

The background of the cover is a scenic photograph of Lake Tahoe. The foreground shows the clear, shallow water of the lake, revealing a rocky bottom with many smooth, dark stones. In the middle ground, the calm water reflects the sky and the distant mountains. A small, rounded rock is visible on the left side of the water. In the background, a range of mountains with patches of snow is visible under a clear blue sky with a few wispy clouds.

LAKE TAHOE REGION AQUATIC INVASIVE SPECIES

ACTION AGENDA 2021-2030

Enhancing Resilience in the Lake Tahoe Region

The Lake Tahoe Region Aquatic Invasive Species (AIS) Action Agenda 2021–2030:

- Increases the pace and scale of aquatic invasive species control work
- Identifies priorities for AIS investments
- Maximizes return on investment
- Incorporates new performance metrics
- Supports adequate levels of monitoring
- Adds capacity to achieve goals
- Defines a complete approach to addressing aquatic invasive species in the Region

Regional AIS Goals:

- Prevent new introductions of AIS to the Region.
- Limit the spread of existing AIS populations by employing strategies that minimize threats to native species, and extirpate existing AIS populations when possible.
- Abate harmful ecological, economic, recreational, and public health impacts resulting from AIS

The Action Agenda is a 10-year plan with two five-year implementation phases:

Phase I (2021–2025) aggressively treats and controls AIS throughout the Region while completing environmental documents and AIS control testing for the Tahoe Keys. The Phase I goal is to reduce aquatic invasive plants to maintenance levels (or complete eradication) in areas outside of the Tahoe Keys.

Phase II (2026–2030) focuses on reducing aquatic invasive plants and invasive fish in the Tahoe Keys while continuing to maintain, reduce, or eradicate AIS in other parts of the Lake Tahoe Region.



This document was prepared by
Creative Resource Strategies, LLC

The Time to Act is Now

Aquatic invasive species pose one of the greatest threats to Lake Tahoe's ecology, and to the \$5 billion recreation-based economy of the Lake Tahoe Region. Now is the time to increase the pace and scale to reduce the distribution and abundance of aquatic invasive species in the Lake Tahoe Region.

Failure to implement comprehensive control actions on all aquatic invasive species through 2030 will:

- Lessen chances of eradicating and controlling AIS populations;
- Harm the ecological function of Lake Tahoe;

- Inject uncertainty into the regional economy;
- Make it more difficult to recover populations of the federally-listed Lahontan cutthroat trout;
- Degrade the quality of experiences of residents and visitors; and
- Significantly increase long-term costs to address AIS in the Region.

Enhancing the resilience of Lake Tahoe by addressing AIS threats will achieve the most strategic return on investment and ensure the Region continues to thrive.

Aquatic Invasive Species Performance Metrics

New performance metrics assess both effort and outcomes associated with AIS control projects in the Region.

Programmatic Metrics



Acres treated for invasive species



Number of projects completed



Invasive species risk assessment completed



Funds expended per unit

Outcome-based Metrics



PLANTS

- Percentage increase or decrease in infested area (acres) per species
- Number of AIS-infested acres
- New aquatic invasive plant populations that have become established



INVASIVE FISH

- Reduction of invasive fish in regions of Lake Tahoe



AQUATIC INVASIVE INVERTEBRATES

- Reductions of signal crayfish and mysid shrimp in designated regions of Lake Tahoe



INVASIVE AMPHIBIANS

- Reductions of bullfrogs in designated regions of Lake Tahoe

Achieving an Optimal Return on Investment, 2021–2030

The Action Agenda proposes a three-fold increase in pace and scale relative to current actions. Complete Action Agenda implementation will cost an estimated \$74 million through 10 years (\$7.4 million annually) and will achieve the greatest return on investment, maximize benefits to ecosystem services, minimize risk, and reduce degradation to fish and wildlife habitats in the Region. Implementing this recommendation will achieve:

- 90 percent reduction to eradication of aquatic invasive plants in nearshore and upstream areas and the Tahoe Keys;
- 90 percent reduction in invasive fish biomass in priority areas;
- Reductions of aquatic invasive invertebrates and amphibians in regions of the lake and upstream areas;
- Support for effective Early Detection Rapid Response actions through the creation of an emergency invasive species fund;
- Newly developed detection and monitoring tools;
- Comprehensive nearshore-wide and in-situ diver survey and drone transects;
- Strategic investment in new technologies and methodologies to control aquatic invasive species;
- An assessment of high-risk invasive species every two years; and
- Investment in a marina engagement strategy.



