LAKE TAHOE NEARSHORE
WATER QUALITY PROTECTION PLAN

STATE WATER RESOURCES CONTROL BOARD
LAHONTAN REGION

REPORT TO THE LEGISLATURE

June 2014

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

EXHIBIT H - TAHOE
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Meeting Date: 06-20-14

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Edmund G. Brown Jr., Governor

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
Matthew Rodriquez, Secretary

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Executive Summary

In October 2013 the Desert Research Institute, UC Davis, and University of Nevada at Reno released the Lake Tahoe Nearshore Evaluation and Monitoring Framework Report (Report) (NeST 2013). The Report presents a conceptual understanding of nearshore environment processes, assesses the heterogenic nature of the nearshore, highlights the lack of data available to characterize the environmental status of the Lake Tahoe nearshore, and emphasizes that current agency implementation efforts will benefit the nearshore environment.

This Lake Tahoe Nearshore Water Quality Protection Plan (Plan) outlines the Lahontan Regional Water Quality Control Board's (Water Board) response to the changes in the Lake Tahoe nearshore environment as informed by the Report. Based on the Report findings and recommendations, the Water Board will proceed with the following actions:

(1) continue implementing programs that benefit nearshore environmental quality;
(2) establish and implement an integrated nearshore monitoring plan to track change in the nearshore environment and track pollutant inputs to the nearshore;
(3) evaluate localized "hotspots" where nearshore change has been documented and assess causes of observed degradation;
(4) investigate climate change influence on nearshore water quality; and
(5) assess the need for revised or new water quality standards to protect nearshore water quality.

In establishing and maintaining nearshore water quality protection policies, the Water Board will continue to coordinate with other government agencies and the public. Because available resources are insufficient to fully implement all recommendations, a dedicated annual funding source must be found to adequately protect and enhance Lake Tahoe's precious nearshore. The Plan elements and funding needs are presented in Attachment 1. The Plan also serves as response to a Legislative request in the 2012-2013 Budget Act specific to the Water Board's approach to the nearshore.

Background

The Lake Tahoe nearshore is the portion of the lake in close proximity to the shoreline. It is the area of the lake that people interact with most when viewing the lake from the shore, wading, swimming, enjoying paddle sports, and boating. The Report defines the nearshore as the part of the lake from the shoreline to 350 feet offshore, or to a depth of 69 feet, whichever is a greater area (Figure 1). In parts of the shoreline where there is a shelf present, the nearshore can extend far beyond 350 feet from shore before the depth reaches 69 feet (Figure 2).

