor of the impacted State). Provide courtesy call to Governor's Office and Office of Emergency Management in affected State(s).

____ Review and approve disaster assessment statements from Lake Tahoe Coordination and Support Staff prior to forwarding to County(ies) and State(s).

____ Facilitate meetings. Ensure documentation of decisions and actions taken.

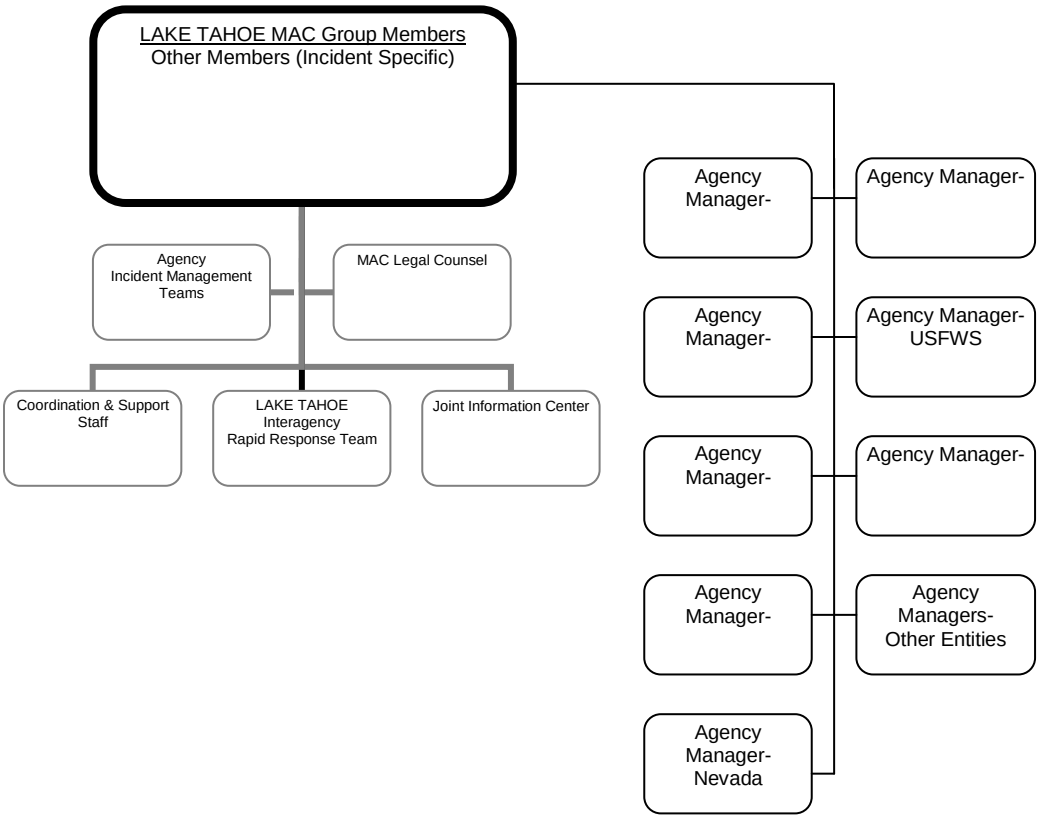
____ Ensure post action review is conducted, and lessons learned are captured and incorporated into training and Plan revisions and updates.

- Conduct a follow-up evaluation of response organizations and other interest groups to identify opportunities for improving rapid response capacity. Disseminate "lessons learned" to other interested organizations (e.g., regional ANS panels).
- Revise the Rapid Response Plan and associated documents/guidelines based on evaluation and long-term monitoring results.
- As resources allow, develop and implement a research plan that evaluates the associated ecological and economic impacts of the invasion, the effectiveness of management interventions, and negative consequences of management interventions (beyond that required by permits).
- Determine the need for long-term funding for the current management effort and seek this funding as warranted.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: MAC Group Member	**Reporting Relationships**: Reports to: Elected Officials Reports to this Position: Agency/Entity Managers

Location in Organization:



General Responsibilities:

Lake Tahoe MAC Group members are responsible for assisting the Lake Tahoe MAC Chair in prioritizing infestations, allocating scarce resources, and establishing policy for management of the incident. **Lake Tahoe MAC Group members must have the authority to commit their agencies/entities to the decisions developed by the Lake Tahoe MAC Group.** Lake Tahoe MAC Group members are responsible for:

- assessing the impact of the infestation on their agencies or entities
- adjusting personnel, financial, and other resources to meet the needs of the incident and to continue service delivery.
- approving appropriate control options and incident priorities.
- ensuring that the priorities and policies formulated by the Lake Tahoe MAC Group are implemented by their agencies/entities.

Lake Tahoe MAC Group Members Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Confirm identification and appointment of MAC Chair (this may be done annually).

____ Obtain initial briefing from Lake Tahoe MAC Chair, Lake Tahoe Coordination and Support Staff Manager and impacted jurisdictions.

- Identify priorities, strategic considerations, and fiscal and policy directives for the management of the emergency.
- Determine the time and location of first Lake Tahoe MAC Group meeting.
- Determine which agency contacts will be yours to establish and maintain.

____ Assess infestation.

- Determine probable scope and impact of infestation.
- Determine the need for/status of disaster declarations.
- Determine impact on services
- Project impact on budget allocations
- Determine current resource priorities
- Assess adequacy of current resources
- Identify available resources
- Identify needed resources
- Assign resources as requested

____ Assist the Lake Tahoe MAC Chair in identifying additional agencies/entities that should be included in the Lake Tahoe MAC Group.

____ Inform Lake Tahoe MAC Chair if emergency will impact the agency's ability to meet current work assignments, or will exceed budget allocations.

____ Review current policies, procedures and agreements for resource sharing. Determine status of implementation. Implement or suspend as appropriate.

____ Anticipate future resource needs.

____ Direct the call back of off duty personnel as needed (keep in mind the possible need to staff additional shifts). Assess staffing needs for:

- Lake Tahoe Coordination and Support Staff
- Lake Tahoe Joint Information Center
- IRRT

____ Approve the assignment of the IRRT as requested by the responsible jurisdiction.

____ Determine information needs and inform staff of requirements.

<u>Lake Tahoe MAC Group Members Response Checklist (page 2 of 2)</u>

____ Ensure that agency personnel observe protocols for resource requests and releases.

____ Participate in Lake Tahoe MAC Group Meetings as scheduled by the Lake Tahoe MAC Chair:

____ With assistance from on-scene representative(s), identify impact of the infestation on your agency/entity. Assist Lake Tahoe MAC Group Chair in establishing incident priorities.

____ With assistance from on-scene representative, identity resource shortages. Assist Lake Tahoe MAC Group Chair in allocating scarce resources according to incident priorities.

____ Identify policies and procedures to facilitate management of the infestation. Assist the Lake Tahoe MAC Chair and Lake Tahoe MAC Legal Counsel in determining appropriate changes.

____ Ensure interagency/inter-jurisdictional coordination.

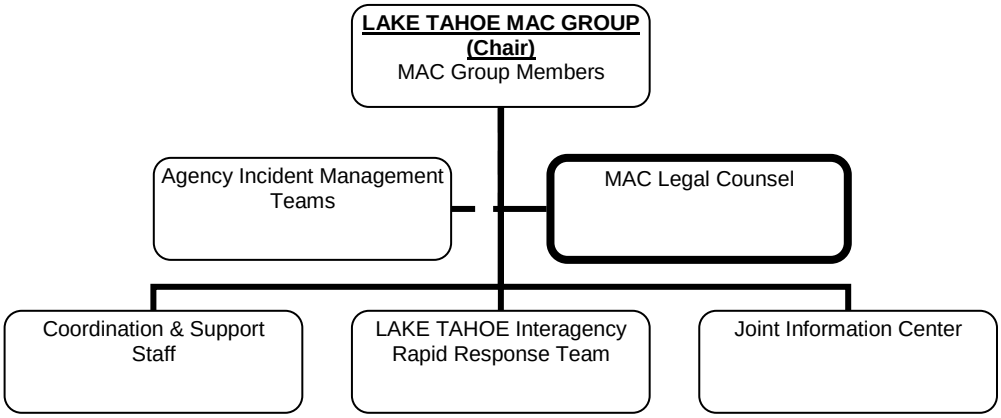
- Make periodic contact with assigned agencies and jurisdictions.
- Ensure that all agency/entity press releases are coordinated with the Lake Tahoe MAC Public Information Officer and/or the Joint Information Center.
- Ensure that situation status is being shared with cooperating and assisting agencies.
- Ensure that logistical support requests are being handled efficiently.

____ Direct agency/entity managers to implement decisions of the Lake Tahoe MAC Group. Monitor outcomes.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: MAC Group Legal Counsel	**Reporting Relationships**: Reports to: MAC Group Chair

Location in Organization:



General Responsibilities:

The Lake Tahoe MAC Group Legal Counsel serves as the Lake Tahoe MAC Legal Counsel, a member of the Lake Tahoe MAC Group Support staff, and is responsible for:

- advising the Lake Tahoe MAC Group in matters of legal authority and responsibility,
- assisting in the drafting of interagency and private-sector agreements necessary to manage the infestation
- advising the Lake Tahoe MAC Group on issues of regulatory compliance,
- coordinating legal issues with outside legal counsel, and
- assisting in the formulation of policies and procedures to manage the infestation.

Lake Tahoe MAC Group Legal Counsel Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from Lake Tahoe MAC Chair. Determine:

- What emergency codes, authorities, or provisions have been implemented or anticipated.
- Regulatory and environmental compliance issues.
- Status of disaster declarations.
- What interagency agreements have been implemented?
- What interagency or private-sector agreements are needed?
- Any known or anticipated legal ramifications of the infestation or proposed management activities.

____ Confirm the assignment of the Coordination and Support Staff Compliance Technical Specialist. Assist as necessary with processing required regulatory compliance applications.

____ Research legal issues associated with management of the infestation. Prepare and present legal opinions to Lake Tahoe MAC Group.

____ Assist in the formulation of policies and procedures as appropriate.

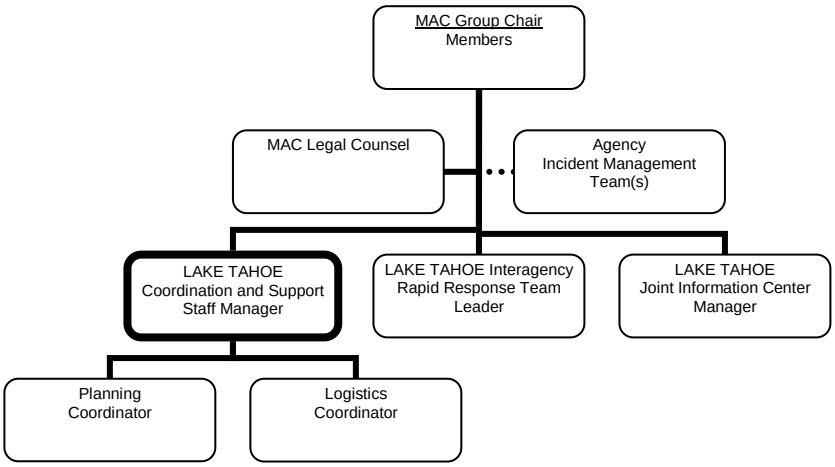
____ Coordinate with legal counsels from cooperating and assisting agencies, and other impacted agencies and jurisdictions as necessary to develop a consistent legal approach to management of the infestation.

____ Attend Lake Tahoe MAC Group Planning Meetings.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: Coordination and Support Staff Manager	**Reporting Relationships**: Reports to: MAC Group Chair Reports to this Position: ▪ Planning Coordinator ▪ Logistics Coordinator

Location in Organization:



General Responsibilities:

The Lake Tahoe Coordination and Support Staff Manager ensures that accurate and timely situation and resource status is provided to the Lake Tahoe MAC Group so that policy can be made, incidents prioritized, and resources allocated. The Manager also assists in ensuring that the organization has the resources it needs to respond to the infestation.

This responsibility has been divided into two general areas, Planning and Logistics:

- Planning requires the activation and management of subject matter experts whose skills and knowledge are vital to confirming the presence of dreissenids, the extent of the infestation, and the most appropriate control actions.
- Logistics requires providing the communications, facilities, and other support required by the MAC Group itself, as well as assisting in the identification, procurement, and delivery of resources that may be required to manage the infestation itself.

The Coordination and Support Staff Manager is responsible for activating and supervising staff assigned to Planning and Logistics.

The individual filling the position of Lake Tahoe MAC Group Chair may also fill the Lake Tahoe Coordination and Support Staff Manager position. In long term or very complex

infestation management efforts, it may be necessary to fill both positions.

Lake Tahoe Coordination and Support Staff Manager Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from Lake Tahoe Notification Coordinator, Incident Commanders, and/or MAC Group Chair.

____ Staff Planning and Logistics Coordinators as appropriate.

____ Confirm that Priority 1 notifications have been completed.

____ Confirm that positive identification of dreissenid species has occurred.

____ Complete or obtain completed ICS form 201 Incident Briefing, ICS Form 232 Resources at Risk and ICS Form 209 Incident Status Summary (see Appendix H for blank forms).

____ Ensure that Lake Tahoe MAC Group room is set up, including resource and situation status displays.

____ Notify and convene appropriate subject matter experts to assist in confirming the presence of dreissenids, the extent of the infestation, and control and management options. Ensure that resource and situation status information is accurate, current, and complete.

____ Develop situation and resource status reports.

____ Brief Lake Tahoe MAC Group.

____ Advise the Lake Tahoe MAC Group on general emergency management issues and procedures.

____ Assist in obtaining and organizing resources.

- Identify scarce resources;
- Research location and availability of additional resources
- With approval of the Lake Tahoe MAC Group, procure and assign additional resources.

____ Determine Lake Tahoe MAC Group Schedule. Ensure Lake Tahoe Coordination and Support Staff provide required information to meet time lines.

____ Document actions taken by the Lake Tahoe Coordination and Support Staff. Provide copies to Planning Coordinator.

____ Brief Lake Tahoe Coordination and Support Staff on decisions made by the Lake Tahoe MAC Group. Ensure decisions are implemented.

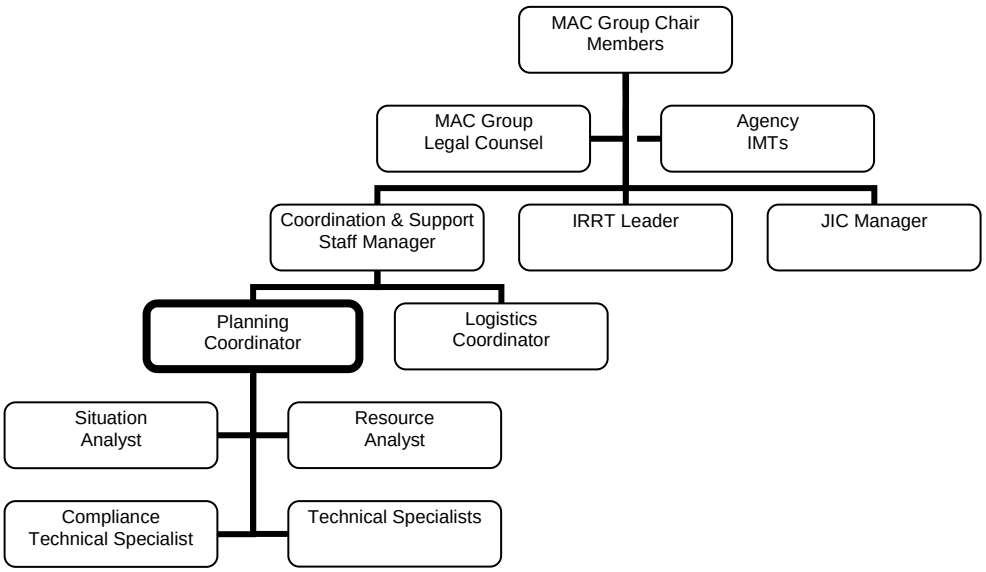
____ Attend Lake Tahoe MAC Group Planning Meetings.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***

Position:	**Reporting Relationships**:
Coordination and Support Staff Planning Coordinator	Reports to: Coordination and Support Staff Manager Reports to this Position: ▪ Situation, Resource Analysts, ▪ Compliance Technical Specialist ▪ Technical Specialists

Location in Organization:



General Responsibilities:

The Planning Coordinator is responsible for the collection, evaluation, dissemination, and use of information about the development of the infestation and status of resources. Information is needed to: 1) understand the scope and implications of the infestation, 2) predict probable course of the infestation, and 3) prepare alternative strategies and control operations for the infestation.

The Planning Coordinator activates, assigns, and supervises Analysts and Technical Specialists who are subject matter experts in their areas of expertise. The Technical Specialists required will vary depending on the nature and location of the infestation, but may include:

- Biologists
- Experts in environmental compliance

- Hydrologists
- Meteorologists.

The Planning Coordinator is responsible for completing a variety of situation status forms to document analysis, management plans, and resource status. These include, but are not limited to the ICS form 201 Incident Briefing, ICS Form 232 Resources at Risk and ICS Form 209 Incident Status Summary (see Appendix H for blank forms).

The Planning Coordinator is also responsible for developing and/or procuring maps, situation and resource status displays, etc. for the use of the Coordination and Support Staff and the MAC Group.

Planning Coordinator Response Checklist (page 1 of 3)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the infestation.

____ Obtain briefing from the Lake Tahoe Coordination and Support Staff Coordinator.

- Determine current resource status
- Determine current situation status
- Determine current strategic goals and tactical objectives
- Determine time and location of first Lake Tahoe MAC Group Planning Meeting.
- Determine desired contingency plans.

____ Activate Situation and Resource Analysts and Technical Specialists as necessary.

____ Assist in obtaining and organizing resources:

- Establish and maintain resource tracking system.
- Identify scarce resources. Identify need for specialized resources; discuss need with Lake Tahoe Coordination and Support Staff Manager; assist in identifying sources and availability of additional resources. Facilitate resource requests with Logistics.
- Form, deploy, and supervise technical specialist teams.

____ Develop situation and resource reports for the Lake Tahoe MAC Group according to the schedule set by the Lake Tahoe MAC Group Chair and the Lake Tahoe Coordination and Support Staff Manager.

____ Advise Lake Tahoe Coordination and Support Staff Manager of any significant changes in incident status.

____ Compile and display infestation status summary information.

- Forward infestation status summary reports to Priority 1 agencies/entities according to schedule established by the Lake Tahoe Coordination and Support Staff Manager.
- Provide copy to JIC and local entity Public Information Officer(s).

____ Obtain/develop infestation maps.

____ Establish information requirements and reporting schedules for Lake Tahoe Coordination and Support Staff and impacted entity/agencies.

____ Ensure sampling and monitoring plan has been developed and implemented (long-term monitoring is the responsibility of the responsible agency/lead entity).

____ Prepare contingency plans and containment/control recommendations.

- Review current and projected infestation and resource status.

- Develop alternative strategies.

<u>Planning Coordinator Response Checklist (page 2 of 3)</u>

- Identify resources required to implement contingency plan.
- Document alternatives for presentation to Lake Tahoe MAC Group.

____ Identify and establish communications points with agencies responsible for compliance issues.

____ Notify Planning Coordinator of Compliance staff activated, including names and location of assigned personnel.

____ Prior to Lake Tahoe MAC Group meetings, meet with Lake Tahoe Coordination and Support Staff Manager and Lake Tahoe MAC Group Chair to discuss proposed strategy and tactics and diagram infestation organization and resource locations.

____ Attend Lake Tahoe MAC Group Meeting.

____ Participate in preparation of MAC Group Management Plan.

- Provide input on regulatory and environmental compliance issues, including approval status, estimated timelines, etc.
- Prepare the compliance assignments for the next operational period based on the contingency plans approved at the Lake Tahoe MAC Group meeting.
- Identify future operational strategies, so as to anticipate compliance requirements

____ Prepare and submit compliance documents in a timely fashion. Coordinate review with Lake Tahoe MAC Legal Counsel as needed.

____ Supervise preparation and distribution of the written MAC Group Management Plan, if indicated. Minimum distribution is to all Lake Tahoe MAC Group Members, the IRRT, and local IMTs.

- Establish information requirements and reporting schedules for use in preparing the IAP.
- Ensure that detailed contingency plan information is available for consideration by the IRRT and local IMTs.
- Verify that all support and resource needs are coordinated with Logistics Section prior to release of plan.
- Coordinate changes with Lake Tahoe Coordination and Support Staff, IRRT, and local IMTs. Obtain approval from Lake Tahoe MAC Group Chair. Distribute written changes as appropriate

____ Coordinate preparation of the MAC Communications Plan with Lake Tahoe Logistics Coordinator.

____ Provide periodic predictions on infestation potential.

____ Establish a weather data collection system when necessary.

____ Ensure Section has adequate coverage and relief.

Planning Coordinator Response Checklist (page 3 of 3)

____ Hold Section meetings as necessary to ensure communication and coordination among planning staff.

____ Ensure preparation of demobilization plan (if appropriate).

____ Ensure preparation of final incident package. Route to US Fish and Wildlife Service for archiving or follow-up.

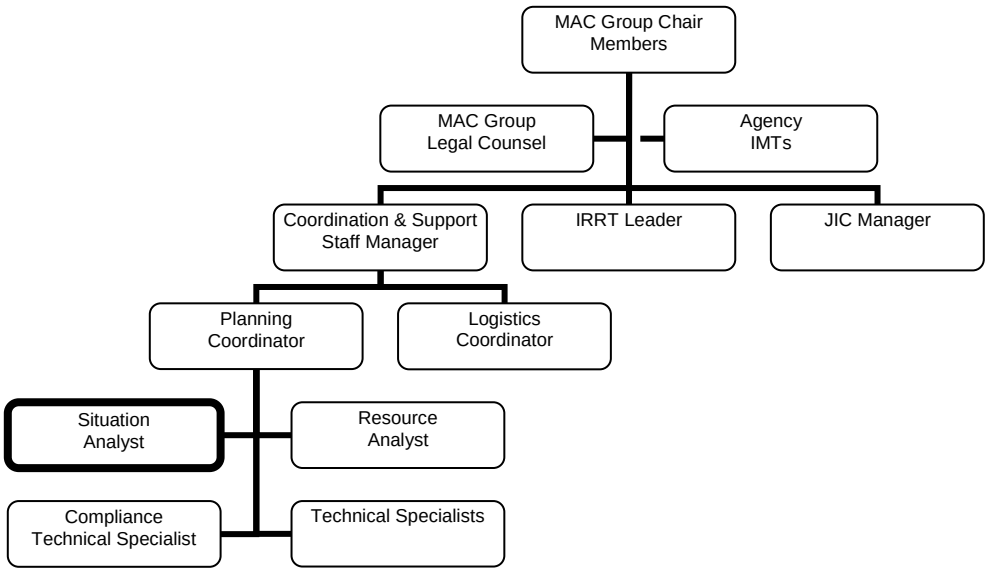
____ Provide briefing to relief on current and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***

Position:	**Reporting Relationships**:
Situation Analyst	Reports to: Planning Coordinator Reports to this Position: Technical Specialists

Location in Organization:



General Responsibilities:

The Situation Analyst is responsible for the collection and evaluation of information about the infestation. The Situation Analyst assigns and supervises Technical Specialists who are subject matter experts in their areas of expertise. Responsibilities will vary depending on the nature and location of the infestation, but may include:

- Determining the scope of the infestation.
- Confirming the presence and positively identifying the invasive species.
- Identifying the source of the infestation.
- Identifying and quantifying resources at risk.
- Researching likelihood of success and possible effects of proposed control options.
- Developing and recommending most appropriate control plan.

The Situation Analyst is responsible for completing a variety of situation status forms to document analysis and management plans. These include, but are not limited to the ICS form 201 Incident Briefing, ICS Form 232 Resources at Risk and ICS Form 209 Incident Status Summary (see Appendix H for blank forms).

The Situation Analyst is also responsible for developing and/or procuring maps, and situation status displays, etc. for the use of the Coordination and Support Staff and the MAC Group.

Situation Analyst Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Planning Coordinator.

- Review current incident status
- Determine current strategy, assess effectiveness
- Determine necessary reports and plans
- Identify reporting requirements and schedules-both internal and external to the incident.

____ Organize and staff unit as appropriate.

- Form, assign, and supervise Technical Specialists groups as necessary.
- Establish reporting requirements, including schedule and format.
- Request additional Technical Specialists as needed.

____ Supervise Technical Specialists as assigned.

- Brief Technical Specialists on current incident status.
- Assign analysis tasks.
- Notify staff of time lines and format requirements
- Monitor progress

(On very complex incidents, it may be necessary to assign a supervisor to oversee Technical Specialists).

____ Compile, maintain and display incident status information for MAC Group and Coordination and Support Staff.

- Sort data into required categories of information (i.e. geographic area, environmental values at risk, location of operations, etc.)
- Determine appropriate map displays
- Review all data for completeness, accuracy, and relevancy prior to posting.
- Plot infestation boundaries, location of perimeters, facilities, access routes, etc. on display maps.
- Develop additional displays (weather reports, incident status summaries, etc.) as necessary.
- Ensure displays and maps are kept up to date.

____ Provide photographic services and maps.

- Provide timely photo processing.
- Develop specialized maps.

Situation Analyst Response Checklist (page 2 of 2)

____ Provide situation evaluation, prediction and analysis for the MAC Group prepare information on alternative strategies.

- Review current and projected infestation and resource status.
- Develop alternative strategies.
- Identify resources required to implement management plan.
- Document alternatives for presentation to MAC Group.

____ Interview operations personnel to determine effectiveness of strategy and tactics, work accomplished and left to be accomplished.

____ Request weather forecasts as necessary. Spot weather forecasts may be requested directly from the National Weather Service.

____ Prepare incident status summary form (ICS209L) and other status reports as assigned prior to each MAC Group Planning Meeting. Provide copies to Coordination and Support Staff and MAC Group. Forward to other entities as directed.

____ Participate in MAC Group planning meetings as required.

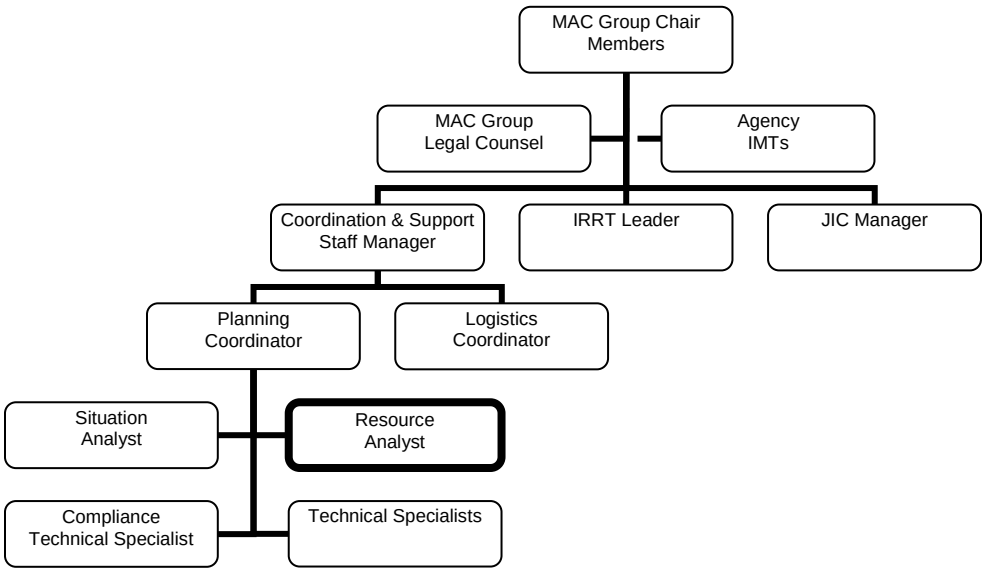
____ Prepare predictions at periodic intervals, or upon request of the Planning Coordinator. Notify Planning Coordinator if unforeseen changes occur.

____ Provide briefing to relief on current and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: Resource Analyst	**Reporting Relationships**: Reports to: Planning Coordinator Reports to this Position: Technical Specialists

Location in Organization:



General Responsibilities:

The Resource Analyst is responsible for the collection and display of critical/scarce resource status, and for assisting in researching and locating additional resources required to manage the infestation.

Resource Analyst Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from the Planning Coordinator. Determine what resources are considered scarce/critical.

____ Organize, staff, and supervise unit as appropriate. Provide for adequate relief.

____ Establish contact with incident information sources to determine what scarce/critical resources have been assigned to the incident, their status, and location.

____ Compile, maintain and display scarce/critical resource status information.

____ Participate in MAC Group planning meetings as assigned.

____ Brief relief on current and unusual situations.

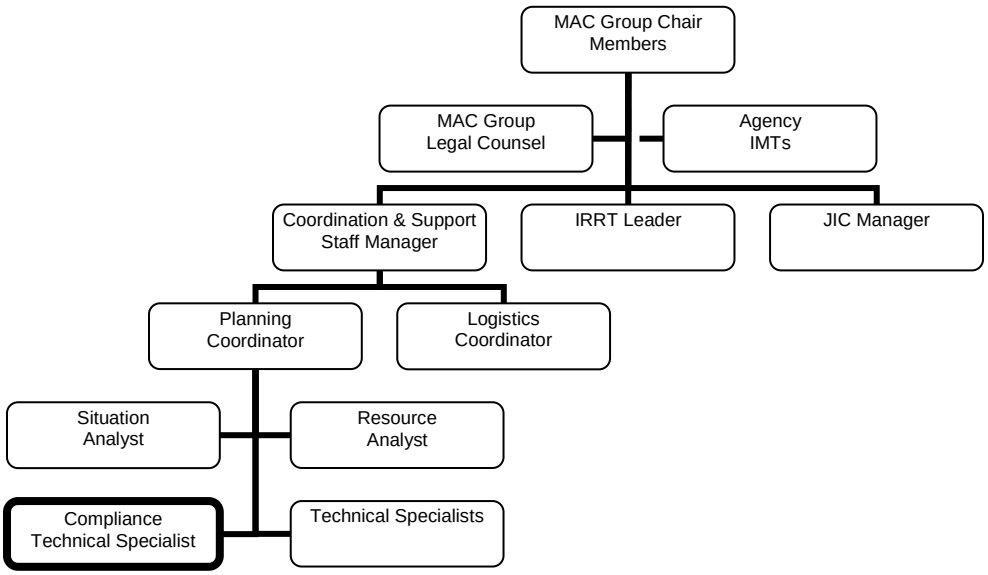
____ Assist in identification of additional and special resources
- Other disciplines
- Technical specialists
- Resources needed to implement proposed management plans

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***

Position:	**Reporting Relationships**:
Compliance Technical Specialist	Reports to: Planning Coordinator

Location in Organization:



General Responsibilities:

The Compliance Technical Specialist assists in identification and compliance with applicable regulatory issues, applications, and other authorizations. Tasks may include:

- Analyzing proposed management plans for regulatory implications.
- Preparing necessary applications, justification for waivers, etc. that may be necessary before the proposed management plan can be implemented.
- Coordinating applications, justifications, etc. with the MAC Group Legal Counsel as necessary.
- Advising the Planning Coordinator and the MAC Group on regulatory and compliance issues.

Compliance Technical Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Planning Coordinator.

____ Obtain copies of proposed management plans.

____ Identify regulatory issues related to the proposed management plan(s).

____ Complete applications, requests for waivers, etc. according to required format and timelines.

____ Advise Planning Coordinator of timelines for review and approval. Timelines may affect choice of management plan.

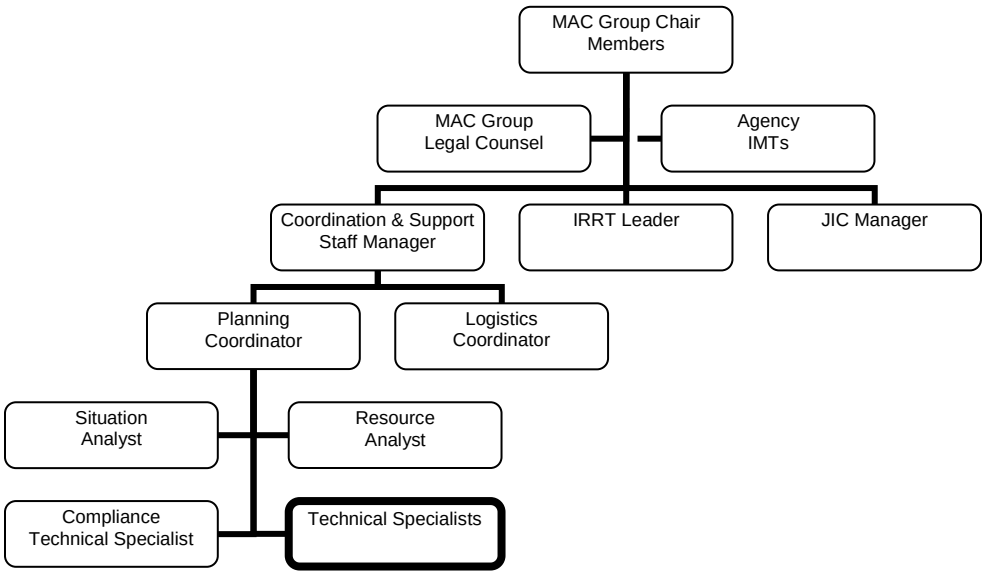
____ Participate in MAC Group planning meetings as requested.

____ Provide technical expertise to supervisor in organization according to established format, timelines, etc.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: Technical Specialist	**Reporting Relationships**: Reports to: Planning Coordinator, Situation Analyst or other positions as assigned.

Location in Organization:



General Responsibilities:

Technical Specialists are advisors with special skills needed to support incident operations. Technical Specialists may report to the Planning Coordinator or Situation Analyst, or to other parts of the organization such as the on scene Incident Management Team, or to the IRRT.

Technical Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions, others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Planning Coordinator.

- Identify supervisor in organization.
- Determine nature and scope of assignment.
- Identify work location, resources available, expectations of Incident organization concerning time-lines, report format, participation in planning meetings, etc.

____ Obtain copies of management plans or Incident Action Plan (if available).

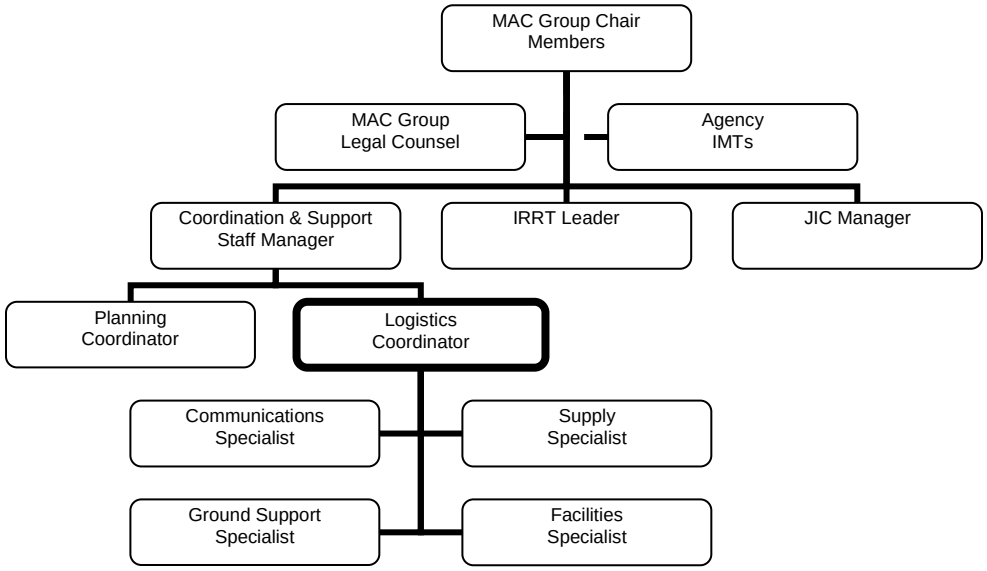
____ Participate in planning meetings as requested.

____ Provide technical expertise to supervisor in organization according to established format, timelines, etc.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: Coordination and Support Staff Logistics Coordinator	**Reporting Relationships**: Reports to: Coordination and Support Staff Manager Reports to this Position: ▪ Supply Specialist, ▪ Facilities Specialist, ▪ Ground Support Specialist • Communications Specialist

Location in Organization:



General Responsibilities: The Logistics Coordinator, a member of the Lake Tahoe Coordination and Support Staff, is responsible for providing facilities, services, and materials (except tactical aircraft) in support of the MAC Group and the on-scene operations managing response to the infestation. Tasks associated with these responsibilities may include, but are not limited to:

- Identifying and procuring facilities for the MAC Group, Coordination and Support Staff, and on-scene incident management team.
- Arranging for hotel rooms and food for the MAC Group, Coordination and Support Staff, and on-scene incident management team.
- Designing, procuring, and implementing communications systems and equipment in support of the MAC Group, Coordination and Support Staff, and on-scene incident management team.
- Assisting in the identification and procurement of resources needed to manage the infestation.

Providing transportation for personnel and materials to the scene of the infestation

Coordination and Support Staff Logistics Coordinator Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the infestation.

____ Obtain briefing from the Lake Tahoe Coordination and Support Staff Manager.
- Review Situation and Resource status for number of personnel assigned to incident.
- Review current MAC Group organization

____ With approval from the Lake Tahoe Coordination and Support Staff Manager, determine system for request and release of additional resources.

____ Assess adequacy of current MAC communications plan.

____ Organize and staff Logistics staff as appropriate. Consider the need for facility security, Communications, and Supply Specialists.

____ Assemble, brief, and assign work locations and preliminary work tasks to Logistics personnel.
- Provide summary of infestation situation
- Provide summary of the kind and extent of support the Lake Tahoe Coordination and Support Staff Logistics organization may be asked to provide.

____ Notify Planning Coordinator of Logistics staff activated, including names and location of assigned personnel.

____ Attend Lake Tahoe MAC Group Meeting.

____ Participate in preparation of MAC Group Management Plan.
- Provide input on resource availability, support needs, identified shortages, and response time-lines for key resources.
- Prepare the Logistics assignments for the next operational period based on the operational objectives generated at the Lake Tahoe MAC Group planning meeting.
- Identify future operational needs (both current and contingency), so as to anticipate logistical requirements
- Ensure MAC Communications Plan is prepared.

____ Establish contact with adjoining and mutual aid cooperators.

____ Review Incident Action Plan and estimate section needs for next operational period; order relief personnel if necessary.

____ Assist in obtaining and organizing resources.

- Research availability of additional resources.
- Process requests for scarce resources.

<u>Coordination and Support Staff Logistics Coordinator Response Checklist (page 2 of 2)</u>

- Provide resource identification information and arrival times with on-scene Logistics Section Chief.

____ Hold Logistics staff meetings as necessary to ensure communication and coordination among Logistics staff.

____ Ensure coordination between Logistics and LTAISCC & WG.

____ Ensure general welfare and safety of section personnel.

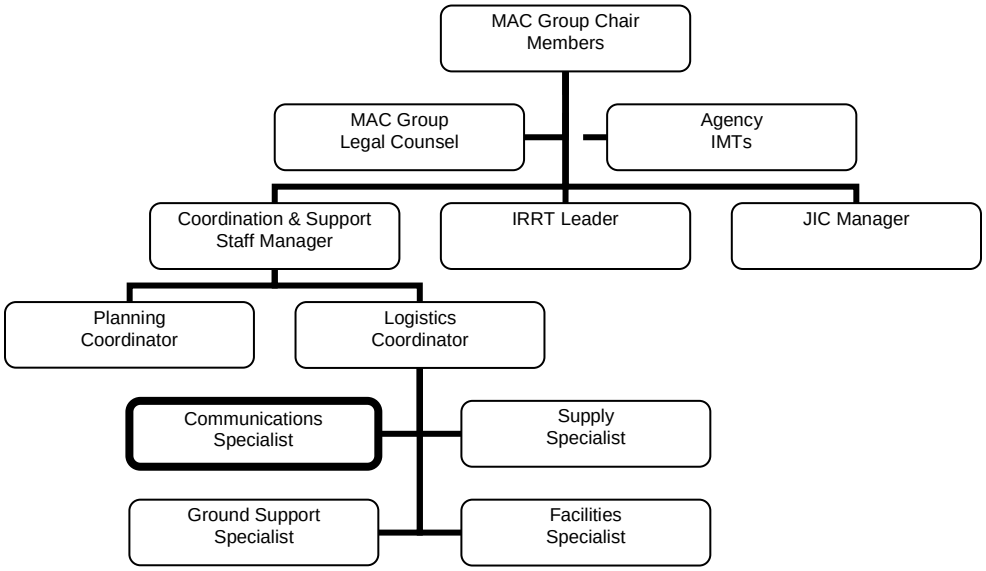
____ Provide briefing to relief on current activities and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***

Position:	**Reporting Relationships**:
Communications Specialist	Reports to: Logistics Coordinator Reports to this Position: ▪ Communications Technicians ▪ Communications providers

Location in Organization:



General Responsibilities:

The Communications Specialist is responsible for designing and implementing communications plans to support the Lake Tahoe MAC Group and the on-scene operations. Tasks may include:

- Identifying communications modes already in use.
- Determining additional communications support that may be required.
- Identifying and activating sources of communication support.
- Developing a communications plan to ensure effective communication between the MAC Group, its constituent agencies/entities, and the on-scene Incident Management Team.

Communications Specialist Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from the Logistics Coordinator.

____ Organize and staff unit as appropriate.
- Ensure adequate staff is assigned to answer phones and email and attend fax machines.

____ Assess communications systems in use; determine communications capabilities/limitations.

____ Develop and implement effective communications procedures (flow) internal and external to the Coordination and Support Staff.

____ Assess phone load. Activate additional lines as needed.

____ Prepare and implement MAC Communications Plan.
- Obtain current organizational chart
- Identify email addresses, cellular and land-line telephone numbers, or radio links for the following:
  - MAC Group Chair
  - Coordination and Support Staff (including Technical Specialists assigned to the field).
  - MAC Group Members
  - Constituent agencies/entities
  - JIC
  - Local/national press
  - Incident Management Team
  - MAC Group Legal Counsel
  - IRRT Leader

____ Determine need and research availability of additional nets and systems. Order through Supply Specialist after approval by Logistics Coordinator.