The plan outlines four funding levels to achieve Region AIS goals:

Level A: Complete AIS control throughout the Region, including Tahoe Keys

Level B: AIS plant-only control throughout Region, including Tahoe Keys

Level C: AIS plant-only control throughout the Region, excluding Tahoe Keys

Level D: AIS plant-only control in nearshore, excluding Tahoe Keys

Implementing Action Agenda Level A achieves the greatest biological integrity in the Lake Tahoe Region while minimizing risk to the economic, environment, and societal values. Implementing Level D funding achieves the least biological integrity and involves the greatest risk.



Strategic Investments Needed to Implement the Action Agenda, 2021–2030

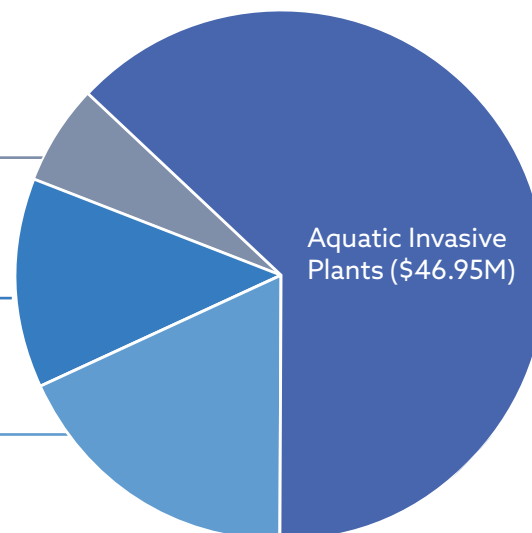
Strategic Outcomes	Phase I (2021–2025)	Phase II (2026–2030)
Aquatic Invasive Plant Control Outside Tahoe Keys 90% reduction in acreage of aquatic invasive plant populations outside the Tahoe Keys	\$12.5 M	\$6.25 M
Aquatic Invasive Plant Control Outside Tahoe Keys Early Detection and Rapid Response - no new aquatic invasive plant populations become established outside the Tahoe Keys	\$1.25 M	\$1.25 M
Aquatic Invasive Plant Control in Tahoe Keys 90% reduction, or eradication, of aquatic invasive plant populations in the Tahoe Keys	\$7.0 M	\$17.2 M
Aquatic Invasive Plant Control in Tahoe Keys Environmental documentation that informs control work in the Tahoe Keys	\$1.5 M	\$0
Aquatic Invasive Plant Control Totals	\$22.25 M	\$24.70 M
Aquatic Invasive Fish, Invertebrate, and Amphibian Control 90% reduction of invasive fish biomass, and invasive aquatic invertebrates and American bullfrogs in regions of the lake	\$2.63 M	\$1.85 M
Aquatic Invasive Fish, Invertebrate and Amphibian Control Totals	\$2.63 M	\$1.85 M
Research and Monitoring Enhanced detection of aquatic invasive species, surveys conducted (nearshore, in-situ diver, drone), assessments of AIS population abundance and distribution, investments in new technologies	\$4.29 M	\$5.235 M
Research and Monitoring Totals	\$4.29 M	\$5.24 M
Assessment, Emergency Fund, Infrastructure Enhancements to Prevent Spread of AIS, and Added Staff Capacity High-risk assessment of AIS every two years, established partnership program to advance infrastructure at marinas and other lake locations, establish an Early Detection and Rapid Response emergency fund, and hire sufficient staffing to implement the Agenda.	\$7.2 M	\$6.28 M
Administrative Totals	\$7.20 M	\$6.28 M
TOTALS	\$36.39M	\$38.06 M
GRAND TOTAL		\$74.45 M