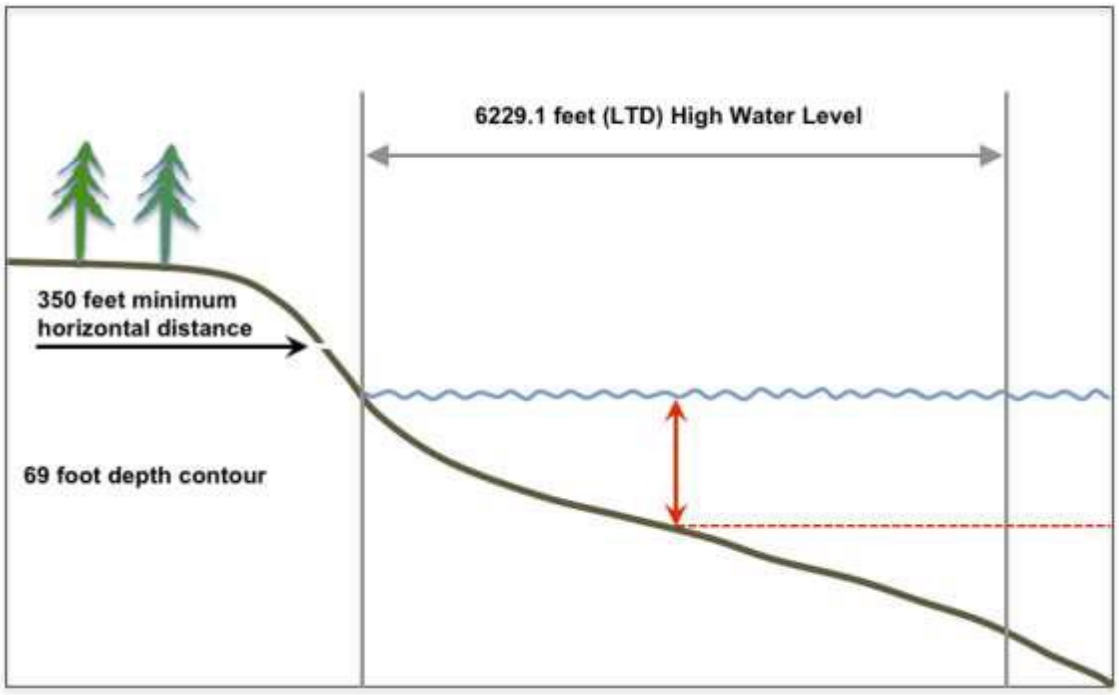

Figure 1. Definition of Lake Tahoe nearshore for purposes of monitoring and assessment (NeST 2013)

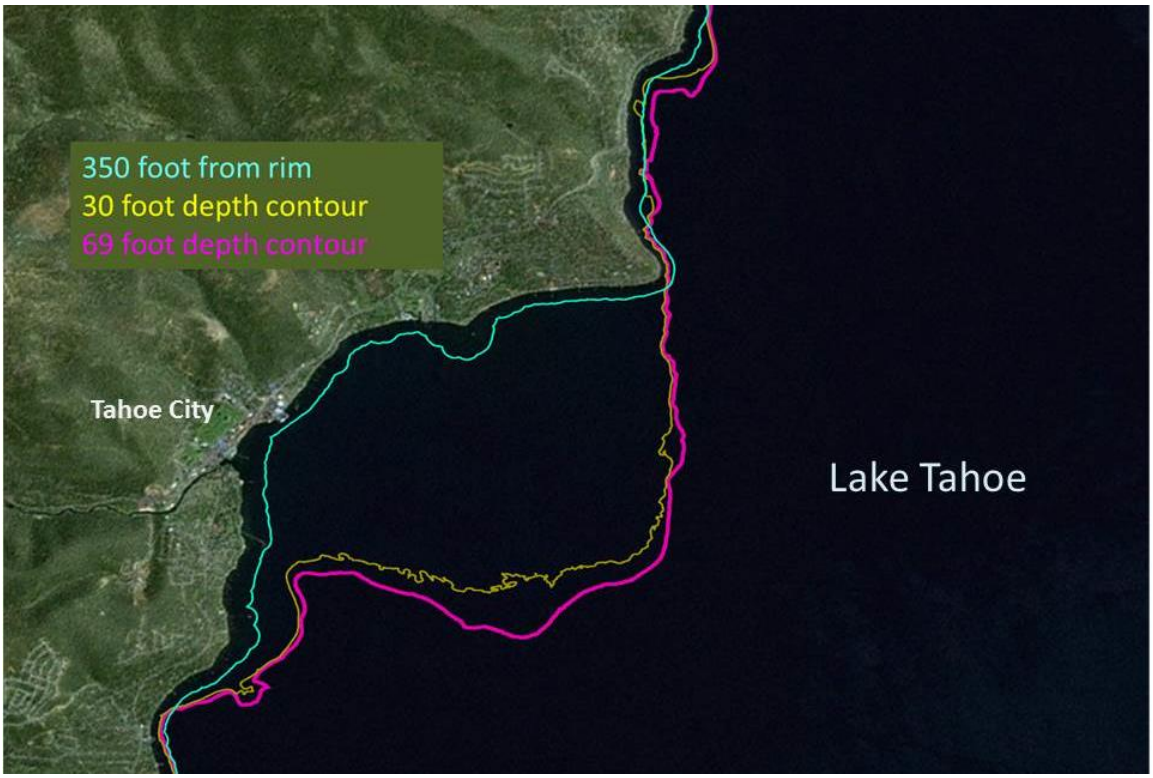

Figure 2. Nearshore area variation due to depth (NeST 2013)

The public and natural resource agencies have observed changes to the nearshore waters and the lake bottom. The anecdotal reports include increased algae growth, increased presence of invasive species, and a reduction in nearshore clarity. Figures 3-5 illustrate some of the observed nearshore conditions. The Water Board, Nevada Division of Environmental Protection (NDEP), the Tahoe Regional Planning Agency (TRPA) and the United States Environmental Protection Agency (USEPA) (hereafter referred to as "nearshore agencies"), initiated the nearshore evaluation work documented in the Report to better understand current nearshore conditions, assess how best to monitor change, and establish the desired conditions and resource management objectives for the nearshore environment.