____ Document malfunctioning communications equipment, facilitate repair.

____ Establish and maintain communications equipment accountability system.

____ Provide technical information, as required, on:
- Adequacy of communications system currently in use.
- Geographic limitation on communications equipment.
- Equipment capabilities.

Communications Specialist Response Checklist (page 2 of 2)

- Amount and types of equipment available.
- Anticipated problems in the use of communications equipment.

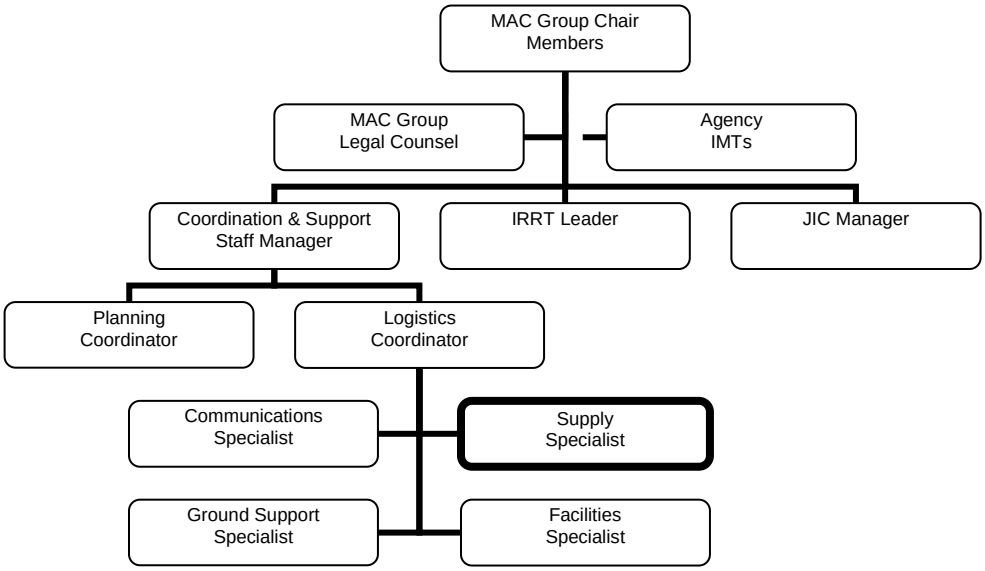
____ Estimate unit needs for expected operations; order relief personnel.

____ Provide briefing to relief on current activities and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: Supply Specialist	**Reporting Relationships**: Reports to: Logistics Coordinator Reports to this Position: ▪ Ordering staff ▪ Technical Specialists-Resources

Location in Organization:



General Responsibilities:

The Supply Specialist is responsible for ordering, receiving, and storing all resources needed to support MAC Group Operations. Tasks may include:

- Identifying and purchasing general office supplies and other resources.
- Activating additional staff upon request from other MAC Group staff.
- Maintaining accountability for resources purchased.
- Identifying and ordering scarce/critical resources.

Supply Specialist Response Checklist (page 1 of 2)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Logistics Coordinator
- Determine charge code or purchasing process for incident.
- Confirm ordering process
- Determine scope of supply process (on scene and MAC Group)

____ Organize and staff unit as appropriate.
- Consider need for "lead agency" representation in ordering process
- Consider dividing ordering responsibilities either by discipline or by type (equipment, personnel, supplies)

____ Determine ordering parameters, authorities and restrictions. Ensure that ordering staff observe ordering system and chain of command for ordering.

____ Contact Resource Analyst to determine what resources are scarce/critical.

____ Receive resource orders from authorized staff. Document:
- Qualifying specifications (size, extra equipment, personnel protective equipment, qualifications, etc.),
- Desired delivery time and location, person ordering, and person to whom the resource should report or be delivered.
- Obtain estimated price for resources which expect reimbursement.
- Ensure rented equipment is inspected before use.

____ Order, receive, distribute, and store supplies and equipment.
- Obtain resource name, number, identifiers, etc., along with ETA's.
- Relay this information to appropriate staff.

____ Advise affected personnel of changes in arrival times of requested resources. Advise immediately if order cannot be filled.

____ Alert Logistics Coordinator to changes in resource availability which may affect incident operations.

____ Maintain inventory of supplies and equipment.

____ Keep and submit copies of all orders and related documentation to the Planning Coordinator.

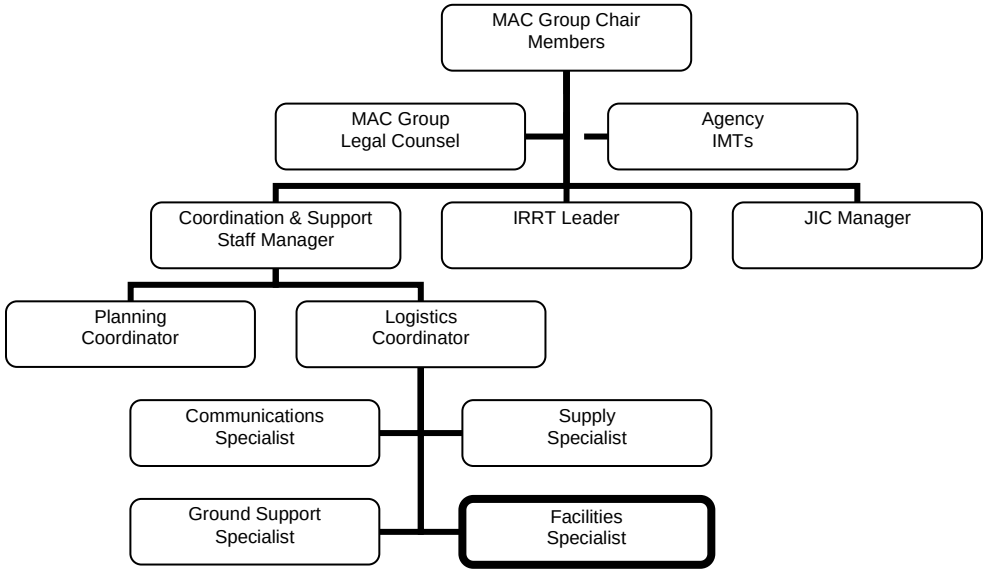
Supply Specialist Response Checklist (page 2 of 2)

____ Brief relief on status of outstanding orders, current activities, and unusual situations.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: Facilities Specialist	**Reporting Relationships**: Reports to: Logistics Coordinator

Location in Organization:



General Responsibilities:

The Facilities Specialist is responsible for the layout and activation of facilities required to support the MAC Group, including office space, meeting rooms, and the JIC. The Facilities Specialist also ensures that staff has sleeping accommodations, and identifies and arranges for food to be delivered to staff who are unable to leave their work assignments to eat. Tasks may include:

- Identifying appropriate office/workspace for the MAC Group and its support elements.
- Negotiating use agreements for workspace.
- Making reservations for hotel/motel rooms.
- Identifying easily accessible restaurants.
- Arranging for food and coffee service as necessary.

Facilities Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from the Logistics Coordinator.
- Expected duration and scope of the incident.
- Anticipated facility needs.

____ Assess need for additional workspace.

____ Determine requirements for each facility to be established.
- Workspace
- Meeting rooms
- Sanitation
- Supply area
- Communications needs (including computers)
- Security needs
- Break areas
- Parking

____ Plan facility layouts in accordance with above requirements.

____ Coordinate negotiation for rental office or storage space:

____ Video or photograph rental office or storage space prior to taking occupancy.

____ Make hotel reservations for staff as necessary.

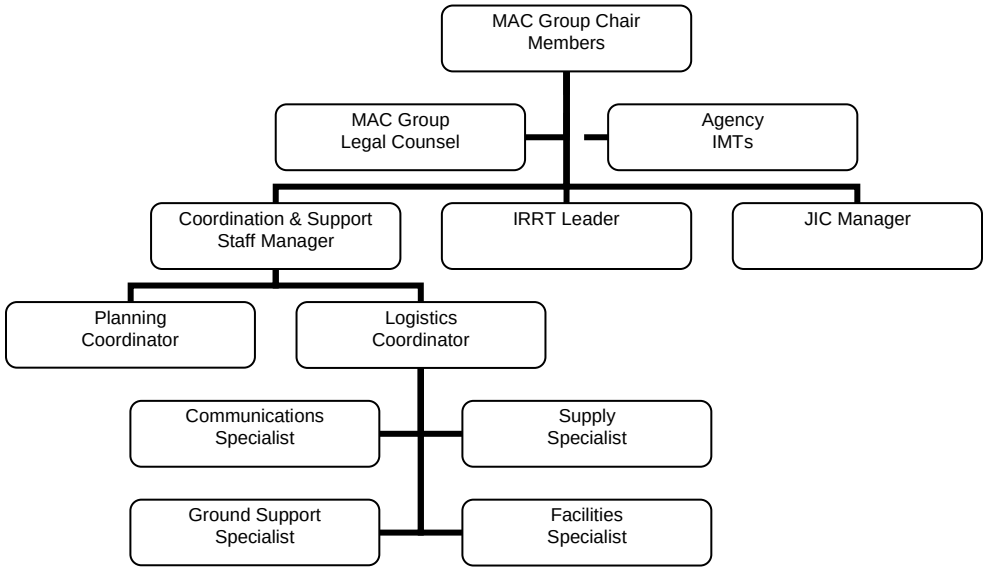
____ Order food and coffee service as necessary.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***

Position:	**Reporting Relationships**:
Ground Support Specialist	Reports to: Logistics Coordinator Reports to this Position: ▪ Drivers ▪ Transportation providers

Location in Organization:



General Responsibilities:

The Ground Support Specialist is responsible for transportation of personnel, supplies, food, and equipment to and from the MAC Group and support staff, and to the scene of the infestation. Depending on the complexity of the operation, and funding agreements, tasks could include:

- Requesting, assigning and tracking agency or rental vehicles.
- Negotiating delivery of resources to the MAC Group or to the scene of the infestation.
- Arranging commercial transportation for personnel responding to or returning home from assignment to the MAC Group or scene of the infestation.
- Ensuring that rental vehicles and other equipment are inspected before use.

Ground Support Specialist Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this manual should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the incident.

____ Obtain briefing from Logistics Coordinator.
- Transportation needed for MAC Group and on-scene Staff.
- Location of Supply Specialist receiving and distribution point(s)

____ Staff Unit as indicated by the above considerations.

____ Consider the need to use agency/entity pool vehicles or rental vehicles to augment transportation resources.

____ Maintain inventory of support and transportation vehicles.

____ Provide transportation services.
- Review management plans for transportation requirements.
- Review inventory for needed resources.
- Request additional resources through Supply Unit. Give type, time needed, and reporting location.
- Schedule use of support vehicles.
- Document mileage, fuel consumption, and other costs.

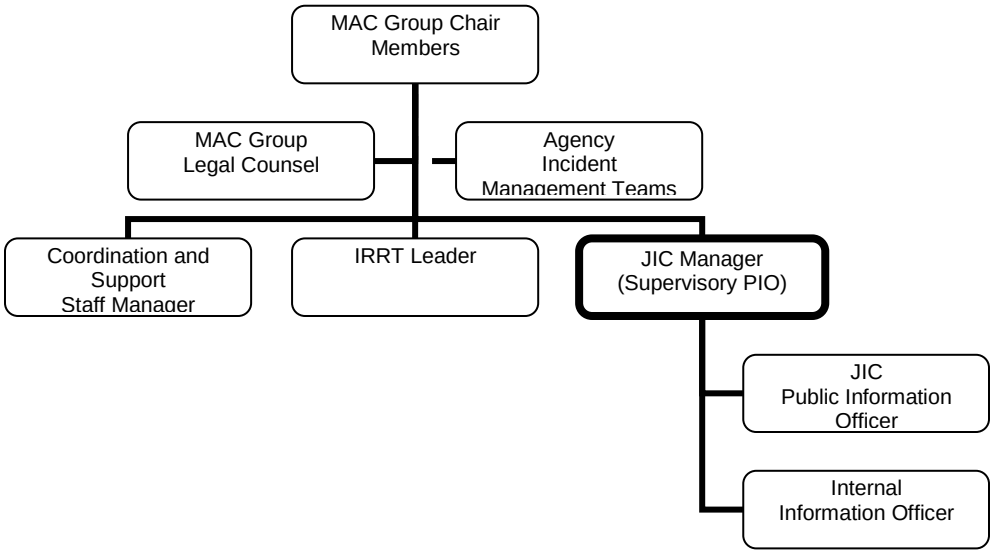
____ Ensure that the condition of rental equipment is documented prior to use.

____ Maintain Unit Log (ICS 214). Provide all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***

Position:	**Reporting Relationships**:
Joint Information Center Manager/Supervisory PIO	Reports to: MAC Group Chair Reports to this Position: ▪ Public Information Officers ▪ Internal Information Officer

Location in Organization:



General Responsibilities:

The Lake Tahoe Joint Information Center (JIC) Manager/Supervisory PIO is responsible for the coordinated formulation and release of information about the infestation to the news media, the public, agency/entity employees, and other agencies and organizations. Tasks may include:

- Developing press releases
- Conducting press conferences
- Developing talking points and other public information documents
- Responding to rumors and incorrect information
- Supervising JIC staff
- Advising the MAC Group in matters pertaining to public information and media relations.

JIC Manager Response Checklist (page 1 of 2)

The following checklist is a guideline for the use of the Lake Tahoe JIC Manager/Supervisory PIO. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from the Lake Tahoe MAC Chair.

- Determine current status of infestation
- Identify current organization
- Determine point of contact for media (scene or JIC)
- Determine current media presence and interest

____ Contact Public Information Officers from impacted agencies and jurisdictions. Determine:

- Status of press contacts.
- Method for coordinating press releases and briefings.
- Need for a Lake Tahoe Joint Information Center (it may be possible to issue a joint press release or hold a joint press conference rather than set up a formal JIC).
- Ensure that information provided to the public is consistent across jurisdictional boundaries when appropriate.

____ Assess need for special alert and warning efforts, including industries especially at risk, or which may need advance notice in order to shut down processes.

____ **The initial release of information about the infestation is the responsibility of the affected jurisdiction.** Prepare initial information summary as soon as possible after activation. If no other information is available, consider the use of the following general statement:

> *We are currently investigating reports of (name of invasive species) in the vicinity of (general location). Experts from the Lake Tahoe Region Interagency Response Team and local agencies are responding, and we will have additional information available as we are able to confirm it. We will hold a briefing at (location), and will notify the press at least ½ hour prior to the briefing. At this time, this briefing is the only place where officials authorized to speak about the incident and confirmed information will be available. Thank you for your assistance.*

____ Ensure adequate work space, materials, telephones, and staff. Consider activating:

- JIC Public Information Officers
- Internal Information Officers

JIC Manager Response Checklist (page 2 of 2)

____ Establish contact with Field (IMT) Public Information Officers. Assist in the development of a coordinated, interagency approach to public information.

____ Establish contact with local and national media representatives as appropriate.

____ Establish location of Information Center for media and public, away from MAC Group and Coordination Group work areas.

____ Establish schedule for news briefings.

____ Coordinate with Logistics the activation and staffing of message center "rumor control" lines to receive requests and answer questions from the public and impacted entities. Provide statement to operators.

____ Obtain current incident status reports from Planning Section; coordinate a schedule for updates.

____ Observe constraints on the release of information imposed by the Lake Tahoe MAC Group and impacted jurisdiction Incident Commanders.

____ Obtain approval for information release from Lake Tahoe MAC Chair.

- Confirm details to ensure no conflicting information is released.
- Identify site and time for press briefings, and confirm participation by other Lake Tahoe MAC Group members, and representatives from impacted jurisdictions.
- Confirm who can authorize information releases in the absence of the Lake Tahoe MAC Chair.

____ Release news to media, and post information in Coordination and MAC Group work areas and other appropriate locations.

____ Record all interviews and copy all news releases. Contact media to correct erroneous or misleading information being provided to the public via the media. Coordinate this activity with PIOs from impacted jurisdictions.

____ Update affected agencies/entities on a regular basis. Electronic mail may be used for updates. Provide standard statement which can be given to general requests for information.

____ Attend Lake Tahoe MAC Group planning meetings.

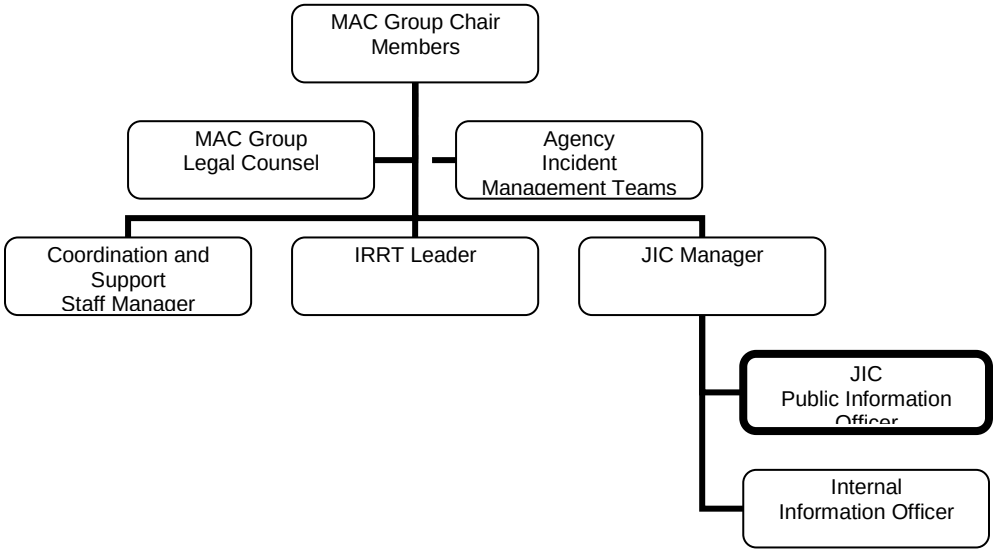
____ Respond to special requests for information.

____ Provide all news releases, bulletins, and summaries to Coordination Group Planning Coordinator to be included in the final incident package.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: JIC Public Information Officer	**Reporting Relationships**: Reports to: JIC Manager/Supervisory PIO

Location in Organization:



General Responsibilities:

Public Information Officers assigned to the JIC are responsible for developing a coordinated approach to public information related to the infestation. Tasks may include

- Developing press releases, talking points, and information summaries for dissemination to the press, agency employees, and outside agencies/entities.
- Coordinating document development with agency and Field Public Information Officers.
- Conducting briefings for the press and other interested groups.
- Identifying trends in press and public opinion and bringing these to the attention of the JIC Manager

JIC Public Information Officer Response Checklist (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Receive briefing from Supervisory Public Information Officer.

____ Determine location and participants in Joint Information Center (JIC).

____ Assist in the development of public information documents such as press releases, internal employee briefings, etc.

____ Determine constraints on information to be provided by the JIC.

____ Observe constraints established on information release. Provide copies of JIC releases to home unit and Field Public Information Officers. Request that errors or misleading/confusing information be identified.

____ Be proactive in requesting updates on information from home unit.

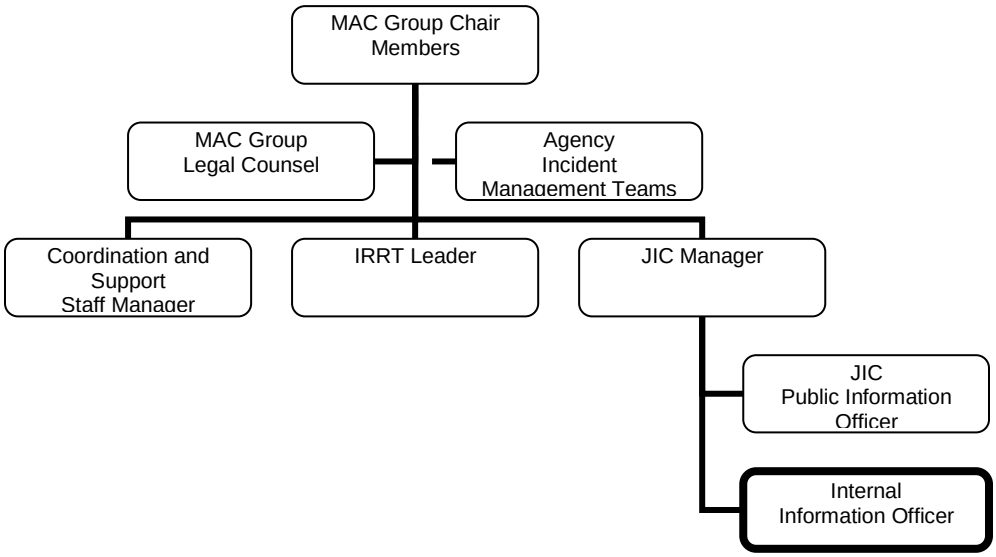
____ Keep home unit Public Information Officer apprised of activities of JIC.

____ Maintain copies of releases; provide to Supervisory Public Information Officer for inclusion in Final Incident Package.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: JIC Internal Information Officer	**Reporting Relationships**: Reports to: JIC Manager/Supervisory PIO

Location in Organization:



General Responsibilities:

The Internal Information Officer assigned to the JIC is responsible for ensuring that employees of agencies and entities responding to the infestation are kept informed on response activities. Tasks may include

- Developing summaries for dissemination to agency employees and communications points.
- Coordinating document development with agency/entity Public Information Officers.
- Conducting briefings for agency/entity employees.
- Identifying and addressing rumors, discrepancies in information, etc.

Internal Information Officer (page 1 of 1)

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Obtain briefing from JIC Manager/Supervisory Public Information Officer.

____ Develop standard statement to be provided to communications points.
- Department secretaries and switchboard operators
- 911 Centers (if necessary)
- Other communications points which may receive calls about the infestation

____ Obtain approval for statements from JIC Manager/Supervisory Public Information Officer.

____ Determine communications methods available. E-mail may be used to update affected entities simultaneously.

____ Determine what phone line has been established for internal updates, make sure affected entities are appraised of the number.

____ Provide copies of statements to Logistics Coordinator for use by rumor control operators.

____ Be proactive in requesting information updates from JIC Manager/Supervisory Public Information Officer and other JIC staff.
- Planning Coordinator for Incident updates
- Logistics Section for information on resource use.

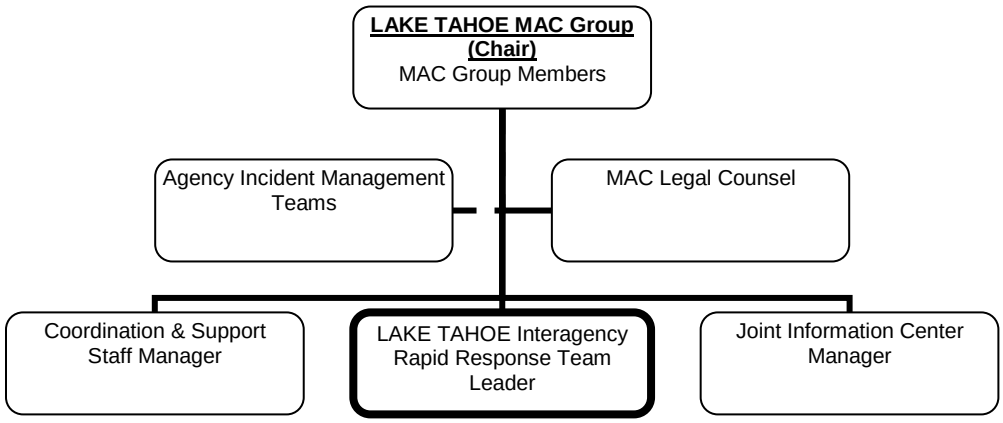
____ Update communications points on a regular schedule.

____ Maintain copies of statements given; provide to JIC Manager/Supervisory Public Information Officer for inclusion in Final Incident Package.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

Lake Tahoe Multi-Agency Coordination Structure	***Position Description***
Position: IRRT Leader	**Reporting Relationships**: Reports to: MAC Group Chair, Agency Administrators (when responding as an Incident Management Team) Reports to this Position: Individual Team Members, Subject Matter Experts

Location in Organization:



General Responsibilities:

The Interagency Rapid Response Team consists of ICS-trained subject matter experts that can be deployed to the scene in three ways:

- as a Unified Command incident management team providing on-scene response, management, and control of the infestation,
- as individual ICS Command/General Staff Filling vacancies within the local Incident Management Team's Command and General Staff or
- as Technical Specialists providing technical expertise to the local Incident Management Team, or serving as Field Observers or Technical Specialists to the MAC Coordination and Support Staff's Planning function.
- depending upon the management needs of the agency suffering from the infestation.

IRR Team Leader Response Checklist (page 1 of 3)

The following checklist is a guideline designed for use by the IRRT Leader/IC. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the emergency.

____ Receive assignment from Lake Tahoe MAC Group. Determine:
- Configuration (IMT or Technical Specialists).
- Status of Delegation of Authority (IMT)
- Team members assigned and en route

____ Name and location of local Incident Commander (Technical Specialist assignment)

____ Conduct assignments according to established agency SOPs.

The remaining elements of the checklist are for use by the IRRT Leader when responding as Incident Commander. Checklists for Command and General Staff can be found in the NIMS Field Operations Guide. Checklists for Rapid Response Objectives assigned to the field operations elements of the responsible agency or to the IRRT Incident Management Team can be found in *Field Operations* beginning on page B-27.

The Incident Commander is responsible for the overall management of the infestation, the development and implementation of strategic goals and objectives (in coordination with the Lake Tahoe MAC Group), and for approving the ordering and release of resources. IRRT Command will be unified, with Command personnel from agencies or jurisdictions who share authority for the incident. **Any functions not assigned by the Incident Commander remain the responsibility of the Incident Commander.**

The following checklist is a guideline. Users of this Plan should feel free to augment the list as necessary. Note that some of the activities are one-time actions; others are ongoing or repetitive for the duration of the incident.

____ Supervise Command and General Staff; ensure welfare and safety of incident personnel.

____ Obtain initial briefing.

____ Assess infestation situation.
- Review the current situation status and initial strategic objectives. Ensure that all County, State and Federal agencies impacted by the incident are notified.

IRRT Leader Response Checklist (page 2 of 3)

____ Conduct Unified Command Meeting. The Command Meeting is usually attended only by the Incident Commanders, and the following topics should be discussed as appropriate:

- Jurisdiction or agency priorities
- Jurisdiction or agency limitations, concerns, restrictions
- Develop a collective set of incident objectives (coordinate with Lake Tahoe MAC Group)
- Establish and agree on acceptable priorities
- Adopt an overall strategy or strategies to achieve objectives
- Agree on basic organizational structure.
- Designate the best qualified and acceptable Operations Section Chief.
- Agree on General Staff personnel designations and planning, logistical, and financial arrangements and procedures.
- Confirm the resource ordering process to be followed (with Lake Tahoe Coordination and Support Staff).
- Agree on cost-sharing procedures.
- Agree on informational matters (with Lake Tahoe JIC if activated).
- Designate one IC to act as the Unified Command spokesperson.

____ Activate appropriate Command and General Staff positions.

- Confirm dispatch and arrival times of activated resources.
- Confirm work assignments.

____ Determine what management plans and activities require MAC Group approval.

____ Brief staff

- Identify strategic goals and any policy directives for the management of the infestation.
- Provide a summary of current organization.
- Provide a review of current activities.
- Determine the time and location of first planning meeting.

____ Determine information needs and inform staff of requirements.

____ Ensure interagency coordination.

- Ensure that affected elected officials have been informed of infestation, and keep them informed as to status and activities. Include elected officials in planning meetings as appropriate.
- Determine status of Disaster Declarations and Delegation of Authority.
- Ensure that the Liaison Officer is making systematic contact with elected officials and cooperating and assisting agency/entity managers.

<u>IRR Team Leader Response Checklist (page 3 of 3)</u>

____ Establish parameters for resource requests and releases.

- Review requests for critical resources.
- Confirm who has ordering authority within the organization.
- Confirm those orders which require Command authorization.
- Establish contact and coordination procedures with Lake Tahoe Coordination and Support Staff Logistics Coordinator.

____ Authorize release of information to the media.

- If operating within a Unified Command, ensure all ICs approve release.
- Coordinate release of information with Lake Tahoe JIC (if activated)

____ Establish level of planning to be accomplished.

- Written Incident Action Plan (in coordination with the Lake Tahoe MAC Group)
- Contingency Planning
- Formal planning meeting

____ Ensure planning meetings are conducted according to schedule.

____ Approve and authorize implementation of the Incident Action Plan.

- Review IAP for completeness and accuracy
- Verify that objectives are incorporated and prioritized.
- Sign ICS202

____ Ensure Command and General Staff coordination.

- Periodically check progress on assigned tasks of Command and General Staff personnel.
- Approve necessary changes to strategic goals and action plan.
- Ensure that Liaison Officer is making periodic contact with participating agencies.

____ Request emergency declaration as necessary (in coordination with Lake Tahoe MAC Group). Ensure declaration is forwarded to affected local or tribal agency Office of Emergency Management, and to the affected State Office of Emergency Management.

____ Review and approve disaster assessment statements from Planning staff prior to forwarding to State.

____ Document all significant actions, information on Unit Log (ICS214). Forward copies of all documentation to the Planning Coordinator.

IV. Field Operations Response Checklists

The following checklists provide additional guidance for field operations. Field operations may be conducted by the responsible agency or by the IRRT Incident Management Team**.**

Rapid Response Objective 4- Define Extent of Colonization

Site Surveys

Purpose: Establish physical range of infestation, and identify life-cycle phase of mussels in order to inform policy and tactical response to the infestation. Determine geographic extent and demography of infestation, (including upstream and downstream areas and connected water bodies) in order to guide subsequent management decisions, including survey design. Since veligers may only be in the water for a short period of time, plankton sampling and identification must have a quick turnaround time (no more than a week) so that further sampling can occur swiftly and in a coordinated fashion that ensures proper geographic coverage.

Lead entity: The agency where the initial sighting(s) of mussels occurs. In the event the agency does not have the incident management capability or the technical expertise to conduct the site survey, it may formally delegate that responsibility to the Lake Tahoe IRRT.

Tasks:

1. Survey nearby water bodies with vulnerability to the same vectors (using information from boater surveys where available to determine high traffic areas). Potential methodologies include:
    - sampling fixed and temporary hard substrates,
    - shoreline surveys,
    - SCUBA and snorkel surveys, and
    - plankton sampling. Plankton sampling may be analyzed microscopically or via Polymerase Chain Reaction (PCR) genetic analysis (see Appendix C for associated analytical resources). Plankton samples should involve sufficient water volume to detect low veliger concentrations via either of those methods. These efforts should follow existing regional or national protocols.
2. Assess maturity and spawning condition of mussels at the infestation site(s).
3. Determine likely water flow dispersal of mussel veligers. Potential methodologies include:
    - dye studies
    - other hydrographic research techniques
    - interviewing field personnel

4. Identify facilities (e.g., hydropower, fish hatcheries, irrigation systems, etc.) that could be affected. See Appendix F-Contingency Plans.
5. Ensure that surveys are completed and that results are reported to the Lake Tahoe Coordination Group via the 100th Meridian Initiative website (http://100thmeridian.org).

Rapid Response Objective 7: Prevent Further Spread Via Quarantine and Pathway Management

Purpose: Minimize all vectors that might further spread the original infestation.

Lead entity: The agency where the infestation of mussels is found. In the event the agency does not have the incident management capability or the technical expertise to conduct quarantine and pathway management tasks, it may formally delegate that responsibility to the Lake Tahoe IRRT.

Tasks:

1. Identify dispersal vectors (including movement by humans, fish and wildlife, water traffic, water flow, and other processes). Assume measures are needed to prevent release of veligers as well as movement of adult mussels.
   - Assess the likely movement of boats that recently used the infested water body to identify inspection needs in other water bodies.
2. Establish public outreach efforts, including:
   - Ensure that zebra/quagga mussel “alert” signs are adequately deployed.
   - Alert prior users of these waters of the risks their boats and equipment create for other water bodies.
   - Design and implement educational outreach programs using print, electronic media and other avenues, with an emphasis on raw water users.
3. Restrict dispersal pathways, where feasible, including:
   - If feasible, identify and eliminate the likely source of mussel inoculation (e.g., infested boat).
   - Quarantine any hatcheries or aquaculture operations that are likely to spread mussels or their larvae via transfers outside the affected watershed(s).
   - Quarantine infested water bodies as needed to prevent spread by watercraft.
   - Consider and implement any needed prevention of overland veliger or adult mussel transport to other water bodies.

- Develop and implement Hazard Analysis and Critical Control Point (HACCP) plans to ensure that response personnel do not further spread the original infestation.
- Stop or slow water release to potentially uninfested sites.
- Draw water from below thermocline.
- Install physical barriers.
- Consider special management measures for operations of locks and commercial vessel traffic

4. Establish wash and inspection requirements on boats and equipment, and provide for associated logistical support (e.g., disinfection kits).
   - Begin a post haul-out inspection of boats and equipment in the areas where mussels were found.
   - Begin a pre-launch inspection program for all boats and equipment in places where boats and equipment from a contaminated area are likely to be launched next.

Rapid Response Objective 8: Initiate Available/Relevant Control Measures

Purpose: Evaluate management options, and then proceed with either eradication efforts or containment/mitigation activities.

Lead entity: The responsible agency where the infestation of mussels is found. In the event the agency does not have the incident management capability or the technical expertise to conduct control measures, it may formally delegate that responsibility to the Lake Tahoe IRRT.

Tasks:

1. Decide if eradication is possible based on rapid analysis of population dynamics and pathways of spread. Consider the following:
   - Cost vs. benefit of treatment options.
   - Type of water body – contained lake, small stream, large river, or water diversion facility.
   - Type of substrate – e.g., rocks that allow mussel attachment on their undersides where chemicals may not reach them.
   - Extent of population distribution – isolated vs. widespread coupled with *a priori* assumptions about the spread of mussels before detection.
   - Life stage(s) present (default assumption is both veligers and adults).
   - Time of year in relation to spawning season.

- Is spawning occurring now or at least possible based on current water temperature?
- When is the likely spawning season based on predicted temperature conditions?
- How do mean monthly temperature patterns for the water body relate to mussel spawning requirements?
- Amount of water in waterway.
- Does the water body need to be drawn down before treatment?
- How far can the water body be drawn down?
- Is river flow low enough for effective treatment?
- Circulation patterns in water body.
- Spreading pattern of population within the water body.
- Inflow rates and sources.
- If drawdown needs to occur, what is the feasibility given input source(s)?
- Rate of outflow and distance of veliger dispersal.
- Do flow patterns help or hinder eradication options?
- Presence of state or federally listed threatened or endangered species.
- Special status of water body, including:
    - Water use designation (e.g., drinking water).
    - 'Wild and scenic' designation.
    - Wilderness area.
    - Potential impact to cultural resources.
    - Department of Defense or other restricted access areas
    - Tribal lands
    - Endangered Species Act critical habitat
    - Clean Water Act 303(d) listing
    - Beneficial Uses of water bodies

2. If eradication is attempted, select appropriate method(s) - see D-2.
3. If eradication is not possible, develop control objectives and select/design appropriate control measures - see D-2.

4. Obtain relevant permits and regulatory agency concurrence (see Appendix E-Regulatory Requirements).
5. Implement eradication or control strategies

Rapid Response Objective 9: Institute Long-Term Monitoring

Purpose: Provide for data for adaptive management and long-term evaluation efforts.

Lead entity: The responsible agency where the infestation of mussels is found.

Tasks:

1. Design a monitoring program to evaluate the status of the zebra/quagga mussel populations, emphasizing veliger sampling. Monitoring activities should be carried out in coordination with other field operations, such as environmental monitoring to meet permit and other regulatory compliance requirements (e.g. National Pollutant Elimination Discharge System [NPDES]).
2. Disseminate findings through an easily-accessible, consolidated, coordinated real-time database and list serve (e.g., via 100th Meridian Initiative website)

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APPENDIX C-Notification Lists and Procedures

Appendix C: Notification List and Procedures

Priority 1 contacts will be notified when a report is received of live dreissenids within the Lake Tahoe Region. Notification of Priority 1 contacts or alternates must be confirmed via return phone call or email. Priority 1 contacts are divided into lists for the standing members and alternates for the Lake Tahoe MAC Group, and the Lake Tahoe Coordination and Support Staff.

Contacts designated as “Priority 2” and “3” are to be contacted by phone, email, and/or fax after positive confirmation that live zebra or quagga mussels and/or their larvae have been introduced to Lake Tahoe Region waters.

Note: *The contacts and agencies listed in this appendix are the result of initial research. Additional Priority 2 contacts for elected officials and others will be added as information becomes available. Additional Priority 3 contacts for recreational user groups, marina operators, water right holders, and others will also be added as information becomes available.*

Rapid Response Notification List

Note: ***Contacts and alternates identified in the Priority 1 table will be responsible for further contacts internal to their organization.*** *Personnel identified by their agency as the primary contact will respond as part of the Lake Tahoe MAC Group (depending on the needs of the incident). Alternates will respond as members of the Coordination and Support Staff or the Interagency Regional Response Team.*

Priority 1: Priority 1 contacts will be notified when a report is received of live dreissenids within the Lake Tahoe Region.

Organization	Name/position	Office Phone	Cell phone/ After hours	Fax	Email	Notes	Assignment MAC	C&S Staff
U.S. Fish and Wildlife Service	Steve Chilton, Aquatic Invasive Species Coordinator	775-589-5265	775-762-7542 775-313-4214	775-588-4527	steve_chilton@fws.gov		X	
Tahoe Regional Planning Agency	Ted Thayer, Aquatic Invasive Species Program Manager	775-589-5301	530-208-8710	775-588-4527	tthayer@trpa.org		X	
Nevada Division of Environmental Protection	Jeryl Gardner, Staff Engineer III, Bureau of Water Pollution Control	775-687-9423		775-687-4684	jgardner@ndep.nv.gov		X	
Nevada Division of Wildlife	After Hours Dispatch	775-687-9423						
Nevada Division of Wildlife	Karen Vargas Wildlife Staff Specialist Aquatic Invasive Species Program	775.688-.1532		775.688-.1595	kvargas@ndow.org		X	
Nevada Division of Wildlife	David Catalano Wildlife Biologist III Nevada Tahoe Resource Team	775-684-2742			dcatalano@ndow.org		X	
Nevada Division of	Paul Dankowski	775-688-			pdankowski@ndow.org			

Wildlife		1500						
California Department of Fish and Game	Jason Julienne, North Central Region Aquatic Invasive Species Coordinator	916-358-2895	916-202-9325	916-358-2912	jjulienne@dfg.ca.gov		X	
U.S. Environmental Protection Agency	Jacques Landy	775-589-5248			landy.jacques@epa.gov			
U.S. Army Corps of Engineers	Kristine Hansen	775-784-5307			Kristine.s.hansen@usace.army.mil			
Washoe Tribe								
U.S. Geological Survey		775-887-7627						
National Oceanic and Atmospheric Administration								
US Coast Guard	Bruce Helterbridle	530-583-4433			Bruce.E.Helterbridle @uscg.mil			
Lahonton Regional Water Quality Control Board	Dan Sussman Environmental Scientist	530 542 5466		530 544 2271	dsussman@waterboards.ca.gov		X	
NV State Lands	Elyse Randles	775-684-2735			erandles@lands.nv.gov			
US Forest Service, Lake Tahoe Basin Management Unit	Holly Eddinger - Biological Program Leader Ecosystem Conservation Department	530) 543-2633		(530) 543-2693	heddinger@fs.fed.us		X	

Priority 2 Contacts: Notify by fax and email within 48 hours of verified report				
Name	**Affiliation**	**Fax**	**Email**	**Notes**
Ronald Smith, Regional Coordinator, Region 8	U.S. Fish and Wildlife Service	209-946-6355	ronald_smith@fws.gov	209-946-6400 x321
Susan Mangin, Executive Secretary, Aquatic Nuisance Species Task Force	U.S. Fish and Wildlife Service		Susan_mangin@fws.gov	703-358-2466
Jill Ralston, Deputy State Supervisor Nevada Fish and Wildlife Office	U.S. Fish and Wildlife Service Reno, Nevada		Jill Ralston/R8/FWS/DOI	775-861-6300
U.S. Bureau of Reclamation	Myrnie Mayville		mmayville@usbr.gov	775-589-5240

	Priority 3 Contacts: Notify by phone or email within 72 hours of verified report			
Name	**Affiliation**	**Email**	**Phone**	**Notes VHF Radio**
El Dorado County Sheriff's Dept			(530) 573-3000	Channels 16 & 22 Marine 3
Douglas County Sheriff's Office			(775) 782-5126 (775) 782-9911	Channels 16 & 22 Marine 7
City of South Lake Tahoe Police Department			(530) 542-6123 (530) 542-6110	Channels 16 & 22 Marine 1
Carson City Sheriff's Department			(775) 887-2500	
Placer County Sheriff's Department			(530) 581-6330 (530) 583-4244	Channel 16 Marine 6
Washoe County Sheriff's Department			(775) 785-4629 (775) 832-4111	Channel 16 Marine 9
South Lake Tahoe Fire Department			(530) 542-6160	
North Tahoe Fire Protection District			(530) 583-6913	
Tahoe Douglas Fire Protection District			(775) 588-3591	
North Lake Tahoe Fire Protection District			(775) 831-0351	
Meeks Bay Fire Protection District			(530) 525-7548	
US Coast Guard			(530) 583-4433	Channel 16 & 22 Coast Guard Station Tahoe

Appendix C: Recognized Experts for Confirming Zebra and/or Quagga Mussel Identification.