AIS Budget, 2021–2030

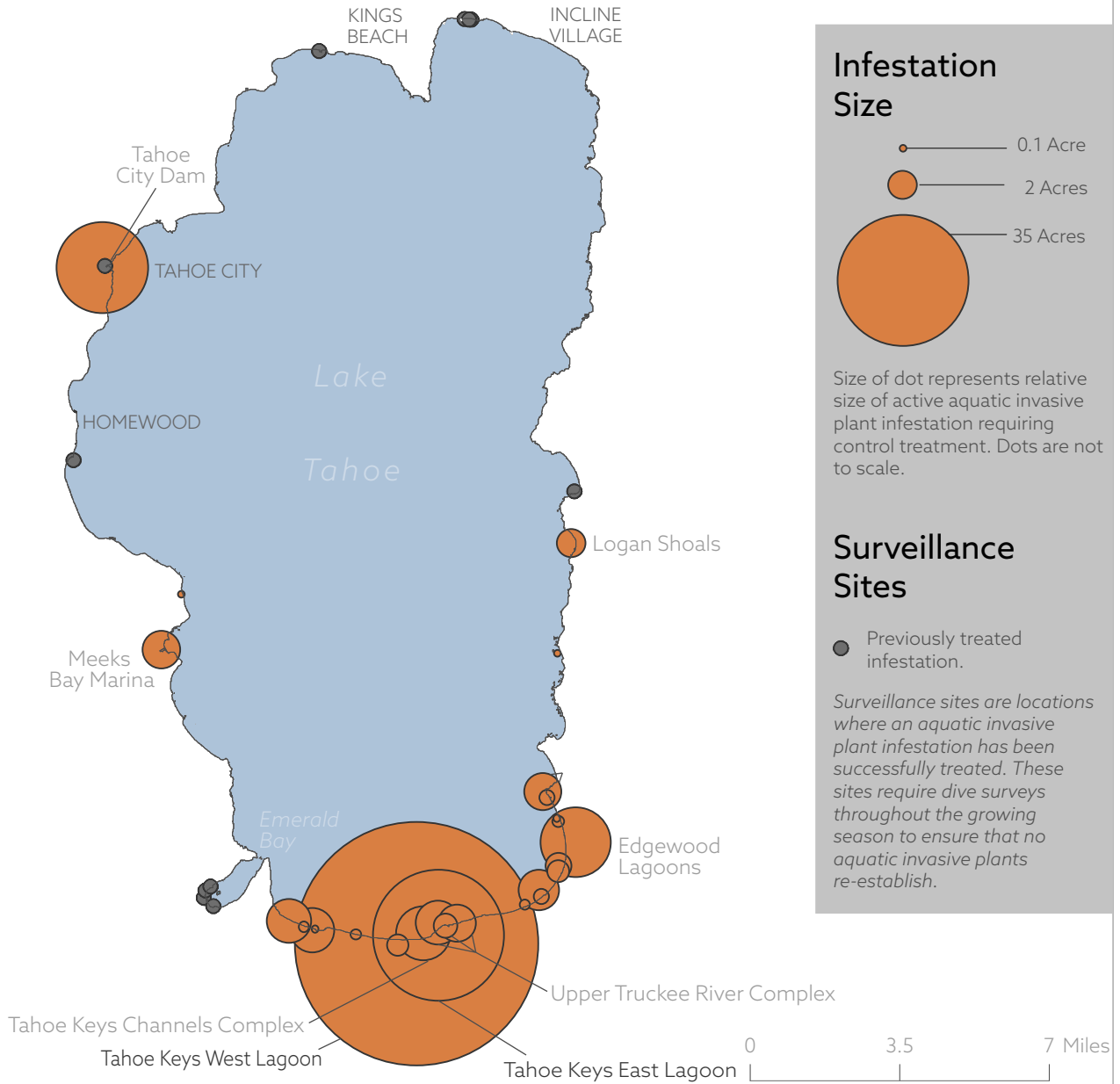
Aquatic Invasive Fish, Invertebrate, and Amphibian Control (\$4.47M)

Research and Monitoring (\$9.53M)

Assessment, Emergency Fund, Infrastructure Enhancements, Staff Capacity (\$13.48M)