Figure 3. Periphyton at Burnt Cedar Beach, Incline Village ***Credit: Sierra Sun***

The Report is the first effort to examine the state of knowledge of the nearshore and establishes a baseline understanding of the Lake Tahoe nearshore environment. The Report includes:

- Nearshore Definition
- Nearshore Desired Condition Statement
- Evaluation of Existing Water Quality Standards for the Nearshore (CA, NV, TRPA)
- Framework for a Nearshore Monitoring Plan
- Evaluation of Recommended Monitoring Metrics
- Conceptual Model of Nearshore Influences and Processes (what affects the nearshore condition)
- Indicator Framework Narrative
- Annotated Bibliography of nearshore research

Key Report Findings

- The nearshore is a heterogeneous environment. Its waters are not well mixed, which means the temperature and water quality varies temporally and spatially and the factors affecting one part of the nearshore may differ substantially from those affecting the nearshore at a different part of the lake.
- The nearshore environment reacts slowly to environmental changes. To be successful, efforts to restore and maintain the Lake Tahoe nearshore must be long term and sustained.
- There are many existing water quality standards that apply to Lake Tahoe's nearshore . The Report analyzed 62 standards identified by the Water Board, the TRPA and NDEP applicable to nearshore water quality. The Report lists 23 of these as "important" or "relevant" for nearshore management, and 18 of these as "important" or "relevant" for nearshore monitoring (Attachment 2). Subsequent to initiation of the Report, the TRPA adopted two additional management standards; one for aquatic invasive species and one for periphyton.
- The Report identified the elevated nutrient concentrations (primarily phosphorus and nitrogen), increased sediment inputs, and aquatic invasive species as the primary drivers of change in Lake Tahoe's nearshore environment.
- The Water Board and NDEP's Lake Tahoe Total Maximum Daily Load (TMDL) program is addressing many of the pollutants of concern influencing the nearshore. Primarily, the Lake Tahoe's urban uplands. Current water quality improvement efforts within the Lake Tahoe basin will help improve nearshore conditions.
- There are relatively little data for many nearshore monitoring metrics, though the data that do exist are generally of high quality. A comprehensive lake-wide nearshore monitoring plan must be developed to effectively assess nearshore status and trends.

Figure 4. Eurasian watermilfoil, an invasive macrophyte, Emerald Bay State Park, before and after treatment to remove the invasive weeds ***Credit: California State Parks***

Lake Tahoe Nearshore Water Quality Protection Plan

In response to the nearshore Report findings and growing stakeholder concern about observed nearshore environment changes, the Water Board is pursuing a multi-faceted nearshore water quality protection Plan. The Plan includes measures to (1) continue implementing programs that benefit nearshore environmental quality, (2) establish and implement an integrated nearshore monitoring plan track change in the nearshore environment and track pollutant inputs to the nearshore, (3) evaluate localized "hotspots" where nearshore change has been documented and assess causes of observed degradation, (4) investigate climate change influence on nearshore water quality, and (5) assess the need for revised or new water quality standards to protect nearshore water quality.

1. <u>Continue implementing programs that benefit nearshore environmental quality</u>
   Programs that benefit nearshore water quality include Lake Tahoe TMDL implementation, the Lake Tahoe Aquatic Invasive Species Program (LTAIS), TRPA Regional Plan implementation elements, and public outreach efforts.

   The Lake Tahoe TMDL was approved by the US Environmental Protection Agency on August 16, 2011 and emphasizes reducing fine sediment particles, nitrogen, and phosphorus inputs to the lake. These pollutants commonly pass through the nearshore on their way to the deep waters of Lake Tahoe. Consequently, Lake Tahoe TMDL pollutant load reduction efforts will also reduce pollutant inputs that are the primary pollutants promoting turbidity and algae growth in the nearshore. Local government and the two state highway departments are responsible for the bulk of the fine sediment and nutrient load reductions called for by the TMDL. In July 2013, the Water Board accepted three Pollutant Load Reduction Plans submitted by the City of South Lake Tahoe, El Dorado County, and Placer County that outline storm water treatment projects and operations and maintenance activities to reduce fine sediment particle loading to the Lake by 10% by 2016. Similar plans are being prepared by the California Department of Transportation and local and state government partners in Nevada. In addition to storm water treatment facilities installed over the past ten years, storm water managers are focusing on cost-effective street sweeping and traction abrasive application strategies to meet sediment and nutrient load reduction requirements. The program targets actions in areas directly connected to the Lake and tributary streams to directly reduce pollutants affecting both deep water transparency and the nearshore environment.