Name and/or Position	Affiliation	Expertise	Phone/Fax	Email	Overnight mail shipping address	Notes
David Britton, Asst. ANS Coordinator	U.S. Fish and Wildlife Service, Southwest Region	Adults	817-272-3714	david_britton@fws.gov		
Mike Hoff, ANS Coordinator	U.S. Fish and Wildlife Service, Great Lakes Region	Adults	612-713-5114	michael_hoff@fws.gov		
ANS Coordinator	U.S. Geological Sur-vey, Western Fisheries Research Center	Adults	See Appendix C	See Appendix C		
Stephen Phillips, ANS Coordinator	Pacific States Marine Fisheries Commission	Adults	See Appendix C	See Appendix C		
Robert McMahon, Director	Center for Biological Macrofouling Research, University of Texas-Arlington	Veligers, Adults, Histology	(817) 272-2412			

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APPENDIX D

CONTAINMENT, CONTROL AND ERADICATION

D-1: Control Options

D-2: Response Scenarios

D-3: Scenario-Based Eradication and Control Option Matrix

D-4: Methods for In-Situ Evaluation of Chemical Control Effectiveness

D-1 Control Options

(Note: Portions of the material in this section were taken from California's Zebra Mussel Early Detection and Public Outreach Program Final Report (Messer, C. and T. Veldhuizen, 2005). Additional information including the data in Tables 2, 3, and 4 was compiled by Bruce Sutherland, consultant to the Pacific States Marine Fisheries Commission.)

Thermal Shock

Hot water treatment can kill zebra mussels. Temperatures of 37°C and above are lethal to zebra mussels. Depending upon acclimation temperature, zebra mussels will die in about 1 hour. At winter acclimation temperatures (5 to 10°C), temperatures of 33°C and above will kill zebra mussels within 13 hours. For further information, see Table 1 below (McMahon et al, 1993).

Freezing

Adult zebra mussels die when aerially exposed to freezing temperatures. In winter, populations can be controlled by dewatering and exposing zebra mussels to freezing air temperatures. Zebra mussels die in 2 days at 0°C and at minus 1.5°C, in 5 to 7 hours at minus 3°C, and in under 2 hours at minus 10°C. Duration to mortality is less for single mussels than for clustered mussels. (Payne 1992).

Oxygen Starvation

Oxygen starvation can be achieved by cycling ambient water through oxygen-starving pumps. The developer of the technology, Wilson J. Browning of Amark Corp, Norfolk County, VA, claims the equipment can cycle 200 million gallons of water. Another method of removing oxygen is to add oxygen scavenging chemicals, such as sodium-meta-bisulfite and hydrogen sulfide gas (USACE-ZMIS at http://www.wes.army.mil/el/zebra/zmis/idxlist.htm.). It should be noted, however, that zebra mussels are able to tolerate oxygen deprivation for up to 2 weeks, provided ambient temperatures are low enough (USACE-ZMIS).

Desiccation

Desiccation is a viable option for eradicating zebra mussels from areas that can be dewatered for several days. Alternatively, desiccation can also act as a population control method in areas that can not be completely dewatered. For example, reservoir levels can be lowered to expose zebra mussels inhabiting shallow water. The majority of the zebra mussel population inhabits shallow water within 2 to 7 m below the surface, with moderate to low densities up to 50m. Colonization is dependent upon water temperature, oxygen content, and food availability. They tend to colonize above the thermocline.

Temperature is positively related and humidity is negatively related to adult zebra mussel mortality. As humidity increases and temperature decreases, survival increases (Table 1). Aerial exposure of zebra mussels to temperatures exceeding 25°C, will result

in 100% mortality in 2.1 days. Temperatures over 32°C are lethal within 5 hours. Instantaneous mortality occurs at 36°C. At temperatures below 30°C, time to mortality is dependent upon relative humidity.

Table 1. Number of days to 100% mortality of adult zebra mussels aerially exposed to different levels of relative humidity and air temperature (McMahon et al, 1993).

	Days to 100 % Mortality at Air Temperature, °C		
Relative Humidity, %	**5**	**15**	**25**
95	26.6	11.7	5.2
50	16.9	7.5	3.3
5	10.8	4.8	2.1

Benthic Mats

Researchers from the Rensselaer Polytechnic Institute in New York are investigating the use of benthic mats that would cover the sediment and zebra mussels, and smother the mussels. Preliminary laboratory bioassays carried out in aquaria demonstrated that benthic mat covering of zebra mussels for 2 weeks resulted in mortality rates of 14.9-100%, while mortality rates were 2.2% or lower for control aquaria without mats. In laboratory studies in which mussels were covered for 4 weeks, mortality rates of 20-100% occurred, and did not vary significantly with duration of covering or size class. Measurements of several water chemistry parameters beneath mats, including dissolved oxygen, ammonia, calcium and magnesium and pH, indicated that dissolved oxygen concentration was the only parameter to exhibit both significant change and a consistent trend over the course of the study, declining from nearly 100% saturation to a mean of 16.5% saturation, and remaining at this level for the duration of the experiment (Sandra Nierzwicki-Bauer, personal communication, 2008).

In field studies carried out in New York's Saratoga Lake, divers created treatment and control zebra mussel colonies at 2m depths on a rocky substrate by placing rocks with attached mussels on fiberglass screens placed on prepared gravel beds. During a field trial where two treatment colonies, composed of approximately30,000 mussels each, were covered with $4m^2$ mats, mortality rates exceeded 99% after nine weeks of covering. As observed in the laboratory tests, dissolved oxygen concentrations declined significantly under the mats, correlating strongly with increased mortality ((Sandra Nierzwicki-Bauer, personal communication. 2008).

Manual Removal

When found in relatively small numbers, manual removal may be an effective way to reduce dreissenid populations and potentially even eradicate them if reproduction has not yet occurred. Manual removal can take place via hand extraction or via mechanical scraping and suction, typically using divers. In Lake George, New York an effort involving hand harvesting by divers appears to have significantly reduced an introduced population. Divers removed 267 mussels in 1999, followed by a peak of nearly 20,000 in 2000. Since then, ongoing removal efforts have yielded fewer than 2,000 mussels per year (Sandra Nierzwicki-Bauer, personal communication, 2008). The apparent eradication of the nonnative sabellid polychaete worm *Terebrasabella heterouncinata* in California provides analogous evidence to the role of hand removal as a control technique. After this marine pest was found at an intertidal site outside of an infected abalone culture facility, over 1.6 million native black turban snails (*Tegula funebralis*) - the preferred native host - were extracted by hand, along with other infested material. This effort reduced the transmission of the pest species to the point that it no longer was detectable in follow-up surveys (Culver and Kuris, 2000).

Predation

The relatively soft shells of zebra mussels and their exposure (on substrates as opposed to buried in sediment) make them vulnerable to predation. Possible predators of adult mussels are some species of carp, catfish, bullhead, sucker, sunfish, sturgeon, crayfish, and muskrats. A possible predator of veligers is the American shad. However, there is no evidence of predation control in the Great Lakes, Ohio River, and Poland. There is some evidence of population reduction in the Hudson River. Despite the lack of clear evidence of population control through predation, it is recommended that harvest of predatory species in infested waterbodies be stopped.

Acoustic Deterrents

It should be noted that the impacts and effectiveness of the following acoustic deterrents are not fully proven, especially in high-flow areas. However, they are relatively low maintenance technologies that have a low likelihood of harming non-targeted organisms, are environmentally friendly, and have few related safety issues. Acoustic methods are only suitable for certain kinds of structures and are limited to areas where power is available.

- Cavitation is a form of acoustic energy that initiates the formation and collapse of microbubbles. At frequencies between 10 and 380 kHz, this type of energy has demonstrated mortalities of veliger, juvenile, and adult zebra mussels. Exposure times are ranges of seconds for veligers, minutes for juveniles, and hours for adults. (Nalepa, and. Schloesser. 1993).
- Sound treatment using low frequency energy has prevented the settlement of zebra mussels and could be a valid option for reducing the spread of the organisms. Sound waves in the 20 Hz to 20 kHz range have been used to cause veligers to

detach and sink. Ultrasound waves in the 39 to 41 kHz range have fragmented veligers in a few seconds and killed adults in 19 to 24 hours. (Sonalysts, and Aquatic Sciences. 1991).

- Vibration is the use of solid-borne acoustic energy in mechanical structures. This treatment will only work on structures that can be subjected to vibration and not suffer structural deterioration. Vibrational energy is effective in killing zebra mussel veligers and juveniles at just below 200 Hz and between 10 and 100 kHz. (Nalepa and Schloesser 1993).

Electrical Deterrents

- Continuous low-voltage electrical fields can control adult zebra mussel settlement. However, veligers and juveniles seem to remain relatively unaffected. Adult settlement can be completely prevented with an eight volt A-C current. This technology has recently been successfully applied using electrodes attached to the hull of a vessel to prevent mussel attachment. (Smythe and Miller 2003).
- Plasma pulse technology (Sparktec Environmental, Inc.) has proven effective in controlling zebra mussels in intake pipes. The system works by releasing stored energy that subsequently causes an intensive shockwave, a steam bubble, and ultraviolet light. (Mackie, Lowery and Cooper 2000).
- Pulse power devices can be utilized to create an electrical field between two electrodes. When the field spans the entire width of the area to be protected, it has been effective in stunning and killing juveniles as they pass through the electrical field. Although not too effective against veligers because of their small body mass, pulse power has also been used successfully to prevent mussel settlement. (Smythe and Miller 2003)

UV Radiation

UV radiation is an effective method for controlling zebra mussels in all life stages, although veligers are more sensitive than adults. Complete veliger mortality can be obtained within four hours of exposure to UV-B radiation, and adult mortalities can also be obtained if constant radiation is applied. UV radiation can be harmful to other aquatic species and its effectiveness may be decreased by turbidity and high suspended solids loads. (Wright et al, 1995).

Chemical Treatment

There are 3 general categories of chemicals used to treat zebra mussel infestations: metallic salts, oxidizing biocides, and nonoxidizing biocides. The most susceptible life stages to chemical treatment are post-spawned mussels that are in a low energy state, and veligers and pediveligers that have undeveloped shells. Application rates and duration data for these compounds come from laboratory studies, power plants, and water treatment plants.

- Metallic salts (electrolytically dissolved metallic ions), are effective on adult mussels because of the incomplete sealing of their shells.

- Potassium salts at a concentration of 50 mg/l have successfully prevented the settlement of zebra mussels. Higher concentrations between 88 and 288 mg/l are necessary to cause mortality. Such concentrations will likely kill native mussels as well but are non-toxic to fish. In 2006, KCl was used to successfully eradicate zebra mussels from a rock quarry pond in Virginia. 100% kill was attained with minimal environmental impacts to other aquatic species and to the drainage waters downstream. This method seems promising if a lethal concentration of KCl can be maintained for a 2 to 3 week period. More information about this project can be found at: http://www.dgif.virginia.gov/zebramussels/index.asp
- The product known as "BioBullets" has been developed that uses the encapsulation of an active ingredient (KCl) in microscopic particles of edible material designed for ingestion by mussels. It is also supposed to affect Asian clams (Aldridge et al. 2006).
- Chloride salts are also effective and safe for most fish species but require high dosages. Copper ions at concentrations of 5 mg/l have resulted in 100% veliger mortality. Copper sulfate concentrations between 5 and 40 mg/l are effective for adult zebra mussel control but are also lethal to native mussels and other aquatic species. The required exposure time for most metallic ions ranges from 5 to about 48 hours.

- Oxidizing biocides such as chlorine have been used by the water treatment industry for disinfection since the late 1800s. Because these chemicals have been in use for so long, their effect on the environment is understood and documented (Claudi. and Mackie, 1994). In mussels, oxidizing chemicals work by oxidizing the gill lamellae and other parts, eventually causing death. Zebra mussels can recognize oxidizing chemicals as toxins. In response to exposure, zebra mussels expel the offending water and close their valves for several days. Periodically, they reopen their valves to "test" the water. Depending upon water temperature, respiration rate, and stored nutrient reserves, zebra mussels can remain closed and withstand exposure for many days before reopening their valves to resume respiration and feeding. Therefore, required exposure time for oxidizing biocides is usually 1 to 3 weeks.

  Chlorine, bromine, hydrogen peroxide, ozone, and potassium permanganate are examples of oxidants that facilitate zebra mussel mortality.

  - Chlorination in various forms such as hypochlorite, sodium chlorite, chlorine dioxide, and chloramines is the most common method of zebra mussel treatment. The use of chlorine and its various forms is usually limited to non-open water situations because of its high toxicity to other forms of aquatic life. Treated waters must either be dechlorinated or held until the residual chlorine has dissipated before discharge.

    An example of chlorine use that may be applicable to a small isolated population of zebra mussels is the practice of using tarps to seal off an area and then injecting chlorine into the enclosed area. The State of Washington Department of Fish and Wildlife used this method in October of 2004 to successfully eradicate a small population of non-indigenous tunicates in Puget Sound near the City of Edmonds. (Personal communication with Pam Meacham, WDFW,

February 2007). This method was also utilized in Huntington Harbor, California to eradicate a marine alga, *Caulerpa taxifolia*. Patches of Caulerpa were treated by covering them with black PVC tarp and injecting liquid chlorine under the tarp. The edges of the tarp were sealed to the bottom with sandbags. While all the organisms under the tarps were killed by the treatment, the tarping method avoided impacts to surrounding areas. More information can be obtained at www.sccat.net/eradication.php.

— Hydrogen peroxide. Although toxic to zebra mussels, hydrogen peroxide is rarely used because of the high dosage rates.

— Ozone is effective at relatively low concentrations. 0.5 mg/l has been 100% effective on veligers in 5 hours and adults in 7 to 12 days. Ozone dissipates quickly and is less harsh on the environment but expensive because of the effort needed to maintain exposure.

— Potassium permanganate is effective at reducing or eliminating zebra mussels at high dosage rates but is also very toxic to other aquatic species. (Minnesota Dept of Natural Resources. 2005)

Non-oxidizing biocides are drawn into the mussel's body and attacks the cell walls. The cells lose the ability to maintain their chemical balance, and the mussel dies. Zebra mussels do not detect most non-oxidizing chemicals and continue to filter water, exposing themselves to the chemical. Treatment with non-oxidizing chemicals can be accomplished in hours as opposed to weeks for oxidizing chemicals.

The most commonly used non-oxidizing compounds are proprietary molluscicides (e.g. Clam-Trol, Bulab, and Bayluscide). These are very effective at zebra mussel control but are also highly toxic to many fish and other aquatic species. They are applied at high concentrations, and, in most cases, the water must be detoxified after treatment. These compounds are usually deactivated by releasing slurry of bentonite clay into the water. The cationic or surfactant active ingredients bind onto the clay, becoming inactive. The clay settles out of the water column and becomes part of the bed sediments. The compound is microbially degraded into nontoxic products. These chemicals are less effective at lower water temperatures, so treatment is recommended during warmer months. The chemicals are usually administered with equipment supplied by the vendors. An example of the successful use of non-oxidizing chemicals to control the Asian clam in the southeastern US can be found in a paper entitled "Strategies for application of non-oxidizing biocides." (Green 1995)).

Additional information on most of these chemicals, such as formula, manufacturer, and application method, is available at http://www.wes.army.mil/el/zebra/zmis/idxlist.htm.

Bacterial Toxin

The naturally occurring bacterium *Pseudomonas fluorescens* strain CL145A is a candidate for the biological control of zebra and quagga mussels, and progress has been achieved at the laboratories of the New York State Museum (NYSM) in moving it toward commercialization. *Pseudomonas fluorescens* is ubiquitous in the environment, and lab studies have indicated that when zebra or quagga mussels ingest artificially

high densities of strain CL145A, a toxin within these bacterial cells destroys their digestive system. Dead bacterial cells are equally as lethal as live cells, providing evidence that the mussels die from a toxin, not from infection. Future commercial products based on this microbe will contain dead cells, thus further reducing environmental concerns.

Laboratory trials to date have been very encouraging regarding nontarget safety (Malloy 2008). At dosages which produced high zebra mussel mortality (76–100%), no bacteria-induced mortality has been recorded among any of the nontargets, including fish, ciliates, daphnids, and bivalves (Malloy 2008). Although originally developed as an environmentally safe alternative for chlorination in power plants, the nontarget safety of this bacterial control agent may allow this technology to also be used for zebra and quagga mussel control in open waters, such as lakes and rivers.

Supported by funding from the National Science Foundation and in partnership with the NYSM, the biopesticide company Marrone Organic Innovations (MOI) expects to bring this bacterial control method to commercialization in 2010. This NYSM-MOI research partnership will focus primarily on: 1) increasing bacterial toxicity so that cells can routinely achieve >90% mussel kill, and 2) conducting additional nontarget toxicology studies mandated by the USEPA for product registration.

Further information on this control method can be found at:

1. http://www.netl.doe.gov/technologies/publications/factsheets/project/Proj291.pdf
2. http://www.aquaticnuisance.org/docs/Dreissena%20Novel%20Green%20Technology%20for%20Dreissena%20Control%20(4)%20Malloy.pdf
3. http://www.marroneorganicinnovations.com/pdf/PressReleaseZebraMussel.pdf

No-Growth Materials (anti-fouling paints) – Can be effective in preventing zebra mussel attachment but the leachate can be toxic to other organisms. Anti-fouling paints are expensive to use and only feasible in certain situations.

The following three tables provide a more detailed look at these control methods including target populations, application rates, efficiency and toxicity. Table 2 details non-chemical methods. Table 3 describes chemical control methods and Table 4 identifies some of the most common commercial products.

TABLE 2: Non-chemical treatment methods for dreissenid control.

METHOD	TARGET AGE	EFFICIENCY	CONTACT TIME /CONCENTRATION	COMMENTS
Thermal shock	All	100%	13 hours @ 33 C in winter 1 hour @ 37 C summer	Lethal to most aquatic species
Freezing	Juveniles Adults	100%	2 days @ 0 C 5-7 hours @ -1.5 C under 2 hours @ -10 C	Must dewater system
Oxygen starvation	All		2 weeks + @ 0 mg/l	Must isolate population
Desiccation	Juveniles Adults	100%	Immediate @ 36 degrees C 5 hours @ 32 degrees C 2.1 days @ 25 degrees C	Must dewater system for several days
Benthic mats	Juveniles Adults	Up to 99%	9 weeks	Initial tests promising for limited infestations
Manual removal	Juveniles Adults	Variable	N/A	Ongoing efforts in Lake George, New York
Predation	All	Low	Continuous	Harvest of potential predatory species must be limited
Cavitation	All	100%	veligers in seconds @ 10-380 kHz juveniles in minutes adults in a few hours	May affect other species, reduced success in high flows, needs power source
Low frequency sound	Juveniles	Inhibits settling	4 to 12 min @ 20 Hz – 20 kHz	Not lethal, needs power source

Ultra sound	All	100%	veligers in seconds @ 39-41 kHz adults in 19-24 hrs	May impact other species, needs power source
Vibration	Veligers Juveniles	100%	intermittent @ 200 Hz & 10-100 kHz	Structural integrity may be threatened
Low voltage electricity	Adults	Prevents settling	immediate results @ 8 volt AC	Not lethal, needs power source
Plasma pulse technology	Juveniles Adults	Prevents settling	intermittent high energy pulses	Not lethal, private technology
Electric field pulse	Juveniles/ adults	Lethal to juveniles Inhibits adult settling	seconds	May affect other species, needs power source
UV radiation	All	100%	juveniles -4 hrs adults – continuous	Lethal to many species, effectiveness limited by turbidity and suspended solids
Bacterial toxin *Pseudomonas fluorescens*	All	95%	6 hours	Low toxicity to other organisms, few treatments needed, not yet available in commercial quantities.

NOTES:

- Extensive information on treatment methods listed above including information sources, application methods, hazards, etc. is available on the US Army Corps of Engineers website at www.el.erdc.usace.army.mil/zebra/zmis/idxlist.htm
- Information on the bacterial toxin, *Pseudomonas fluorescens* is available on the National Energy Technology Laboratory website at http://www.netl.doe.gov/technologies/publications/factsheets/project/Proj291.pdf

TABLE 3: Chemical treatment methods for dreissenid control.

NON-OXIDIZING CHEMICALS	TARGET AGE	EFFICIENCY	CONTACT TIME/ CONCENTRATION	COMMENTS
Potassium salts (KCL)	Juveniles/ adults All	Prevent settlement 50% 95-100%	50 mg/l 48 hrs @ 150 mg/l 3 weeks @ 95 – 115 mg/l	Lethal to other mussel species, non-toxic to fish at required dose rate
Potassium ion (KH2PO4)	All	100%	continuous @ 160-640 mg/l	As above
Potassium ion (KOH)	All	100%	Less than 10 mg/l	As above
Chloride salts (Nail,)	Veligers/ juveniles	95-100%	6 hours @ 10,000-20,000 mg/	Low cost, low environmental Impacts, very high dosage rates
Copper ions	Veligers	100%	24 hours @ 5 mg/l	Lethal to other aquatic species
Copper sulfate	All	55% 40% 50%	5 hrs 300 mg/l @ 22.5 C 5 hrs 100 mg/l @ 22.5 C 48 hrs 2 – 2.5 mg/l @ 17 C	Lethal to other aquatic species
OXIDIZING CHEMICALS				
Chlorine	Veligers All Adults Adults	100% 90% 95% 75%	0.25-5mg/l in 1 to 9 days 2.0 mg/l continuous 0.3 mg/l 14-21 days 0.5 mg/l 7 days	Lethal to many aquatic species
Chlorine dioxide ClO2	Veligers	100%	0.5 mg/l 24 hours	Most successful on veligers
Chloramine	Veligers	100% 95%	1.2 mg/l 24 hours 1.5 mg/l continuous	Less toxic to other aquatic life than chlorine

Hydrogen peroxide	Veligers Juveniles	100%	6 hours	High dosage rates required. Lethal to other aquatic species
Ozone	All	100%	Veligers in 5 hours @ .5 mg/l Adults in 7 days @ .5 mg/l	Lethal to other aquatic species
Potassium permanganate	All	90-100 %	2.0 mg/l for 48 hours	`Must have high continuous dosage, lethal to other species

NOTES:

- Extensive information on the chemical treatment methods listed above, including information sources, application rates, toxic effects, hazards, etc. is available on the US Army Corps of Engineers website at www.el.erdc.usace.army.mil/zebra/zmis/idxlist.htm.

TABLE 4: Non-oxidizing chemical treatment methods (commercial products) for dreissenid control.

UNDER GOING TESTING	TARGET AGE	EFFICIENCY	CONTACT TIME/CONCENTRATION	COMMENTS
Zequanox	Adults	In testing	Unknown	BOR Testing in Davis Dam/Lake Mohave

QUATERNARY AMMONIUM COMPOUNDS	TARGET AGE	EFFICIENCY	CONTACT TIME/ CONCENTRATION	COMMENTS
Clam-Trol CT 1	All	100% 48 hours after exposure	1.95 mg/l @ 11 C for 12 hours 1.95 mg/l @ 14 C for 14 hours 1.95 mg/l @ 20 C for 6-14 hours	More toxic to veligers than adults and more toxic to mussels than to trout
Calgon H-130	All	100% after 48 hours	0.85-1.12 mg/l	1.1 mg/l toxic to salmonids, must be deactivated, corrosive, flammable
Macro-Trol 9210	All	100%	5-50 mg/l continuous	Lethal to aquatic organisms, must be detoxified
Bulab 6002	All	100%	2 mg/l 7-10 days 4 mg/l 5-8 days	Lethal to fish, especially salmonids
AROMATIC HYDROCARBONS				
Mexel 432	Deters veliger settlement		Dose at 1-4 mg/l once a day	96 hr LC 50 for rainbow trout 11mg/l, corrosive
EVAC – endothal formulation	All	100%	0.3-3 mg/l for 5 to 144 hours	Lethal to fish but rapidly degrades, does not bioaccumulate
Bulab 6009	All	100%	2 mg/l 4 to 10 days	96 hr LC 50 for rainbow trout

			4 mg/l 3 to 8 days	1,1 mg/l, corrosive

NOTE: The commercial products listed above have been approved for aquatic use by EPA if applied according to label instructions by a licensed applicator. It is important to note that they may not have been approved by the individual states and must have that approval before they can be applied. The molluscicides have been primarily developed for use at water impoundment and hydropower facilities, treatment facilities, water intake structures, etc. Their use in open water is not generally recommended but might be possible under certain circumstances. For example, the herbicide Endothal has been shown to be effective against zebra mussels and has been permitted for use in open waters in Washington State to control noxious weeds.

Extensive information on the products listed above, including manufacturer, chemical formulation, application rates, toxicity, hazards, etc. is available on the US Army Corps of Engineers website at www.el.erdc.usace.army.mil/zebra/zmis/idxlist.htm

References

References for Appendix A are incorporated in the main document.

D-2 Rapid Response Scenarios

The detection of dreissenid mussels into the Lake Tahoe Region could occur through numerous scenarios. The following cases may be more probable based on risk factors and recent history, and should be considered both for planning purposes as well as during initial investigations of actual reports. They also relate to Appendix D-3 (table of scenario-based response options).

- Veligers found in Lake Tahoe; no adults detected

- Settled mussels found growing on moored watercraft and/or fixed structures within Lake Tahoe; no veligers detected (*eradication might be feasible in this scenario)*

- Veligers and/or settled mussels found in an isolated, non-draining water body within the Lake Tahoe Region (*eradication might be feasible in this scenario)*

- Reproductive mussels and veligers found in Lake Tahoe and/or a hydrologically connected water body (*eradication would probably not be feasible in this scenario)*

Appendix D-3

SCENARIO BASED ERADICATION AND CONTROL OPTIONS

(FROM: MESSER, C. AND T. VELDHUIZEN. 2005)

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
Pond, Isolated, non-draining	• Evaluate for natural control (e.g. Winter freeze, summer desiccation) • Chemically treat area and buffer zone • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Chemically treat entire waterbody • Stop water diversions, if any, and chemically treat diversion infrastructure • Mandatory cleaning of all departing vessels and equipment • Quarantine and/or stop all recreational uses
Pond, draining	• Chemically treat released water or prevent water release • Chemically treat area and buffer zone • Monitor for spread within pond and downstream • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Minimize or prevent water release • Chemically treat released water • Chemically treat diversion infrastructure, if any • Monitor for spread downstream • Chemically treat entire waterbody • Mandatory cleaning of all departing vessels and equipment • Quarantine and/or stop all recreational and commercial uses

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
Small Reservoir	• Minimize water releases • Chemically treat released water • Chemically treat area and buffer zone • Monitor for spread within reservoir and downstream • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Evaluate need to reduce reservoir volume through water releases • Chemically treat released water • Chemically treat diversion infrastructure, if any • Monitor for spread downstream • Chemically treat entire waterbody • Mandatory cleaning of all departing vessels and equipment • Quarantine and/or stop all recreational and commercial uses
Large Reservoir	• Reduce reservoir volume • Chemically treat released water • Chemically treat infested area and buffer zone • Monitor for spread within reservoir and downstream • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Mandatory cleaning of departing vessels and equipment	• Chemically treat released water • Monitor for spread downstream • Chemically treat diversion infrastructure, if any • Evaluate potential for a water level drawdown to reduce the population • Evaluate ability to chemically treat entire waterbody • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses • Mandatory cleaning of all departing vessels and equipment

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
River, Small Volume	• Minimize or stop inflow and increase upstream water diversions to reduce stream volume and flow rate • Install veliger settlement materials at downstream end of population • Create pool conditions at downstream end of population to facilitate veliger settlement (e.g., installation of temporary weir) • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread downstream • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment	• Minimize or stop inflow and increase upstream water diversions to reduce stream volume and flow rate • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread downstream • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
River, Large Volume	• Minimize inflow and increase upstream water diversions to reduce stream volume and flow rate • Install veliger settlement materials at downstream end of population • Create pool conditions at downstream end of population to facilitate veliger settlement (e.g., installation of temporary weir) • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread downstream • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment	• Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses • Mandatory cleaning of all departing vessels and equipment • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Closure of unattended boat ramps, especially In zebra mussel-free areas • Mandatory inspection/cleaning of all vessels entering zebra mussel-free waterbodies • Evaluate ability to chemically treat

Eradication and control options for various zebra mussel waterbody infestation scenarios.		
Population Level / Waterbody	Isolated Population	Widespread Population
Marina	• Install veliger settlement materials at perimeter of population • Divert upstream water to reduce river volume and flow rate (e.g. Rock barrier) • Create pool conditions at downstream end of population to facilitate veliger settlement (e.g., installation of temporary weir, tidal flow/rock barrier) • Treat with molluscicide • Detoxify downstream of infested area • Monitor for spread • Prevent spread to upstream waterbodies and other watersheds • Quarantine and/or stop all recreational and commercial uses in infested area and buffer zone • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory cleaning of all departing vessels and equipment	• Eradication doubtful • Implement population level control measures (e.g. Salt water intrusion during spawning season and veliger settlement) • Prevent spread to upstream waterbodies, other watersheds, pumping plants, and aqueducts/diversion canals • Mandatory cleaning of all departing vessels and equipment • Closure of unattended boat ramps, especially in zebra mussel-free areas • Installation of travel barrier and mandatory cleaning station for all vessels traveling upstream via waterway • Mandatory inspection/cleaning of all vessels entering zebra mussel-free waterbodies • Establish regulations for ships traveling to/from ports of the Lake Tahoe • Evaluate treatment/spread prevention at all points of diversion

Appendix D-4

METHODS FOR IN-SITU EVALUATION OF THE CHEMICAL CONTROL EFFECTIVENESS

(MESSER, C. AND T. VELDHUIZEN. 2005)

Mortality Monitoring

- Suspend test cages containing attached live mussels into the water to be treated.
- Use at least 10 mussels per cage and multiple cages per waterbody or use a statistically designed replication study.
- Monitor kill rate as chemical is administered.
- Conduct multiple tests for alternative chemical concentrations based on kill success of mussels in test cages.
- Follow by extensive inspections of the facility (ies) (surface and by diver) looking for live mussels.

Visual determinations of dead mussels

- Valve gaping with no response of exposed mantle tissue to external stimuli.
- For mussels with gaping shells failure of plantigrade mussel to respond to the touch of a probe.
- If shell is closed absence of ciliary beating and adductor muscle activity when inserting probe between the valves of the mussel.

Mortality verification

- Monitor test cages conducting mortality counts every 24 hours post-treatment or in accord with the chosen statistical design.
- Transfer test cages to recovery tank(s) to test for false-positive kill observations.
- Transfer in-situ-killed mussels to recovery tank(s) for false-positive kill observations.

APPENDIX E- REGULATORY REQUIREMENTS

APPENDIX E-Regulatory Requirements

I. Introduction

The decision to use chemical agents and/or physically change the aquatic environment to treat an infestation of Dreissena in the waters of the Lake Tahoe Region will be costly, as well as environmentally and politically sensitive. Establishing a transparent, well documented, and effectively communicated decision-making process is essential. It is also essential that the process comply with all relevant rules and regulations governing chemical applications. Because of the importance of regulatory issues, the Lake Tahoe Coordination and Support Staff have established a Compliance Technical Specialist within the Planning Function. In addition to staffing this position, the following steps will help ensure appropriate regulatory review and compliance:

- Determine the permits, regulatory reviews, and applicable emergency provisions required for chosen eradication methods.
- Identify existing permits and/or templates for required permits.
- Assign Agency Representative from each regulatory agency to facilitate permit approval in a timely manner within their respective agency.
- Determine if an environmental impact statement or environmental assessment is required and if so, ensure assignment is staffed appropriately and completed in a timely fashion.

Table 1 lists some of the primary permits and regulatory reviews that may be necessary before treatment can begin.

Table 1: Partial List of State/Federal Permits and Regulatory Reviews Likely To Apply to Eradication of Zebra Mussels in the Lake Tahoe Region.

- Corps of Engineers Section 10 permit for discharge of dredge/fill material
- Clean Water Act Section 404 permit for work in navigable waters from Corps of Engineers
- Clean Water Act National Pollutant Discharge Elimination System (Section 402) permit (or modification of existing general permit) from Environmental Protection Agency or delegated state
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) – particularly Section 18 emergency exemption
- National Environmental Policy Act reviews, such as Environmental Impact Statements (triggered by other federal authorizations) – includes provisions for emergency consultations+
- Endangered Species Act Section 7 consultations by U.S. Fish and Wildlife Service and/or National Oceanic and Atmospheric Administration consultations (triggered by other federal authorizations) – emergency
- State aquatic land use authorization
- State water diversion/water-based construction permits and project approvals
- State archaeological excavation permit
- State hazardous chemical storage and reporting requirements

II. Regulatory Requirements for the Use of Chemicals

The four tables below attempt to portray the regulatory regime from the perspective of the states that could be involved in the decision making process leading up to the emergency chemical treatment of a zebra mussel infestation in the Lake Tahoe Region. Of particular relevance to the application of pesticides to state waters is the recently issued final Environmental Protection Agency (EPA) rule which clarifies two specific circumstances in which a CWA permit is not required before pesticides are applied. (Federal Register Vol 71, No. 227, November 27, 2006) The two situations are when: 1) pesticides are applied directly to water to control pests, including mosquito larvae, aquatic weeds and other pests in the water; and 2) pesticides are applied to control pests that are present over or near water where a portion of the pesticide will unavoidably be deposited to the water in order to target the pests effectively

The action puts into effect a rule that confirms EPA's past operating approach that pesticides legally registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) for application to or near aquatic environments, and legally applied to control pests at those sites, are not subject to NPDES permit requirements. The rule became effective January 26, 2007. EPA has determined that pesticides applied in accordance with the requirements of FIFRA are not pollutants as defined in the CWA. Specifically they are not “chemical wastes” or “biological wastes”. The EPA ruling does not address local water quality concerns under the authority of an individual state which could chose to address these concerns with an NPDES permit.

As can be seen in tables 2-5 below, each of the four states in the Lake Tahoe Region have different approaches to implementing the laws that apply to pesticide application. Users of this plan need to understand those differences because it may affect the method and timing of implementing control measures. The tables are not all inclusive since depending on the circumstances, local issues and concerns may add additional steps to the approval process.

The following assumptions have been made in developing the tables:

A. The goal is to eradicate the population before it spreads to other locations.
B. The control method of choice is a pesticide. Note that any chemical used as a treatment method for controlling aquatic pests is by EPA definition, a pesticide and thus falls under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).
C. The laws and regulations described below are applicable but not necessarily limited to the following three situations if no physical alterations are made to the landscape:

1. Juvenile or adult zebra mussels found on boats or within the confines of a protected marina in a Lake Tahoe waterbody connected to the Lake; no mussels or veligers found outside marina.
2. Juvenile or adult zebra mussels found on a shallow, low current substrate that could be isolated from main stem flows;

3 Live zebra mussels in any life stage found in an isolated (no direct hydraulic connection) water body within the Lake Tahoe Region.

As noted, the tables have been developed to address a situation where a zebra mussel population could be isolated from the Lake without altering the landscape. Under some circumstances, however, isolating a population of mussels might involve erecting a temporary barrier around a site to prevent the escape of mussels and to facilitate the application, effectiveness and control of the pesticide. In this situation, not only would pesticide rules be applicable but land use laws might also apply. In Section G 2 below which focuses on non-pesticide control options, the laws that affect the placement of structures or otherwise physically altering the landscape are described in detail.

The tables also do not consider other scenarios where the use of pesticides might be possible. If populations are confined to shallow water, low current areas, then a method such as tarping and injecting pesticides might work. **Where currents, water depth, location and extent of the population preclude the possibility of physically isolating the population and the negative impacts can not be controlled or mitigated, the possibility of obtaining approval for the rapid deployment of pesticides would be remote and pesticide treatment should probably not be considered.**

At the end of this appendix are a series or recommendations aimed at filling existing gaps in knowledge, addressing regulatory issues and improving response capabilities.

TABLE 2: Pesticide Use Matrix for an Isolated Quagga/Zebra Mussel Infestation In The Lake Tahoe Region (Nevada)

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) administered by US EPA. Pesticide licensing and application authority delegated to NDEP	• Pesticides approved for aquatic application by the EPA must also be covered under a general NPDES permit or a State Waste Permit issued by the State of Nevada. • For commercial pesticides not currently approved by EPA, a formal Section 3 application process would be required. The requesting body would submit an application through the EPA Regional Office. • For an emergency situation, FIFRA provides for exemptions under Sections 18 and 24. See next column.	• Section 18 of FIFRA allows for an emergency use exemption for a pesticide that is not already approved. The request would go through NDEP who would evaluate the request and forward it to EPA. EPA would then have 50 days to do a risk assessment. The total process would have to be completed in 120 days if it is a new request, 80 days if is a repeat request. If approved, the approval would last for one year. • Section 18 also allows for a crisis exemption that would allow unregistered use for 15 days. The requesting entity would have to justify the crisis to NDEP who would then notify EPA; EPA would do a cursory review, confer with the state and give crisis exemption. Use beyond the 15 days would require an emergency exemption. • Section 24 (c) allows the states to register

		an additional use of a federally registered pesticide or a new use as long as there is a "special local need" and a current tolerance for the use approved by EPA. The request would go through NDEP for review and approval and then be submitted to EPA for review.
Endangered Species Act (ESA) administered jointly by the US Fish and Wildlife Service (USFW) and NOAA Fisheries.	• Actions undertaken in the Lake Tahoe would likely involve a species listed under the Endangered Species Act and require a Section 7 consultation. See next column for Section 7 consultations and emergency provisions	• Section 18 or Section 24 requests would have to include an ESA Section 7 consultation with EPA and either NOAA or USFW or both depending on the species potentially impacted and the location and timing of the proposed action,. In an emergency situation, an emergency consultation under 50CFR Part 402.5 as amended in the Federal Register Vol 69 No 150 August 5, 2004 could take place while the emergency is occurring. It would involve an informal consultation and a determination by EPA and the resource agencies that the action would "not adversely affect" any listed species or critical habitat. Once

		the emergency is under control, the normal consultation process could occur if needed.
National Environmental Policy Act (NEPA) administered by US EPA.	• Any federally initiated action or action on federal lands or action that uses federal funds must also comply with the provisions of NEPA. An environmental assessment (EA) would be required and a finding of no significant impact needed before the action could take place. For an emergency situation, see next column. •	• NEPA provides for an emergency action through consultation with the Council on Environmental Quality. The lead federal action agency would call CEQ, write a letter of notification, and prepare an environmental action statement. CEQ would respond in 24 hours. After the action is complete, a formal EIS or EA would have to be prepared
Clean Water Act (CWA) administered by US EPA with authority delegated to Nevada for regulating pollutants in state waters.	• A number of pesticides approved for aquatic applications are covered NPDES permits but currently there are no approved applications for mollusk eradication. • A State Waste Permit or NPDES Permit (see notes below) would be required for bodies of water that are not man made, are larger than 5 acres, and that have drainage. The process would involve the development of a permit for zebra mussel eradication that would include using one or more pesticides such as	• Under either Section 18 or Section 24, the applicant would also have to comply with

	KCl. Each approved pesticide must undergo a risk assessment. The analysis takes from 6 to 9 months for each chemical. The permit would be written simultaneously and would include addressing EPA provisions. As much as possible local jurisdictional issues would be addressed as well. Once complete, the permitted chemical could be used immediately. • For an emergency situation where a facility has an existing NPDES permit or State Waste Permit, the permitted chemical could be used. • For an extreme situation where there are no existing permits, an emergency order can be issued. (see next column)	
Resource Conservation and Recovery Act administered by US EPA with authority delegated to the State of Nevada.	• Pesticide waste must be managed in a non leak, closed container or tank that is appropriately labeled • Properly managed containers may be stored for up to one year • Containers must be transported to permitted hazardous waste facility following Federal Dept of Transportation regulations	• Releases must be immediately contained and transferred to appropriate container. Releases over 200 #s or 25 gallons must be reported to the National Response Center 1-800-424-8802.

TABLE 3: Pesticide Use Matrix for an Isolated Zebra Mussel Infestation in the Lake Tahoe Region (California).

REGULATORY REGIME	REGULATORY APPROVAL PROVISIONS	EMERGENCY PROVISIONS
Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) administered by US EPA. Pesticide licensing and application authority delegated the State of California.	• Pesticides approved for aquatic application by the EPA need no approval from California if they are applied according to label and license requirements. • For commercial pesticides not currently approved by EPA, a formal application process would be required. The pesticide registrant would submit an application through the state and EPA. • For an emergency situation, FIFRA provides for exemptions under Sections 18 and 24. See next column.	• Section 18 of FIFRA allows for emergency use exemption for a pesticide that is not already approved. The request would go through the State Water Board who would evaluate the request and forward it to EPA. Requests should be submitted 100 to 120 days prior to expected use. This timeframe includes the EPA 50 day risk assessment If approved, the approval would last for one year. • Section 18 also allows for a crisis exemption that would allow unregistered use for 15 days. The state agriculture department would notify EPA; EPA would do a cursory review, confer with the state and give crisis exemption. Use beyond the 15 days would require an emergency exemption • Section 24 (c) allows the states to register an additional use of a federally registered

		pesticide or a new use as long as there is a "special local need" and a current tolerance for the use approved by EPA. The request would go through the water Board for review and approval and then be submitted to EPA for review.
Endangered Species Act (ESA) administered jointly by the US Fish and Wildlife Service and NOAA Fisheries.	• Actions undertaken in the Lake Tahoe would likely involve a species listed under the Endangered Species Act and under TRPA?? Sensitive Species Rules and require a Section 7 consultation. See next column for ESA consultations and emergency provisions	• Section 18 or Section 24 requests would have to include an ESA Section 7 consultation with EPA and either NOAA Fisheries or US Fish and Wildlife or both depending on the species potentially impacted and the location and timing of the proposed action.. • In an emergency situation, an emergency consultation under 50CFR Part 402.5 as amended in the Federal Register Vol 69 No 150 August 5, 2004 could take place while the emergency is occurring. It would involve an informal consultation and a determination by EPA and the resource agencies that the action would "not adversely affect" any listed species or critical habitat. Once the emergency is

		under control, the normal consultation process could occur if needed.
TRPA		• TRPA would have to participate on an informational basis in ESA consultations if the species of concern was listed as sensitive, threatened or endangered.
.**National Environmental Policy Act (NEPA)** administered by US EPA	• Any federally initiated action or action on federal lands or action using federal funds must also comply with the provisions of NEPA. An environmental assessment (EA) would be required and a finding of no significant impact (FONSI) needed before the action could take place. For an emergency situation, see next column	• .NEPA provides for an emergency action through consultation with the Council on Environmental Quality. The lead federal action agency would call CEQ, write a letter of notification, and prepare an environmental action statement. CEQ would respond in 24 hours. After the action is complete, a formal EIS or EA would have to be prepared.
Clean Water Act (CWA) administered by US EPA with authority delegated to the Lahonton Regional Water Quality Control Board for regulating pollutants in state waters.	• No NPDES permits are required in this situation.	
Resource Conservation and Recovery Act administered by US EPA with authority	• Pesticide waste must be managed in a non leak, closed container or tank that is appropriately labeled • Properly managed	• Releases must be immediately contained and transferred to appropriate container. Releases over 200 #s or

delegated to LRWQCB.	containers may be stored for up to one year • Containers must be transported to permitted hazardous waste facility following LRWQCB and Federal Dept of Transportation regulations	25 gallons must be reported to the CA Emergency Response System and the National Response Center at 1-800-424-8802.