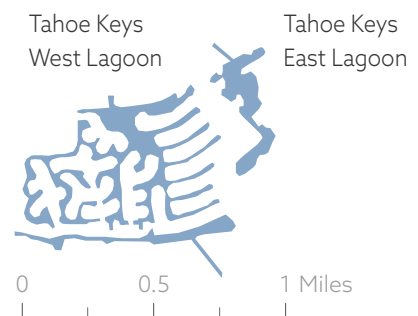
Aquatic Invasive Plant Infestations 2019



The Tahoe Keys Challenge

Based on acreage, the Tahoe Keys comprise 70 percent of all aquatic plant infestations in Lake Tahoe. The size of these infestations and the complexity associated with the geography of the Tahoe Keys make identifying and implementing control treatments a challenge. Although most marinas contain one or two embayments, the Tahoe Keys complex contains a myriad of connected waterways equalling approximately 170 acres.

Map produced by S. Matthews, Tahoe RCD 2019.



MOST UNWANTED LAKE TAHOE AQUATIC INVASIVE SPECIES

Aquatic invasive plants, fish, invertebrates, and amphibians are degrading Lake Tahoe Region ecosystems.

Plants

Eurasian Watermilfoil and Curlyleaf Pondweed

- Reduce native species
- Degrade water quality by
 - Contributing to nutrient loading
 - Impairing boating navigation
 - Reducing clarity
- Reduce scenic quality
- Create habitat for other invasives



Invasive Fish

- Alter food web function
- Decrease the biodiversity of native fish
- Compete with native fish
- Inhibit Lahontan cutthroat trout recovery



Aquatic Invertebrates

Asian Clams

- Where present, Asian clams comprise the majority of benthic community biomass
- Contribute to algal blooms
- Shell deposits affect nearshore aesthetics



Mysid Shrimp

- Reduce or eliminate native phytoplankton
- Alter food web dynamics
- Inhibit Lahontan cutthroat trout recovery
- Reduce clarity



Signal Crayfish

- Comprise the bulk of littoral-zone benthic biomass
- Reduce food for native benthic macroinvertebrates
- Degrade water quality
- Reduce native aquatic invertebrates