   Aquatic invasive species (AIS) in Lake Tahoe primarily occur in the nearshore. AIS can have considerable impact on native species and the aquatic community structure. They also indirectly affect trophic status and in some cases may contribute to diminished clarity of the nearshore environment. The LTAIS Program addresses the threat of aquatic invasive species through prevention, early detection and control efforts. Outreach efforts and boat inspections have prevented new introductions of AIS, while control efforts are underway to address invasive macrophytes (Eurasian watermilfoil and curlyleaf pondweed) and Asian clams. Ongoing LTAIS Program implementation, including boat inspections and weed and Asian clam control work, is

crucially important for preventing the introduction of new and aggressive aquatic invasive species to Lake Tahoe and for reducing the extent of existing aquatic invasive infestations.

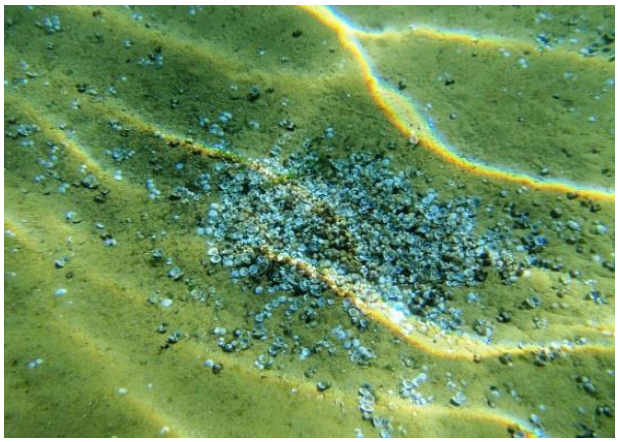

Figure 5: Invasive Asian clam shells on the bottom of Lake Tahoe

In 2012, the TRPA approved amendments to its Regional Plan, including several requirements that will aid the protection of the nearshore. Updated policies on limiting fertilizer use, incentives for the removal and restoration of impervious surfaces on sensitive lands, an emphasis on restoring and protecting riparian areas, and promoting the reduction of vehicle miles traveled are all important elements for nearshore water quality protection. TRPA retained its existing nearshore clarity threshold standard and adopted two new nearshore related threshold standards to reduce extent and distribution of attached algae and aquatic invasive species.

Finally, nearshore protection is a responsibility shared by the resource management agencies and the public. The nearshore agencies are developing outreach materials to educate the public about the nearshore environment and inform the public about actions they can take to protect the nearshore. Many of these actions relate to existing programs, such as the LTAIS Program, or direct the public to volunteer opportunities, such as those offered by the League to Save Lake Tahoe.

- Costs and challenges:
    - Local government partners lack funding needed to sustain efforts to achieve required Lake Tahoe TMDL pollutant load reduction targets. In particular, cost efficient and highly effective operations and maintenance actions are estimated at $4 million annually for regulated jurisdictions in California. Proposition 218 limits local government's ability to raise local revenue and federal and state grant funds generally don't allow for operation and maintenance expenditures.
    - The LTAIS Program faces an uncertain future if sustained funding is not found. Federal funding sources supporting the program are expected to expire after 2014, leaving an estimated shortfall of approximately $1.5 million annually.

2. Establish and implement an integrated nearshore monitoring plan.

   Current nearshore monitoring efforts funded by the Water Board include monitoring phytoplankton related metrics (algal growth potential bioassays that measure biostimulatory content of nutrients in the water and the quantification/identification of phytoplankton species in the water column) and periphyton quantification. The Water Board is working cooperatively with the nearshore agencies to develop a more comprehensive nearshore monitoring program that will incorporate water quality, water clarity, and biological community status monitoring in addition to the parameters already measured. Additional nearshore monitoring will enable the agencies to characterize environmental conditions, track changes in key environmental indicators, and identify nearshore areas that warrant further investigation. The Water Board also supports additional monitoring efforts to track pollutant inputs to the nearshore from tributary streams

   The Report recommends ten important monitoring metrics to track nearshore health status:

   - Turbidity (cloudiness of the water)
   - Transmissivity (light penetration in the water)
   - Chlorophyll (an indicator of lake productivity)
   - Phytoplankton (floating algae)
   - Periphyton (attached algae – see Figure 3)
   - Macrophytes (vascular plants – see Figure 4)
   - Macroinvertebrates (see Figure 5)
   - Fish and crayfish
   - Toxicity
   - Harmful Micro-organisms

   Evaluating these metrics in addition to current monitoring tasks will allow resource managers to better understand the physical attributes and the biological elements of the nearshore environment.