III. Regulatory requirements that may apply for non-chemical control methods

Table 2 (Appendix D) provides an array of possible non-chemical control methods that might work under certain conditions. With the exception of natural predation, they all have some environmental consequences and would thus also fall under the federal/state regulatory umbrella. FIFRA would no longer play a role for non pesticide control methods but the ESA, CWA and NEPA as well as state and federal land use laws would still be a part of that regulatory regime. The procedures described in Tables 2-3 for ESA and NEPA compliance remain the same. The following paragraphs describe other Federal regulatory requirements that could apply to the use of non-pesticide zebra mussel control methods. Following the Federal requirements is a discussion of the individual state's requirements and coordination with Federal laws.

Federal Permits and Authorities

Section 10 of the Rivers and Harbors Act of 1899 gives the US Army Corps of Engineers authority to authorize the erection of structures within navigable waterways of the United States. The formal process requires filing an application with the District Engineer who then has 15 days to review the application and issue a public notice. The public notice is usually for 30 days. The District Engineer has 60 days to make a decision. During this process, the District Engineer must determine whether the project with meet the requirements of the CWA, the Endangered Species Act, and the National Environmental Policy Act.

Two options exist for shortening the process. The first, a "Letter of Permission" provides an abbreviated process for a project where the District Engineer determines that the work is minor, has no individual or cumulative impacts on environmental values and should encounter no appreciable opposition. The District Engineer would coordinate with Federal and state fish and wildlife agencies during the determination.

The second option provides for emergency procedures. Division engineers are authorized to approve special processing procedures in emergency situations. An "emergency" is a situation which would result in an unacceptable hazard to life, a significant loss of property, or an immediate, unforeseen, and significant economic hardship if corrective action requiring a permit is not undertaken within a time period less than the normal time needed to process the application under standard procedures. Reasonable efforts will be made to receive comments from interested Federal, state, and local agencies and the affected public. Also, notice of any special procedures authorized and their rationale is to be appropriately published as soon as practicable.

Section 401 of the CWA requires that any activity that may affect water quality receive certification from the EPA that water quality standards for the particular body of water will not be violated. The EPA has delegated this authority to the state environmental agencies in Nevada and California. The states have 60 days to respond to the 401 notification with a determination regarding state water quality standards. In an emergency situation, the states would be consulted but the formal process would be waived until the emergency had been resolved.

Section 404 of the CWA gives the Secretary of the Army authority to issue permits, after notice and opportunity for public hearings for the discharge of dredged or fill material into the navigable waters at specified disposal sites. The formal process which could take up to a year can be shortened under the following circumstances.

A “Letter of Permission” In those cases subject to section 404 of the CWA can be issued after:

1. The district engineer, through consultation with Federal and state fish and wildlife agencies, the Regional Administrator, Environmental Protection Agency, and the state water quality certifying agency, develops a list of categories of activities proposed for authorization under LOP procedures;
2. The district engineer issues a public notice advertising the proposed list and the LOP procedures, requesting comments and offering an opportunity for public hearing; and

3 A 401 certification has been issued or waived and, if appropriate, CZM consistency concurrence obtained or presumed either on a generic or individual basis.

Emergency Procedures: (same as for a Section 10 Permit see above)

Summary of Control Methods and Applicable Regulations

The following table attempts to provide an overview of how the federal and state regulations described in the tables and sections above might apply to the various control methods. It does not cover all situations and should be used as reference only.

	PESTICIDES	BACTERIAL TOXINS	FREEZING & DESSICATION DEWATERING	THERMAL SHOCK & OXYGEN STARVATION	SOUND	VIBRATION	ELECTRICAL
FIFRA LICENCING	YES	??	NO	NO	NO	NO	NO
CWA / NPDES PERMIT	NO but recommended for facilities	NO	NO	NO	NO	NO	NO
ESA SECTION 7	YES	YES	YES	YES	YES	YES	YES
NEPA	YES	YES	YES	YES	YES	YES	YES
RHA SEC 10 CWA SEC 404	NO unless isolation structure used	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
CWA SEC 401	NO unless toxins released	NO unless toxins released	YES unless WQ standards not affected	YES unless WQ standards not affected	NO	NO	YES unless WQ standards not affected
CZMA CONSISTENCY	NO unless isolation structure needed	NO unless isolation structure used	YES	NO unless structure needed	NO unless structure needed	NO unless structure needed	NO unless structure needed
RCRA STORAGE & DISPOSAL	YES	MAYBE	NO	NO	NO	NO	NO

APPENDIX F-CONTINGENCY PLANS

ATTACHMENT 1

Information Paper: Introduction of Quagga/Zebra Mussels into the Lake Tahoe Region

1. Background: Since zebra mussels (*Dreissena polymorpha*) were introduced into the United States in the late 1980s from eastern Europe, they have rapidly dispersed throughout the Great Lakes and major river systems including the Hudson, Ohio, Mississippi, lower Missouri, and other rivers to the south and east covering 22 states and two Canadian provinces. This rapid dispersal is due primarily to its tremendous reproductive capability and the fact that larval zebra mussels are able to remain free-floating for several weeks before settling. This ability allows them to be dispersed by downstream water currents, which has been the major vector for their rapid expansion in North America. They are also dispersed by attaching to various types of watercraft moving within or from infested waters. They are particularly troublesome because of their ability to attach to any submerged hard surface, preferring secluded areas with moving water.

If zebra mussels are introduced and become established within the Lake Tahoe, it is uncertain how densely they will colonize. They can probably be expected to thrive at least as well as the invasive Asian clam (*Corbicula fluminea*) that is already widely distributed in the Lake Tahoe. Densities ranging up to hundreds of thousands per square meter could be attained under favorable conditions – enough to completely cover surfaces several layers deep. The severity of impacts on hydropower, navigation, and fish passage facilities and extent and frequency of mitigation actions will depend on mussel production levels.

2. Potential Impacts: If zebra mussels colonized the Lake Tahoe Region (Lake Tahoe) they could affect ….
4. Response Actions: Initial response is to determine if zebra mussels are present, where they have settled, and how dense the population is.

ATTACHMENT 2

Draft Talking Points: Introduction of Zebra Mussels into the Lake Tahoe Region

1. Where did zebra mussels come from?
Zebra mussels originated in the Balkans, Poland, and the former Soviet Union and were introduced in the mid-1980s into the Great Lakes as a result of ballast water discharge. Since their introduction, zebra mussels have spread to 22 states and two Canadian provinces. They rapidly dispersed throughout the Great Lakes and much of the Mississippi River basin due to their tremendous reproductive capability, the planktonic

nature of the larvae allowing water currents to cause downstream drift over great distances, and ability to attach to boats traveling within and from infested waters. The recently-discovered population in _____ is believed to have been from mussels attached to _____ (a recreational boat) that was brought from _____.

2. What is the problem?
If zebra mussels colonized the Lake Tahoe Region (Lake Tahoe) they could affect

3. What can/is being done to deal with them?
A comprehensive, coordinated regional effort, led by _____ Team, has been assembled to address the problem. First priority is to contain and control the existing population to prevent further dispersal into the region. This could include a general quarantine of the infected area with access restricted to authorized parties or _____. At the same time, discussions are underway to determine if any practical means of eliminating the zebra mussels exists. As this is unlikely, long-term management options are also being developed. These efforts are being guided by a Rapid Response Plan that was developed by the Lake Tahoe Region Coordinating Committee in 2009 to deal with this very problem.

ATTACHMENT 3

Draft Press Release Example: Introduction of Quagga/Zebra Mussels into the Lake Tahoe Region Raises Concerns [Public Affairs Office review for style/content]

The recent discovery of zebra mussels in _____ has raised serious concerns among regional experts about their potential effects on our aquatic resources and economy. This small freshwater mussel, originally from Eastern Europe, was introduced into the Great Lakes area in the late 1980s and rapidly spread throughout the eastern United States and Canada. They are believed to have been brought into our area by _____.

Some estimates of the economic impact of these small mussels to water intake and conveyance facilities in the eastern U.S. are several $1 billion. Much of the existing infrastructure had to be modified or replaced to deal with the prolific mussels that are able to attach to about every hard surface in contact with raw water supplies. Possibly even more significant, are the as of yet unquantified, monetary impacts they are expected to have on recreation and natural resource values.

It is not certain how great the impact will be in _____ but an interagency coordinating group, led by _____, is extremely concerned. Once the zebra mussels become established, it is almost impossible to get rid of them. The best hope is to launch an early, coordinated program to contain the current infestation and hopefully determine a means of control.

The _____ (group) is fortunate to have a head start using a rapid response strategy that was developed earlier in anticipation of just this kind of problem. Other similar rapid response programs have been most successful when there was early

detection of an invasive species and all of the agencies that had to be involved were able to quickly respond with a well-coordinated plan.

In the meantime, the _____ (agency) has _____ (restricted access) to _____ (infected location) to help prevent further dispersal of the zebra mussels. The public can help by avoiding the ____ (infected area) and following some good general guidelines. They should clean all boats, trailers, and other equipment after leaving a lake or stream and never release any live organisms into the wild.

Additional information could be added about other species already in the region and how they are being dealt with – Eurasian watermilfoil and Asian clam.
Quotes:
"We have been aware of problems zebra mussels have caused in the Great Lakes region and have been working with various agencies organizations since the early 1990s to prevent their introduction into the west."
"Although eradication is extremely difficult, our first concern is to contain the zebra mussel infestation within _____ to avoid it being spread to other vulnerable areas."
"Although the recent discovery of zebra mussels is alarming, we are fortunate to have a Rapid Response Plan available to facilitate a coordinated regional effort to deal with this new invader. "The successes we have seen in other areas were the result of the region's ability to rapidly respond with a coordinated intense effort."

APPENDIX G

SAMPLE DOCUMENTS

G-1: Model Letter of Agreement

Date

Agency

This letter affirms that [insert agency/entity] adopts the *Lake Tahoe Region Interagency Response Plan for Zebra Mussels and Other Dreissena Species* (Plan) as its guiding document in the event that zebra mussels or other *Dreissena* species are introduced into Lake Tahoe Region waters. As such, [insert agency/entity] agrees to:

- Treat the introduction of zebra mussels or other *Dreissena* species in the Lake Tahoe Region as a natural resources emergency that merits immediate and significant response as long as opportunities exist to contain or eliminate the invasion.
- Appoint staff to serve on the organizational elements described in the Plan.
- Coordinate our organization's monitoring, public information, and other rapid response activities through the organizational elements described in the Plan.
- Evaluate our preparedness to respond to an invasive mussel introduction into the Lake Tahoe Region and take steps to enhance our capabilities as outlined in the Plan and as resources allow.

Signed this _____ day of _____

[Signature block]

G-2: Sample Press Release in the Event of Discovery of Dreissenid Mussels in the Lake Tahoe Region

Date

Lead agency contact information:

On [date], [agency] received a report that live zebra [and/or/quagga] mussels were present in _____. This report has been initially verified by [agency/recognized expert], and efforts are underway to [describe what's next, if anything, to confirm i.d.].

This discovery is a serious environmental and economic concern for the Pacific Northwest. Zebra mussels are small nonnative freshwater mollusks that have caused major problems in the eastern United States after their introduction in the 1980s.

[Insert quote from a lead agency administrator]

Officials have not yet determined how these mussels arrived to the Lake Tahoe Region. Recreational boats are known to be a major source of zebra mussel spread in the United States, and there are a number of past incidents where boats fouled by live zebra mussels have been intercepted prior to launching in Lake Tahoe waters. [If quagga mussels are found/suspected, insert information on the Colorado River invasion].

Under the national 100th Meridian Initiative campaign, regional aquatic invasive species experts have been preparing for this unfortunate incident, and recently completed a rapid response plan for zebra and quagga mussels in the Lake Tahoe Region. As called for by this Plan, agencies are coordinating activities such as measuring the extent of invasion, evaluating control options, and initiating measures to prevent further spread.

[Insert more details on specific next steps for surveys, etc.]

<u>Background on Zebra and Quagga Mussels</u>:

Zebra mussels are native to Eastern Europe. They were introduced into the Great

Lakes area in the late 1980s, likely via ballast water from commercial ships. They have since rapidly spread throughout the eastern United States and Canada.

Zebra mussels are freshwater bivalve mollusks that typically have a dark and white (zebra-like) pattern on their shells, but may be any combination of colors from off-white to dark brown. Zebra mussels are usually about an inch or less long, but may be larger. When healthy, they attach to hard substrates.

Until the mid 1980s there were no zebra mussels in North America. That changed when they were inadvertently introduced into waters near the Great Lakes region. It is suspected that zebra mussels hitched a ride in ballast water tanks of commercial ships. Zebra Mussels were first discovered in the United States in Lake St. Clair near Detroit, Michigan in 1988. Since the 1980s, zebra mussels have spread, unchecked by natural predators, throughout much of the eastern United States. They currently infest much of the Great Lakes basin, the St. Lawrence Seaway, and much of the Mississippi River drainage system. The have begun to spread up the Missouri River and Arkansas River. In 2008 zebra mussels were confirmed in California and Colorado.

Zebra mussels negatively affect the environment by reproducing quickly and in large numbers. Zebra Mussel densities have been reported to be over 700,000 individuals per square meter in some facilities in the Great Lakes area. Zebra mussels are biofoulers that obstruct pipes in municipal and industrial raw-water systems, requiring millions of dollars annually to treat. They produce microscopic larvae that float freely in the water column, and thus can pass by screens installed to exclude them. Monitoring and control of zebra mussels costs millions of dollars annually. As filter feeders, zebra mussels remove suspended material from the habitat in which they live. This includes the planktonic algae that are the primary base of the food web. Thus, zebra mussels may completely alter the ecology of water bodies in which they invade.

Some estimates of the economic impact of these small mussels to water intake and conveyance facilities in the eastern U.S. are several billion dollars. Much of the existing infrastructure had to be modified or replaced to deal with the prolific mussels that are able to attach to about every hard surface in contact with raw water supplies. Possibly even more significant, are the as of yet unquantified, monetary impacts they are expected to have on recreation and natural resource values.

It is not certain how great the impact will be in _____ but an interagency coordinating group, led by _____, is extremely concerned. Once the zebra mussels become established, it is almost impossible to get rid of them. The best hope is to launch an early, coordinated program to contain the current infestation and hopefully determine a means of control.

The _____ (group) is fortunate to have a head start using a rapid response strategy that was developed earlier in anticipation of just this kind of problem. Other similar rapid response programs have been most successful when there was early

detection of an invasive species and all of the agencies that had to be involved were able to quickly respond with a well-coordinated plan.

In the meantime, the _____ (agency) has _____ (restricted access) to _____ (infected location) to help prevent further dispersal of the zebra mussels. The public can help by avoiding the ____ (infected area) and following some good general guidelines. They should clean all boats, trailers, and other equipment after leaving a lake or stream and never release any live organisms into the wild.

Additional information could be added about other species already in the region and how they are being dealt with – Eurasian watermilfoil and Asian clam.

How can boaters help prevent the spread of zebra mussels:
These aquatic nuisance species can hitch a ride on our clothing, boats, and items used in the water. When visitors go to another lake or stream, the nuisance species can be released. And, if the conditions are right, these introduced species can become established and create drastic results. By following a simple procedure each time boaters leave the water, they can help stop aquatic hitchhikers. Knowing which waters contain nuisance hitchhikers is not as important ---- as doing the procedure every time boaters leave any lake, stream or coastal area:

- Remove any visible mud, plants, fish or animals before transporting equipment
- Eliminate water from equipment before transporting
- Clean and dry anything that came in contact with water (Boats, trailers, equipment, clothing, dogs, etc.)
- Never release plants, fish or animals into a body of water unless they came out of that body of water.

Additional information can be found at www.100thMeridian.org.

Possible Quotes:
"We have been aware of problems zebra mussels have caused in the Great Lakes region and have been working with various agencies organizations since the early 1990s to prevent their introduction into the west."
"Although eradication is extremely difficult, our first concern is to contain the zebra mussel infestation within _____ to avoid it being spread to other vulnerable areas."
"Although the recent discovery of zebra mussels is alarming, we are fortunate to have a Rapid Response Plan available to facilitate a coordinated regional effort to deal with this new invader. "The successes we have seen in other areas were the result of the region's ability to rapidly respond with a coordinated intense effort."

G-3: SAMPLE STATE DECLARATION OF EMERGENCY

Note: the below template is provided as a resource to governmental agencies that intend to issue an emergency proclamation/order in response to an introduction of invasive mussels in the Lake Tahoe Region. It is not intended to obligate any government to take such action.

DREISSENID MUSSEL INVASIVE SPECIES PROCLAMATION OF EMERGENCY AND EXECUTIVE ORDER

[DATE]

WHEREAS, Dreissenid mussels are harmful, highly invasive species, not native to the United States. Dreissenid mussels, more commonly known by the species names of zebra or quagga mussels, were discovered in the Great Lakes region in and around 1988. Since this time, dreissenid mussels have spread throughout much of the eastern United States, including infesting much of the Mississippi, Missouri, and Arkansas River drainages. This infestation has caused billions of dollars in economic costs to public agencies and private industry. The environmental costs have been significant, too.

WHEREAS, Live dreissenid mussels were discovered in Lake Tahoe on [DATE], and additional surveys may reveal the presence of dreissenid mussels within other waterbodies within the State of _____.

WHEREAS, their presence in the Lake Tahoe greatly advances the known range of dreissenid mussels, emphasizing the fact that that dreissenid mussels can readily move from place to place, either as free-swimming larvae contained in hydrologically connected or transported water, or as adults that are attached to boat hulls, makes their presence in or near Lake Tahoe a threat to rivers, lakes and reservoirs throughout the state.

WHEREAS, Dreissenid mussels alter the natural food web of aquatic ecosystems. They filter nutrients like planktonic algae that are the primary base of the food chain, from the water making these nutrients unavailable for native species, resulting in decline or extirpation of native species and disruption to the ecological balance of the water body. If allowed to reach other nearby waters, these mussels would further threaten sensitive fish species that are already in severe decline. Maintaining the ecological balance of [INSERT STATE]'s waterbodies is critical to the long-term sustainability of native species, and to [INSERT STATE} businesses, recreational sites and local communities.

WHEREAS, dreissenid mussels foul submerged pipes and other infrastructure including water diversion structures, piers and pilings, power plant intakes and cooling systems, fish screens, and boat hulls. These mussels reproduce quickly and in large numbers. They have been reported in densities of over 700,000 per square meter in some facilities in the Great Lakes.

WHEREAS, should they become established in Lake Tahoe, the impact of dreissenid mussels on region's ecosystem is difficult to estimate but would significantly increase.

WHEREAS, dreissenid mussels damage the hulls, props, and motors of boats and other watercraft, imposing additional costs and burdens on recreational boaters and diminishing the attraction of water-based recreation in [INSERT STATE].

WHEREAS, the [INSERT APPROPRIATE STATE AGENCY] has extensive authority over non-native species. For example, [CITE RELEVANT LAWS/REGS REGARDING POSSESSION, ETC.] However, these authorities do not provide [INSERT APPROPRIATE STATE AGENCY] with all of the tools it needs to deal with this crisis.

[REPEAT ABOVE FOR OTHER RELEVANT AGENCIES]

NOW, THEREFORE, I, [INSERT GOVERNOR NAME**],** Governor of the State of [INSERT STATE], in light of the aforementioned, find that a condition of extreme peril to the safety of persons and property exists in and around the various waterbodies of the State of [INSERT STATE] due to the infestation of dreissenid mussels. I further find that the ability of the agencies and departments of the State of [INSERT STATE] to effectively control the spread of these mussels in the State is limited. Accordingly, under the authority of the [CITE APPROPRIATE STATE EMERGENCY LAW/CODE], I hereby proclaim that a State of Emergency exists within the State of [INSERT STATE].

IT IS HEREBY ORDERED that all departments and agencies of state government utilize and employ state personnel, equipment and facilities for the performance of any and all activities consistent with the *Lake Tahoe Region Interagency Response Plan for Zebra Mussels and other Dreissena species* and associated incident response plans and interagency agreements. This includes assisting with the education of the public on the risks posed by the presence and spread of Dreissenid mussels within the Region.

FURTHER, employees of the [INSERT APPROPRIATE AGENCIES], and their designees (hereinafter referred to as "inspectors") may stop and conduct inspections of boats and other watercraft entering into or present within the Region to determine if dreissenid mussels could be present. In the event that the inspectors make this determination, the inspectors can take such actions they

determine are reasonably necessary to kill the dreissenid mussels and thereby reduce the possible spread of this damaging species within the Region. These actions may include, but are not limited to, temporarily stopping vehicles with boats or other watercraft, ordering that areas in the boat or other watercraft that contain water be drained and/or dried, that areas that cannot be completely drained or from which water cannot be eliminated be decontaminated, that boats or other watercraft may be impounded or quarantined for such time as is necessary to ensure that dreissenid mussels can no longer live on or within that boat or watercraft.

FURTHER, the inspectors may order that waterbodies where dreissenid mussels are found to be present on marinas, boat launch facilities, or other property be closed, quarantined, or access otherwise limited in such a manner as will not permit the spread of dreissenid mussels within the Region. Any such property may be decontaminated, impounded or quarantined for such time as is necessary to ensure that dreissenid mussels can no longer live on or within that property.

I FURTHER DIRECT that as soon as hereafter possible, this proclamation be filed in the Office of the Secretary of State and that widespread publicity and notice be given of this proclamation.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of [INSERT STATE] To be affixed on this [INSERT DATE].

G-4: Sample Delegation of Authority

Everglades and Dry Tortugas National Parks

Homestead, Florida

As of 1800, May 20, 20XX, I have delegated authority to manage the Ingraham Fire number 8930 to Incident Commander XXXXXXXXX and her Incident Management Team.

The fire is burning in legislated wilderness. My considerations for management of this fire are:

1. Provide for firefighter safety.
2. I would like the fire managed under a containment strategy with suppression actions done with as little environmental damage as possible. The NPS definition of containment is attached.
3. Key cultural features requiring priority protection are: Mahogony Hammock, overlook boardwalks, park headquarters, the Pinelands campground and residential area, Royal Palm Visitor Center, hydrostations with recording equipment.
4. Key resource considerations are: protecting endangered species by providing aircraft telemetry monitoring of Florida panther, preserving as much Cape Sable Sparrow habitat as possible, and avoiding wildlife entrapment situations.
5. Restrictions for suppression actions are no tracked or wheeled vehicles in the wilderness except where roads exist and are identified for use, and no retardant will be utilized.
6. Tools approved for use are Type II/III helicopters, chainsaws, and weed whips.
7. My Agency Advisor will be the park Fire Management Officer.
8. The NE flank of the fire borders Florida Department of Forestry (DOF) protection. Chekika State Park must be protected if threatened. The District Forester will be the DOF representative.
9. Managing the fire cost-effectively for the values at risk is a significant concern.
10. Providing training opportunities for the South Florida parks personnel is requested to strengthen our organizational capabilities.
11. Minimum disruption of visitor access of the main park road consistent with public safety.

_____

Superintendent, Everglades and Dry Tortugas National Parks

Amendment to Delegation of Authority

The Delegation of Authority dated May 20, 20XX, issued to Incident Commander XXXXXXXXX for the management of the Ingraham Fire number 8930 is hereby amended as follows. This will be effective 1800 May 22, 20XX.

3. Key cultural features requiring priority protection are: Mahogony Hammock, overlook boardwalks, park headquarters, the Pinelands campground and residential area, Royal Palm Visitor Center, hydrostations with recording equipment, Shark Valley, Hammock 55, Binky Hammock Chain.

12. Use of tracked vehicles authorized to protect the Miccosukee Strip.

_____

Superintendent, Everglades and Dry Tortugas National Park

Appendix H - Forms

The attached listing of forms is commonly used during a response with the deployment of the Rapid Response Team and Technical Specialists.

Form:	**Form Number**
ANS Initial Report Form	PSMFC 1
Incident Action Plan Cover Sheet	PSMFC 2
Incident Briefing	ICS-201
Incident Objectives	ICS-202
Organization Assignment List	ICS-203
Division Assignment List	ICS-204
Radio Communications Plan	ICS-205
Phone Communication Plan	ICS-205a
Medical Plan	ICS-206
ICS Organization Chart	ICS-207
Incident Status Summary	ICS-209
Check In List	ICS-211
General Message	ICS-213
Resource Request Message	ICS-213RR
Unit Log	ICS-214
Operational Planning Worksheet	ICS-215
Incident Meeting Schedule	ICS-230
Resources At Risk	ICS-232
Open Action Tracker	ICS-233
Work Analysis	ICS-234
Technical Specialist Report	ICS-234a
Technical Specialist Analysis	ICS-234b

1. Incident Name	2. Prepared by: (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

3. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, over flight results, trajectories, impacted shorelines, or other graphics depicting situational and response status)

4. Current Situation

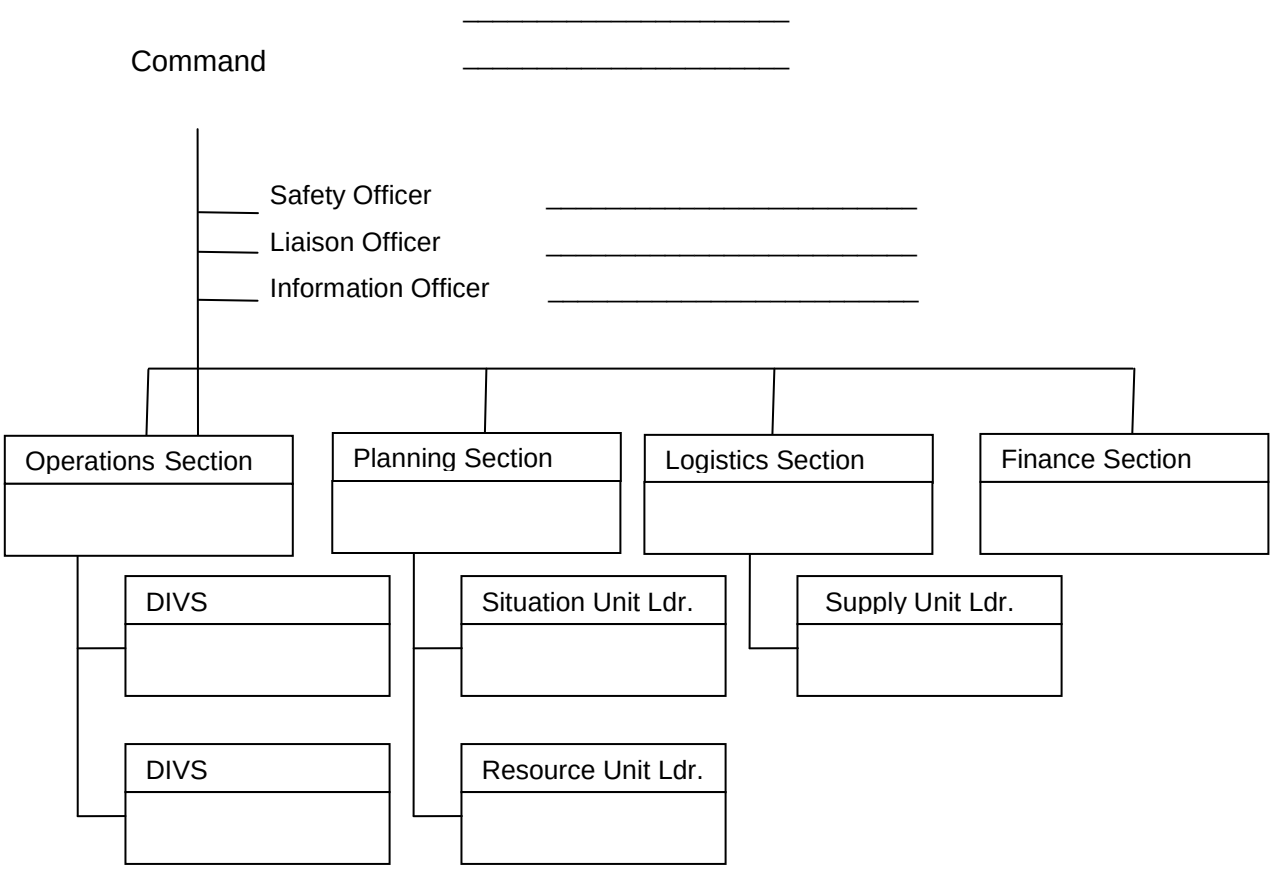
1. Incident Name	2. Prepared by: (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

5. Initial Response Objectives, Current Actions, Planned Actions, Potential

	Objectives:
	Priorities:
	Current Actions:
	Planned Actions:
	Potential:
	Key Decisions:

1. Incident Name	2. Prepared by: (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

6. Current Organization (fill in additional appropriate organization)



1. Incident Name	2. Prepared by: (name) Date: Time:	INCIDENT BRIEFING ICS 201 PSMFC RRT

7. Resources Summary

Resource	Resource Identifier	Date Time Ordered	ETA	On-Scene (X)	NOTES: (Location/Assignment/Status)

1. Incident Name	2. Operational Period to be covered by IAP (Date/Time) From: To:	IAP COVER SHEET PSMFC RRT

3. Approved by Incident Commander(s):

ORG	NAME

INCIDENT ACTION PLAN

The items checked below are included in this Incident Action Plan:

- ☐ ICS 202 (Response Objectives)
- ☐ ICS 203 (Organization List)
- ☐ ICS 204's (Assignment Lists)
  One Copy each of any ICS 204 attachments:
- ☐ ICS 205 (Communications Plan)
- ☐ ICS 206 (Medical Plan)
- ☐ ICS 208 (Site Safety Plan) or Note SSP Location _____
- ☐ Map/Chart
- ☐ Weather forecast / Tides/Currents

Other Attachments

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

4. Prepared by: **Date/Time**

1. Incident Name	2. Operational Period (Date/Time) From: To:	INCIDENT OBJECTIVES ICS 202 PSMFC RRT

3. Objective(s)

4. Operational Period Command Emphasis (Safety Message, Priorities, Key Decisions/Directions)

Approved Site Safety Plan Located at:

5. Prepared by: (Planning Section Chief)	Date/Time

1. Incident Name	2. Operational Period (Date/Time) From: To:	ORGANIZATION ASSIGNMENT LIST ICS 203 PSMFC RRT

3. Incident Commander(s) and Staff

Agency	IC	Deputy

Safety Officer:	
Information Officer:	
Liaison Officer:	

4. Agency Representatives

Agency	Name

5. PLANNING/INTEL SECTION

Chief	
Deputy	
Resources Unit	
Situation Unit	
Documentation Unit	
Demobilization Unit	
Technical Specialists	

6. LOGISTICS SECTION

Chief	
Deputy	
a. Support Branch	
Director	
Supply Unit	
Facilities Unit	
Ground Support Unit	
b. Service Branch	
Director	
Communications Unit	
Medical Unit	
Food Unit	

7. OPERATION SECTION

Chief		
Deputy		
Deputy		
Staging Area Manager		
Staging Area Manager		
Staging Area Manager		
a. Branch – Division Groups		
Branch Director		
Deputy		
Division Group		
Division Group		
Division Group		
Division/Group		
Division/Group		
b. Branch – Division/Groups		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
c. Branch – Division/Groups		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
d. Air Operations Branch		
Air Operations Br. Dir		
Helicopter Coordinator		

8. FINANCE/ADMINISTRATION SECTION

Chief	
Deputy	
Time Unit	
Procurement Unit	
Compensation/Claims Unit	
Cost Unit	

9. Prepared By: (Resources Unit)	Date/Time

1. Incident Name	2. Operational Period (Date/Time) From: To:	**Assignment List** **ICS 204 PSMFC RRT**
3. Branch	**4. Division/Group/Staging**	

5. Operations Personnel Name Affiliation Contact # (s)

Operations Section Chief: _____

Branch Director: _____

Division/Group Supervisor/STAM: _____

6. Resources Assigned "X" indicates 204a attachment with additional instructions

Strike Team/Task Force/Resource Identifier	Leader	Contact Info. #	# of Persons	Reporting Info/Notes/Remarks	↓
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐
					☐

7. Work Assignments

8. Special Instructions

9. Communications (radio and/or phone contact numbers needed for this assignment)

Name/Function	Radio: Freq./System/Channel	Phone	Cell/Pager	_____

Emergency Communications

Medical _____ Evacuation _____ Other _____

10. Prepared by	Date/Time	11. Reviewed by (PSC)	Date/Time	12. Reviewed by (OSC)	Date/Time

1. Incident Name	2. Operational Period (Date / Time) From: To:	INCIDENT RADIO COMMUNICATIONS PLAN ICS 205 PSMFC RRT

3. BASIC RADIO CHANNEL USE

SYSTEM / CACHE	CHANNEL	FUNCTION	FREQUENCY	ASSIGNMENT	REMARKS

4. Prepared by: (Communications Unit) **Date / Time**

INCIDENT RADIO COMMUNICATIONS PLAN
ICS 205 PSMFC RRT

1. Incident Name	2. Operational Period (Date / Time) From: To:	**COMMUNICATIONS PHONE LIST ICS 205a PSMFC RRT**

3. Basic Local Communications Information

Assignment	Name	Method(s) of contact (radio frequency, phone, pager, cell #(s), etc.)

4. Prepared by: (Communications Unit) **Date / Time**

1. Incident Name	2. Operational Period (Date / Time) From: To:	**MEDICAL PLAN** **ICS 206** **PSMFC RRT**

3. Medical Aid Stations

Name	Location	Contact #	Paramedics On site (Y/N)

4. Transportation

Ambulance Service	Address	Contact #	Paramedics On board (Y/N)

5. Hospitals

Hospital Name	Address	Contact #	Travel Time		Burn Ctr?	Heli-Pad?
			Air	Ground		

6. Special Medical Emergency Procedures

7. Prepared by: (Medical Unit Leader) Date/Time	8. Reviewed by: (Safety Officer) Date/Time

1. Incident Name	2. Operational Period (Date / Time) From: To: Time of Report	INCIDENT STATUS SUMMARY ICS 209 PSMFC RRT

3. Type of Incident

☐	Oil Spill	☐	HAZMAT	☐	
☐	Marine Disaster	☐	SI/Terrorism	☐	
☐	Civil Disturbance	☐	Natural Disaster	☐	
☐	Planned Event	x	ANS Discovery		

4. Situation Summary as of Time of Report:

5. Future Outlook/Goals/Needs/Issues:

6. Status Summary

	Since Last Report	Adjustments To Previous Op Period	Total
Mussel Finds			
Zebra Mussel Confirmation			
Vessels Involved			
Facilities Involved			
Responder Injuries			

7. Property Damage Summary

Vessel	$ Unknown
Cargo	$ Unknown
Facility	$ Unknown
Other	$ Unknown

8. Attachments with clarifying information

☐	Costs	☐		☐	
☐		☐		☐	
☐		☐		☐	

9. Equipment Resources					
Kind	Notes	# Ordered	# Available	# Assigned	# Out of Service

10. Personnel Resources	
Agency	**Total # of People**
WDFW	
WA-SCS	
USCG	
USFW	
PSMFC	
State	
Local	
Contractors	
Other	
Total Personnel Resources Used From all Organizations:	

11. Prepared by:	Date/Time Prepared:

CHECK-IN LIST	1. INCIDENT NAME	2. CHECK-IN LOCATION	3. DATE/TIME

CHECK-IN INFORMATION

4. LIST PERSONNEL (OVERHEAD) BY AGENCY NAME – OR LIST EQUIPEMENT BY THE FOLLOWING FORMAT: S=Supplies, H=Helicopter, O=Overhead, VL=Vessels, E=Equipment, C=Crew, A=Aircraft, VH=Vehicle			5. ORDER/ NUMBER	6. DATE/TIME CHECK-IN	7. LEADER'S NAME	8. TOTAL NO. PERSONNEL	9. INCIDENT CONTACT INFORMATION	10. INCIDENT LODGING INFO/CONTACT INFO	11. HOME UNIT	12. METHOD OF TRAVEL	13. INCIDENT ASSIGNMENT	14. SENT TO RESTAT TIME/INT.
AGENCY	**RESOURCE IDENTIFIER**	KIND										

15. ICS 211-CG PAGE _____ of _____	16. PREPARED BY (Name and Position) USE BACK FOR REMARKS OR COMMENTS

1. Incident Name	2. Date and Time of Message	GENERAL MESSAGE ICS 213 PSMFC RRT
3. TO:	ICS Position	
4. FROM:	ICS Position	
5. Subject:		
6. Message		
7 Reply		
8. Signature/Position (person replying)	Date/Time of reply	
GENERAL MESSAGE		ICS 213 PSMFC RRT

1. Incident Name	2. Operational Period (Date/Time) From: To:	UNIT LOG ICS 214 PSMFC RRT

3. Unit Name/Designators	4. Unit Leader (Name and ICS Position)

5. Personnel Assigned

NAME	ICS POSITION	HOME BASE

6. Activity Log (Continue on Reverse)

TIME	MAJOR EVENTS

7. Prepared by:	Date/Time

UNIT LOG ICS 214 PSMFC RRT

1. Incident Name	2. Operational Period (Date/Time) From: To:	UNIT LOG (CONT.) ICS 214 PSMFC RRT

6. Activity Log (Continue on Reverse)

TIME	MAJOR EVENTS

7. Prepared by: **Date/Time**

UNIT LOG ICS 214 PSMFC RRT

1. Incident Name	2. Operational Period (Date/Time) From: To:	DAILY MEETING SCHEDULE ICS 230 PSMFC RRT

3. Meeting Schedule (Commonly-held meetings are included)

Date/ Time	Meeting Name	Purpose	Attendees	Location
	Tactics Meeting	Develop primary and alternate Strategies to meet Incident Objectives for the next Operational Period.	PSC, OPS, LSC, EUL, RUL & SUL	
	Planning Meeting	Review status and finalize strategies and assignments to meet Incident Objectives for the next Operational Period.	Determined by the IC/UC	
	Operations Briefing	Present IAP and assignments to the Supervisors / Leaders for the next Operational Period.	IC/UC, Command Staff, General Staff, Branch Directors, Div. Sups., Task Force/Strike Team Leaders and Unit Leaders	
	Unified Command Objectives Meeting	Review/ identify objectives for the next operational period.	Unified Command members	

4. Prepared by: (Situation Unit Leader) **Date/Time**

1. Incident Name	2. Operational Period (Date/Time) From: To:	**RESOURCES AT RISK SUMMARY** **ICS 232 PSMFC RRT**

3. Environmentally-Sensitive Areas and Wildlife Issues

Site #	Priority	Site Name and/or Physical Location	Site Issues

Narrative

_____

_____

_____

_____

_____

4. Archaeo-cultural and Socio-economic Issues

Site #	Priority	Site Name and/or Physical Location	Site Issues

Narrative

_____

_____

_____

_____

_____

5. Prepared by: (Environmental Unit Leader) **Date/Time**

RESOURCES AT RISK SUMMARY ICS 232 PSMFC RRT

1. Incident Name		**OPEN ACTION TRACKING**			ICS 233 PSMFC RRT		
2. No.	3. Item	4. For	5. Status	6. Start Date	7. Briefed	8. Target Date	9. Actual Date
1							
2							
3							
4							
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		WORK ANALYSIS MATRIX ICS 234-PSMFC RRT
1. Operation's Objectives DESIRED OUTCOME	2. Optional Strategies HOW	3. Tactics/Work Assignments WHO, WHAT, WHERE, WHEN

TECHNICAL SPECIALIST REPORT ICS-234a PSMFC RRT	1. Incident	2. Date/Time
3. Situation Assessment		
4. Hazard Analysis		
5. Mitigation Strategies		
6. Weather		
Page 1 of _____	Technical Specialist (Signature)	

Recommended Yes	Recommended No	Strategic/Tactical Option	Analysis

Page _______ of ________		Technical Specialist (Signature)	

	Technical Specialist Analysis ICS-234b PSMFC RRT
Tactical Options (From ICS-234)	**Analysis**
1.	**Recommended/Not Recommended**. (Explain)
2.	**Recommended/Not Recommended**. (Explain)
3.	**Recommended/Not Recommended**. (Explain)
4.	**Recommended/Not Recommended.** (Explain)
5.	**Recommended/Not Recommended.** (Explain)
	ICS-234b PSMFC RRT

1. Sighting Report	2. Report Date / Time Date Time of Report	3. Reported by: (Name and Agency)

4. Type of Sighting

☐ Zebra Mussel	☐ Other		
☐ Quagga Mussel	☐ Other		
☐ Chinese Mussel	☐ Other		
☐ Unknown	☐ Other		

5. Site Description: (Affected water body, landmarks, mile marker, GPS)

6. Mussel Colony Description: (Number, density and extent)

7. Incident Summary

	Initial Report	Update Report	Total
Size of Find			

8. Facilities involved

Vessels	
Docks/Piers/Moorings	
Natural Barriers	
Other	

9. Attachments with clarifying information

☐ Photographs	☐ Lab Results		
☐ Maps/Charts	☐ Narrative		
☐ Sample	☐		

10.	Narrative:

11. Prepared by: **Date/Time:**

APPENDIX I:

GLOSSARY

Appendix I: Glossary

Aquatic Nuisance Species (ANS): Also called "aquatic invasive species (AIS)" are aquatic organisms that have been introduced into new ecosystems and cause harmful impacts on the natural resources in these ecosystems and the human use of these resources.