Invasive Amphibians

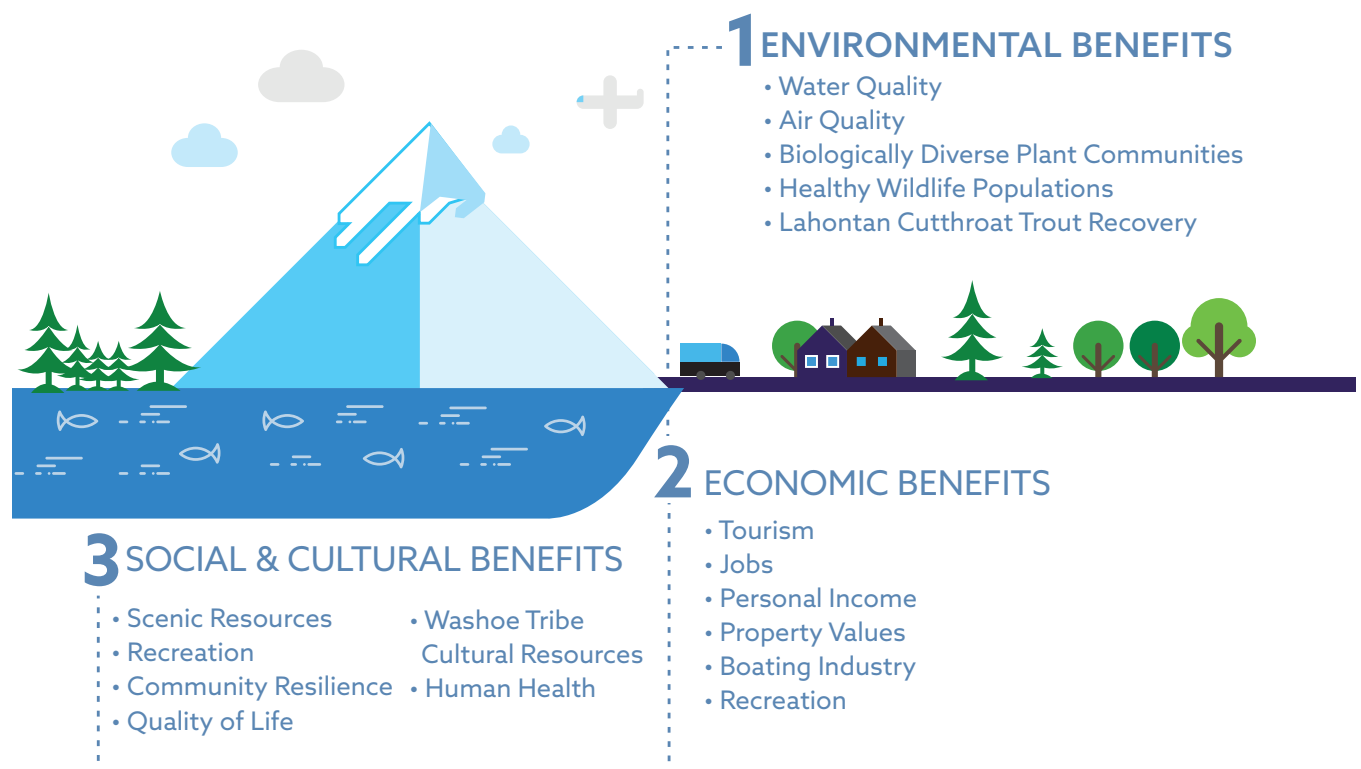
American Bullfrogs

- Transmit fungus to other amphibians
- Outcompete native species
- Consume native fish, birds, and amphibians



The Regional Economy Depends on a Healthy Lake Tahoe

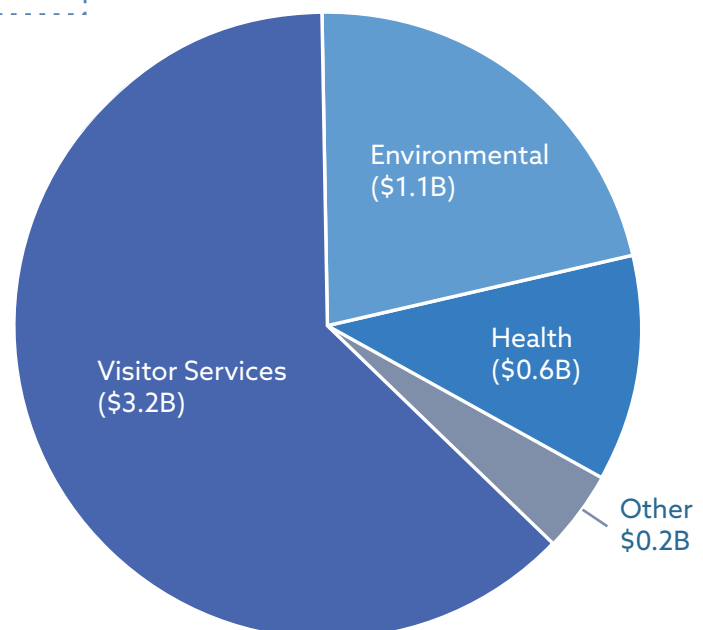
Lake Tahoe is one of the largest subalpine lakes in the world and is recognized nationally and globally as a natural resource of special significance. Lake Tahoe is also an Outstanding National Resource Water known for its extraordinary clarity and blue color. Maintaining and sustaining a healthy Lake Tahoe protects valuable economic, environmental, and social/cultural resources in the Region.