   A nearshore water quality monitoring program is one element of the larger Lake Tahoe water quality monitoring effort that includes monitoring Lake Tahoe's deep waters, a stormwater monitoring program, and the Lake Tahoe Interagency Monitoring Program that monitors tributary waters. These combined monitoring efforts enable resource managers to track and understand the relationship between stormwater, stream inputs, and the status of the nearshore and mid-Lake environments.

   - Schedule:
     - Pilot monitoring program implementation - 2014-2015 (as resources allow)
     - Ongoing data collection, analysis, and reporting - 2015-annually (as resources allow)

- Costs and Challenges:
    - A sustained nearshore monitoring effort is estimated to cost approximately $450,000 annually (Attachment 1). Currently available nearshore monitoring resources are estimated at $300,000/year, leaving an annual monitoring budget shortfall of roughly $150,000.
    - Refining monitoring program methods - further work is needed to establish appropriate sample locations and frequencies and identify efficient monitoring parameters to limit monitoring program costs.
    - Additional Water Board staff resources (1 PY Environmental Scientist) will be needed to support water quality monitoring at Lake Tahoe. The Environmental Scientist will develop experimental designs, evaluate complex monitoring data to track pollutant inputs to the lake, provide quality assurance, and produce comprehensive water quality reports.

3. <u>Evaluate localized "hotspots" where nearshore change has been documented</u>

   The nearshore agencies have identified the need for geographically focused investigations of land uses and soils/geology to determine the causal factors affecting localized nearshore "hotspots" where elevated periphyton, increased turbidity, and/or high invasive clam populations have been measured. Controllable factors, such as proximity of impervious surface to the lake, sewer line exfiltration, concentrated recreation activities, and uncontrollable factors such as climate change and geology may be responsible for observed conditions. The nearshore agencies have identified increased periphyton growth on the northwest shore (from Tahoe City south through the outlets of Blackwood and Ward Creeks) as an initial hotspot to begin causal assessment analysis. Some stakeholders have expressed concern that leaking sewage lines may be a source of nutrients to the nearshore. While the large collection and conveyance systems are regularly inspected for leaks, smaller systems that are less frequently inspected and maintained could pose a problem. At the Water Board's direction, Water Board staff will work with local wastewater management agencies to investigate the integrity of laterals and other small collection and conveyance facilities and assess their integrity and evaluate whether leaks from these systems could be causing shallow groundwater pollution.

   In addition, the Lahontan Water Board will work cooperatively with other nearshore agencies to conduct targeted stormwater monitoring, land use assessment, groundwater monitoring, and sewer line infrastructure analysis coupled with nearshore condition monitoring to investigate the factors possibly responsible for the observed elevated periphyton growth.

   Following causal assessments monitoring and analysis, the Lahontan Water Board and other regulatory agencies in the Lake Tahoe region will be better suited to adapt current regulatory and implementation tools to address identified problems. Future causal assessment studies may target the invasive clam populations noted on the east shore in Marla Bay and areas of elevated turbidity along Lake Tahoe's south shore.

- Schedule:
    - Targeted causal analysis for northwest shore periphyton growth – 2015 - 2016
    - Targeted causal analyses for other identified nearshore hotspots – as identified by monitoring (as resources allow).

- Costs and challenges
    - Individual causal analysis studies are estimated at $250,000-$400,000 per investigation. The Water Board secured $200,000 from the State Water Resources Control Board to investigate nearshore changes in the northwest part of the lakeshore. Further analysis or investigations of other hotspots will require additional resources.

4. <u>Investigate climate change influence on nearshore water quality</u>
   Climate change impacts on Lake Tahoe's nearshore environment are evident in elevated water quality temperature, changing species composition, and increased algal growth potential. The nearshore agencies are committed to better understanding the impacts of climate change and how those changes differ from locally controllable inputs and natural environmental variability. Ongoing status and trend monitoring, along with the causal analysis studies will provide critical context for determining how the changing climate is influencing Lake Tahoe's nearshore environment.