Aquatic Nuisance Species Task Force: An intergovernmental organization dedicated to preventing and controlling aquatic nuisance species, and implementing the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990. (Go to http://www.anstaskforce.gov/default.php).

Bivalve: A type of mollusk with two hinged shells (e.g., clams and mussels)

Lake Tahoe Region: The entire region which drains into Lake Tahoe.

Lake Tahoe Region (Lake Tahoe) Team of the 100th Meridian Initiative: The Lake Tahoe Region Team has been established as part of the 100th Meridian Initiative to address the special needs of the Lake Tahoe Region. The Lake Tahoe Team includes state, federal, Tribal, and university ANS managers and researchers.

Coordination and Support Staff: Provide technical, scientific, and logistical support to the MAC Group, the Interagency Rapid Response Team, and local affected agencies/entities, including positive confirmation of extent and scope of the zebra mussel infestation. The Coordination and Support Staff are made up of subject matter experts activated in response to the specific needs of the reported infestation, and assist in identifying appropriate containment, control, and eradication efforts.

Multiagency Coordination (MAC) Group: A group of interagency representatives with decision making authority for their agencies that coordinates the overall management policy for a response, and may be convened at the national level, the geographic area level (e.g. Lake Tahoe Region), and/or at the local or zone level.

Lake Tahoe Notification Coordinator: A designated staff member by the MAC that has the authority and responsibility to convene the rest of the Lake Tahoe MAC Coordination and Support Staff and the standing members of the Lake Tahoe MAC Group, and to ensure all organizations on the Priority One notification list (see Appendix C) have been notified of the infestation.

Joint Information Center (JIC): A centralized support system comprised of federal, state, and other external communications staff that coordinates development and dissemination of information to the media, public and other interest groups.

Interagency Rapid Response Team (IRRT): Interagency personnel that may be assigned to provide on-scene technical support to the Coordination and Support Staff, the MAC Group, or incident management support at the request of the impacted

jurisdiction/entity and the approval of the MAC Group. Assist in confirming the presence and determining the scope of the infestation, as well as identifying and implementing appropriate containment, control, and eradication efforts. Team members will be selected based on the technical and management needs of the specific infestation.

Druse: Large colonies of young mussels that settle on the older, larger zebra mussels, forming a clump.

Dreissenid: Referring to freshwater mussels in the family Dreissenidae, which includes zebra (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis*).

Epilimnetic Zone: The surface water mass in a lake above the thermocline which is well mixed and therefore of uniform temperature; the surface mixed layer.

Eutrophic: High in nutrients. Water clarity is generally lower in eutrophic water bodies due to high amounts of plant growth, including phytoplankton.

Hazard Analysis and Critical Control Point (HACCP): An internationally recognized planning tool that identifies potential introduction pathways of unwanted hazards and facilitates development of associated preventative measures.

Hypolimnetic Zone: The deepwater layer below the thermocline in a stratified lake.

Incident Command System (ICS): A systematic tool used for the command, control, and coordination of emergency response. ICS allows agencies to work together using common terminology and operating procedures to control personnel, facilities, equipment, and communications at a single incident scene. It facilitates a consistent response to any incident by employing a common organizational structure that can be expanded and contracted in a logical manner based on the level of required response.

Larvae: Juvenile form of certain organisms. For dreissenids, also called “veligers.”

Mitigation: Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards. Examples of zebra mussel mitigation measures for industrial systems include chlorination, mechanical cleaning, and dewatering.

National Incident Management System (NIMS)— A system mandated by Homeland Security Presidential Directive 5 that provides a consistent nationwide approach for governments, the private sector, and non-governmental organizations, to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity.

Oligotrophic: Low in nutrients. Oligotrophic water bodies have relatively few plants and algae, and tend to be very clear.

100th Meridian Initiative: A cooperative effort between state, provincial, and federal agencies and other partners to 1) prevent the spread of zebra mussels and other aquatic

nuisance species (ANS) into the western United States and 2) monitor and control zebra mussels and other ANS if detected in these areas. (http://www.100thmeridian.org/).

Pathway: The means by which a species are transported into a geographical region or into an ecosystem. For example, recreational watercraft are one of the pathways by which zebra and quagga mussels have spread across the country.

Polymerase Chain Reaction (PCR): A method for creating millions of copies of a particular segment of DNA. If a scientist needs to detect the presence of a very small amount of a particular DNA sequence, PCR can be used to amplify the amount of that sequence until there are enough copies available to be detected. This technique has successfully been used in monitoring for zebra and quagga mussels.

Priority 1 Notifications: Agency staff indentified in this Plan (see Appendix C: Notification Lists/Procedures) that are the first to be contacted by the Lake Tahoe Notification Coordinator in the event of a reported zebra mussel infestation.

Quagga Mussel (*Dreissena rostriformis bugensis*): A small freshwater bivalve mollusk that resembles the zebra mussel, but is rounder, with shells that appear asymmetrical when viewed from the front or ventral side.

Rapid Response: Immediate actions taken to contain a recently discovered invasive species before a final determination has been made that further containment or eradication is no longer feasible or warranted.

Thermocline: layer within a water body (e.g., a lake) where there is an abrupt change in temperature that separates the warmer surface water from the colder deep water.

Vector: See definition for Pathway.

Veliger: A larval stage of a mollusk (e.g. zebra mussel) characterized by the presence of a velum: the locomotory and feeding organ provided with cilia.

Western Regional Panel (WRP): A regional committee of the national ANS Task Force. Formed by a provision in the National Invasive Species Act of 1996, the WRP is comprised of western region representatives from Federal, State, and local agencies and from private environmental and commercial interests. The goal of the WRP is to protect limited western aquatic resources by preventing the introduction and spread of exotic nuisance species into western marine and freshwater systems though the coordinated management and research activities of state, tribal, federal, commercial, environmental, research entities and other regional panels. (Go to: http://www.fws.gov/answest/index.htm).

Zebra mussel (*Dreissena polymorpha*) -- The zebra mussel is a small freshwater bivalve mollusk with two matching half shells. Its name is derived from the striped pattern on its shell.

Appendix F2: Aquatic Invasive Species Early Detection Plan: Zebra and Quagga Mussel Veliger Monitoring

Aquatic Invasive Species Early Detection Plan: Zebra and Quagga Mussel Veliger Monitoring

Tahoe Regional Planning Agency

Early detection monitoring is a crucial element of invasive species management. In addition to prevention and control efforts, aquatic invasive species (AIS) management in the Lake Tahoe Basin will include implementation of early detection and response plans. Early detection of new infestations and investigations into environmental thresholds of established species improve success in control and eradication efforts. Zebra and Quagga mussels (*Dreissena polymorpha* and *D. bugensis*,) are two of the largest threats to North American freshwater ecosystems. If prevention efforts in the Lake Tahoe Basin were to fail, early detection of these mussels will be essential to controlling an infestation because the species are essentially impossible to eradicate. Zebra and quagga mussels have a planktonic larval lifestage (microscopic, free-swimming in water column) and are called veligers, which range in size from 70-200 microns (µm). Veligers can be detected in a water column, are relatively easy to identify in a taxonomic laboratory, and offer a cost effective way to monitor for potential invasive mussel infestations. This scope of work provides a framework for monitoring Lake Tahoe for zebra and quagga mussel veligers.

Objective

The objective of this monitoring plan is to achieve rapid and early detection of the free-swimming life stages (veliger) of quagga or zebra mussel in the Lake Tahoe Basin.

Monitoring Locations and Frequency

Monitoring will be conducted at various locations throughout Lake Tahoe and surrounding lakes to optimize the likelihood of detecting veliger presence. Monitoring locations will target boat ramps, open water, near water outflows and inflows, downwind areas, and eddies, or areas where plankton collects (i.e., behind islands, etc). In each location, the entire depth of the water column will be sampled to capture the vertical distribution of free-swimming invertebrates.

Veliger plankton tows will be conducted in Lake Tahoe once a month from June to September. The following monitoring locations are proposed to represent Lake Tahoe conditions and potential points of mussel and other invasive species introduction:

1) Sand Harbor
2) Elk Point
3) Tahoe City dam area
4) Emerald Bay
5) Cave Rock boat launch
6) Lakeside Marina
7) Lake Forest boat launch
8) Tahoe Keys lagoons

Plankton tows will also be conducted in surrounding lakes within the Lake Tahoe Basin or in response to any identified risks, such as a contaminated boat or unconfirmed reports of quagga or zebra mussel presence. The frequency of early detection monitoring can be determined based on use and identified risks. Monitoring in surrounding lakes should include a minimum of two events conducted at the beginning and the end of the recreation season, generally June through September. Surrounding lakes that have been identified for monitoring are listed here:

1) Fallen Leaf Lake
2) Echo Lake
3) Cascade Lake
4) Spooner Lake

Methods - Veliger Plankton Tow

One field technician will be employed to conduct sampling and one or two alternates will be trained initially to ensure sampling is consistent through the sampling season. The initial sampling event in Lake Tahoe will be conducted by the project manager in order to establish annual sampling sites and protocols. Subsequent sampling events in Lake Tahoe will be conducted by the field technician. Additionally, the project manager will collect samples from other water bodies at the appropriate frequency described above.

The vertical distribution of aquatic invertebrates will be sampled by lowering the net to 1 meter above the bottom and pulling the net up to the surface as described above. Locations will be recorded using a Global Positioning Satellite (GPS) receiver.

To prevent cross-contamination and reduce the risk of spreading zebra and quagga mussels, one plankton net and rope will be used per site. All sampling gear (including net, rope, wash bottles, buckets, etc) that comes into contact with the water will be decontaminated using appropriate measures.

Samples will be kept chilled and preserved in 250 or 500 ml bottles with 24% ethyl alcohol solution for shipping. California Department of Fish and Game (CDFG) and/or Bureau of Reclamation (BOR) will carry out the laboratory analysis of plankton tow samples for quagga or zebra mussel veliger presence. Microscopy or DNA analysis will be conducted to screen for dreissenid veligers. Microscopic examination of a subset of samples will be conducted to determine presence or absence of quagga and zebra veliger and other potential invasive invertebrates.

Field and laboratory crews will maintain a log sheet of samples and complete a datasheet for each sample. Datasheets will be completed while sampling to ensure accuracy. Data will be archived in digital and hard copy formats at Tahoe RCD and TRPA offices. Sampling data and results will also be provided to the California Department of Fish and Game quagga contact for the Lake Tahoe region.

Appendix F3: Lake Tahoe Region New Zealand Mudsnail Early Detection Monitoring Plan

Appendix F3
New Zealand Mudsnail Monitoring Plan

To be inserted prior to final submission to the ANSTF.

Appendix F4: Lake Tahoe Region Aquatic Plant Citizen Monitoring

Appendix F4
Aquatic Plant Citizen Monitoring

To be inserted prior to final submission to the ANSTF.

LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix G: Finance Planning

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This appendix contains planning documents and analysis related to the potential economic impacts from aquatic invasive species to the Lake Tahoe Region, and potential funding strategies to address the ongoing needs of the Lake Tahoe Aquatic Invasive Species Program. The analysis in these documents is based on economic information available at the time that they were produced.

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Appendix G1: Potential Economic Impacts of Aquatic Invasive Species

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Appendix G1
Potential Economic Impacts of Aquatic Invasive Species

1. Objectives

This Economic Appendix to the Lake Tahoe AIS Management Plan documents the results of literature review, research, and analysis of potential damages (costs) associated with AIS at Lake Tahoe to help inform policy decisions regarding the potential costs and benefits of AIS management (or lack thereof).

The analysis presented in this report was focused on estimating the potential future impacts of AIS in Lake Tahoe to provide a direct comparison to future costs of AIS Management (prevention, detection, control, and /or eradication) to inform policy making. The future damage streams were evaluated over a fifty year period of analysis (2009-2059) and all figures are presented in 2008 prices.

2. Economic Study Area

The study area for this economic evaluation focuses primarily on the Lake Tahoe Region as defined by the TRPA (TRPA Compact P.L 96-551).

2.1 Socioeconomic Setting

The Washoe Indians gathered on the shores of Lake Tahoe prior to pioneer discovery in 1844, but it wasn't until heavy silver prospecting began in the 1860s that a local economy began to take shape. Prospectors gave up as lodes waned, but already rich San Franciscans had heard of a pristine lake tucked away in the Sierra Nevada. Soon luxury inns sprang up on the lake to provide seasonal accommodations. Once the first modern era casino opened in 1944, the local economy brought in enough revenue to justify plowing the roads during winter for year round access to the lake. Soon the first permanent residents were living at Lake Tahoe. The combination of a pristine mountain sanctuary, a variety of high quality outdoor recreation opportunities, and resort attractions like gambling and luxurious hotels has made the Lake Tahoe Region an internationally known recreational destination (LTVA 2008).

The Lake Tahoe Region has drawn over three million visitors every year for over a decade and is now home to approximately 75,000 permanent residents (United States Census Bureau 2000) and. The main attraction at Lake Tahoe is its scenery. Local tourism surveys have identified that over 80% of visitors report that the pristine environment and natural amenities attract them to the region (TCSF 1996). A recent consumer survey for the TRPA concluded that visitors and residents in the Lake Tahoe Region chose it as a vacation destination or place of residence primarily because of the natural amenities and outdoor recreation opportunities provided in the basin (TRPA 2002).

With the multitude of recreation options available, tourism has steadily increased to the Lake Tahoe Region, increasing the permanent population and local revenue streams. It was estimated in 1999 that visitors to the Region spent over 400 million dollars in the Tahoe Basin annually

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(Nechodom et al. 1999). The threat that AIS pose to future recreational opportunities, the local tourism economy, property values, and added boat and pier maintenance costs is a concern within the region and the subject of this analysis.

2.2 POPULATION

Population counts and population projections are available for El Dorado and Placer Counties in California, and Washoe and Douglas Counties and Carson City Municipality in Nevada. The four counties and the municipality were collectively home to about 1,015,000 permanent residents in 2007 and are predicted to grow to around 1,436,000 by 2026 (Table 1).

Table 1. Population History and Projection, Greater Lake Tahoe Area, 1990-2026

Jurisdiction	1990	2000	2007	2026[1]
El Dorado County, CA	126,000	156,000	176,000	237,000
Placer County, CA	173,000	248,000	333,000	479,000
Douglas County, NV	27,600	41,300	45,400	61,700
Carson City Municipality, NV	40,400	52,400	54,900	77,700
Washoe County, NV	255,000	339,000	406,000	580,000
Total	**622,000**	**838,000**	**1,015,000**	**1,436,000**

Source: United States Census Bureau 1990 and 2000. NSBDC, 2008. CA Dept. of Finance, 2008

[1] Referenced population growth projections are based on historical trends and do not attempt to project the indirect effects of any future condition of the lake on population growth

In order to estimate the population within the Lake Tahoe Region, population data from the 2000 census was assimilated for census tracts falling within the Region boundaries. In 2000, there were about 75,000 people living within the Lake Tahoe Region, of which the California counties accounted for about 67% and the Nevada jurisdictions the remaining 33% (Table 2). Rural Carson City, Nevada has a very small population in the Region with most of its land designated open space or government parkland and is not included in the table.

Table 2. Populations within the Lake Tahoe Region, 2000

Jurisdiction	Year 2000	% of Total 2000 Four-County Population within Lake Tahoe Region
El Dorado County, CA	32,200	21%
Placer County, CA	18,000	7%
Douglas County, NV	6,100	15%
Washoe County, NV	18,700	5%
Total	**75,000**	**10%**

Source: United States Census Bureau 2000

Within the Lake Tahoe Region, the densest communities/population centers are found at the south end of the lake on the California and Nevada sides at the South Lake Tahoe and Meyers

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areas, respectively. The average annual population compound growth rate for the Lake Tahoe Region was predicted to be about 0.4% per year from 2000 to 2010 (TRPA 2002).

2.3 EMPLOYMENT AND INCOME

The working population in the Lake Tahoe Region derives as much as 60% of their wages from local sources (TRPA 2002). Table 3 shows an estimate of over 66,000 direct jobs in the Lake Tahoe Region in 1999 resulting from tourism (Nechodom 1999). The data indicate that the stability and continued growth of the recreation and tourism sectors at Lake Tahoe is important to the stability and growth in the Region's economy.

The average median annual household wage, weighted by population, of the Lake Tahoe Region was $66,352 (United States Census Bureau 2000). In per capita terms, the weighted average was $33,409. Applying the weighted average annual per capita income to tourism induced employment estimate yields an estimate of annual tourism-induced employment-based income of approximately $2.2 billion.

Table 3. Tourism-Induced Direct Employment, Lake Tahoe Region, 1999

Economic Sector	# of Jobs	% of Total
Food stores	1,000	1.5%
Service stations	360	0.5%
Eating and drinking	4,040	6.1%
Miscellaneous retail	1,310	2.0%
Hotels and lodging places	15,000	22.6%
Amusement and recreation	5,290	8.0%
Subtotal (all visitor serving sectors)	27,020	40.7%
All other sectors	12,370	18.6%
Total	**66,420**	

Source: Nechodom (1999)

3. Potential Effects of AIS on the Regional Economy

As the regional economy of Lake Tahoe developed, local concerns grew that the Tahoe Region could become overcrowded and lose its scenic appeal. In 1968, the Tahoe Regional Planning Agency was formed to achieve and maintain defined environmental threshold carrying capacities (thresholds). Significant resources have been channeled into the simultaneous regulation of development while moving toward achievement of thresholds (LTVA 2008). A challenge lies in minimizing adverse impacts of the recreation industry, including introduction of AIS, on the lake's natural environment, which in turn is the major draw for the recreational visitation. Sustainable recreational visitation is vital to the local economy.

In 2007, the Lake Tahoe Region's natural and recreational amenities were estimated to draw about 3.9 million visitors (see Table 4). The 1999 Lake Tahoe Watershed Assessment reported that visitors spend an average of around $114 dollars per visitor day (Nechodom *et al.* 1999). This spending translates to local employment and income. In addition to supporting local jobs and generating income, the natural beauty and recreational utility at Lake Tahoe is reflected in

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property values within the region. Shoreline properties, in particular, are especially valuable and sensitive to AIS impacts. The lake also provides drinking water for around 34,000 residents and thousands of visitors in the Region, requiring an average annual daily flow of around 6.6 million gallons to be pumped from the lake between 2003 and 2006 (TWSA 2007).

AIS have the potential to negatively impact the local and regional economy in a variety of ways. For example, lake clarity, a unique feature of Lake Tahoe, may be indirectly affected by AIS. Recreational options can become constrained or lost, reducing the quality and quantity of the recreational experience (ANSTF 2008). Less recreational visitation will negatively impact the local tourism industry. Diminished recreation opportunities and degraded environmental conditions can adversely affect property values as well. AIS can also damage water supply intakes, requiring costly maintenance and repairs of intake pipes (Sprecher and Getsinger 2000). Similarly, AIS can result in the need for costly maintenance to boats, docks and marina floats in the lake (ANSTF 2008). AIS management will also add an additional critical funding requirement during an era of competing critical restoration funding requirements.

Limited research has been conducted on the economic impacts of AIS. Pimentel et al. (2004) is frequently cited as a source for a rough estimate of the nationwide losses due to AIS. Their work estimates the nationwide economic losses (damages plus control costs) from AIS at around $120 billion annually. A decade before Pimental's work, the U.S. Office of Technology Assessment (OTA) estimated the cumulative nationwide losses between 1906 and 1991 from invasive species in the United States at around $96.9 billion. Plants, fish, and aquatic invertebrates accounted for about $2.3 billion (OTA 1993). The differences in results of these two national impact estimates have been attributed to differences in methodology (Lovell and Stone 2005), damage categories included (for example, Pimental et al. [2004] values ecosystem services affected by AIS), and the increase in AIS prevalence and awareness. These often cited studies are included here as a backdrop to demonstrate the potentially huge economic impact of AIS to the nation. Some research has also been completed on impacts at individual lakes and for individual species. However, these studies usually only attempt to estimate one category of damage, such as to sport fishing or power generation facilities.

Data gaps are a persistent problem for those attempting economic analysis of AIS. As early as 1993 the U.S. Department of Technology Assessment reported that a lack of quantitative data on the impacts of AIS made reporting the associated economic losses an anecdotal process (OTA 1993). Reports on specific AIS cases in California and Nevada concur that while some study has been conducted on the various types of economic effects that AIS create, little documented knowledge of the magnitude of those effects exists (Eiswerth et al. 2000). Similarly, previous published literature has identified gaps in data necessary for estimating economic effects of AIS at Lake Tahoe. The 1999 TRPA Watershed Assessment found that there was a lack of region-wide estimates of recreation visitation levels. More specifically, they identified the need for tracking of visitation to specific recreation areas on the lake by community and recreation activity (Nechodom et al. 1999).

Though limited by the availability of existing data, this report documents an analysis of the potential range of economic impacts that could reasonably be associated with further AIS establishment and infestation in Lake Tahoe. The methodology employed herein is designed to aggregate pertinent existing data and present a reasonably conservative estimation of potential future damages associated with AIS at Lake Tahoe. Specific categories of potential impact

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evaluated include: recreation, tourism, property values, water supply, and boat and pier maintenance.

In the Summary of Potential AIS Economic Impacts (Section 4), damage estimates from each category are aggregated and presented in total present value and average annual terms. Damage streams over a fifty year period of analysis were estimated in 2008 prices and converted to their total present value using the U.S. Government Fiscal Year 2008 Federal discount rate for water resources study ($4^7/_8$ %) (USACE 2007). The total present value of the stream of damages for each category was also converted to its average annual value also by amortizing the present value over 50 years at the $4^7/_8$ % discount rate.

3.1 RECREATION

Lake Tahoe provides visitors with various outdoor recreation options while at the lake. Among the five highest participation rates for visitors and residents alike are beach activities, walking, trail hiking, swimming, and sightseeing (Nozicka 2001). In order to better understand the lake's recreation and tourism patterns, it is useful to consider the activities preferred by visitors and residents. Visitors to Lake Tahoe tend to favor fewer activities than residents. Visitors tended toward the resort-like activities such as beach activities, swimming, shopping, sightseeing, pleasure driving, and gaming. Residents, in contrast, favored more outdoor activities such as hiking, biking, backpacking, power boating, fishing, and local cultural or sporting events (Nozicka 2001). Still, both groups tended toward activities provided by the lake and surrounding environment.

In order to estimate lake-related outdoor recreation visitation, data was compiled from visitation estimates at the USFS-LTBMU, CADPR, and NDSP. Data is collected at these agencies in the form of number of visitors per month[1].

To more closely approximate the visitation that is lake-related (and prone to AIS impacts), the visitation data was limited to include only the months of May through October. These six months represent the "summer" season, which favors lake recreation as opposed to mountain recreation seen in winter. While the CADPR and NDSP data were provided by month, the USFS data was only available on an annual basis. To approximate USFS summer season visitation, the CADPR and NDSP data during the summer months were referenced. This data showed that from 2000 - 2005 about 82% of visitation to the parks took place from May to October. Thus, the USFS annual data was reduced to 82% of its original value to approximate visitation during the six month summer season.

In 2007, there were an estimated 3.8 million visitors to the Lake Tahoe Region (Table 4). Based on historical trends, and assuming current conditions at the lake remain constant, this number is expected to grow at a rate of around 1.6% a year for the next twenty years (TRPA 2007). Table 4 presents historical visitation data.

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[1] Given the methods by which the above agencies collected their visitation data, it was not possible to disaggregate visitation from regional residents and visitors who came from outside the region. As such, the data used in this analysis includes both resident recreation participants and visiting participants. The number is considered conservative because it does not include resident boaters who do not access the lake via public parkland.

Lake-related recreation activities are expected to experience the greatest impact from AIS infestation. Four major lake recreation activities were examined in this analysis: beach activities, swimming, boating, and fishing. Boating was broken down according to power boating and canoeing/kayaking. An additional potential impact of AIS at Tahoe is loss of water clarity. Tahoe's level of clarity is a unique feature and contributes greatly to the quality of the recreation experience.

Existing information relative to reductions in recreation participation/visitation as a result of AIS were not available for application in this study, thus were based on the author's best professional judgment.

Table 4. Lake Tahoe Region Outdoor Summer Recreation Visitation Statistics

Year	U.S. Forest Service LTBMU RVD	CADPR	Nevada State Parks	Basin Total
1995	2,882,000	671,300	960,200	4,514,000
1996	2,999,000	903,000	885,900	4,787,000
1997	2,947,000	802,400	892,800	4,643,000
1998	3,152,000	713,000	562,100	4,427,000
1999	3,003,000	909,000	735,000	4,646,000
2000	3,005,000	885,100	787,100	4,677,000
2001	3,053,000	564,000	858,200	4,475,000
2002	3,102,000	647,000	895,600	4,645,000
2003	3,152,000	417,700	943,300	4,513,000
2004	3,202,000	573,300	632,400	4,408,000
2005	2,759,000	226,500	620,700	3,606,000
2006	2,803,000	313,000	613,800	3,730,000
2007	2,848,000	318,000	696,500	3,863,000

Source: USFS NVUM 2006, CA State Parks 2007, NV State Parks 2008

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Beach Activities

With over 40 public beaches, beach activities are a staple recreation activity at Lake Tahoe. In a recent recreation survey, 76% of respondents said they take part in beach activities when visiting the lake (Nozicka 2001). Not including swimming (which is accounted for in its own category) beach related activities include walking, hiking, volleyball/sports/games, picnicking, fire pits, relaxing, barbequing, sand play/sand castles, et cetera. Table 4 and growth rate projections yield a projection of 3.92 million visitors to Lake Tahoe in 2008. Given the results of the survey, this equates to an estimate of approximately 2.9 million people participating in beach activities during the 2008 summer season.

The continued presence and growth of AIS in Lake Tahoe will likely inhibit beach recreation opportunities and degrade the quality of the experience. AIS like Eurasian watermilfoil, mussels, and clams are especially limiting to beach recreation options. Invertebrate shells that wash onto

the shore are hazardous to bare feet and pets. Additionally, decaying organisms, including aquatic plants and invertebrates, release foul odors and attract insects.

AIS invasion can also impact the beaches' positive aesthetic qualities. Water clarity, a famed characteristic of Lake Tahoe, is adversely impacted when Eurasian watermilfoil becomes established. In some situations where poor water quality exists, it has been documented that invertebrates may positively affect water clarity. However, it is not expected that they would have a beneficial effect in the clear waters of Lake Tahoe; especially in shallow areas near the beaches. This is because they could increase the light reflective colloid concentrations above existing levels.

The above impacts on the beach have had the effect of deterring people from recreating on other lake beaches following AIS infestations. It is reasonable to expect a 10-20% decrease in participation in beach activities as a result of AIS infestation.

Swimming

Another major activity by respondent level of participation at Lake Tahoe is swimming. According to Nozicka (2001), 62% of respondents reported participation in swimming while at Lake Tahoe. Visitors enjoy the pristine clarity of the lake's water and the many swimming beaches around the lake. The lake's bathymetry is such that swimming areas are shallow and large, making for great near-shore swimming. The participation survey and the 2008 visitation projection result in an estimate of approximately 2.4 million visitors who participate in swimming during the summer season.

However, the shallow nature of the swimming beaches means that AIS can drastically affect swimmers. Plants are the main concern for swimmers. Dense, vine-like plants like Eurasian watermilfoil is not just annoying to swimmers, they are hazardous. A swimmer can become entangled in milfoil, possibly leading to drowning. In addition, swimmers will shy away from beaches with milfoil, avoiding the weed-choked water (ANS 2008). As lake levels drop later in the summer, dense mats of the AIS growth may be left exposed and will decay, likely emitting noxious odors and will generally be offensive to swimmers. Aesthetically, decreasing water clarity will degrade the quality of the swimming areas. It is reasonable to expect a 20-80% decrease in swimming participation, depending on the density of vegetative growth.

Power Boating

Many residents own power boats of various sizes and types, including ski boats, luxury boats, fishing boats, personal watercraft, et cetera. A study published on the 1998 boating season reported approximately 99,300 power boat trips from launches and ramps (Hagler-Bailly 1999). In addition, there is a resident population that keeps their boat on the lake in slips and on buoys. There are an estimated 2,964 slips and 4,454 buoys on Lake Tahoe, creating an estimated 7,418 resident boats (Ted Thayer [TRPA], personal communication and TRPA 2004). Adjusting the number of trips to reflect the decline in visitation over this period, and assuming residents take 32 boat trips per year (4 trips per week over the four month peak summer season), yields an estimate of approximately 325,436 boat trips in 2008.

Power boating activities are expected to be less impacted by AIS (in percentage terms) than recreation activities that must take place on or near the shore like swimming. Still, power boating participation may be reduced 10 – 30% depending on the extent of aquatic vegetation in shallow

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areas. This estimation is based on the fact that AIS are unlikely to directly impact boating activities in the middle of the lake; however, getting from the shore to the middle will be challenging, particularly in areas with dense vegetation. Power boats will likely be able to continue operation, but the lake will begin to seem more crowded as all boaters must move further from shore to avoid the invasive vegetation that can harm propellers and make the water unfavorable to skiers.

Canoeing/Kayaking

The second boating category is canoeing/kayaking. According to Nozicka (2001), 26% of respondents reported participating in canoeing or kayaking. Using the estimated 3.92 million visitors in 2008, this translates to about 1 million non-motorized boating visitors. Canoeing and kayaking are likely to be most impacted by aquatic weed infestations because these activities are concentrated in the near-shore environments where the lake bathymetry is conducive to infestation, making paddling difficult. Weeds and other AIS can also impact water clarity, especially in nearshore areas. Because of this, a reduction ranging between 20 - 40% in this category is reasonably expected.

Fishing

The last recreation category discussed is fishing. Lake Tahoe supports self-sustained populations of at least four popular sport fish: lake trout, brown trout, rainbow trout, and Kokanee salmon (BoatTahoe.com 2008). Although these species are non-native to Lake Tahoe, they are considered desirable sport fish by the states of Nevada and California. The summer survey indicated that 20% of visitors to Lake Tahoe participated in fishing, amounting to around 914,000 fishing visits in 2008. Most anglers are likely to fish in the shallow areas of the lake that are more susceptible to AIS infestation, not the deep areas far from shore (BoatTahoe.com 2008).

Invasive plants, invertebrates, and non-native fish, can adversely impact native fish populations. However, the impact of AIS to fisheries is more difficult to identify due to dynamic food web interactions. For example, a quagga mussel infestation can reduce primary production (phytoplankton), altering the food chain from the bottom up. Plants and invertebrates may impact fish populations in different ways. As mussels reduce food supply, fish may become stunted and fail to grow large enough for anglers to pursue.

Invasive plants on the other hand, alter fish populations by changing the vegetation cover within the lake. Invasive plants that grow near the shore, from the lakebed to the surface, shade out native submersed vegetation and tend to grow at a higher density. The result is increased cover for predatory non-native fishes (Michigan Sea Grant 2007).

Non-native fish considered invasive species in the Lake Tahoe Region AIS Management Plan include: bluegill, black crappie, brown bullhead carp, goldfish, green sunfish, and particularly largemouth bass. Predatory bass species pose an especially large threat to the lake's native fish. The explicit impacts of the other warm water fish at Lake Tahoe are not fully known; however, all invasive fish compete with native and sport fish for food resources. The presence of invasive fish has the potential to damage food webs and disrupt ecosystem function.

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For angler's, invasive weeds can be aggravating and possibly damaging to a boat. Fishing from shore is not desirable when casting into a dense mat of aquatic vegetation such as Eurasian watermilfoil.

AIS not only reduce the availability of catchable fish, it also reduces the angler access to them. Fishing in weeds can require special lures to penetrate the canopy (Montgomery 2007). In fact, sport fishing in the Great Lakes reduced from 10 to 35% as the result of AIS (Lodge and Finnoff 2008). This impact range was used in this study to estimate impacts to sport fishing participation at Lake Tahoe with AIS infestation.

Summary of AIS Recreation Impacts

Given data gaps in the existing body of literature on recreation visitation and AIS, it was not possible to precisely estimate visitation effects related to AIS impacts on each recreation activity described above at Lake Tahoe. Specifically, the tendency of visitors to substitute activities was not quantifiable.

In the absence of published data, best professional judgment was used to estimate future recreation participation impact scenarios by activity. Table 5 summarizes the estimated recreation participation impacts of AIS.

Table 5. Estimated Recreation Participation Impacts

Activity	% Who Participate	Instances of Participation	Potential Reduction in Participation Percentage
Beach Activities	76%	2,979,200	10 - 20 %
Swimming	62%	2,430,400	20 - 80 %
Power Boating	28%	1,097,600	10 - 30 %
Canoeing/Kayaking	26%	1,019,200	20 - 40 %
Fishing	02%	784,000	10 - 35 %

Recreationists at Lake Tahoe likely participate in multiple activities during each visit. The participation data in Table 5 indicate the relative level of participation across lake-related activities. There was no data available to estimate the extent to which AIS impacts on individual activities might affect visitation to the Lake Tahoe Region. While AIS might preclude visitors from participating in some activities, they might still visit the Lake Tahoe Region to participate in others. However, available data does not exist for quantifying visitors' substitution of activities. As such, impacts to recreational visitation are expected to be less than the potential reductions in participation presented in Table 5, though how much less is not calculable. Given the lack of data on participant visitation response to AIS infestations, several hypothetical scenarios of visitation reduction were evaluated. These scenarios represent overall decreases in visitation that might be caused by AIS given the activity-specific decreases previously discussed. These overall reductions are conservatively less than reductions specific to any one activity in an attempt to account for substitution. Table 6 presents the range of visitor-day reduction scenarios evaluated in this study.

Reductions are subtracted from an estimation of recreation value in the Region of $63,704,200. This estimate was derived from visitor days provided by Nechodom (1999) and the value of a

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day of general recreation ($29.88 in 2008 dollars) in the USFS Pacific Region (Nechodom et al. 1999, Rosenberger and Loomis 2001). Table 6 presents the resultant ranges in potential future lost recreation values associated with each reduced level of visitation scenario. Table 6 shows that an estimate of 2% visitation reduction yields a lost recreation value of approximately $1.3 million, while a median estimate of 5% yields approximately $3.2 million of lost recreational value.

Table 6. Estimated Recreation Impact Scenarios

% Visitation Reduction	Reduction in Visitor Days	Lost Value
2.0%	42,640	1,274,083
5.0%	106,600	3,185,208
10.0%	213,200	6,370,416

Source: 2008 visitation data. Rosenberger and Loomis (2001)

3.2 TOURISM

Revenue from recreation visitation to outdoor areas makes a large contribution to the national economy. The National Park Service estimated that, in 2006, park visitors spent 10.73 billion dollars in the local regions surrounding the National Parks (Stynes 2006). The Lake Tahoe Region encompasses recreation areas managed by the USFS, CADPR, NDSP, and local governments.

Tourism at Lake Tahoe is one of the local economy's largest sources of revenue (Nechodom 1999). Resort destinations like the hotel-casinos at Lake Tahoe generate revenue streams much larger than a stand-alone outdoor recreation area could (Nozicka 2003). And while these activities are popular and bring in tourists, the gaming industry is at the same time dependent on the recreation benefits that the lake provides. Without the recreation opportunities at Lake Tahoe, it would be less likely that gaming-oriented tourists from afar would choose to visit the Lake Tahoe Region instead of Las Vegas or Reno. This is evidenced by the intercept surveys conducted by Nozicka (2001). That study concluded that visitors to the Lake Tahoe Region prioritized activities that involved the natural environment, but they supplemented those activities with resort-oriented ones, like shopping and gaming. In addition, both residents and visitors felt that beach quality, beach access, maintenance, and forest access were the most important factors in determining the quality of their visitation experience, reinforcing the idea that it is primarily the lake and its natural setting that draws visitors (Nozicka 2001).

The total value of tourism to the Region can be estimated using recreation visitation data and an estimate of visitor spending. The Lake Tahoe Watershed Assessment represents the most complete research on visitation and visitor spending to date (Nechodom et al. 1999). The report uses an estimation of visitor days and dollars spent per visitor day in each of the Lake Tahoe communities to estimate tourism-derived spending in the Region. The report's estimate of visitor days was based on reported lodging rentals and the reported number of persons per room. Spending data was accumulated from visitor surveys (Nechodom et al. 1999). Still, visitor estimation remains a highly contentious recreation datum but has been estimated at 23 million (Fisk et al. 1997, Nechodom et al. 1999). This number stands in high contrast to the 2.6 million annual visitor days used in the Watershed Assessment, originally published for the LTVA (Strategic Marketing Group 1999).

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Contributing to the data uncertainty is the fact that most federal and state park agencies are currently recording visitation data in number of visits rather than visitor days, which does not lend itself to straightforward economic analysis because no Lake Tahoe-specific model exists that allows the translation of number of visits into visitor days across all recreation types and sites. When this data becomes available, an estimation of the current tourism spending associated with lake-related outdoor recreation in the Lake Tahoe Region will be a more straightforward calculation. In its absence, the 1999 Watershed Assessment is the best available data. Table 7 summarizes the findings of the 1999 Watershed Assessment, adjusted to 2008. In order to adjust the 1999 report, annual visitor days are assumed to change in proportion to change in number of visits over the 1999-2008 period.

In order to estimate summer visitor days, the annual number was divided by 2, yielding an estimate of 1.5 million visitor days. Assuming that 50% of the visitation occurs during summer is a conservative assumption because previous reports have, using employment change as a proxy, estimated that a modestly larger proportion of the recreation occurs in summer (Nechodom et al. 1999). This summer reduction ratio is different than the 82% reduction used in Section 3.1 which was based on *outdoor* recreation visitation during the summer season. The 50% reduction is pertinent to *total* (including other activities such as gaming) Lake Tahoe Region visitation during the summer season.

Table 7. Visitor Spending by County, May-October 2008

Jurisdiction	$/Visitor Day	Visitor Days	Spending
El Dorado County, CA	$145	360,000	$52,211,000
Placer County, CA	$180	240,000	$43,095,000
Douglas County, NV	$236	660,000	$155,628,000
Washoe County, NV	$230	240,000	$55,092,000
Total	**-**	**1,500,000**	**$306,026,000**

Source: 1999 Lake Tahoe Watershed Assessment, BLS CPI calculator

The spending data reflects the value of tourism to the Lake Tahoe Region's economy. Given the research that has been conducted on consumer preferences in the Region (Nozicka 2001), it is apparent that a significant decrease in available recreation would adversely impact the regional tourism economy.

As illustrated in the Recreation section, an AIS infestation could cause significant decreases in recreation participation and losses in recreation value. These decreases have direct effects on the tourism revenue the Lake Tahoe Region receives. In order to assess possible impacts to the Region's tourism industry from AIS, it is assumed that tourism spending is proportional to visitation, meaning that a given percent decrease in visitation would result in the same percent decrease in visitor spending.

Table 8 shows a range of percent reductions in visitation, and the corresponding reduction in spending. When considering the AIS impacts on the local economy's revenue, it is apparent that even a small reduction in visitation yields large losses in revenue. A decrease of 2% in visitation would result in about $6.1 million less dollars entering into the local economy in 2008 dollars. A median scenario like 5% could mean a decrease in spending of as much as $15.3 million dollars.

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At the upper end of the impact scenarios, a 10% reduction could result in a $30.6 million loss of tourism spending.

Table 8. AIS-Induced Reduction Scenarios, 2008

% Reduction in Visitation	New Visitor Spending Level	Net Loss, $'08
2%	299,905,820	6,120,527
5%	290,725,030	15,301,317
10%	275,423,713	30,602,635

Source: Nechodom et al. (1999)

3.3 PROPERTY VALUES

The Region is comprised of around 60,000 parcels. Of those, about 50,000 are privately owned parcels. The remaining 10,000 are publicly owned; a combination of parks, recreation areas, government administration facilities, campgrounds, and open space. Not surprisingly, lakeshore parcels are the most expensive in the region. By area, privately owned lakefront property accounts for 27% of the total lakeshore. That 27% translates to over 5,600 parcels at an average size of 0.7 acres and with an average value of $852,878 per parcel. In contrast, there are 449 public parcels with an average size of 75 acres and an average value of $418,667 per parcel. Private property (including improvements) on Lake Tahoe's shore is valued at around $1.46 million per acre, while public property is valued around $19,200 per acre. In total, the value of lakefront property at Lake Tahoe is estimated at around $3.7 billion. Tables 9 and 10 provide an overview of the property in the Lake Tahoe Region. It should be noted that the dollar value per acre of private and public land was calculated using assessor's data, which likely underestimates the real value of public land because public land is not assessed for tax collection purposes. If the public land were to be analyzed using the value per acre of private land, waterfront public land value would amount to about $12.7 billion dollars. However, to be consistent in this analysis' reliance on existing data, and to maintain a conservative approach to valuation, public land was valued according to assessor's data in this analysis.

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Table 9. Summary Table: Private Property Values in the Lake Tahoe Region

Jurisdiction	Number of Parcels	% Private by Area	Average Value	Total County Value	Avg. Size (acres)	Total Acres	$ / Acre
El Dorado County, CA	2,190	24%	$838,700	$1,836,803,000	0.4	928	$1,980,000
Placer County, CA	639	61%	$1,233,300	$788,098,000	1.4	877	$898,500
Douglas County, NV	2,356	66%	$765,900	$1,804,569,000	0.5	1,121	$1,609,000
Washoe County, NV	463	6%	$892,000	$413,001,000	0.7	302	$1,366,000
All Lakefront Totals	**5,648**	**27%**	**$853,000**	**$4,842,471,000**	**0.7**	**3,229**	**$1,463,000**

Source: TRPA 2008, Washoe Co. Assessor's Office, Douglas Co. Assessor's Office, United States Census Bureau 2000
Notes:
1. Lakefront Average values were weighted by % parcels or acres per county
2. CA is a Prop 13 State. A sample of recently sold properties was used to determine average values for CA counties.
3. Public lands include all non-private lands, such as open space, recreation areas, campgrounds, and government buildings.