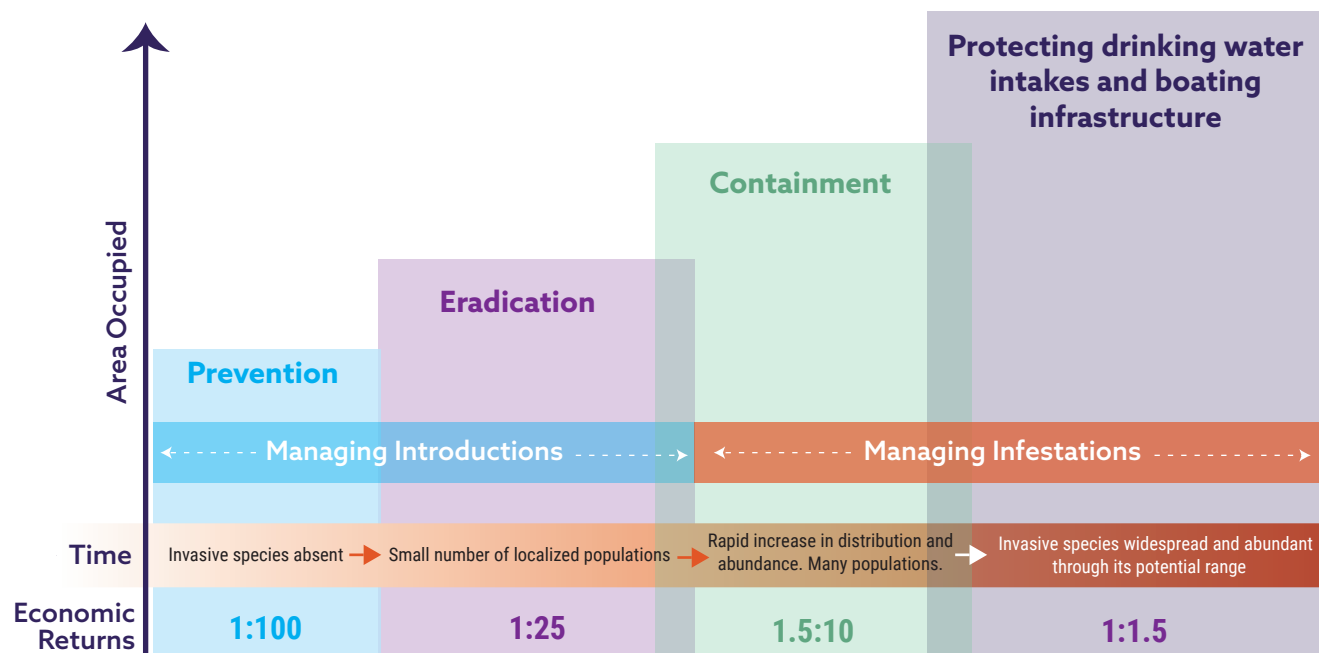
\$5 Billion Regional Economy

Visitor services, Environmental, Health, and Other clusters drive 95 percent of the regional economy (Applied Development Economics 2015). Recreation is the second most important component of the Visitor Services cluster. The top three clusters depend on the continued outstanding quality of the natural environment.

Total Tahoe Economy = \$5.1 billion



Cost-Effectiveness of AIS Management Approaches



Prevention

The most cost-effective approach to managing invasive species is to **prevent** their introduction. As populations become established, containment and management result in the greatest long-term economic, environmental, and social damages.

The watercraft inspection program shields the Tahoe Basin from an invasive mussel infestation by focusing on the *Clean, Drain and Dry* strategy. This includes watercraft inspection and decontamination stations, and outreach and education. During the past 11 years, these strategic investments have prevented the introduction of quagga or zebra mussels to the Region, at a fraction of the cost of containment and eradication. An infestation of these invasive mussels would cost the Region millions of dollars annually and in perpetuity.

Eradication

The next most cost-effective invasive species management method is to eradicate infestations when their populations are small and localized. Eurasian watermilfoil is an aquatic invasive

plant found both inside the Tahoe Keys and along Lake Tahoe's shoreline. Managers have effectively **eradicated** newly detected populations of Eurasian watermilfoil along the shoreline while populations are small.

Containment

The Tahoe Keys, which are infested with aquatic invasive plants and invasive fish, serve as invasive species source populations for the Region. Managers work to **contain** AIS in the Tahoe Keys while pilot projects are completed to test the efficacy of eradication methods. Containment is costlier than eradication, or prevention.

Asset Protection

When invasive species cannot be prevented, eradicated, or contained, actions to **protect assets, such as drinking water intakes and boating infrastructure**, have the greatest cost and fewest returns on investment.



The Lake Tahoe Environmental Improvement Program is a collaborative partnership working together to achieve the environmental goals of the region. The Aquatic Invasive Species Action Agenda implements the partnerships' priorities to control or eradicate aquatic invasive species to protect the biological diversity and scenic resources of the Lake Tahoe Basin.



LAKE TAHOE
INVASIVE SPECIES
PROGRAM