- Schedule:
    - Initial status and trend monitoring to continue from 2014-2016
    - Causal analysis studies to be initiated in 2015 (as resources allow).

- Cost and challenges:
    - Technical challenges associated with defining the scope, duration and cost of climate change study with an emphasis on assessing nearshore conditions.
    - Integrating existing data and the need for data collection
    - Securing funding for status and trend monitoring and causal analysis studies needed to support climate change assessment

5. <u>Assess the need for revised or new water quality standards to protect nearshore water quality</u>
   The Water Quality Control Plan for the Lahontan Region (Basin Plan) includes specific water quality standards for Lake Tahoe, including several that are important to the management of nearshore waters. The Report identified nine Basin Plan standards as important to nearshore water quality management, including standards for water clarity, phytoplankton growth, concentrations of biostimulatory substances, suspended materials, and biological indicators. These standards protect Lake Tahoe's clear waters and the biological community that lives in the nearshore. The clarity standards are designed to prevent clarity loss from upland and in-lake

causes. The biostimulatory substances, biological indicator, and phytoplankton standards are designed to prevent algae growth from reaching nuisance status and impacting clarity. Data collection anticipated as part of the comprehensive nearshore monitoring work will provide the Water Board with needed information to assess compliance with existing nearshore-related standards and to take action where monitoring shows a violation of these standards.

In assessing the need for new water quality standards, the Water Board must consider whether any proposed metric would provide added value over existing standards. Any new metric would need to be dynamic enough to reflect environmental change, yet static enough for consistent and accurate measurement, and be responsive to controllable inputs to allow for meaningful resource management input. The Water Board must also consider the cost associated with standard development, including data collection and target setting, to determine if the expense related to developing a new water quality standard would outweigh the benefit of applying resources to other actions to protect, improve, and maintain the nearshore environment.

Of the ten metrics recommended for monitoring in the Report, only one (periphyton) is identified as having sufficient data at this time to support creation of a new numeric standard. The Basin Plan currently includes a narrative water quality objective for biological indicators in Lake Tahoe that explicitly addresses the importance of controlling periphyton growth. The standard states:

> *For Lake Tahoe, algal productivity and the biomass of phytoplankton, zooplankton, and periphyton shall not be increased beyond the levels recorded in 1967-71, based on statistical comparison of seasonal and annual means.*

The Water Board may consider updating the above-referenced standard or other nearshore standards, pending the collection of monitoring data, but such action is not necessary to support ongoing nearshore water quality protection work.

Metrics other than periphyton do not have sufficient data available to support creation of new water quality standards. The monitoring program framed in the Report has been crafted to track the environmental status and trends of nearshore water quality. Data collection support standard development for parameters other than periphyton would require a more intensive and directed effort. A water quality sampling program explicitly targeted at collecting data to support new standard development would need to be developed, funded, and implemented.

As noted, the Water Board is committed to the ongoing collaborative work to develop and implement a comprehensive status and trend monitoring program, as well as targeting investigative monitoring at nearshore hotspots. As data become available, the Water Board will continue to assess the need and value for revised and/or new water quality standards that explicitly address Lake Tahoe's nearshore environment.

- Schedule:
    - Limited periphyton monitoring - 2014-2016
    - Additional data collection for other parameters - 2016+ (as resources allow).
- Costs and challenges:
    - Insufficient data for establishing new standards
    - Insufficient funding for a targeted standard-specific monitoring study - $200,000-$500,00 depending on selected metric and available data

Assembly Bill 1464 (Chapter 21, Statutes of 2012)

California Governor Edmund G. Brown signed into law the Budget Act of 2012, which included a requirement that the Water Board prepare a schedule for nearshore objectives based on the Report. Specific language from the law states:

> *The Lahontan Regional Water Quality Control Board shall, within 120 days of receipt of a scientific report on Lake Tahoe near-shore indicators, establish a schedule for the development and adoption of Lake Tahoe near-shore water quality objectives to improve Lake Tahoe near-shore water quality conditions along with a comprehensive implementation strategy describing the nature of actions and associated timelines that will be necessary to implement the plan or its component parts.*

This Plan serves as a direct response to the above-referenced requirement.