Table 10. Summary Table: Public Property Values in the Lake Tahoe Region

Jurisdiction	Number of Parcels	% Public by Area	Average Value	Total County Value	Avg. Size (acres)	Total Acres	$ / Acre
El Dorado County, CA	108	76%	$634,000	$57,443,000	27.6	2,980	$19,300
Placer County, CA	39	57%	$431,000	$15,813,000	21.0	820	$19,300
Douglas County, NV	264	18%	$23,100	$5,896,000	1.2	306	$19,300
Washoe County, NV	38	94%	$2,478,000	$88,527,000	120.9	4,593	$19,300
All Lakefront Totals	**449**	**73%**	**$418,700**	**$167,679,000**	**75.3**	**8,700**	**$19,300**

Source: TRPA 2008, Washoe Co. Assessor's Office, Douglas Co. Assessor's Office, United States Census Bureau 2000
Notes:
1. Lakefront Average values were weighted by % parcels or acres per county
2. CA is a Prop 13 State. A sample of recently sold properties was used to determine average values for CA counties.
3. Public lands include all non-private lands, such as open space, recreation areas, campgrounds, and government buildings.

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Lakeshore properties are the most likely to be adversely affected by AIS. Whether a property experiences direct impacts such as loss of a useable pier, or indirect ones like aesthetic losses due to murky water, property values on the lake will be affected by the presence of AIS. Assessment of lost property values is based exclusively on existing literature. In order to present a range of possible outcomes, damages were estimated using the percent property value reduction estimates published in existing studies (Table 11).

Three referenced studies for lakes around the country were used to estimate loss scenarios for private land. All of these studies focused on value reductions on private property only. Lake Tahoe's shoreline is 73% government owned. Therefore, while existing data did not allow for an estimate of public land value loss, it is evident that the large loss scenario for private land is a conservative estimate. Even a small loss per parcel on public lands would be substantial overall.

The existing literature facilitated a general estimation of losses in property value associated with direct impacts from AIS. These studies have estimated that AIS-induced reductions in value range from 5.4% to 20%. If the values are applied to lakefront private property, they equate to losses in value ranging from around $260 million to $968 million. Table 11 provides results of the three value reduction scenarios.

The assessed values of parcels located on the lakefront are very sensitive to the quality of lake access. For example, a pier is a high value added feature, as is beach. However, the benefits of either of these two features might be diminished by the presence of AIS. Invasive plants can make the property's lakefront un-swimmable by entangling the legs of swimmers. Both plants and invertebrates wash up on shore when they die, leaving a foul smelling beach full and sharp mussel shells. In addition, plants can ruin a pier's functionality by making access to it difficult without the use of a weedless propeller. Invasive plants can also destroy habitat for native species of fish and flora while fostering mosquito reproduction, making lakefront properties less attractive to anglers and beach visitors.

Aesthetics are also important in the valuation of a property. A home's value may decrease as a result of diminished aesthetics like dirty beaches and reduced water clarity (Halstead et al. 2003). Given the importance of clarity at Lake Tahoe, loss in clarity is likely to have an effect on a property's' value. Species likely to affect clarity most quickly are plant species such as Eurasian watermilfoil. Plants can decrease perceived clarity by direct shading and light absorption, and release of nutrients upon plant decay (resulting in increased algae growth). Existing literature on the effects of water clarity on property values report that a loss in one meter of clarity can result in property value declines ranging from 2% (Ara et al., 2006), 1 to 6% (Boyle and Bouchard, 2003), and 3 to 8.5% (Gibbs et al. 2002).

Studies have shown that AIS (mussels, clams) can have a positive effect on clarity in some waterbodies; for example, in Lake Erie (USEPA 2008). However, Lake Tahoe presents a unique clarity case. Waterbodies referenced in the literature had dramatically reduced clarity than that found in Lake Tahoe. The Secchi depths at Lake Tahoe (about 70 feet in 2007) are much higher than those found in the various lakes studied in the literature. For example, Lake Erie had a Secchi depth of no more than 5 meters for measurements taken in the western basin between 2000 and 2005 (USEPA 2008). At the least, a one meter decrease in clarity at this lake would be equal to a 20% decrease. In contrast, a one meter decrease at Lake Tahoe would be equal to

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about a 4.3% decrease in clarity. While this decrease is noteworthy, it might not affect property values as quickly as by the effects of invasive nearshore plants.

Table 11 illustrates two things. First, that available literature varies widely in its estimation of AIS-induced property value reductions. Second, that even the conservative estimations predict a decrease in private property values of approximately $261 million. Higher impact scenarios show a decrease of up to $968 million. Additionally, reductions in property tax receipts by the surrounding jurisdictions will be associated with private property devaluation. Based upon 2007-2008 tax rates in the study area, property tax receipt reductions would range between $3.7 million and $13.8 million annually depending on the reduction scenario from Table 11 (NTA 2005, Berrum 2008, Douglas County Assessor 2008, Placer County 2008, Zutter 2008).

In summary, this analysis of property value losses represents a conservative lower bound. Not considered in this analysis are the losses that would be experienced by parcels off the lakefronts. Furthermore, the value of public land in this analysis should also be considered a conservative lower bound. The tax receipt losses estimated above would also increase when considering non-lakefront parcels.

Table 11. AIS Impacts on Private Property Values.

Lakefront Property	Current Value	% Reduction	Net Loss	New Value
Study 1	$4,842,471,000	5.4%	$261,493,000	$4,580,977,000
Study 2	$4,842,471,000	13.0%	$629,521,000	$4,212,949,000
Study 3	$4,842,471,000	20.0%	$968,494,000	$3,873,976,000

Sources: *Study 1.* Krysel et al. (2003), *Study 2.* Horsch (2008), *Study 3.* Halstead et al. (2003)

3.4 WATER SUPPLY

The Lake Tahoe Basin is fed by 63 streams from the Sierra Nevada Mountains to the west and the Carson Range to the east. The only outlet from Lake Tahoe is the Lower Truckee River. Historically, the lake's water has been very high. Some Nevada water suppliers have been granted filtration avoidance status from the Health Division, program now overseen by Division of Environmental Protection, so long as source water quality remains within specified required limits for turbidity and coliform and an annual Watershed Control program update indicates the watershed is at low risk for pathogens.

The main concern that AIS present with regard to water supply is the tendency of quagga and zebra mussels to biofoul freshwater intake pipes. This invasion not only requires costly maintenance or periodic replacement of pipes, but it can result in the loss of filtration exemption due to the presence of mussels and plants in the water intake systems that raise human health concerns. Plants and invertebrates may colonize in large numbers near intakes, depositing organic contaminants into the water. If water suppliers cannot rely on the water drawn from the lake to be free of microbial contaminants then further purification infrastructure might be necessary, raising unit costs for suppliers, and ultimately consumers (TWSA 2007).

Table 12 provides estimates of the necessary infrastructure spending to maintain current production levels without sacrificing drinking water quality in the event of a serious mussel and

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plant infestation near, on, or in the intake system. The redundant intake system would allow suppliers to take intakes offline in rotation for cleaning and maintenance without interrupting service.

The presence of organic material in supply water can result in taste and odor problems that require another level of purification. In 1990, $1 million per million gallons per day (MGD) was estimated in capital costs for design and construction of tertiary treatment. The estimate includes a chlorine injection system to prevent mussels from colonizing the inside of intake pipes.

In total, a conservative infrastructure cost of approximately $25 million could be borne by the Region's water suppliers if invasive mussels infest the lake. The low and median estimates are presented in Table 12. Operation and maintenance costs will contribute to this total. For example, according to the recommended chlorine levels for injection systems by the U.S. Army Corps of Engineer's Zebra Mussel Chemical Control Guide, Lake Tahoe Region suppliers as a whole will need to use about 147 pounds of liquid chlorine per day, or 27 tons per year (Sprecher and Getsinger 2000). At a price of around $500 per ton (City of Lewisville 2008), water suppliers would need to spend more than $250,000 per year on chlorine alone.

Table 12. Estimated Water Supply Infrastructure Costs

Cost Category	$'08 Low	$'08 Median	Justification
Redundant Intake System	3,100,685	4,429,549	Continued operation while performing maintenance
Taste and Odor Control System	20,326,710	29,038,157	Maintains clean taste and odor
Chlorine Intake Injection System	252,000	360,000	Prevents mussel colonization on inside of intakes
Annual Cleaning and Maintenance	1,219,603	1,742,289	De-foul intakes on rotation and regular O&M
Annual Liquid Chlorine Supply	175,000	250,000	One year chemical supply cost
Total	**24,898,997**	**35,819,996**	

3.5 MAINTENANCE COSTS

In addition to increased water supply infrastructure maintenance costs identified above, AIS introduce a suite of general maintenance costs, including those associated with boats and piers. Boaters with jet boats or personal watercraft will require screens to filter plants and an annual flush to maintain their intake and cooling systems. In addition, fishing boats may need to be fit with a weedless propeller and trolling motor that allows them to navigate the plant-filled shallows without damaging the drive shaft of the boat's main engine (Bellows 2003).

Boats must also be thoroughly cleaned and inspected before being moved to another water body to reduce the possibility of further spreading AIS. Those boaters who could previously store their craft in the water for whole seasons may need to buy a boat hoist to avoid the damage done to hulls by mussels. When in the lake, boats may need to run the engine every few days to prevent

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mussels from colonizing the cooling system, resulting in large repair bills (Bellows 2003). Winter dry storage and winterization/activation will be mandatory to avoid mussel damage or if boats are permanently stored on the lake they may need a coat of biocide bottom paint to keep mussels from growing on the hull.

AIS also impact boaters and business owners who have private piers and docks. There are over 700 piers, around 20 docks, and about 4,400 buoys on Lake Tahoe (TRPA 2006). Piers may become non-functional to boats without weedless propellers if they are located in infested shallows. Piers may also degrade and wear more quickly as result of mussel biofouling penetrating the piles. Floating docks and buoys can be weighed down by mussel colonies and will require periodic cleaning, replacement, or reinforcement to remain functional (Indiana DNR 2005).

There are also costs to marinas to maintain their facilities and provide adequate service to their customers. Infestations of Eurasian watermilfoil and curlyleaf pondweed are extremely problematic in marinas around Lake Tahoe. Their impacts are most notable in the Tahoe Keys where aquatic weed harvesters are used continuously during the growing season. Tahoe Keys Marina spent about $260,000 in 2007 to mechanically harvest aquatic weeds from the Keys Lagoon (Harry Dotson, TKPOA, Personal Communication 2008). While not every marina is large enough to warrant use of harvesters, each will incur removal costs from aquatic weeds with AIS infestation. Smaller marinas will need to invest in physical methods such as benthic barriers or hand pulling to control infestations. Lakeside and Ski Run marinas actively control invasive aquatic plants by these physical methods.

The magnitude of these future maintenance costs are difficult to quantify because the financial impact is dependent on the severity of the AIS invasion and the precautions boat and business owners take. However, some costs do facilitate estimation based on existing data.

Through interviews of local marine service shops, estimation of AIS-induced additional expenses produced a range of $200 to $400, based on an approximation of at least two additional hours of labor time per year per vessel. The more conservative ($200 per vessel per year) value was applied for this analysis. The number of boats, 7,418, was estimated by assuming the number of slips and buoys from the Lake Tahoe 2004 Shorezone Ordinance EIS was representative of the number of boats permanently stored at Tahoe (TRPA 2004). This number likely underestimates the number of boats that use the lake regularly because it only includes resident boaters, providing a conservative estimation of impact. The estimate suggests that the annual additional maintenance costs to Lake Tahoe boaters may result in an additional AIS impact of $1,483,600 per year in 2008 prices.

In addition, there are additional costs that will be incurred for pier maintenance. As mentioned above, the functional life of a pier may be shortened due to AIS. The TRPA estimated that the piers on Lake Tahoe are worth between $18.5 million and $36.8 million depending on the assumed cost per square foot (TRPA 2004). Adjusted to 2008 dollars, piers are valued between $21.3 and $42.5 million. It is likely that AIS-induced damages would result in accelerated depreciation of the piers. It was assumed that AIS might cause advanced depreciation equivalent to 15 to 25% of the current value of piers. Referencing the conservative value from TRPA, and using the conservative percent reduction, this equates to about $4.3 million in losses.

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4. Summary of Potential AIS Economic Impacts

The potential for economic loss at Lake Tahoe as a result of AIS infestation is high. Given Lake Tahoe's unique combination of outdoor recreation that draws in visitors and resort and gaming oriented entertainment that yields large tourism revenues, AIS has the potential to severely impact the economy in the Lake Tahoe Region.

To obtain an estimate of the potential combined impacts of AIS infestation at Lake Tahoe, each category of AIS damages described in Section 3 (Recreation, Tourism, Property Values, Water Supply, and Maintenance Costs) was evaluated over a fifty year period of analysis and the present value of each stream of AIS damage was calculated and converted to an average annual equivalent damage for comparison. Present value and amortization calculations were based upon the U.S. Government Fiscal Year 2008 Federal discount rate for water resources study of 4 $^{7}/_{8}$ % (USACE 2007).

The assumptions applied for estimating the 50 year stream of damages for each category are described in the following paragraphs. Table 13 provides a summary of the resultant present value and average annual damage calculations by category and in total.

Table 13. Summary of AIS Economic Impacts

Economic Impact Category	Present Value of 50-Year Stream of Damages[1]	Average Annual Damage[1]
Recreation	$32,594,000	$1,751,000
Tourism	$156,576,000	$8,412,000
Property Values[2]	$162,458,000	$8,728,000
Water Supply	$37,243,000	$2,001,000
Boats/Piers	$28,593,000	$1,536,000
Totals	**$417,462,000**	**$22,427,000**

Notes:
1. Present value and average annual cost calculations are based upon 2008 Federal discount rate for Water Resource Studies (4 7/8%) and a fifty year period of analysis. All values are presented in 2008 prices.
2. Does not include associated property tax reductions, estimated at a present value of $70 million, average annual value of $3.7 million.

4.1 RECREATION

In order to conservatively assess the present value of recreation over the period of analysis, the low to median lost recreation values from Table 6 were distributed over the 50 year period of analysis based on the assumption that damages grew from the low end of 2% to the median of 5% at a consistent rate over the period and the present value of the stream of damages was calculated in 2008 dollars. Based on these assumptions, the resultant present value of lost recreation value due to AIS in the Lake Tahoe Region over a 50 year period of analysis was estimated to be $32,594,000, with an associated average annual loss of $1,751,000.

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4.2 TOURISM

The present value of lost tourism spending as a result of AIS was assessed using the same percent reductions as the recreation section. Low to median lost spending values from Table 8 were distributed over the 50 year period of analysis under the assumption that damages grew at a constant rate over the period in proportion to the diminished recreation visitation. Based on these assumptions, the present value of AIS-induced lost visitor spending in the Lake Tahoe Region over the 50 year period of analysis was estimated to be $156,576,000, with an average annual equivalent value of $8,412,000.

4.3 PROPERTY VALUES

Private lakeshore property at Lake Tahoe is very valuable and is the most susceptible to devaluation as a result of environmental degradation associated with AIS infestation. Table 11 summarizes the assessment of property values using reduction values from existing literature. For this summary section, the conservative reduction percentage of 5.4% was chosen. Because of the nature of real estate, evaluating a stream of losses in property value over a 50 year period is likely not representative of probable market reactions to AIS. It is more likely that property values will decline when AIS become well established and Lake Tahoe becomes known as an infested lake. Assessed property value reductions were assumed to take effect 10 years from now based upon time estimated for spread of AIS (most notably Eurasian watermilfoil) around the lake perimeter. Based on these assumptions, the present value of AIS impacts to property values for properties on Lake Tahoe is estimated to be $162,458,000 over the 50 year period of analysis with an average annual equivalent value of $8,728,000.

Additionally, reductions in property tax receipts by the surrounding jurisdictions will be associated with private property devaluation. Based upon 2007-2008 tax rates in the study area, property tax receipt reductions would range between $3.7 million and $13.8 million annually depending on the reduction scenario from Table 11. The lower conservative end of the range was selected at $3.7 million in annual tax receipt reductions. Assuming tax rates remain the same, the present value of these reductions over the 50 year period of analysis would be approximately $70 million.

4.4 WATER SUPPLY

Damages to water suppliers were assessed in terms of added infrastructure, operation, and maintenance costs that would be incurred in the event of mussel or plant infestations in and around the water intake locations. The infrastructure costs in Table 12 were assessed at years 10, 30, and 50, implying initial construction in year 10 and a 20 year design life. Operation and maintenance costs were assessed annually, except in years where infrastructure was assessed. The conservative AIS-induced cost estimate from Section 4.4 was used to assess the damage stream. The conservative present value of AIS-induced damages to water suppliers over the 50 year period of analysis is estimated to be $37,243,000 with an average annual equivalent value of $2,001,000.

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4.5 MAINTENANCE COSTS

Present value of AIS-induced added boat maintenance was assessed based on resident boats and the conservative estimate of $200 per year of additional maintenance cost for each vessel from Section 4.5. Based on these assumptions, the present value of boat damages from AIS over the 50 year period of analysis is estimated to be $27,616,000 with an average annual equivalent value of $1,484,000.

The value of AIS-induced damages to piers was assessed based on the assumption that depreciation would amount to between 15 and 20% of the 2008 value during year 25 of the 50-year period of analysis. Using the conservative estimate from TRPA and the 15% value reduction, the resulting present value of the damage estimate, over the 50 year period of analysis, is $976,000. This is equivalent to an average annual payment of $52,000.

5. AIS Management Costs

Resources in the Region are managed by multiple agencies with additional agencies and organizations providing funding and technical assistance. A complex matrix of these agencies has evolved with some agencies providing grant funding, others performing work with the funding, and others doing both. Many agencies are expending funds on AIS prevention, control, and research and that amount has escalated significantly in the last couple of years in the face of increasing threat of AIS impacts. To date, funding secured and allocated for spending on AIS prevention, control/eradication, research, monitoring, and education during the period of 2007 through 2009 amounts to around $5.2 million (Table 14 and Figure 1).

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Table 14. AIS Funding Awards and Sources from January 2007 to May 2009

Award Source	Award Amount
BOR	$550,000
IVGID	$20,000
LRWQCB	$100,000
LTSLT	$40,000
NDSL	$154,000
NLTLPF	$158,000
SNPLMA Rd 10	$985,000
SNPLMA Rd 8	$535,000
SNPLMA Rd 9	$620,000
TKPOA	$795,000
TRCD	$15,500
TRF	$50,000
TRPA	$160,000
USACE	$972,000
USACE - CTC	$70,000
USDA-ARS	$25,000
USFWS	$35,000
Grand Total	**$5,284,500**

Note: Awards rounded to nearest $1,000; See the main document's Acronyms and Abbreviations list (pg. iv) for the full name of the above agencies.

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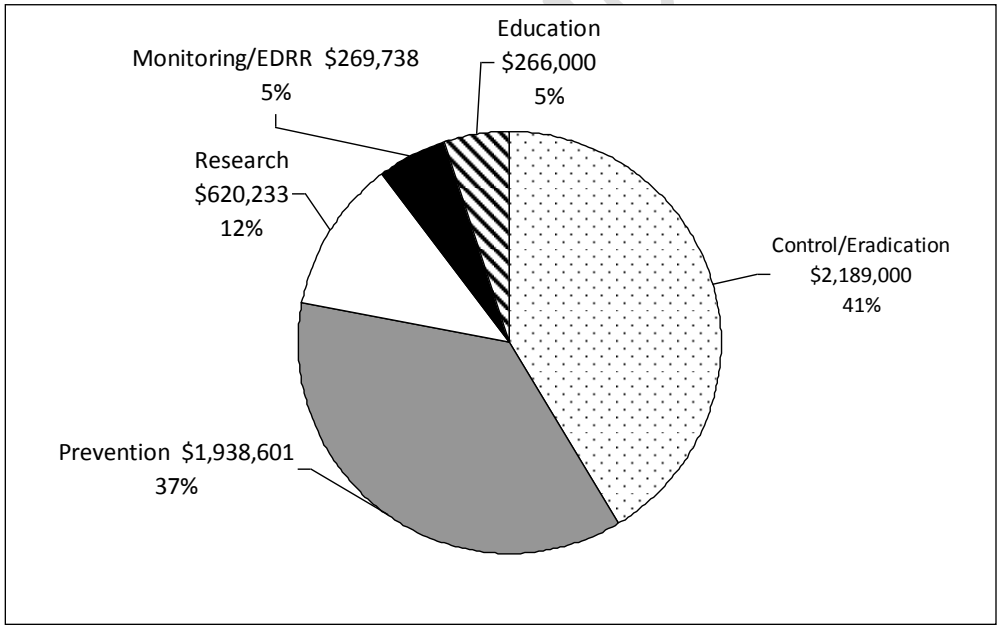

Figure 1. AIS Funding by Task and Category from January 2007 to May 2009

If the AIS problem matures it will require greater resources. Agencies must adapt constantly, working not only to secure funding, but to hire new employees to carry out programs. For regions like Lake Tahoe, that have not yet experienced full scale infestations, prevention, early detection, education, and research, are a primary focus. Containment and control of existing AIS populations before they spread throughout the suitable habitats at the lake are another focus area.

The ability stakeholders to maintain and, if necessary, increase funding will be critical to effectively manage AIS at the lake. If the AIS problem grows quickly as it has done in other locales, these agencies will likely need to increase their AIS budgets accordingly.

Based upon the estimates in this study, the cost of preemptive spending on prevention, detection, and aggressive early control should be far less than the potential AIS damages inflicted on all facets of the Lake Tahoe Region. Existing literature was referenced to review benefit-cost ratio estimates from AIS work at other lakes around the country (OTA 1993, Rockwell 2003). Sampled benefit-cost ratios ranged from as low as 1:1 to as high as 300:1. Some studies point out that benefit to cost ratios decrease rapidly as you move from prevention to control to eradication (Leung et al. 2002). Based on a 20-year simulation model of the economic impacts of public investment in zebra mussel prevention and eradication in Lake Okeechobee, Florida, Lee et al. (2002) estimated the benefit to cost ratio of prevention to be 70:1; early eradication produced a lower ratio of 4.4:1, and late eradication yielded benefits of just 1.2:1. (Note: zebra mussels are not currently present in Lake Okeechobee). The wide ranges of values presented in other studies illustrate that each species and each lake is unique. Nevertheless, they also illustrate that maximum benefits are likely realized through early, preemptive action. From a financial perspective, success of prevention and detection hinges on the willingness of funding sources to invest substantially during this early phase of infestation.

6. Conclusions

The existing literature on Lake Tahoe Region concluded that outdoor recreation opportunities are the unique characteristic of the economy that allows the nearby resort and gaming oriented entertainment industry to prosper. The lake and the pristine natural environment have been found to be the primary draw for summer recreationists to the Lake Tahoe Region. This analysis of potential impacts of AIS infestation at Lake Tahoe found the combined losses of recreation visitation value and associated tourism spending to have the potential to reach over $189 million over a fifty year period of analysis (an average annual damage of $10.2 million). Adding private property value losses ($8.7 million in average annual losses), water supply infrastructure costs ($2.0 million in average annual losses), and boat and pier damages ($1.5 million in average annual damages) results in an estimated combined average damage of $22.4 million per year.

This economic analysis was based entirely on existing socioeconomic data for the study area, existing studies of AIS impacts at other sites, and professional judgment on the part of the study team. The results present a reasonable estimation of the potential economic impacts of unchecked AIS infestation at Lake Tahoe given available information. The report noted data gaps presented in the AIS literature addressing economic impacts. Research that would help to improve future analysis of AIS impacts at Lake Tahoe, include: research related to recreation visitation (specifically a methodology for converting existing visitor counts by various state and

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federal parks agencies into a consistent visitor-day count), Lake Tahoe specific recreation value, and expected changes in recreation visitation and value under various AIS infestation scenarios.

The demonstrated potential for significant economic impacts attests to the economic threat posed by AIS at the lake and should serve to inform policy decisions regarding the merits of committing limited funding to AIS detection, prevention and control in the Lake Tahoe Region.

The last two years have witnessed escalation of local, state, and federal agency spending on AIS management at Lake Tahoe. As of 2008, based on available data, the Lake Tahoe Region has secured around $5.2 million dollars for spending on AIS from 2007 through 2009. While a significant sum, professional experience suggests that this level will need to be sustained, if not increased, as the AIS problem at Lake Tahoe matures.

Previous research indicates the most cost effective strategies for AIS Management are those that focus on early prevention, detection and control before AIS populations become fully established. The findings of this economic study should inform development of the Lake Tahoe Region AIS Management Plan as well as future decision making regarding commitment of financial resources to AIS management in the Lake Tahoe Region.

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Appendix G2: AIS Funding Strategy Synthesis Memo

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MEMORANDUM

DATE	April 3, 2013
FROM	AIS Program Staff
TO	Partner agency executives and directors
RE	AIS Program Funding Strategy Analysis

With the sunset of current federal funding, the Aquatic Invasive Species (AIS) Program seeks stable funding to avoid the severe economic and ecological consequences of AIS invasion of Lake Tahoe. This funding strategy analysis outlines specific options to secure funding from diverse, reliable and long-term sources to sustain core elements of the AIS program. This memo summarizes the approach and recommendations of a funding strategy analysis prepared for the consideration of AIS program staff, coordinating committee, and agency directors in implementing the Lake Tahoe AIS Management Plan and program.

APPROACH

This funding strategy analysis is based on three underlying analyses that should be referenced for additional findings and supporting rationale. The supporting documents described below the figure were reviewed by the AIS coordinating committee and staff.

Economic Consequences of Aquatic Invasive Species in Lake Tahoe: Summary - Estimates of the economic consequences of two potential AIS program implementation scenarios. The analysis and summary memo were developed by ECONorthwest, an environmental economics consultant familiar with AIS issues.

Funding Opportunities Memo – An evaluation of funding sources used by other nationally prominent AIS programs and applicability of analogous funding sources to Tahoe. This analysis and summary memo were produced by Evergreen Funding Consultants, a firm specializing in funding environmental policy initiatives.

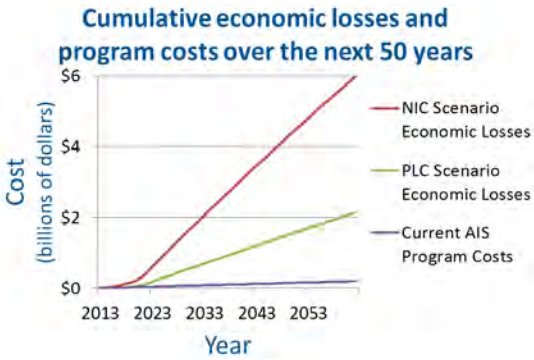
Stakeholder Input Memo – A synthesis of diverse stakeholder perceptions related to AIS concerns, funding mechanisms and investments. This analysis and memo were developed by Environmental Incentives, a Tahoe-based environmental policy development group.

FUTURE OUTLOOK

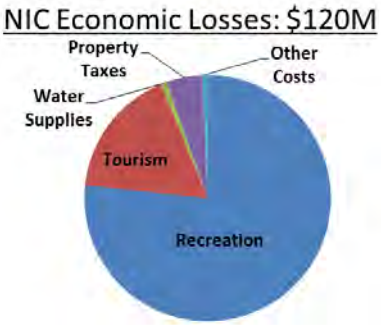
The projected economic consequences of AIS invasion are severe. Program operating costs are decreasing; however, the elimination of current federal funding will create a significant revenue shortfall that will hinder the ability of the AIS program to provide core protection and treatment functions.

ECONOMIC IMPACTS OF AIS INVASION

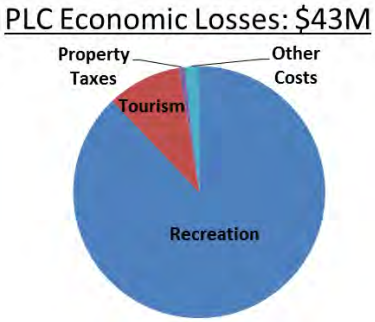
The direct annual losses to the Tahoe Basin economy are projected to be 10-30 times higher than annual costs to operate the current AIS program. The direct economic losses include decreases in expenditures from visitors to the lake, increases in municipal water supply costs, decreases in property values and taxes, and increases in costs to maintain boat equipment and pier structures due to AIS.



The economic consequences analysis explored two AIS management scenarios:



No Inspection or Control (NIC) scenario could occur if inadequate funding ends boat inspections and uninspected boats are allowed to launch. This scenario creates a likelihood that contaminated boats will introduce new AIS invasions and that current populations will expand and foul shorelines. Average annual direct expenditure losses over the next 50 years are estimated to be $120 million, mostly due to reduced desire for recreation and tourism for the purposes of boating, swimming and fishing.



Prevention and Limited Control (PLC) scenario could occur if funding does not allow regular inspection but the requirement for inspection before boat launch is enforced. Essentially only "local" boats would be likely to enter Lake Tahoe - curtailing new AIS introductions but enabling expansion of current populations, to a lesser degree than the NIC scenario. Average annual direct expenditure losses over the next 50 years are estimated to be $43 million, mostly due to reduced recreation from loss of boats from outside Tahoe and reduced recreation quality.

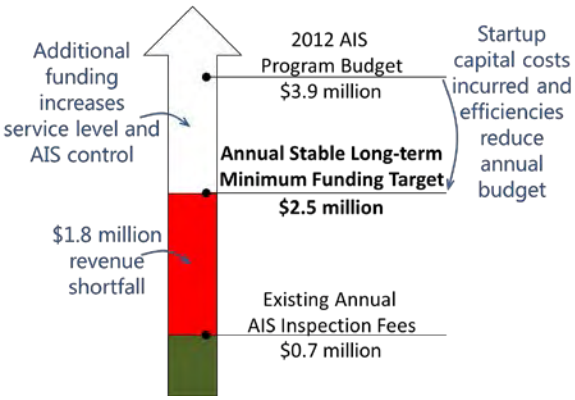
Scenario Commentary

The economic consequences analysis aligns well with local stakeholder views but does not incorporate additional economically important losses. Stakeholders are concerned with loss of recreational and the resulting economic losses, and prioritize efforts related to prevention of further AIS introductions. Stakeholders mentioned that AIS are already reducing recreation desirability of some areas and potential invaders like the Quagga mussel have great potential to make recreational losses substantially greater. Direct economic losses presented above underestimate the total cost to society by leaving out losses of consumer surplus, which add roughly 20% to the NIC and PLC scenario losses above.

The economic consequences have been critiqued because people commonly recreate in more polluted and less aesthetic lakes than Lake Tahoe, and thus some believe visitors will continue to recreate in Lake Tahoe if AIS infestations and resulting ecological impacts ensue. However, Lake Tahoe recreational visitors have other lakes in closer proximity to their homes, and are likely to switch to these other lakes if Lake Tahoe is more costly to visit and is no longer more beautiful and unique than other lakes.

COSTS TO MAINTAIN AIS PREVENTION AND CONTROL

The AIS program costs averaged about $3.9 million annually for the last two years. However, agency staff anticipate a decrease in program costs now that capital investments in equipment are substantially complete and operations efficiencies have been discovered. The target annual budget for the program moving forward is $2.5 million. This budget would be allocated between the prevention/inspection aspect of the AIS program and a basic level of control/treatment. This target budget is currently being analyzed and refined through a pro-forma modeling effort that will estimate the level of service expected with this budget. If additional funding becomes available through competitive sources, inspection wait times could decrease and control efforts could further reduce existing infestations.



FUNDING STRATEGY

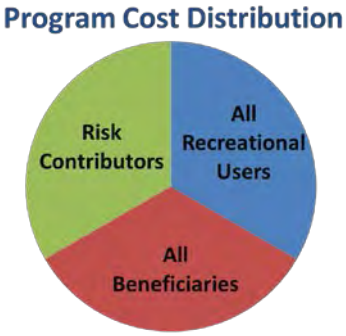
A goal and objectives guided this funding strategy analysis and should be considered by AIS program staff and decision-makers as they evaluate policy options to replace lost funding. This section also presents context for evaluating funding opportunities before prioritizing specific funding sources.

GOAL & OBJECTIVES

The goal of this funding strategy is to *"replace the revenue shortfall created by elimination of current funding with stable, long-term sources in order to avoid the severe economic and ecological consequences of AIS invasion of Lake Tahoe."*

Objectives

1) Secure $1.8 million in annual funding for AIS program beyond the funding currently raised by boat inspection fees.
2) Equitably distribute program costs among three groups of people: Risk Contributors, All Recreational Users and All Beneficiaries.
3) Use long-term, stable sources to fund $2.5 million annually for prevention and basic control efforts, while leveraging other funding sources for control efforts and increased service levels.



FUNDING STRATEGY SUPPORTING RATIONALE

Three groups were evaluated to support AIS program costs, each has important advantages as well as drawbacks to consider.

GROUP	DESCRIPTION	STRENGTHS	WEAKNESSES
Risk Contributors	Concentrates costs on those entities that contribute most directly to the incidence of AIS - primarily boaters and fishermen	▪ The most supported approach by local stakeholders. ▪ Well enshrined in CA state law, which authorizes a wide range of fees to cover costs of programs to address specific pollutants.	▪ Fairly small group results in substantial fee levels. ▪ Fees and taxes may be sufficient to dissuade some users from visiting Lake Tahoe, further limiting the incidence of payers and increasing rates.
All Recreational Users	Shares costs among the broad range of entities that use Lake Tahoe to recreate – most visitors to the Tahoe Basin	▪ Expansion of the number of payers relative to Risk Contributors group. ▪ Fees and taxes are unlikely to dissuade users to visit Lake Tahoe. ▪ CA and NV routinely apply user fees, including those for fishing licenses, boat registrations and highway tolls.	▪ Stakeholder support is lacking as existing taxes such as the transient occupancy tax (TOT) is already relatively high. ▪ There is little existing infrastructure to aggregate fees from various recreation permits for a single use, and this would be challenging to develop.
All Beneficiaries	Shares costs among those entities that directly and indirectly benefit from a clean and healthy Lake Tahoe – primarily Basin residents	▪ Very wide base of entities paying these fees would allow very low rates. ▪ Very dependable revenue stream. ▪ Clearly established system for collecting sales taxes and could be adapted easily. ▪ Many state services in CA and NV are paid for on the beneficiary pays approach, such as state general funds, public utility fees and large water projects.	▪ Passing a property tax (e.g. voter approval) is likely difficult. ▪ The absence of a clear state authority to levy a utility tax in Nevada. ▪ The large number of small water providers in the Tahoe Basin requires significant overhead to implement a new fee.

Most AIS programs use a diversified funding strategy with the largest share of funding coming from state appropriations and dedicated funding accompanied by mandatory surcharges. A broad review of funding sources for 26 AIS programs around the country found that AIS programs which have dedicated funding most commonly have mandatory surcharges on boat registration and launch fees. On the high end, boat registration fees generate $2.7 million/year for AIS protection in Minnesota. AIS programs are also using hunting/fishing license fees and parcel taxes.

Stable funding is a high priority for consistent prevention and inspection efforts, while control efforts are better suited to use some dedicated funding and a wider range of funding sources. Based on the ongoing nature of the AIS threat and the importance of consistent vigilance, the AIS program would be most consistent and effective with long-term, stable funding sources for prevention and inspection efforts. A control program that treats existing infestations is more suited to a combination of funding sources with stable, ongoing funding supporting a streamlined and minimalist effort, while supplemental financial support via grant or other competitive funding is used to accomplish large gains when available.

POTENTIAL FUNDING SOURCES

More than twenty funding sources were subjected to a criteria-based evaluation using principles from the publication California's Tax System: A Primer published by the California Legislative Analyst's Office in 2007:

- ***Adequacy, Stability, and Reliability***. Can the system routinely be counted on to generate sufficient revenues to fund agreed-upon public services?
- ***Broad Bases With Low Rates.*** Is the tax base sufficiently diverse so as to allow for the financing of public services to be shared broadly, with tax rates kept to a minimum?
- ***Administrative Feasibility***. Can the system be administered in an efficient, effective, and uniform manner, with a high degree of voluntary compliance?
- ***Equity.*** Are taxpayers in similar situations treated similarly, and are the differing tax burdens placed on taxpayers with differing characteristics fair?

The funding sources evaluated are listed below and organized by three categories: (1) recommended, (2) possible, and (3) considered. Each source is described with their funding group, funding sector, selection rationale, fee rate increase or retention rate range used to estimate potential annual funding and potential annual funding range. The funding sources are regional unless otherwise labeled in the title.

Recommended Sources

Recommended funding sources are well-aligned with the evaluation criteria based on initial research.

FUNDING SOURCE	FUNDING GROUP	ACTION LEVEL	SELECTION RATIONALE	FEE RATE INCREASE OR RETENTION RATE	ANNUAL FUNDING RANGE
Boat AIS inspection fees	Risk Contributors	State	This source is consistent with other AIS programs and has been successfully implemented in the basin for several years.	0.0% Increase	$700-750 k
Redirect existing moorage and lease fees	Risk Contributors /All Recreational Users	State & Local	An innovative source that may not require fee increases. This source redirects and localizes existing fees already paid to state lands agencies for piers, buoys and fuel.	40-60% Retention	$35-50 k

Lodging tax	All Recreational Users	Local	This tax is the simplest and most equitable method to generate revenue from all recreational users since the existing distribution structure can easily be adapted and most recreational visitors stay overnight. However, the business community feels the tax is already a competitive disadvantage due to its high rate relative to room cost.	0.175-0.25% Increase	$800-1,140 k
Basin-specific sales tax	All Beneficiaries	State & Local	This is the most direct way to raise substantial revenue without major impacts on specific groups, and there are broad authorities for local sales taxes in both CA and NV. However, taxes on essentials such as food and gasoline are regressive, concentrating funding burdens on low-income population	0.0075-0.01% Increase	$635-845 k
Water utility tax	All Beneficiaries	State & Local	Water utilities could incur significant costs due to AIS infestations and a utility tax would spread costs among many rate payers. Utility taxes are authorized under CA and NV law.	0.1-0.2% Increase	$175-350 k

Possible Sources

Possible funding sources are viable but may not be well-aligned with one or two of the evaluation criteria based on initial research.

FUNDING SOURCE	FUNDING GROUP	ACTION LEVEL	SELECTION RATIONALE	FEE RATE INCREASE OR RETENTION RATE	ANNUAL FUNDING RANGE
Boat & fishing equipment sales tax	Risk Contributors	State & Local	A tax on boats and sport fishing-related equipment purchased in Tahoe targets new boats and fishing only. Collection infrastructure is substantially in place.	0.6-0.9% Increase	$260-390 k
Vessel registration fees	Risk Contributors	State & Local	Stakeholders support retention of fees for Tahoe boats to at least partially stay in Tahoe, and collection and distribution infrastructure is in place.	20-30% Retention	$180-265 k
Fishing license fees & tackle taxes	Risk Contributors	State & Local	This source is consistent with CA and NV laws, has a collection infrastructure substantially in place and is complimentary to other sources.	4.0-7.0% Increase	$100-175 k
Boat rental & guide tax	All Recreational Users	State & Local	This source is a primary contributor to AIS but there is minimal infrastructure in place to collect and distribute the funds.	0.5-1.0% Increase	$85-175 k
Recreation permit surcharge	All Recreational Users	State & Local	There is great potential to collect the funding from this source with rates low enough that there would be minimal impact on the recreational choices of users. The collection and distribution system would be complex, require additional infrastructure and expensive to initiate.	0.5-1.0% Increase	$10-25 k

Considered Sources

Considered funding sources are not expected to be viable (thus not recommended) due to substantial divergence with one or more evaluation criteria based on initial research. Similar funding sources in this category have been combined to save space.

FUNDING SOURCE	FUNDING GROUP	ACTION LEVEL	SELECTION RATIONALE	ANNUAL FUNDING RANGE
Boat Launch Fees	Risk Contributors	Local	This source is closely linked to the primary contributor to AIS; however, boat inspection fees already garner funding from this source and high rates create equity and economic concerns.	Not Estimated
Federal, state & local appropriations	All Beneficiaries	Federal/ State/ Local	The Lake Tahoe Restoration Act includes funding for AIS; however the passage of the legislation is uncertain at this time, influenced by uncontrollable factors and sunsets after 10 years.	Not Estimated
Federal & State grants	All Beneficiaries	Federal	Competitive grant programs cannot be relied on to provide the stable funding necessary to consistently maintain prevention efforts.	Not Estimated
State-Wide Taxes & Fees	All Beneficiaries	State	Regional taxes and fees such as general sales tax and fishing license fees listed as "recommended" were also evaluated on a state-wide basis. Although very low rates can provide significant funding, they are not equitable since most payers would not benefit from Lake Tahoe.	Not Estimated
Other Utility Assessment Fees	All Beneficiaries	State & Local	Utility assessment fees for sewerage, electricity generation, etc. are authorized under CA law. However, non-water utilities are considered unrelated to the AIS issue and initial research did not identify a similar mechanism in NV.	Not Estimated
Property tax	All Beneficiaries	State & Local	Property taxes could be a substantial revenue source; however historically it is challenging to pass local property taxes, making this source less attractive than others. Another potential challenge is the restriction on the ways that funds can be used.	Not Estimated
Voluntary Private Donations & Grants	All Beneficiaries	Private	Private donations by organizations such as water suppliers or ski resorts are historically unreliable over time and rarely given to governmental entities.	Not Estimated
NGO Programs	All Beneficiaries	Private	NGO Programs rarely give funding to governmental entities or provide long-term reliable funding.	Not Estimated

ACTION PLAN FOR IMPLEMENTATION

Implementing selected strategies would involve a set of actions that will reveal the best avenues to acquire dedicated, long-term funding. Overall implementation of this funding strategy would require two major phases: clarification of state authorization followed by local enactment. Further information about local enactment steps is available in the Funding Opportunities Memo.