Citation:

NeST 2013: Heyvaert, A.C., Reuter, J.E., Chandra, S., Susfalk, R.B., Schaldow, S.G. Hackley, S.H. 2013. Lake Tahoe Nearshore Evaluation and Monitoring Framework. Final Report prepared for the USDA Forest Service Pacific Southwest Research Station.

Attachment 1. Estimated Nearshore Plan Funding Needs and Schedule

	Nearshore Plan Measures	Existing Funding, 2014	Funding need 2014	Annual Funding Need
1	Existing Program Implementation			
	- Lake Tahoe TMDL			$4M[1]
	- LTAIS Program	$1,660,000[2]		$1.5M
2	Nearshore Monitoring Program	$300,000[3]	$150,000	$450,000, 1 PY
3	Nearshore Hotspots Investigation	$200,000[4]		$250,000-400,000
4	Climate Change Influence Investigation			$200-500K
5	Nearshore Specific Standard Assessment			$200-500K

[1] Estimated local government storm water facility and roadway operations and maintenance costs that are critically important for achieving Lake Tahoe TMDL load reduction targets.

[2] Estimated 2014 inspection fee collection of $680k; One-time funding of $680k; 2014 program cuts. Also includes $150k from the Lake Tahoe Science and Lake Improvement Account, matched by $150k from the California Tahoe Conservancy. The Lake Tahoe Science and Lake Improvement Account was created by Senate Bill 630 (Chapter 762, Statutes of 2013).

[3] Existing annual funding of $150k and $150k from The Lake Tahoe Science and Lake Improvement Account for monitoring nearshore parameters and nearshore pollutant inputs. Funding need includes 1.0 PY Environmental Scientist.

[4] State Water Resources Control Board, Discretionary Contracts Fund

	Nearshore Plan Measures	**2014**	**2015**	**2016**	**2017+**
1	Existing Program Implementation				
2	Nearshore Monitoring Program				
3	Nearshore Hotspot Investigation				
4	Climate Change Influence Investigation				
5	Nearshore Specific Standard Assessment				

Attachment 2: Existing standards evaluation for nearshore relevancy. The 62 standards of the nearshore agencies overlap and cover 38 parameter categories (NeST 2013).

Table B-1. Existing Standards Potentially Relevant to the Nearshore of Lake Tahoe.

ID #	Parameter Category	Nearshore Management	Nearshore Monitoring
1	Total Nitrogen	Important	Relevant
2	Total Soluble Inorganic Nitrogen	Important	Relevant
3	Ammonia	Less relevant	Less relevant
4	Nitrite	Less relevant	Less relevant
5	Dissolved Inorganic Nitrogen Loading	(see #8)	(see #8)
6	Total Phosphorus	Important	Relevant
7	Soluble Phosphorus	Important	Relevant
8	Biostimulatory Substances	Important	Relevant
9	Clarity	Important	Important
10	Pytoplankton	Important	Important
11	Algal Growth Potential	Relevant	Relevant
12	Biological Indicators (with Periphyton)	Important	Important
13	Suspended Materials	Important	Relevant
14	Settleable Materials	Less relevant	Less relevant
15	Suspended Sediment Loading	(see #13)	(see #13)
16	Total Dissolved Solids	Relevant	Less relevant
17	Conductivity	Relevant	Less relevant
18	pH	Relevant	Less relevant
19	Sodium Absorption Ratio	Less relevant	Less relevant
20	Chloride	Less relevant	Less relevant
21	Sulfate	Less relevant	Less relevant
22	Boron	Less relevant	Less relevant
23	Chemical Constituents	Less relevant	Less relevant
24	*E. coli*	Important	Important
25	Coliform Bacteria	Relevant	Relevant
26	Fecal Coliform	Relevant	Relevant
27	Temperature	Relevant	Relevant
28	Temperature Change	Relevant	Relevant
29	Dissolved Oxygen	Relevant	Relevant
30	Aesthetic Condition	(see #9 and #12)	(see #9 and #12)
31	Color	Less relevant	Less relevant
32	Taste and Odor	Relevant	Less relevant
33	Floating Materials	Less relevant	Less relevant
34	Oil and Grease	Less relevant	Less relevant
35	Toxicity	Important	Important
36	Radioactivity	Less relevant	Less relevant
37	Aquatic Communities and Populations	Important	Important
38	Nondegradation	Important	Less relevant