#	ACTION	DESCRIPTION
1	***Develop funding scenario tool***	Developing spreadsheet models to estimate the total funding available from all sources and compare it to the funding allocated to AIS program areas. This tool would evolve into a dynamic program design system to project service levels and estimate future program capacity based on funding and other best available information.
2	***Seek state authorization of AIS funding strategy***	Begin legislative outreach to build support for the funding strategy. State authority would provide clear direction for regional collection of taxes consistently across counties and states. This would reduce legal vulnerabilities based on differences in jurisdictional tax/fee rates. This would also signal state support for grants.
3	***Engage business stakeholders on occupancy tax adjustment***	Engage the business community to further explore the viability of using an increase to the transient occupancy tax to fund the AIS program. The Chamber of Commerce felt strongly that the transient occupancy tax is relatively high and should not be increased for AIS program funding.
4	***Contact state lands agencies & marina stakeholders for moorage fee localization***	Contact the fee assessment authorities that allow state lands agencies to collect dock, buoy and fuel fees/taxes to evaluate the ability to adjust policy to keep at least a portion of the fees in Tahoe for AIS protection. Engage marina stakeholders for strategies and contact points within assessment agencies.

Appendix G3: AIS Stakeholder Interview Memo

DRAFT - Not for Distribution

DRAFT - Not for Distribution

MEMORANDUM

DATE	11/29/12
FROM	Environmental Incentives
TO	AIS Program Staff
RE	Stakeholder Input to AIS 5-Year Finance Strategy

Stakeholders have strong input that should guide the development of a 5-year finance strategy for the Aquatic Invasive Species (AIS) Program. This memo contains key findings synthesized from the eight stakeholder interviews conducted and provides a summary of each stakeholder's input.

Purpose & Use

The purpose of this assessment is to (1) provide context to ensure the consulting team has necessary background on the AIS Program and (2) update AIS Program Staff on current perspectives from a broad cross section of important stakeholders. The key findings will guide AIS Program staff and consultants as they develop a sustainable 5-year funding strategy for preventing and mitigating AIS impacts in Lake Tahoe.

Approach

The consulting team developed a structured interview plan document that was reviewed by AIS Program staff. The interview plan was used to guide one to two hour interviews with eight stakeholders that were able to represent perspectives from management/regulatory agencies, research institutions, tourism businesses, marinas, drinking water providers and environmental interests. Stakeholders were asked a series of eight questions unless questions were not applicable to their perspective. Stakeholders were also encouraged to provide unstructured input if desired. The interview plan is included as Annex A of this memo. Questions were focused on each stakeholder's

- Primary AIS concerns
- Level of support for AIS Management Plan goal and objectives
- Willingness to pool funding
- Level of funding decision drivers
- Suggested funding sources
- Potential contributions and resources
- Preferences for distributing costs of AIS protection
- Costs already incurred due to AIS

KEY FINDINGS

Key findings have been synthesized from all interviewed stakeholders' responses. The level of detail in each set of findings is reflective of the interest and engagement from stakeholders on the topic. The length of topics ranges from nearly two pages to just a single paragraph; however, each finding is important for AIS Program staff and the consultant team in development of an AIS finance plan.

Findings are organized by the questions listed in the Approach section above. For some questions an additional level of organization is used to group findings by theme. Each finding begins with a clear statement of synthesized input followed by supporting information in narrative or tabular format.

PRIMARY AIS CONCERNS

Economic & Recreation Losses (theme mentioned 13 times)

Loss of recreational value is the greatest concern of stakeholders.
All stakeholders mentioned that AIS can impact important recreation resources in the basin. Stakeholders mentioned that AIS are already reducing recreation desirability of some areas and potential invaders like the Quagga mussel have great potential to make recreational losses substantially greater.

Loss of economic activity due to the prevention program is a widely-held concern.
Agency, business and marina stakeholders agreed it is critical to avoid driving boaters away. High inspection costs or substantial delays in the launch process are factors that may discourage boaters from visiting Lake Tahoe and create an economic impact. The marina stakeholders feel that boaters have begun to visit other lakes instead of Lake Tahoe because there are no AIS requirements there.

Economic losses due to effects of AIS invasion and costs of control concern many stakeholders.
Agency staff are aware of the potential for great economic losses from AIS invasion, and have been disseminating information about AIS threats to the economy as well as the costs required to avoid these threats. The marina stakeholder interviewed has not incurred substantial costs to control AIS but is aware of other marinas that have. Water purveyors are very concerned about potential loss of the EPA filtration exemption as well as the increase in infrastructure maintenance if mussels invade.

Policy & Management Issues (theme mentioned 7 times)

Current funding sources are not sustainable.
Public funding for the AIS program is about to drop substantially. Inspection fees currently provide only 1/4th to 1/3rd of AIS Program costs. Therefore, additional sources are needed to avoid a major loss of program services and staff. Stakeholders are also concerned that there is leakage of Tahoe-generated funds to bureaucratic or non-related uses in both Nevada and California.

There are mixed perspectives on use of chemical controls.
AIS management agency and marina stakeholders are interested in pilot testing chemicals as a cost-effective control for aquatic weeds and clams. However, water suppliers and water quality regulators are concerned that even pilot tests could result in adverse impacts that will need additional treatment processes and hurt water-customer confidence in the safety of their water supply.

Agency staff value AIS regional planning & coordination while other stakeholders often do not.
Agency staff advocate regional coordination to bring more public funding, make the AIS program more effective and reduce costs. Business and marina representatives are not convinced of the value of planning and coordination, and have little trust that investing their funds in government programs to prevent and control AIS would be an effective use of their money. Environmental and agency staff agree that having an AIS Management Plan is key to securing funds for AIS protection, but most feel that revising it is not necessary. At least one stakeholder was concerned that the current program may allow new AIS into Lake Tahoe through intentional introductions or gaps in the inspection program.

Ecosystem harm (theme mentioned 6 times)

Environmental and science stakeholders are concerned with the potential for AIS induced ecosystem damage.
AIS are likely to alter Lake Tahoe's historic ultraoligotrophic conditions by reducing the number of native species, changing trophic dynamics, and changing the nutrient cycles by increasing the biological nutrients available. These ecosystem alterations will reduce many ecosystem services including the clarity of Lake Tahoe and the recreational value of beaches.

AIS PROGRAM GOAL, OBJECTIVES & STRATEGIES

AIS Management Plan goals are on target and do not need to be substantially changed.
Essentially all stakeholders felt that the goals were conceptually important and comprehensive. The addition of education was the only suggested change but this was not critical to the stakeholder since this concept is covered in objectives.

There is strong agreement to prioritize the Prevention objective in the AIS Management Plan.
Watercraft are the primary source of AIS. Stakeholders consistently agreed the Prevention objective, the basis for motorized watercraft inspections/decontamination and voluntary non-motorized watercraft cleaning should be funded first.

Stakeholders are polarized on the Control & Education objective- three called it a top priority while five called it a bottom priority for funding.
Stakeholders who prioritized this objective feel that aquatic plant control, general education and control of satellite populations of Asian Clams are important priorities. Stakeholders who rated this objective as a bottom priority either did not think it would be feasible to treat existing infestations or did not find them to be a severe concern.

Table 1: Top Priority Objectives/Strategies Table

AIS MANAGEMENT PLAN OBJECTIVE & STRATEGIES	NUMBER OF STAKEHOLDERS LISTING AS A TOP PRIORITY	COMMENTARY
C: Prevention – Inspection and Decontamination	8	▪ Nearly all stakeholders expressed broad support for prioritization of this objective. ▪ Many stakeholders focused their preference on the Inspection & Decontamination strategy while a few preferred Education. ▪ No stakeholders mentioned Vectors/Pathways strategy as a priority.
D: Monitoring Detection & Response	5	▪ Most stakeholders prioritized this objective; focusing on cost-effective monitoring for existing infestations and rapid response to new infestations.
E: Control & Education	4	▪ Stakeholders expressed polarized views on this objective - some rated it as a top priority while others a bottom priority. ▪ Several stakeholders expressed strong support to prioritize aquatic plant control and general education about AIS control. ▪ Supportive stakeholders suggest focusing on controlling satellite populations of Asian Clams because it is excessively costly to control Asian Clams on the scale necessary to treat the main infestation.

Table 2: Bottom Priority Objectives/Strategies Table

AIS MANAGEMENT PLAN OBJECTIVE OR STRATEGY	NUMBER OF STAKEHOLDERS LISTING AS A BOTTOM PRIORITY	COMMENTARY
F: Research and Information Transfer	6	▪ Stakeholders consistently rated this objective and nearly all of its strategies as a low priority noting that they did not understand the value of transferring information to other areas.
G: Laws and Regulations	6	▪ Although many stakeholders mentioned this objective as a very low priority, very little funding is invested in this aspect of the AIS program.
E: Control & Eradication	5	▪ Many stakeholders listed this objective as a low priority, however reasons differed. There were several stakeholders who did not support specific species control (e.g. Bullfrog, Asian Clams) and others who were more broadly skeptical of the need or ability to effectively control any of the listed species.
A: Management Plan Implementation and Updates	3	▪ Several stakeholders mentioned that the Management Plan has done its job to bring attention and show readiness for funding, while one stakeholder felt it is important to update.

WILLINGNESS TO POOL FUNDS

Agency stakeholders tend to accept the idea of contributing to a pool of funds if projected future costs would be lower. However, non-agency stakeholders are less likely to contribute due to lack of confidence that the funds would be used effectively.

Stakeholder willingness to pool funds can be expressed as a spectrum with organizations falling between being very willing to contribute and being very unwilling to contribute. In general the stakeholders most willing to contribute feel that the value of protecting the natural resource (Lake Tahoe) is worth it and that investment now will save money in the future. Those stakeholders least willing to contribute funds cited concerns that the funding would be used inefficiently and spent without their input. Figure 1 shows where each of the stakeholder entities interviewed fall on the spectrum.

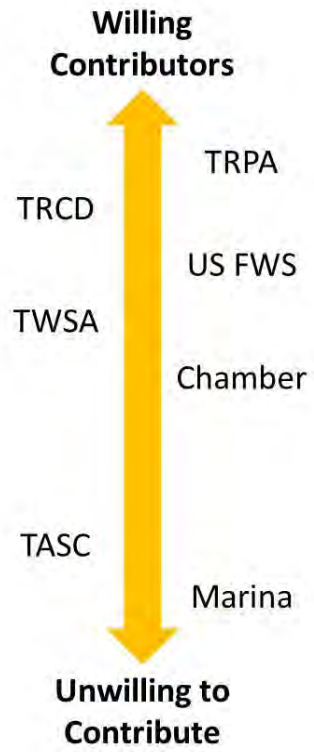


Figure 1: Organizational willingness to pool funds

LEVEL OF FUNDING DECISION DRIVERS

Level of funding for AIS prevention and control is primarily based on relevance to the mission of the stakeholder organization. However, the cost of AIS invasion, cost of prevention versus costs of control, and political/public interest also influence organizational interest.

Stakeholders cited a wide-ranging set of rationale driving their willingness to fund AIS prevention and control.

Many stakeholders mentioned the costs that AIS invasion has imposed other lakes, as well as the costs for prevention and control. The educational institution was concerned with broad applicability of new knowledge that could benefit society. The business organizations wanted to protect their economic interests by streamlining inspection requirements and (conversely) maintaining a high quality nearshore that attracts visitors. Resource management agencies and the environmental NGO were concerned with making sure AIS control aligns with their mission or current objectives. Most stakeholders felt that little funding for AIS will materialize without political and public interest.

SUGGESTED FUNDING SOURCES

Stakeholders suggested more than 40 unique funding sources from multiple sectors that could provide resources to the AIS Program. The funding sources have been broken into eight categories in the following table. Innovative funding sources are highlighted within the description of each category. Some of the most innovative and promising sources are listed at the bottom of the table because they were noted by stakeholders few times. Additional sources and perspectives on these funding sources can be found in the Summarized Interviewee Responses section of this memo.

Table 3: Suggested funding sources[1]

FUNDING SOURCE	DESCRIPTION	TIMES NOTED
Mandated Fees	User fees for motor boat inspections are accepted by all stakeholders. The environmental stakeholder felt that the full cost of program should be recovered. A room night fee (i.e. TOT) on hotels and vacation rentals for as much as 1/3rd of room cost is popular with agencies but not recommended by Chamber. (A previous effort to charge a room night fee was rejected by CA.) A mandatory surcharge on ski tickets, boat rentals, golf and other recreation activity was mentioned by many stakeholders. A surcharge on recreation equipment purchases (boats, fishing gear, etc) was also mentioned several times. A surcharge on water suppliers or individual consumers was mentioned. Other taxes/fees such as property tax, gas tax and Tahoe Basin entry fee were mentioned.	20
Federal Agency Budgets	Many agencies and their programs were noted. Several agencies (e.g. EPA, NSF, NOAA) provide research grants. Others implement ecosystem restoration (e.g. Army Corps, BOR, USFS). Transportation agencies/funds could be leveraged for capital facility costs. State and interstate AIS Management Plan funds have not been used, but Tahoe will apply in 2013.	15
State Bond Issuances	A variety of state bonds have provided funding to water quality and other aquatic programs. These bonds include: CA Proposition 50 and 84, NV Question 1, Nevada Tahoe License plate. Several stakeholders mentioned IRWM Plans: CABY, MAC, Sierra Tahoe and inter-plan funds but noted that bonds are unreliable and currently it may be a while before new bonds will be attractive to the public.	10
State/Bi-state Agency Budgets	CA Dept of Natural Resources - Water Board has clean up and abatement funds that are already used for Tahoe AIS. TRPA has used general funds to support program coordination and expects to do so in the future.	8

[1] Note to reviewers: the funding matrix within the Finance Strategy Memo is not ranked according to stakeholder input in this memo.

FUNDING SOURCE	DESCRIPTION	TIMES NOTED
Private/NGO Contributions	The Tahoe Fund could provide privately-sourced funds to meet government match requirements. Lakefront property and business owners and associations could be willing to contribute to keep property value. Examples noted: Tahoe Keys Property Owners Association, Aramark Cruises. It is unlikely but possible that the Chamber would consider using a portion of membership fee for AIS.	7
Direct Appropriation	The Lake Tahoe Restoration Act is being considered for update and passage but is not currently being debated in the Federal legislature. SNPLMA is winding down but still will distribute funds for several years. US FWS could be a venue for direct appropriations.	5
Voluntary Surcharges	Consider program models like River Keepers in which ski area or golf course patrons make a voluntary contribution with purchase of a ticket/round (i.e. "a buck for the lake"). This approach is highly recommended by Chamber of Commerce.	3
Redirect Existing Taxes/Fees	CA State Lands has a tax on piers, buoys, mooring and fuel- this surcharge could be adjusted to keep revenue in Tahoe. NDOW has a permitting program that could allocate funds. CA and NV boat registration fees could be set aside for Tahoe.	2

POTENTIAL CONTRIBUTIONS & RESOURCES

Six of eight stakeholders offered new or ongoing contributions of funding, staff time or technical resources. Agencies typically have already provided general funds, staff management, contracting oversight and coordination. Academic organizations provide technical expertise, technology transfer and grant writing. Environmental and marina stakeholders felt their focus on their mission would not allow them to provide substantial contributions in the future. The following stakeholders noted specific contributions

- **TRCD** –Currently providing seasonal staff management, stakeholder engagement, flexible fiscal agent
- **UCD** – Currently providing technical expertise, technology transfer, grant writing effort
- **TRPA** – Currently providing general fund dollars & staff time, communications expertise, monitoring/detection equipment (e.g. boat & divers), technology for fee collection, fee waiver for AIS projects, contract management, coordination via MOUs/management plan/facility
- **US FWS** – Currently providing contract management of about $800k/yr, resource coordination and MOUs, outreach to other states and tribes
- **Chamber** – Willing to provide strategic communications to business community, lobbying for funding, membership perspectives, partners for negotiating cost shares
- **TWSA** – Possibly willing to provide some funding, veliger monitoring at intakes, education and outreach to ratepayers
- **Environmental Perspective** – Organization is too grassroots to provide resources, but can provide access to meetings for member perspective sharing
- **Obexer's Marina** – Focused on business execution and not able to provide resources

PREFERENCES FOR COST DISTRIBUTION METHOD

The most well supported approach to distributing costs of AIS control is according to the portion of the cause or level of risk generated.

This method was supported by seven of eight stakeholders and was by far the most strongly supported option by the stakeholders who mentioned it.

Several stakeholders were agreeable to distribute costs according to current or historical precedents.
Two stakeholders felt that a cost distribution similar to the EIP 's 1/3rd federal, 1/3rd state, 1/3rd private/local would be politically acceptable. This approach is compatible with the current prevention program fee structure that collects about 1/3rd of the program's cost through boat inspection fee; however, the other funding from other current sources is expected to decrease.

COSTS ALREADY INCURRED DUE TO AIS

Only the marina stakeholder has incurred direct costs from AIS, however agencies have contributed funds from their baseline/general budgets for staff.
Direct costs to marinas include increased staffing needs due to managing/inspecting boat seals and infrastructure costs to install a ramp gate/camera. Obexer's marina has not yet incurred any operating costs to control weeds. Obexer's does feel that they have lost revenue due to boaters going elsewhere based on the complication of inspection requirements. TRPA has provided substantial funding from its general fund for coordination and leadership of the AIS Program.

SUMMARIZED STAKEHOLDER INPUT

Each interviewee responded to a set of structured questions and was also asked to provide additional perspectives in an unstructured discussion. The themes of concern and interest expressed by interviewees are synthesized in the *Key Findings* section above. Interviewees represented a broad range of perspectives, as summarized in the following table.

STAKEHOLDER	ORGANIZATION	PERSPECTIVE REPRESENTED	INTERVIEW DATE
Kim Boyd	TRCD	Program Implementation	4/23/12
John Reuter	UC Davis	Science & Research	4/24/12
Ted Thayer	TRPA	Program Leadership/Admin	4/30/12
Steve Chilton	US Fish & Wildlife Service	Program Leadership/Funding	5/1/12
Betty "B" Gorman	SLT Chamber of Commerce	Business/Commerce	5/3/12
Madonna Dunbar	Tahoe Water Suppliers Association	Water Purveyors	5/3/12
Bob Anderson	Consultant	Environmental Protection	5/31/12
Keith Fields & Darren Kramer	Obexer's Marina	Marina Operators	8/9/12

Kim Boyd

Ms. Boyd is the AIS Coordinator at Tahoe Resource Conservation District. She is responsible for managing the seasonal staff of most "off-ramp" inspection and decontamination stations for motorized boats. Kim is a leader of the AIS Coordinating Committee and represents one of three core agencies for the AIS Program. The interview began with a valuable overview of the AIS Program and its history.

1. What are your organization's biggest concerns for aquatic invasives in Tahoe?
   - Driving down cost of inspection program
     - Would like to share facilities with surrounding lakes (e.g. Boca, Stampede)
   - Regional coordination – finding locations where off-ramp inspections and decontaminations can serve many lakes or whole states
   - Recreational & tourism economic losses
2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
   - No change to goals
   - First Objectives to Fund (in order presented by stakeholder)
     - C1: Inspection & Decontamination
     - C3: Education (re: Prevention)
     - F3: Research Needs
     - E1: Aquatic Plant Control
     - E3: Warm Water Fish Control/Education
     - D3: Early Detection and Rapid Response
   - Last Objectives to Fund
     - G3 & 2: Laws and Regulations (notes Lacy Act issue)
     - D1: Potential AIS (other strategies cover this topic)
     - C2: Pathways/Vectors (Prevention)

        - A2: Management Plan - Review Process
3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
    - Would be happy to contribute funding to a pool if it would lower overall costs
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
        - Cost of consequences on businesses
        - Knowing what funds are used for (not into a black hole)
        - Connect payment directly to valued local service/expense
        - Communication hints
            - Tell meaningful story of case study
            - Avoid sky is falling stories
5. What funding sources are you aware of that could be used for the AIS Program?
    - CA Proposition 84
        - IRWMP
    - CA Proposition 50 – for control projects
    - SNPLMA final rounds
    - Local fees for service
    - Emergency funding from Army Corps
    - Bureau of Reclamation – for control projects
    - Tahoe Fund for private contributions to satisfy match requirements
    - Lake Tahoe Restoration Act – revised version (if passed)
    - Lodging fees (note that a room tax was rejected by CA government)
    - Line item in state general fund for local government
        - See model in Lake County for AIS enforcement of sticker checks or police response to belligerent boaters
6. What would be the most equitable way to share costs of AIS prevention and control?
    - According to share of direct benefit
    - Sliding scale – local businesses contribute based on ability to pay
    - According to cause of problem is of less interest
    - Use mandate as a last resort only
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
    - TRCD is entirely grant funded so cannot offer in-kind assistance
    - Through grant funds TRCD has offered
        - 45 seasonal staff for inspections
        - Stakeholder organization and support
        - A flexible fiscal agent
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
    - Question not relevant to this organization
9. Unstructured Discussion
    - Historical facts about program implementation and lessons learned

John Reuter

Dr. Reuter is a professor at UC Davis with a very extensive history of Tahoe water quality research including science consultation to the Lake Tahoe TMDL. He is the Associate Director of the Tahoe Environmental Research Center and member of the Tahoe Science Consortium, Committee of Scientists. John's perspective focused on the ecological value of Lake Tahoe and potential changes due to AIS.

1. What are your organization's biggest concerns for aquatic invasive in Tahoe?
    - Protecting Tahoe's ecosystem – movement away from the ultra oligotrophic historic condition
        - Ecosystem loss matters because
            - Nearshore recreation will be less attractive
            - Nutrient cycling disruption that makes more Nitrogen and Phosphorous biologically available and would lead to increased algae in the nearshore and mid-lake
            - Trophic dynamics will change (the who eats what of Lake Tahoe)
    - Sounding the alarm to get the message out about the decade-long history of AIS in tahoe
2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
    - All three goals of the plan seem highly relevant and it would be hard to prioritize
    - First objectives to fund
        - C3: Education re: prevention
        - C1: Inspection and Decontamination
        - E1: Aquatic Plant Control/Education
        - E3: Warm Water Fish Control/Education
        - E2: Asian Clam Control/Education (on satellite populations only)
        - D2: Existing AIS (for Monitoring Detection and Response)
        - D3: Early Detection and Rapid Response (EDRR) Planning (for Monitoring Detection and Response)
    - Last objectives to fund
        - G1-3: Laws and Regulations
        - A3: Funding (Management Plan Implementation and Updates)
        - C2: Pathways/Vectors (of Prevention)
        - E4: Bullfrog Control/Education
    - General recommendations
        - Avoid trying to control biggest infestations due to cost
        - Don't cut prevention & control to do monitoring
            - Fund monitoring as a % of control costs
3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
    - Question not relevant to this organization
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
        - Severity relative to other lakes
        - Benefits of research and education
        - Greater understanding of life history and environmental requirements of AIS
        - External applicability of lessons learned to society
        - Potential to gain understanding of AIS transport vectors
        - Novel control approaches
        - Effects of climate change on AIS
        - The potential for technology/science transfer
5. What funding sources are you aware of that could be used for the AIS Program?
        - EPA – research grants
        - NSF – research grants
        - NOAA – research grants for climate and AIS
        - BOR –

        - CA Dept of Nat Resources
        - NGOs/Foundations – researchers currently checking into this
        - User fees
6. What would be the most equitable way to share costs of AIS prevention and control?
    - Preferred not to directly answer the question
    - Recommends finding funding then designing program around available resources
        - We are unlikely to find a funding situation like SNPLMA's "golden age" again
        - The 1/3 local, 1/3 state, 1/3 federal (modeled after EIP) seems unlikely at this stage
        - Identify a level of funding under which it is not worth doing anything
    - Will need proof of economic benefits of control (relevant to question #4)
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
    - Technical expertise and advice
    - Grant writing effort (hours)
    - Transfer of knowledge gained in Tahoe to other lakes/regions
    - Bring knowledge and best practices from other lakes/regions
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
    - Question not relevant to this organization
9. Unstructured Discussion
    - Agencies need to make clear the risk of AIS to the ecosystem and economy. Is the threat of invasion enough?
    - Don't sell approaches to AIS management to gain support, selling scenarios will be more effective in motivating adequate funding
    - Ensure that prevention is done (see question #2)

Ted Thayer

Mr. Thayer is the AIS Program Coordinator at TRPA. He provides strategic leadership of the AIS Program and represents one of three core agencies for the AIS Program. The interview began with a valuable overview of the AIS Program and its history.

1. What are your organization's biggest concerns for aquatic invasive in Tahoe?
    - Inspection program hurting economy due to inconveniencing boaters
    - New invasive species (e.g. quagga) could severely affect Nearshore and undo much of the work done by the EIP to date.
    - Single Sticker Issue: there is no way that boaters can have access to Tahoe with a single licensing sticker because Nevada requires their registration to be in their waters. This is leading to a leakage of funds collected in Tahoe because they are being used elsewhere in Nevada
    - The AIS Coordinating Committee is working with equipment manufacturers (WSIA) to design AIS resistant products. Public domain of the intellectual property is an issue.
    - One Regional Plan Update Alternative incorporates AIS as a part of the environment/economy
    - Updating the AIS Program goals that are listed in the 2009 Management Plan to better reflect the current intent/needs of the program. {this seems contradictory to answer to #2 below – check with Ted}
2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
    - No change to goals

- First Objectives to Fund
  - C1: Inspection & Decontamination
  - E1: Plant Control
  - C3 & E: Education (of all types)
  - Keeping funding available to leverage additional funding
- Last Objectives to Fund
  - F: Research and Information Transfer
  - E1: Aquatic Plant Control/Education
  - E2: Asian Clam Control/Education
  - G: Laws and Regulations (be opportunistic only)

3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
   - Of course this is the case and TRPA will continue to contribute its general funds
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
   - Demonstrated needs – political and environmental
     - Environmental monitoring (e.g. Marla bay) can motivate
   - Threat to Threshold Standards
   - Leverage for other funding
   - Potential Impact – (i.e Appendix E of AIS Management Plan successfully justified fee in Nevada)
   - Benchmark comparisons to other lake control costs not particularly motivating in funding decisions
   - Benchmark comparison to other agency contributions somewhat motivating but not a top driver of decisions
5. What funding sources are you aware of that could be used for the AIS Program?
   - Federal
     - SNPLMA
     - Army Corps
       - Section 208 – for planning
       - Section 108 – for implementation/operations
     - USFWS – direct appropriation
     - NIH – science and research
     - NSF – science and research
   - State
     - Nevada License Plate – can use for staff time
     - California – Proposition 50 for weed removal
     - Water Board – Clean Up and abatement for clams (not for ongoing costs)
   - Sources not yet leveraged
     - Transportation – Regional Transportation Plan (for permanent facility capital costs)
     - State (and Interstate) AIS Management Plan – haven't used in the past due to availability of SNPLMA funds, but planning to apply in 2013
     - IRWMP – lots of potential (including inter-plan funding)
       - CABY
       - MAC
       - Sierra Tahoe
     - CA Dept. Water Resources
   - Private

        - Inspection program (approx.: $30/seal, $75 inspection, $25 decon)
        - Resort Community – Room night fee
        - Counties – assessment or surcharge on vacation rentals (be sure not to miss this portion of visitors- they are more likely to have boats)
        - Tahoe Fund (and other philanthropy)
        - Lake Front Property Owners (Jan Brisco)
        - Tahoe Keys Property Owners Assn
        - Aramark (weed control at ski run marina)
6. What would be the most equitable way to share costs of AIS prevention and control?
    - Portion of risk or problem (polluter pays)
    - Historical precedent (Tahoe AIS program was 75% federally funded due o the precedent of WQ funding)
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
    - Communications knowledge – Julie Regan and staff
    - Monitoring/Detection – Patrick Stone and TRPA boat, divers
    - Technology – IT infrastructure for fee collection
    - Regulation – permit monitoring, waiver of permit fees for AIS projects
    - Coordination – facility lease, MOUs, bringing funding, managing plan
    - Contract Management – fiscal agent, control and oversight (divers)
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
    - Question not relevant to this organization
9. Unstructured Discussion
    - Articulation of living with AIS is important – it seems unlikely that there will be funding necessary to remove all clams from Lake Tahoe
    - Commercial harvest of crayfish has led to a statute change in Nevada
        - There is a good analogy to marketable timber harvest during forest fuels thinning
    - Tahoe is on the cusp of good regional coordination (with nearby lakes) – it is successful with Truckee area but tougher with Nevada
    - It will be valuable to recreationists to honor seals between Donner Lake and Lake Tahoe; this is analogous to the current situation with Fallen Leaf and Echo Lakes
    - Valuable resource contributions to the program are:
        - Cash
        - Time
        - Lobbying
        - Education

Steve Chilton

Mr. Chilton is the primary representative from the US Fish & Wildlife Service to the Tahoe Basin. His organization has provided substantial funding and represents one of three core agencies for the AIS Program. The interview began with a brief review of the AIS Program funding.

1. What are your organization's biggest concerns for aquatic invasive in Tahoe?
    - Loss of SNPLMA funding source in the next year or two
        - Likely to result in the loss of the USFWS position in Tahoe Basin
    - Achievement of the USFWS mission: Protect the fish & wildlife of the nation for the enjoyment of the people of the US

2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
    - Goals are still relevant and do not need major change
    - First Objectives to Fund
        - D3: Early Detection and Rapid Response (inexpensive and important)
        - C1: Inspection & Decontamination
        - B1: Regional Coordination (provides connections and influence over awards)
        - C3: Education (re: Prevention)
        - G: Laws and Regulations (little to no cost)
    - Last Objectives to Fund
        - A1-3: Cut entire Management Plan update
        - F1-3: Research and Information Transfer
        - E1-4: Control/Education (for clams, would need to do chemical control to succeed)
    -
3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
    - Yes. Decision drivers are
        - Quagga detection
        - Management Plan in place
        - ONRW – Outstanding National Water Resource
        - Endangered species findings
        - Congressional involvement or concern
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
        - Number of users
        - Invasion's impact on users
        - Effects on endangered species reintroduction
        - Effect of quagga in Fallen Leaf Lake
        - Difference in cost of protection vs control
        - Benchmarks to other places (definitely) and agencies (to a lesser extent)
5. What funding sources are you aware of that could be used for the AIS Program?
        - Federal
            - Federal funding seems like an extremely low probability without a revision to Lake Tahoe Restoration Act (LTRA)
            - USFWS is 1/5 of size of USFS
                - If funding is to come from USFWS it should come from interim funds rather than the general fund
                - Nationally there is $6m for AIS in the USFWS budget
            - Direct Appropriation (LTRA)
            - Land Fund
            - NOAA has a funded group, also the SEA Grant Program
        - Local
            - Transient Occupancy Tax
            - Surcharge on ski tickets
            - Golf surcharge
        - State
            - User fee
            - Bond funds (tied to larger water bond)
            - Property Tax

        - Gas Tax
        - Aquarium purchase fee
6. What would be the most equitable way to share costs of AIS prevention and control?
    - Like historical EIP precedent
        - 1/3 fedral
        - 1/3 state
        - 1/3 local & private
    - Using economic benefit only touches the private/commerce sector
    - According to risk or cause
    - According to current precedent – Boater pays 1/3
        - It is important to keep perspective – gas is $100/day, AIS is $35/year
        - Boaters will think twice if we double the price (and boat on other lakes)
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
        - Has been providing $800k/yr for 2 years (off-ramp stations and decon stations)
        - Manage contracts and funding for sources bigger than TRPA
        - Coordinate resources and MOUs
        - Outreach – to other states & tribes
            - Western states panel of AIS coordinators – award $1M nationally ($35k/state)
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
    - Question not relevant to this organization
9. Unstructured Discussion
    - Lake Mead showed first mussel infestation in 2007, this opened the door to federal funding in the west
    - Northshore people have a greater connection to the lakeshore than southshore
    - Steve Teschera would be a good interviewee based on his knowledge of funding processes and historic funders
    - One analogy for the AIS program: it is in a similar pace of development as the fuels program would be if it was starting with the Angora fire
    - Program is currently spending $4M/yr
        - $3.2 SNPLMA
        - $500k CA cleanup and abatement funds
        - $small from NV license plate program
    - The AIS program could survive a 50% cut in funding after 2014 and then the program could survive until better fiscal conditions arrive
    - It looks possible to extirpate Tahoe Keys weeds in 5 years with chemical controls
    - Prioritize stable money to prevention of new invasive and use grant funding for control efforts as opportunities become available

Betty "B" Gorman

Mrs. Gorman is the CEO of the South Lake Tahoe Chamber of Commerce and a board member of the Tahoe Prosperity Center. The Chamber represents 650 businesses and seeks to serve its members and improve the local economy. The Prosperity Center is driving three economic clusters that are expected to create sustainable economic development in the Tahoe Basin. Mrs. Gorman's perspective focused on the commerce and business aspects of the AIS Program.

1. What are your organization's biggest concerns for aquatic invasive in Tahoe?
    - Constituents are very concerned; particularly interested in the visitor/resident experience in nearshore areas

- Controlling costs of AIS to business
- Not aware of major issues with the AIS prevention program causing undue business hardship

2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
   - Goals seem like the right direction
   - First objectives to fund
     - C: Prevention
     - E: Eradication and Control
     - D: Monitoring and Rapid Response (some cost-effective version)
   - Last Objectives to fund
     - F: Research and Information Transfer
     - G: Laws and Regulations
3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
   - There could be an appetite for this – potentially as a small portion of Chamber membership fees (<10%); however this is a Board decision and would not be easy
   - Consider use of a BID (business improvement district)
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
     - Estimated costs are important
     - Benchmarks of payments from other businesses
     - Benchmarks of economic costs in other places (like Tahoe)
5. What funding sources are you aware of that could be used for the AIS Program?
     - Consider voluntary contributions (like River Keepers); it seems possible that every visitor would voluntarily give a dollar
     - Tahoe Fund
     - TOT increase <u>not</u> recommended (it is close to 1/3 the cost of many hotel rooms and there is little appetite to increase it); requires 2/3 vote of membership to pass an increase for a specific purpose
     - Don't try a Basin gateway with fee – it can't be done due to administrative issues
6. What would be the most equitable way to share costs of AIS prevention and control?
   - Portion of usage
   - Portion of cause is ok, but need to have a very good quantitative analysis
   - Spread the costs over a large number of recreationists
   - Portion of economic benefit is worth looking at, but may not be acceptable
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
   - Chamber's main contribution would be bringing partners to the negotiating table
   - Lobbying
   - Strategic communications to get the word out
   - Survey of membership opinions
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
   - Yes, but not sure what order of magnitude. Possibly tens of thousands.
9. Unstructured Discussion
   - It seems like a communication strategy is needed for the AIS Program – the most useful information seen was from homeowner's association newsletter
   - Appendix E of the AIS Management Plan seemed to use the wrong number of visitor days

- Carl Ribaudo would be a great person to interview
- Wants information that would be helpful to explain potential AIS consequences to Board of Directors

Madonna Dunbar

Mrs. Dunbar is Executive Director of the Lake Tahoe Water Suppliers Association. She leads this organization of 12 drinking water providers to manage an effective watershed control program so that Lake Tahoe remains a viable source of drinking water. Mrs. Dunbar's perspective focused on the potential for AIS to make drinking water more costly to provide.

1. What are your organization's biggest concerns for aquatic invasive in Tahoe?
   - Potential use of chemical controls for AIS – this could result in the need for new treatment processes (for chemicals rather than just disinfection) and hurt consumer confidence
   - Loss of the EPA filtration exemption from 6 water suppliers
     - This could result in $10M/supplier in capital costs
   - Cost of maintaining infrastructure if/when mussels arrive; weeds are not as substantial of a concern as other AIS that have not yet invaded
2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
   - Goals are very good
     - It would be good to add something about education
   - First objectives to fund
     - C: Prevention
     - D2: Monitoring of existing AIS (but some other monitoring is also valuable)
     - B.1: (Coordination and Collaboration) Regional, Bi-state, National and International
   - Last Objectives to fund
     - F: Research and Information Transfer
     - E: Long-Term Controls/Education (current species not of great concern)
3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
   - TWSA would contribute only if there was good scientific evidence of reduced cost and good value for their mission (see #7 below)
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
   - #1 driver is the cost of consequences of AIS
   - Clear understanding of marginal benefit for their investment
   - Benchmarks for cost of prevention and control
     - Benchmarks are usually normalized per capita, per connection or % of total water bill in this industry
5. What funding sources are you aware of that could be used for the AIS Program?
   - Individual water suppliers (ie. water rate payers)
   - TWSA Board
   - NDOW
   - Corporate
     - Recreation equipment surtax
     - Boat sales surtax
     - Boat registration in NV and CA
       - Get some set aside for Tahoe
6. What would be the most equitable way to share costs of AIS prevention and control?
   - According to portion of cause

    - It is ok to start the discussion with economic benefit
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
    - It is possible that the TWSA Board could provide $10-20k annually, but more significant sums would need to be ratified by individual water supplier leadership
    - Staff time
        - WQ sampling
        - Veliger monitoring around intakes
        - Education and outreach (ratepayer newsletter inserts)
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
    - Minimal costs so far
9. Unstructured Discussion
    - Most important to fund prevention of new AIS (mussels) and eliminate vectors within Tahoe
    - Tahoe is federally designated as Outstanding National Resource Water – Tier 3
    - Water suppliers are very concerned that Lahontan did not put a moratorium on use of herbicides and pesticides in Lake Tahoe

Bob Anderson

Mr. Anderson is an independent consultant in the energy policy sector. He is a member of the Lake Tahoe Federal Advisory Committee, board member of the Tahoe Area Sierra Club and active with several other organizations. Mr. Anderson's noted that his comments represented his own opinion and not the perspective of the organizations in which he is active.

1. What are your organization's biggest concerns for aquatic invasive in Tahoe?
    - The current prevention program will inadvertently allow a new invader
    - Nearshore ecosystem – mussels will take over and nothing else will live there
    - Secondarily, reduced recreation
2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
    - He goals are agreeable
    - First objectives to fund
        - D3: Monitoring and Rapid Response (some cost-effective version)
        - C1: (Prevention) Inspection and Decontamination
        - A: Management Plan Implementation and Updates (it is important to have a plan, but possibly not necessary to update it)
    - Last Objectives to fund
        - B1: Coordination and Collaboration
        - E (all): Long Term Control/Education
        - F2,3: Research and Information Transfer
        - G3: Laws and Regulations – Provide for All Appropriate Treatment and Control Methods
3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
    - Not likely to contribute (Sierra Club)
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
        - Not going to contribute

5. What funding sources are you aware of that could be used for the AIS Program?
    - Inspection fees are preferred
        - It is best for "polluters" to pay the full cost of their choices. A 2-3 times higher cost for inspections is justifiable if that is the cost of the program.
6. What would be the most equitable way to share costs of AIS prevention and control?
    - Polluter pays!
    - Second choice by far: distribute according to benefit
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
        - Question not relevant
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
    - Question not relevant
9. Unstructured Discussion
    - The AIS issue is really important
    - Prevention requires perfection – review the literature that exists on High Reliability Organizations (e.g. nuclear power plants) and apply these lessons learned to the AIS Program.
    - The Sierra Club's mission is to explore and protect – this is reflected in some of Mr. Andersons answers to the questions.

Keith Fields & Darren Kramer

Mr. Fields & Mr Kramer own and manage Obexer's Marina, a resort on the west shore of Lake Tahoe that has a 100-year history. Obexer's is one of the most progressive marinas in adoption of AIS prevention and has a strong working relationship with the AIS Program. The views expressed represented the perspectives of a business that directly feels the effects of AIS regulations and control costs.

1. What are your organization's biggest concerns for aquatic invasive in Tahoe?
    - #1 Reduced recreation
    - #2 future maintenance of Obexer's infrastructure
    - Other related concerns
        - Costs of preventing invasion
        - Inspection effort becoming an uncompensated marina responsibility
        - Driving away business due to high fees
        - Counties don't provide necessary support
            - Often no police response to belligerent boaters who don't want to comply with ramp staff instructions
2. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
    - Prevention is the most important goal but all are supportable
    - First objectives to fund
        - C: Prevention
    - Last Objectives to fund
        - F & D: Research and Information Transfer; Monitoring, Detection & Response
        - G: Laws and Regulations
3. If your organization was able to reduce its AIS costs by contributing to a pool of funding, would your organization contribute?
    - No! [strong emphasis]
    - Losing direct control of funds would dilute effectiveness and focus on this marina

        - It would be well worth paying 20% more to do it on own
        - Even with assurance of effective maintenance of marina infrastructure
    - Very high concern for bureaucracy and waste
4. What information would your organization use to make decisions about how much to spend on AIS prevention and control?
    - Would like to understand costs of control just for reference but each marina will have different costs
5. What funding sources are you aware of that could be used for the AIS Program?
    - Recapture existing State Lands Tax on piers, buoys, mooring and fuel
        - The tax is currently 5%, and it is totally unclear where this money is spent
        - Recommend working on changing this policy to keep funds local for AIS Program
    - Tahoe Basin entry fee
6. What would be the most equitable way to share costs of AIS prevention and control?
    - According to cause of the problem – seems like Obexer's is 1% of the problem
7. What personnel, technical or financial resources has your organization already offered or would potentially consider offering in the future?
        - None offered due to need to focus on the business during the three months/year that provide a living for marina owners and staff
8. If any, what kind of costs has your organization incurred due to AIS? This could include lost revenue.
    - Reduced revenue: cost and hassle have reduced number of boat launches
        - Even in the down economy, Obexer's would expect that launches would be increasing because drive-up customers increase when more expensive travel options become less attractive due to cost.
    - Increased staff at ramp: about $50k/year for extra work due to seals and related effort
    - Infrastructure cost: $80k capital for gate and camera
    - Not substantial operating costs for maintenance of weeds (or other AIS) yet
9. Unstructured Discussion
    - Presence of mussels would create a revenue stream for the marina – cleaning customer boats
    - Boaters are becoming more knowledgeable about requirements- this reduces the amount of processing time; more boats are arriving clean, drained, dry
    - Front-line inspection is the core of the prevention effort and could now be self-managed
    - Compensation for boat sealing efforts is very appreciated
    - Seek funding assistance from water purveyors
    - It would be cool to have biologists at ramps to identify organisms more confidently
    - What are the regulations for sea planes? The marina has received calls from conscientious pilots but staff don't know what to tell them.
    - Consultants and others involved in AIS program should spend a day at an inspection facility so they understand the front-line needs and concerns of the program.
    - Mr. Kramer has contacts at marinas on the east coast that have been experiencing mussel invasion and costs. These might be useful contacts for the AIS Program or other marinas.

MEMO ANNEX A.

STAKEHOLDER INTERVIEW PLAN

AQUATIC INVASIVE SPECIES FUNDING PLAN

Stakeholder interviews are part of the AIS 5-Year Finance Plan development. Interviews are intended to collect targeted feedback on the goals, strategies and funding of the AIS Program. This document outlines a consistent and comprehensive process by which all stakeholder interviews will be conducted. In order to fairly compare feedback and evaluate perspectives, it is important that all interviewees are provided the same information and that complete information is collected from each stakeholder.

INTERVIEWEES

1. USFWS – Steve Chilton
2. TRCD – Kim Boyd
3. TRPA – Ted Thayer
4. Marina Owner – Primary: Bob Hasset or backup Sara/Keith Fields
5. Non-aquatic tourism business – Primary: Chamber of Commerce, B Gorman, or backup Visitor's authority (Carol Chaplin)
6. Environmental NGO – Bob Anderson
7. Science Rep – primary: Sudeep Chandra or John Reuter
8. Water purveyor – Primary: Water Supplier's Association (Madonna Dunbar) or KGID (Cameron McKay)

INTERVIEW SCHEDULING INSTRUCTIONS

1) Explain opportunity for input and use of information
    - Best available research estimates that worldwide invasive species cost $1.4 trillion annually, while in Tahoe estimates are $22.4 million annually.
    - Tahoe's AIS Program is developing a finance strategy that will enable sustained protection of Lake Tahoe from invasives that hurt our economy and our ecosystem.
        i. This effort will provide public and private decisionmakers the tools they need to decide how to invest in AIS prevention and control.
    - You are one of eight people who are asked to provide direct input to the finance strategy.
    - Your input will be used to create a project guidance memo which: (1) clarifies stakeholder needs, (2) adjusts strategies for combating invasive species, and (3) gauges initial reactions to approaches for sharing the cost of protection.
2) Provide target interview time: 30-60 minutes
3) Provide a quick summary of the interview questions
    a) Your concerns regarding aquatic invasive species in Tahoe
    b) Your preferences and concerns with the AIS Management Plan
    c) Your thoughts on funding AIS prevention and eradication
    d) Equitable ways to distribute costs of AIS prevention and eradication
4) Note contextual/preparation information available. Also note that this interview can be done without preparation if that is all the stakeholder's time will permit.
    - 1-page memo

- AIS Management Plan

5) Suggest time for meeting based on Chad's calendar (to be provided). The highest priority for scheduling is completing all interviews soon. The second priority is attempting to group them on the same few days.
6) Send Chad an event invitation using Outlook (cpraul@enviroincentives.com) as each interview is scheduled with the interviewee.

PROJECT & INTERVIEW INTRODUCTION

Goal: Develop a 5-year finance strategy for Lake Tahoe AIS program that allocates costs among beneficiaries based on an open and collaborative approach.

Purpose: The AIS Finance Plan will create tools to (1) motivate private and public decisionmakers to allocate funds and (2) demonstrate value of the AIS program to economic beneficiaries.

Approach: The project team's approach leverages stakeholder insight, expert public-funding strategists, and economic analysis of costs to produce: (1) a durable forecasting tool for use by managers and (2) a funding strategy document based on current assumptions.

INTERVIEW QUESTIONS

1. What are your organization's biggest concerns for aquatic invasives in Tahoe? (Structured Prompts if needed:)
    a. Reduced recreation/lost revenue
    b. future maintenance/control costs
    c. property value decline
    d. Specific species damage from_____
    e. Overall ecosystem loss
2. Have you reviewed any of the Lake Tahoe AIS Management Plan?
    a. Do you have any preferences, concerns or comments on the goals and objectives of the AIS Management Plan?
    b. Which of the 23 management strategies are (Provide a list of the strategies)?
        i. Most important/valuable to you?
        ii. Least important/valuable to you?

    (Ted suggests avoiding too much time with this question)
3. If you were able to reduce your organization's AIS costs through spreading the costs over a group of beneficiaries, would your organization contribute funding to the group? What would be the main decision drivers of this decision?
4. What information would your organization need to decide how much to contribute to AIS prevention and control?
    a. Projected costs of AIS consequences
    b. Estimated costs of AIS prevention and control
    c. Benchmarks from similar organizations
    d. Analysis of cost to contribute vs. cost to go it alone
5. What other funding sources are you aware of?
    a. What is the level of flexibility or limitation of the funding sources?
    b. Which do you prefer?
6. What would be the most equitable way to share costs of AIS prevention and control?
    a. According to economic benefit
    b. According to legal responsibility

   c. According to portion of the cause
   d. According to historical precedent
   e. Other _____

7. Are there any personnel or technical resources your organization has already offered or can offer in the future? (Examples could include in-kind time, staff expertise, technical tools, equipment, etc)

Potential question for appropriate interviewees

8. Do you feel like your organization currently incurs costs or loses revenue due to AIS?
   a. What kind of costs or losses and what magnitude?
      i. Thousands of dollars per year
      ii. Tens of thousands of dollars per year
      iii. Hundreds of thousands of dollars per year
      iv. Millions of dollars per year
      v. Other_____
   b. What about if the invasive problem intensified? What would the magnitudes be then?

Appendix G4: Economic Consequences Update

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Economic Consequences of Aquatic Invasive Species in Lake Tahoe: Summary

November 2012

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I. Introduction and Background

Lake Tahoe is currently experiencing detrimental effects of Aquatic Invasive Species (AIS) and is at risk of invasion by others. AIS are already having negative effects on recreational, industrial, and institutional activities in the Lake Tahoe basin. The types of effects and magnitude of effects of AIS in Lake Tahoe have the potential for substantial expansion.

In this analysis, we look at two potential futures: one assuming a no control or prevention approach to AIS - the No Inspection or Control (NIC) scenario - and one that focuses on prevention of new AIS without limiting the extent of existing invasive species - the Prevention and Limited Control (PLC) scenario. Below we describe these two scenarios and present our findings related to the 50-year economic costs for each scenario. Our analysis evaluates the economic costs at Lake Tahoe stemming from (1) changes in expenditures and revenues for recreation, tourism, water supplies, property taxes, and other costs and (2) from changes in the net economic benefits[1] of recreation activities.

Resource constraints make it necessary for this analysis to use existing studies and simplifying assumptions rather than collecting primary data. Studies used are cited and major assumptions are noted in this summary. More detailed description of these assumptions can be found in Appendix A.

Baseline Conditions

As a baseline for comparison, we assume that current prevention and control actions successfully constrain the natural expansion of existing AIS and there are no introductions of new AIS into Lake Tahoe.

No Inspection or Control Scenario (NIC Scenario)

The NIC scenario assumes that current measures of controlling and monitoring invasive species in Lake Tahoe will be discontinued in the future and that existing AIS will be able to colonize other parts of the lake. Such a scenario could occur, for example, if no funding sources can finance the existing control programs (Ted Thayer, personal communication) and if current prevention strategies are dropped. Relative to the baseline, the NIC scenario describes conditions under which AIS populations grow unrestrained, affecting the natural ecosystem of the lake and the resident native species.

In general, aquatic plants disrupt navigation of boats and other recreational water activities, impede water flow, increase phytoplankton, and negatively affect water quality and aesthetics (USACE 2009). Aquatic invasive species, such as lake trout, largemouth bass, and the Asian clams contribute to declines in the populations of native species. Asian clams have also been found to increase the water nutrient load, which leads to increased production of algae and decreased water clarity, a renowned feature of Lake Tahoe. The quagga and zebra mussels promote the development of blue-green algae blooms, colonize structures, such as piers, docks, pilings, anchors, restrict water movement by colonizing pipes and other water conveyance infrastructure, and increase water clarity (USACE 2009).

Prevention and Limited Control Scenario (PLC Scenario)

The current level of effort for preventing and controlling AIS in Lake Tahoe is proving to be successful in some areas of control and eradication (Tahoe Resource Conservation District, No Date). These management programs have also been effective at preventing the introduction of new AIS, such as the zebra and quagga mussels. The measures are only sustainable, however, if funding continues at current levels. A decrease in funding would reduce the availability of inspection services for motorized watercraft prior to launching. Since non-local watercraft would need an inspection prior to launch (Ted Thayer, personal communication). Reduced inspection due to funding would prevent these boats from launching, and therefore there could be a de facto prohibition on non-local boats. A reduction in funding would also limit the control efforts that occur lake-wide, though navigation-related maintenance of private marinas would continue. As a result, the PLC scenario assumes that prevention actions continue into the future, though they would take the form of a prohibition on non-local boats, and limited control of existing AIS.

The Management Plan has classified a smaller group of AIS as not having known effective methods of operational control. The AIS identified in this group are rock snot, signal crayfish, and gill maggot. Under the PLC scenario, we assume that the effects of these species cannot be avoided and will continue during the period of time covered under this scenario.

II. Changes in Expenditures and Revenues Around Lake Tahoe

AIS biophysical consequences described in the two scenarios have economic implications to the extent that they affect economic activities on or around Lake Tahoe directly or indirectly. In this section we describe possible changes in expenditures from visitors to the lake, as reflected in decreases of recreation and tourism spending, as well as possible increased costs of municipal water supplies, decreased property values and taxes, and increased costs of maintaining boat equipment and pier structures. Below we describe the economic consequences for both scenarios.

Recreation Expenditures

Recreation at Lake Tahoe is expected to be the main category of economic activity that would be impacted under the two AIS scenarios (USACE 2009). Lake Tahoe is one of the most important attractions for outdoor recreationists on the west coast and supports activities, such as motorized and non-motorized boating, swimming, fishing, beach activities, and others. An increase in the presence of AIS in the lake would deter some of the visitors from recreating at the lake, reducing the revenues from recreation expenditures for businesses that provide goods and services related to lake recreation. (See Section III for a more detailed description of AIS impacts on recreation activities.) We anticipate that the scenario effects will not fully materialize for another 10 years but that the rate of expenditure decline during this decade is linear and that these effects remain constant for the following 40 years. Since we could not identify any sources of expenditure data at the lake, we use the estimates for general recreation on federal land in the Sierras from a recent economic study of outdoor recreation in California (BBC Research &

[1] Economists call the net economic benefit consumer surplus, which represents the total economic value of a good or a service minus its cost.

Consulting 2011). To estimate the impact of AIS on recreation spending, we multiplied the number of recreation days lost under each scenario for motorized and non-motorized boating, swimming, fishing, and beach activities by the amount that recreationists spend on average daily when they recreate in the Sierras ($63.64 per person per day, 2011 dollars). Under the NIC scenario, we estimate that recreation activities will decrease by 196 million days over the 50 years (3.9 million days annually), which would translate into a decrease of $4.6 billion in recreation spending ($91.9 million annually). Under the PLC scenario, recreation days would decrease by 78.9 million days over the next 50 years (1.6 million days annually). This decrease would be expected to reduce recreation spending by a total of $1.9 billion and $37.7 million annually.

Tourism

Directly related to recreation activities is the tourism industry in the Lake Tahoe basin. Previous studies have found that much of the visitation occurring in the Lake Tahoe area is motivated by access to the natural amenities, even when the trip to the lake's resorts are directed towards participation in other touristic activities, such as shopping or gaming (USACE 2009). Thus it is reasonable to conclude that in the absence of Lake Tahoe and its ecosystem goods and services, lower rates of tourism would occur.

Under a NIC scenario, AIS may significantly affect the aesthetics of the lake and its ability to attract visitors to the nearby resorts. A PLC scenario would have a similar type of effect on tourism, though it would be reduced relative to the NIC scenario. Between the months of May and October 2008, the Management Plan estimated that the lake's tourists spent approximately $306 million. Depending on the scenario, AIS effects may reduce the visitor spending by 2 percent to 10 percent (USACE 2009), which translate into spending decreases between $6.4 million and $32.1 million annually, in 2011 dollars. This value is most likely an underestimate as other evidence suggests that expenditure levels for the same 2008 season may be higher than those assumed in the Management Plan. For instance, a study by Dean Runyan Associates (2009) found that during the calendar year 2008 visitors to North Lake Tahoe spent approximately $361.4 million. While the study does not report monthly expenditures and thus it would be difficult to compare the estimates from the two studies, it is likely that the actual summer spending in 2008 was higher than those reported in the Management Plan, as the North Lake Tahoe area runs along about 25 percent of the lake perimeter and attracts an important share of the lake's visitors. Assuming the effects and tourism spending from the Management Plan, we estimate that the impact of AIS in 2011 dollars on the local tourism industry would range between $204.7 million, for the PLC scenario, and $1 billion, for the NIC scenario, over the next 50 years. The estimates are based on the assumption that visitor spending will grow at the same rate as the national GDP. The annual average impact would have values between $4.1 million and $20.5 million for each scenario.

We do not have sufficient information to assess to what extent there may be an overlap between the recreation spending and tourism estimates. If such overlap exists, our estimates will double-count some of the expenditures lost at Lake Tahoe due to AIS.

Water Supplies

Lake Tahoe provides water for 92 public water systems, including 42 small systems, and for individual consumers through various intakes to the lake and groundwater wells (Tahoe Water Suppliers Association, No Date). The lake supplies water for both irrigation and municipal water users.

Under a NIC scenario, AIS, quagga and zebra mussels in particular, pose the danger of colonizing the intake pipelines clogging the infrastructure and reducing the water supplies that can be delivered to end users. Furthermore, a reduction in water quality due to AIS can result in a loss of water-treatment exemption that some utilities have been granted by the Environmental Protection Agency. In 2008, the median annual costs of cleaning and maintaining the pipeline system of a municipal water supplier was approximately $1.7 million, while the median cost of installing a redundant intake system was about $4.4 million (USACE 2009). The minimum costs municipal water plants could incur would be between $4,900 and $61,300 (2007 dollars) (Rothlisberger et al. 2012). Consumers would bear the costs of building additional water treatment facilities, if necessary. In 2008, control systems that improve taste and odor were estimated at a median value of $29 million, while a chlorine injection system was estimated at $360,000. Additional costs of chlorine supplies can run as high as $250,000 annually (USACE 2009). Overall, based on calculations from the Management Plan, we estimate that under the NIC scenario providers of water supplies would incur on average about $0.9 million annually and about $47 million over the 50-year analysis period.[2]

Under the PLC scenario, the prevention measures would be sufficient to prevent the introduction of AIS into the lake. As a result, water suppliers would avoid all the costs they would have incurred under the NIC scenario.

Property Values and Taxes

Under the NIC scenario, AIS would affect the amenities the lake can provide homeowners by degrading the lake aesthetics and by impairing access to the lake for recreational activities. Economic studies have found that reductions in lake clarity due to infestations of Eurasian watermilfoil can lower lakeside property values in Wisconsin by 13 percent (Horsch and Lewis 2009), those in Vermont by 1 percent to 16 percent (Zhang and Boyle 2010), and those in New Hampshire by 20—40 percent (Halstead et al. 2003).

Other amenities that homeowners and their families enjoy and that AIS could jeopardize are boat access to the lake, swimming, and enjoyment of native fish species, under the NIC scenario (USACE 2009).

Taking into account decreases in property values due to the economic recession, we estimate that property values would decrease by $639.2 million, for a 20 percent decrease under the NIC scenario, and by $32 million, for a one percent decrease under the PLC scenario. The actual value of the impacts will depend on changes in Lake Tahoe's

[2] To convert these costs to 2011 dollars we used the Engineering News-Record (ENR) Construction Cost Index.

aesthetics due to AIS infestations and on future trends in the real estate market.

For the same two scenarios, we estimate that county property taxes could decline by $283.2 million under the NIC scenario and by $14.2 million under the PLC scenario.

Other Costs

In addition to costs imposed on water supply providers in the Lake Tahoe basin, AIS colonies damage the existing piers and landing structures, increasing maintenance costs and reducing the life of the docking systems at the lake. The Management Plan estimates that the value of increased depreciation can rise to $4.5 million in 2011 dollars (USCAE 2009).

Additional costs materialize when boat owners have to increase the maintenance of their equipment and gear due to the spread of Eurasian watermilfoil and curlyleaf pondweed. Such costs have an annual value of approximately $1.6 million in 2011 dollars (USACE 2009). Assuming that these costs continue at a constant rate over the next 50 years, these maintenance costs would sum up to $33.5 million.

Under a NIC scenario, we assume that no control and prevention AIS would continue into the future and thus these costs would be zero. Under the PLC scenario, only prevention costs through inspection of local boats would be incurred. These costs are expected to be negligible, however, and for the purposes of this study we assume they are zero.

Summary

Costs related to AIS management programs for the two scenarios are summarized in Table 1. The estimate for tourism assumes that the loss of lake-related activities would result in direct impacts to tourism expenditures. It does not account for those individuals who may choose to get involved in terrestrial activities such as hiking near Lake Tahoe, to compensate for the loss of access to the lake.

Consequently, we regard these values as the maximum economic costs under the assumptions of the two scenarios.

Table 1. Average annual economic costs of AIS under the two scenarios, 2013-2062 (millions of dollars)

Areas of Impact	NIC Scenario	PLC Scenario
Recreation	91.9	37.7
Tourism	20.5	4.1
Water Supplies	0.9	0
Property Taxes	5.7	0.3
Other Costs	0.8	0.8
Total	***119.8***	***42.9***

III. Changes in Net Economic Benefits for Recreation Activities

AIS can also impose economic costs if they affect the values people place on the lake's ecosystem. In this section we describe the impacts of each scenario on recreation activities in terms of changes in recreationists' net economic benefit (consumer surplus), which is equal to the difference between the amount of money visitors are willing to pay for a recreation day at the lake and the actual amount they pay for that particular day. Economists consider this measure an indicator of the well-being people derive from the consumption or use of resources. Similarly with the calculation of recreation expenditure impacts, we assume that the scenario effects on the same five recreational activities will not fully materialize for another 10 years but that the rate of net benefit decline during this decade is linear and that these effects remain constant for the following 40 years. For the purposes of this analysis, we use the net benefit values of recreationists on the Pacific coast, adjusted to 2011 dollars, as identified in Loomis (2005), a study that analyzed the economic values of several outdoor activities in different regions of the U.S. Since Lake Tahoe provides recreational opportunities in a unique, world-class setting, it is likely that the net benefit recreationists experience at the lake is higher than that of recreationists at other sites on the Pacific coast. Accordingly our values probably underestimate rather than overestimate the net benefit of recreational activities at Lake Tahoe. For each type of recreational activity and for each scenario, we estimate the net benefit decrease due to a reduction in the number of days people recreate at the lake and due to a reduction in the net benefit those who still choose to recreate in or by Lake Tahoe experience.

Our analysis is based on the findings of the Lake Tahoe Management Plan by USACE (2009), which estimated a range in the recreation reduction due to AIS. Unless otherwise specified, we assume that the lower bound of this range applies to our findings for the effects of the PLC scenario, while the upper bound applies to the effects of the NIC scenario.

Figure 1 shows the distribution of AIS impacts on the net benefits of the lake's recreationists. Overall, the NIC scenario would decrease net benefits by $3.9 billion over the 50-year analysis period ($78.3 million annually). The PLC scenario would decrease the recreation-related net benefits by $1.7 billion, with an annual average of $33.1 billion.

Figure 1. Distribution of net benefit losses for five recreational activities

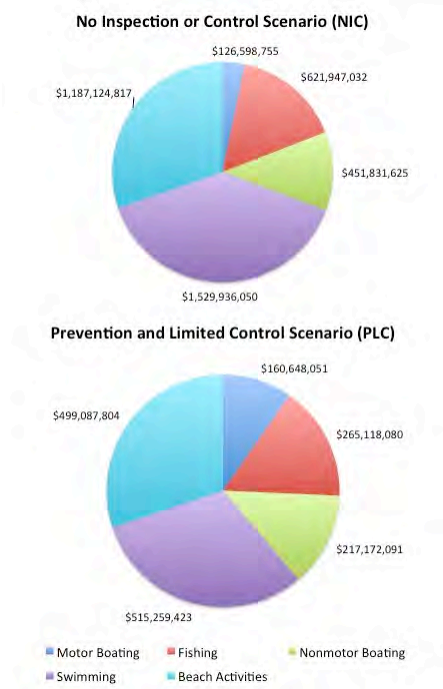

Table 2 presents the same information on net benefit losses as Figure 1 but as annual means, in a tabulated form. A comparison of the losses under the two scenarios shows that all recreationists, with the exception of those using motorized boats, would be better off with a PLC scenario than with an NIC scenario. This result is to be expected since the PLC scenario assumes a de

facto ban on nonlocal motorized boats. The estimates do not take into account that users may substitute one lake-related recreational activity, such as swimming, for another, such as boating. As a result, these estimates represent upper ranges of net economic losses.

Table 2. Average annual losses of net benefit related to recreation activities at Lake Tahoe under the two AIS scenarios, 2013-2062 (millions of dollars)

Activity	NIC Scenario	PLC Scenario
Motor Boating	2.5	3.2
Fishing	12.4	5.3
Nonmotor Boating	9.0	4.3
Swimming	30.6	10.3
Beach Activities	23.7	10.0

Motorized Boating

Motorized boating is likely to decline under a NIC scenario as the density of the plant AIS increases in shallow water. The thick plant growth makes it difficult to steer boats out of the dockings and constrains the navigable area of the lake to deeper water. This results, however, in more crowding for boaters and thus a decrease in the quality of this recreation activity. Furthermore, the plant AIS decrease the lake clarity near-shore (USACE 2009). The decline in the quality of the experience would deter approximately 30 percent of boaters from recreating at Lake Tahoe while those who would still choose to participate in boating activities at the lake would feel that the enjoyment they derive from boating on the lake would be diminished. We anticipate that these impacts on motorized boating would average $2.5 million annually and over the next 50 years they would sum up to $126.6 million.

Under the PLC scenario, the lack of inspection services would severely reduce the opportunities for boats that use other waters to launch on the lake. Assuming that the proportion of local to non-local boats seen in 2011 remains constant in the future, 52 percent of the boats would not have regular access to Lake Tahoe as they are also used in waters outside of the basin and would need an inspection prior to launch (Ted Thayer, personal communication). Reduced inspection due to funding would prevent these boats from launching. Additionally, we assume that the presence of AIS would deter 10 percent of the local boaters from recreating at the lake and that the remaining boaters who continue to boat would experience a 10 percent decrease in the consumer surplus. Under these scenario conditions, we find that consumer surplus would decline by $160.6 million dollars over the next 50 years, at an average rate of $3.2 million annually.

Fishing

AIS are expected to affect fishing at Lake Tahoe in two ways. First, AIS reduce the amount of phytoplankton in the lake, which is part of the food chain for the native and sport fish species, thus decreasing fish survival rates. Second, plant AIS populate shallow areas and interfere with recreationists' fishing experience by covering these parts of the lake with vegetation that obscures fish and obstructs movement of the boats (USACE 2009). Under the NIC scenario, we assume that recreational fishing will decrease by 35 percent annually and estimate the total consumer surplus would decrease by $621.9 million through 2062. On average, the annual impacts on recreational fishing would be about $12.4 million.

For the PLC scenario, we assume that current fishing levels would decline due to AIS effects on the lake's ecosystem and due to the ban on non-local boats. USCAE (2009) estimates that AIS would affect fishing recreation days by at least 10 percent and a survey of boaters on Lake Tahoe found that 24 percent of nonlocal boaters fish (Responsive Management 2006). Accounting for these assumptions, we estimate that the decline in consumer surplus related to fishing is about $265.1 million dollars over the next 50 years, with a yearly average of $5.3 million.

Non-motorized Boating

Plant AIS have a similar but probably more distinct impact on non-motorized boating relative to motorized boating because plant infestations in the near-shore areas would impair the navigation of the small boats and decrease the clarity of the water in the shallows (USACE 2009). Both these effects reduce the quality of recreational experiences for those using non-motorized boats. Reductions in recreation days for non-motorized boating are expected to be about 40 percent. Under the conditions of the NIC scenario, we estimate that recreational values at Lake Tahoe would decline by $451.8 million. Over the next 50 years, the value of these effects would be about $9 million annually.

When AIS prevention but no control is conducted, non-motorized boating is expected to decline by 20 percent due to AIS adverse effects on boating conditions. Additionally, some people who recreate using motorized boats also use non-motorized watercraft. About 4 percent of the nonlocal boaters who participated in a survey said they were also engaged in kayaking or sailing (Responsive Management 2006). As a result of the interdiction for nonlocal boats to access the lake, non-motorized boating is expected to decrease slightly further. Under the conditions of the PLC scenario described here, we anticipate that the economic value associated with this activity over the next 50 years would decline by $217.2 million, at a $4.3 million rate annually.

Swimming

Further infestation of Lake Tahoe with plant AIS, in particular, is expected to deter swimmers from recreating in the lake. The thick plant mass that builds over time hinders swimming, endangering recreationists who risk entanglement and drowning in the aquatic weeds. Along with decreased clarity and repellent odors from decaying plants in the near-shore water, these risks are expected to contribute to the decline in swimming activities (USACE 2009). Under conditions of unchecked growth, such as those of the NIC scenario, swimming activities would decline by about 80 percent, with a total economic loss of about $1.5 billion over the next 50 years and an average of approximately $30.6 million annually.

Under the PLC scenario, swimming activities would be affected less but would still experience a decrease of about 20 percent due to AIS effects on the lake. Assuming also that 13 percent of the non-local boaters who won't be

allowed to recreate on the lake were also involved in swimming activities (Responsive Management 2006), the total economic loss for this scenario would be about $515.3 million and average $10.3 million annually.

Beach Activities

The majority of recreationists (76 percent) visiting Lake Tahoe are involved in beach activities that include walking, hiking, picnicking, playing games. AIS infestations produce build-ups of decaying matter on the beach and in shallow waters that release foul odors and are conducive to insect population growth. A decline in lake clarity would add to the decrease in the satisfaction visitors gain from spending time on the beach, as would an increase in the shell material on the beach that could pose hazards to beach walkers and their pets (USACE 2009). For a NIC scenario, should declines in beach activities materialize at a 20 percent rate (USACE 2009), the economic losses over the next 50 years would be about $1.2 billion, with a yearly average of $23.7 million.

Under the PLC scenario, beach participation level is expected to decline by 10 percent due to the effects of AIS on the water quality near-shore and the beach quality around the lake. The overall impacts of AIS on beach activities would be about $499.1 million over the next 50 years and average $10.0 million annually.

Summary

Our analysis shows that all five recreation activities will experience losses of net benefits under both AIS scenarios. The PLC scenario, however, is associated with lower losses in comparison to the NIC scenario, with the exception of motor boating activities.

IV. Distribution of AIS Effects

Continuous growth of existing AIS and the establishment of new species are expected to trigger changes in the behavior of visitors and residents of the Lake Tahoe basin. These changes have both direct and indirect impacts on the local economy. Data show that the economic sectors that support recreational activities and tourism in the basin are important components of the economy in the four counties that provide access to the lake's amenities (i.e., El Dorado and Placer counties in California and Douglas, and Washoe counties in Nevada).[3] In 2010, economic areas that are directly related to recreation and tourism represented 16 percent of the total earnings and 25 percent of the employment in the four counties.

Figure 2 and Table 3 show the distribution of income across all economic sectors in the four counties, organized into four major groups. Data show that the contribution of the businesses providing services related to recreation and tourism to the local economy is significant and can range from 15-16 percent in El Dorado, Placer, and Washoe counties to 31 percent in Douglas County (Figure 1). Table 2 shows the relative importance of income and jobs in the tourism and recreation-related services compared to the entire economy of the basin. Data indicate that in 2010 the income from these services amounted to $4 billion out of a total of $25 billion for the entire basin. During the same year, employment from the businesses providing the recreation and tourism services represented almost 137,000 jobs compared to approximately 544,000 jobs for the economy of the four counties.

When the growth of different AIS starts to affect the ecosystem and water quality of Lake Tahoe, people may be induced to reduce the amount of time and money they spend on recreating at the lake or to change the types of activities in which they participate. These decisions impact businesses providing recreation and tourism services directly and other economic sectors indirectly. Impacts can range from losses of income and jobs in the affected industries, to loss of tax revenues that patrons of the impacted businesses would have contributed to local governments, or to capital depreciation and reevaluation of decisions to invest in new capital and infrastructure supporting the lake's natural resources.

A better understanding of the AIS effects on the lake and recreationists' behavior is needed to estimate the initial impacts on all economic sectors of the basin and to then evaluate the economy's ability to adjust and absorb some of the losses. The economy of the Lake Tahoe basin is the result of a series of dynamic interactions between multiple participants and losses in one area of the economy can be recuperated, partially or entirely, through the diversion of resources to other areas. Only after accounting for these network effects can differences in magnitude of the AIS effects be predicted accurately under a NIC scenario or under a PLC scenario.

[3] The Carson City Rural Area also borders Lake Tahoe but due to the low-population, rural nature of the area and due to the lack of easy access to the lake, we exclude the municipality from our analysis.

Figure 2. Income distribution across groups of economic sectors in the four counties that make up the Lake Tahoe basin, 2010

Source: ECONorthwest, with data from BEA (2012).

Table 3. Income and employment from recreation and tourism services in four counties that make up the Lake Tahoe basin, 2010

Economic Sector Groups	Income (thousands of dollars)					Employment				
	El Dorado	Placer	Douglas	Washoe	Total	El Dorado	Placer	Douglas	Washoe	Total
Professional, management, and other services (including government)	2,392,510	5,666,417	481,218	7,734,584	16,274,729	51,421	99,276	11,526	143,209	305,432
Tourism and recreation related services	450,560	1,397,740	300,728	1,870,487	4,019,515	18,826	44,706	9,352	63,884	136,768
Construction and real estate	421,858	1,197,756	86,663	1,002,009	2,708,286	15,250	26,164	4,471	28,425	74,310
Manufacturing and other production of goods	137,374	849,879	87,247	846,078	1,920,578	2,483	8,942	1,916	13,866	27,207
Total	***3,402,302***	***9,111,792***	***955,856***	***11,453,158***	***24,923,108***	***87,980***	***179,088***	***27,265***	***249,384***	***543,717***

Source: ECONorthwest, with data from BEA (2012).

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LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix H: Comments

DRAFT - Not for Distribution

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Appendix H
Comments

1 Summary of Comments from the ANSTF

Insert upon completion

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LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix I: Contributors and Resources

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Appendix I
Contributors and Resources

1 Authors and Reviewers

The 2014 Plan revision was prepared by the Lake Tahoe AIS Coordination Committee (LTAISCC) revision subcommittee in conjunction with Tetra Tech, Inc. staff.

2 Stakeholders and Contributors

Valuable input on current AIS prevention, control and research activities was also provided by the LTAISCC (Table 1). The roles of each group are summarized in Appendix A. General internet resources are summarized in Table 2.

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Table 1. Lake Tahoe Aquatic Invasive Species Coordination Committee

Organization	Name	Position	Email
California Department of Fish and Wildlife (formerly California Department of Fish & Game)	Kevin Thomas (for Stafford Lehr)	District Fisheries Biologist (Senior Environmental Scientist)	kthomas@dfg.ca.gov (slehr@dfg.ca.gov)
California Department of Parks and Recreation, Sierra District[1]	Tamara Sasaki	Senior Environmental Scientist	Tamara.sasaki@parks.ca.gov
California State Lands Commission	Jason Ramos	Senior Environmental Scientist	Jason.ramos@slc.ca.gov
California Tahoe Conservancy	Tricia York	Science and Policy Liaison	Tricia.york@tahoe.ca.gov
Lahontan Regional Water Quality Control Board	Daniel Sussman (for Doug Smith)	Environmental Scientists (Supervising Engineering Geologist, Division Manager, Planning and Restoration Division)	dsussman@waterboards.ca.gov (dfsmith@waterboards.ca.gov)
Nevada Department of Wildlife	Karen Vagas	Aquatic Invasive Species Coordinator	kvargas@ndow.org
Nevada Division of State Lands	Elyse Randles	State Land Agent III	erandles@lands.nv.gov
Tahoe Resource Conservation District	Nicole Cartwright	Aquatic Invasive Species Program Coordinator	ncartwright@tahoercd.org
Tahoe Regional Planning Agency	Dennis Zabaglo	Aquatic Invasive Species Program Coordinator	dzabaglo@trpa.org
Tahoe Science Consortium	Maureen McCarthy	Executive Director	mimccarthy@unr.edu
U.S. Department of Agriculture – Agricultural Research Service			
U.S. Fish & Wildlife Service	Steve Chilton	Lake Tahoe Aquatic Nuisance Species Coordinator/Chair, LTAISCC	Steve_Chilton@fws.gov
U.S. Forest Service – Lake Tahoe Basin Management Unit	Holly Eddinger	Supervisory Forest Biologist, Life Sciences Group Program Leader, Ecosystem Conservation Department	heddinger@fs.fed.us

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Table 2. Internet Aquatic Invasive Species Resources

Organization	Website	Notes
100th Meridian Initiative	http://www.100thmeridian.org/	
Aquatic Invasions Research Directory	http://invasions.si.edu/aird/	
Aquatic Nuisance Species Task Force	http://anstaskforce.gov	
California Department of Fish & Wildlife (formerly California Department of Fish & Game)	http://nrm.dfg.ca.gov/documents/ContextDocs.aspx?cat=AquaticInvasiveSpecies	Clearinghouse for AIS updates (e.g., press releases, education/outreach materials, research notes)
	http://www.dfg.ca.gov/invasives/quaggamussel/	California Invasive Species Program
International Conference on Aquatic Invasive Species	http://www.icais.org/	
Invasive Species Specialist Group (ISSG)	http://www.issg.org/	IUCN Species Survival Commission
Lake Tahoe Watershed Assessment Vols. 1 & 2	http://www.fs.fed.us/psw/publications/documents/gtr-175/	Dennis D. Murphy and Christopher Knopp, Editors
National Center for Research on Aquatic Invasive Species	http://www.glerl.noaa.gov/res/Programs/ncrais/	
National Invasive Species Council	http://www.invasivespeciesinfo.gov/council/main.shtml	National Framework for Early Detection, Rapid Assessment, and Rapid Response to Invasive Species
National Sea Grant	http://www.seagrant.noaa.gov/	
Nevada Invasive Species Initiative	http://www.nv.blm.gov/invaders/default.htm	
U.S. Department of Agriculture – National Agricultural Library	http://www.invasivespeciesinfo.gov/	National Invasive Species Information Network
U.S. Geological Survey	http://nas.er.usgs.gov/	USGS-Nuisance Aquatic Species
Western Regional Panel on Aquatic Nuisance Species	http://www.fws.gov/answest/	

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Attachment 1: Letter in Support of Forming the Lake Tahoe Aquatic Invasive Species Coordination Committee

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September 18, 2007

Letter sent to directors, executive Officers, supervisors or chairpersons of the following entities:

- Lahontan Regional Water Quality Control Board
- California Department of Parks and Recreation
- California State Lands Commission
- California Department of Fish and Game
- Tahoe Regional Planning Agency
- Nevada Division of Wildlife
- Nevada Division of State Lands
- US Forest Service, Lake Tahoe Basin Management Unit
- US Fish and Wildlife Service
- US Department of Agriculture, Agriculture Research Service
- Washoe Tribe

Subject: Formation of a standing committee to lead an Aquatic Invasive Species program in the Lake Tahoe Basin

Dear Sir or Madam,

I am writing to request your agency's active participation in a standing committee to lead an Aquatic Invasive Species (AIS) program in the Lake Tahoe Basin. We are extending this request to agencies and entities with significant land management, resource management, regulatory, or cultural heritage responsibilities in the Lake Tahoe Basin. The initial charge of this committee is to provide high-level leadership and direction to the implementation of the Lake Tahoe AIS program. Committee members will be expected to understand the policy and management implications of AIS actions and work within the committee to ensure these actions are effective and consistent with their agency policies. Committee members may also work within their agency to expand or modify policies and management strategies as a means to expanding the tools available to the Lake Tahoe AIS program.

An AIS technical working group was established earlier this year. This working group is comprised of agency and stakeholder technical staff, consultants, and members of the science community who are all working to implement various AIS

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projects and activities. The technical working group will be the operating arm of the new standing committee, and the chairperson of the work group will be a member of the standing committee.

Over the last year numerous agency, stakeholder, and science representatives have been working to establish a comprehensive AIS program in the Lake Tahoe Basin. Efforts are underway or will soon be initiated to stop the spread of existing introduced species, including control of aquatic weeds and eradication of invasive fishes. Additional efforts aim to prevent new introductions (especially introduced invertebrates) and include education and outreach efforts critical to the success of the AIS program. Planning, monitoring, and focused research also are being funded to ensure this comprehensive effort has a firm, objective basis that is consistent with State and Federal mandates. Federal, State, local, and private funding has been secured and is sufficient to sustain AIS efforts over the next 2-3 years. The US Fish and Wildlife Service has initiated efforts to hire a biologist who will be based in the Lake Tahoe Basin and who will focus on the coordination and implementation of the AIS program.

We believe it is essential to establish a standing high-level committee that can work with the AIS technical work group to lead and implement a comprehensive AIS program in the Lake Tahoe Basin. This committee will help to ensure the efficiency and effectiveness of a sustained AIS program that meets all State and Federal requirements. Initially we expect this committee with need to meet once every two months at agency offices in the south shore area of Lake Tahoe. However, over the longer term we expect meetings might occur quarterly with intervening conference calls as required.

Active participation by a representative from your agency is considered critical to the success of this committee. We are targeting senior technical staff or senior managers to serve as representatives. It is expected that this person will have a firm understanding of your agency's policies and management strategies related to AIS issues. It also is expected that this person will be able to communicate with agency executives to confirm agency policies, priorities, and resource commitments related to AIS efforts in the Tahoe Basin.

Some of the agencies contacted may have individuals focused on aquatic invasive species issues. These representatives are especially appropriate, although we understand that these individuals will have statewide responsibilities which limit their ability to participate in this regional effort. Continuity and sustained commitment are critical to the success of this effort, so it may be appropriate to select a regional representative who can communicate with your statewide coordinator.

Lake Tahoe is a national treasure that is now degraded by established introduced species and further challenged by potential new introductions. We hope that you will give serious consideration to this request and provide a

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representative from your agency who can fully participate in this new committee. We would appreciate a response to this request by October 30, 2007. Please contact me at (775) 881-7561 if you have any questions or require further information.

Sincerely,

Zach Hymanson,
Executive Director

Cc: Jenny Francis (TRCD)
Phil Brozek (COE)
Tricia York (CTC)
Susie Kocher (UC Extension)

LAKE TAHOE REGION AQUATIC INVASIVE SPECIES MANAGEMENT PLAN

Appendix J: Key Management Questions

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Appendix J
Key Management Questions

The following research gaps have been identified and should be considered for future funding and Plan revisions. These gaps were determined from literature reviews of AIS currently in or threatening the Region and those identified by researchers and resource managers:

ENVIRONMENTAL

- Are calcium levels in Lake Tahoe water, including marina and lagoon areas, adequate to support all life stages of quagga/zebra mussels?
- How do seasonal changes in the calcium concentration of lake water affect mussel survivability, growth, and reproduction?
- What are other substantial sources of calcium to Lake Tahoe that could facilitate dreissenid mussel establishment?
- What is the timing and scale of largemouth bass and other warm water fish spawning cycles in Lake Tahoe?
- Are there unique microhabitats in the Region that are more likely to support establishment of invasive species than otherwise expected, e.g., geothermal springs?
- Is the algal assemblage in Lake Tahoe sufficient to support invasive invertebrate growth and reproduction?
- Will physical habitat in the Lake Tahoe be limiting to quagga and zebra mussel growth or establishment?
- Will physical habitat in the Tahoe Region be limiting to New Zealand mudsnail growth or establishment?
- What causes the mass die-offs of signal crayfish along the west shore of Lake Tahoe?
- What are the impacts of signal crayfish on sedimentation, native biodiversity and water clarity?
- Which waterbodies and streams in the Tahoe Region are at highest risk for New Zealand mudsnail establishment?
- What other areas of Lake Tahoe physically resemble those currently inhabited by Asian clams? And, are chemical or other ambient conditions limiting to establishment of Asian clams in these areas?

MANAGEMENT

- Will control strategies for established AIS alter Lake Tahoe water quality, food web structure, and benthic ecology?
- How can IPM be better incorporated into AIS control/eradication efforts?

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- What is the most effective integrated management strategy for controlling curlyleaf pondweed (*Potamogeton crispus*) growth and propagation, e.g. preventing turion production?

INTERACTION WITH OTHER EXISTING AIS

- Can nearshore habitats currently infested with AIS (e.g., Eurasian watermilfoil, Asian clams) facilitate the establishment of other AIS (e.g., quagga/zebra mussels, New Zealand mudsnails, and hydrilla)?
- How does competition with other invasive species (bivalves and macrophytes) affect Asian clams colonization or establishment?
- What is the energetic contribution of signal crayfish to predatory warm water fishes such as largemouth bass?
- Can Asian clam treatment through placement of bottom barriers or physical removal of clams facilitate recolonization by Asian clams or other invasive species (e.g., aquatic weeds, dreissenid mussels)?
- Are there potential predators of the New Zealand mudsnail currently in Lake Tahoe or its tributaries?
- How do established colonies of New Zealand mudsnails affect potential colonization for other invasive species?

SURVEYS

- What is the level of *Batrachochytrium dendrobatidis* (Bd) infection (cause of the disease chytridiomycosis) in native amphibian populations and their habitats?

VECTOR PATHWAYS

- Examine new vector pathways for existing species of concern.
- What are the primary pathways of potential AIS introduction to Lake Tahoe in addition to motorized and non-motorized watercraft?
- What are the primary pathways of potential New Zealand mudsnail introduction to Lake Tahoe?

CLIMATE CHANGE

- What is the response of warm-water fishes and bullfrog in Lake Tahoe to regional/local climate change?
- Will physicochemical factors resulting from climate change enhance potential for successful colonization of new AIS, e.g. New Zealand mudsnail and *Egeria densa*?

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