ENCLOSURE 1

PROPOSED WATER QUALITY CONTROL PLAN AMENDMENTS
TOTAL MAXIMUM DAILY LOAD FOR SEDIMENT AND NUTRIENTS IN LAKE TAHOE

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The Basin Plan language below will be added to the Water Quality Control Plan for the Lahontan Region (Basin Plan), as indicated below. Final Basin Plan revisions will include appropriate changes to the "record of amendments" page and the Table of Contents, List of Figures, Index, bibliography, page numbers and headers to reflect the new material. Final locations of tables in relation to text may be changed to accommodate the Basin Plan's two-column format.

A. Lake Tahoe TMDL for Sediment and Nutrients

Insert the following text into Chapter 5 as section 5.18:

"Total Maximum Daily Load for Sediment and Nutrients, Lake Tahoe, El Dorado and Placer Counties

Introduction: Lake Tahoe is designated an Outstanding National Resource Water by the State Water Resources Control Board and the United States Environmental Protection Agency due to its extraordinary deep water transparency. However, the lake's deep water transparency has been impaired over the past four decades by increased fine sediment particle inputs and stimulated algal growth caused by elevated nitrogen and phosphorus loading.

The Regional Water Quality Control Board, Lahontan Region (Regional Board) and the Nevada Division of Environmental Protection (NDEP) developed the bi-state Lake Tahoe Total Maximum Daily Load (TMDL) to identify the pollutants responsible for deep water transparency decline, quantify the major pollutant sources, assess the lake's assimilative capacity, and develop a plan to reduce pollutant loads and restore Lake Tahoe's deep water transparency to meet the established standard.

The NDEP is responsible for implementing the TMDL on the Nevada side of the Lake Tahoe basin. Because the Regional Board's authority lies with the state of California, there will be no further mention of Nevada's role in TMDL development and implementation in this chapter. Refer to the Lake Tahoe TMDL Report and associated documentation for additional details regarding the state of Nevada's role in the Lake Tahoe TMDL effort.

Problem Statement: Continuous, long term, deep water transparency monitoring at Lake Tahoe has documented a decline of approximately 30 feet from 1968 to 2000. The deep water transparency standard of approximately 100 feet has not been achieved since the standard was adopted in 1975. Lake Tahoe TMDL research indicates light scattering by an increase in the number of fine sediment particles in suspension and light adsorption by increased algae production has caused the deep water transparency decline.

Lake Clarity Model results show that approximately two thirds of the deep water transparency condition is driven by the number of inorganic fine sediment particles less than 16 micrometers in diameter. Consequently, the Lake Tahoe TMDL effort has focused on the number of fine sediment particles as the primary pollutant causing deep water transparency decline.

Desired Conditions: The desired condition for Lake Tahoe's deep water transparency is the annual average depth recorded from 1967 to 1971, which is an annual average Secchi depth measurement of 97.4 feet (29.7 meters).

Source Assessment: The Regional Board and NDEP conducted extensive research and numeric modeling to estimate nutrient and fine sediment particle loads to Lake Tahoe. The sources contributing the largest annual pollutant loads that affect the deep water transparency are runoff from upland areas (both urbanized and undeveloped), atmospheric deposition, and stream channel erosion. Table 5.18-1 presents the pollutant load estimates for all of the identified fine sediment particle, total nitrogen, and total phosphorus sources, including groundwater and shoreline erosion inputs. Average annual nitrogen and phosphorus loads are expressed in mass units (metric tons) while average annual fine sediment particle loads are presented as the actual number of particles less than 16 micrometers in diameter.

Upland runoff: Tetra Tech, Inc. developed the Lake Tahoe Watershed Model to simulate runoff and pollutant loads from both the developed and undeveloped upland areas. Supported by a two-year Tahoe basin storm water monitoring study and validated with the long term Lake Tahoe Interagency Monitoring Program water quality dataset, the Lake Tahoe Watershed Model provides average annual, land-use based fine sediment, total nitrogen, and total phosphorus loading values. Model outputs have been divided between urban (or developed) and forest (or undeveloped) upland areas and results indicate that approximately 72 percent of the average annual fine sediment particle load, 47 percent of the average annual total phosphorus load, and 18 percent of the average annual total nitrogen load reaching Lake Tahoe is generated in the urban landscape. Undeveloped portions of the Lake Tahoe watershed are estimated to contribute approximately 9 percent, 32 percent, and 18 percent of the average annual fine sediment particle, total phosphorus, and total nitrogen loads, respectively. Details of the Lake Tahoe Watershed Model development and model results can be found in *Watershed Hydrologic Modeling and Sediment and Nutrient Loading Estimation for the Lake Tahoe Total Maximum Daily Load* (Tetra Tech 2007).

Atmospheric Deposition: The California Air Resources Board (CARB) performed the *Lake Tahoe Atmospheric Study* to quantify the contribution of dry atmospheric deposition (i.e. non-storm event deposition) to Lake Tahoe and the UC Davis Tahoe Environmental Research Center (TERC) collected wet (i.e. storm event) and dry deposition samples. The data from these two efforts were used to estimate lake-wide atmospheric deposition of nutrients and fine sediment particles. The findings show that atmospheric deposition is the second largest source of fine sediment particles entering the lake at 16 percent of the basin-wide total load and is the dominant source of total nitrogen, contributing approximately 63 percent of the basin-wide total nitrogen load.

Stream Channel Erosion: The first estimates of stream channel erosion came from the *Lake Tahoe Framework Study: Sediment Loadings and Channel Erosion* (Simon et al.

2003). To better quantify the contributions of fine sediment from stream channel erosion in all 63 tributary stream systems, the USDA-National Sediment Laboratory completed additional work reported in *Estimates of Fine Sediment Loading to Lake Tahoe from Channel and Watershed Sources* (Simon 2006). These research efforts found that while stream channel erosion is a significant source of bulk sediment to the lake, the contribution to the fine sediment particle load is relatively small, accounting for approximately four percent of the average annual fine sediment particle load. Stream channel erosion contributes approximately two percent of the average annual total phosphorus load and less than one percent of the average annual total nitrogen load.

Groundwater: Thodal (1997) published the first basin-wide evaluation of groundwater quality and quantity from 1990-1992. The United States Army Corps of Engineers completed the *Lake Tahoe Basin Framework Study Groundwater Evaluation* (USACE 2003) as an independent assessment of Thodal's (1997) analysis to provide the primary source of groundwater nutrient loading estimates for the TMDL based on existing monitoring data. Because sediment is effectively filtered through the soil matrix, groundwater transport of fine sediment particles to the lake is assumed to be zero.

Shoreline Erosion: Shoreline erosion is the smallest source of pollutants entering Lake Tahoe. The *Historic Shoreline Change at Lake Tahoe from 1938 to 1998: Implications for Water Clarity* (Adams and Minor 2002) report estimates the volume of material eroded by wave action from aerial photographs from 1938-1994 along with grab samples to analyze the nutrient content of the lost shorezone material. The supplementary report *Particle Size Distributions of Lake Tahoe Shorezone Sediment* (Adams 2004) assesses the particle size distribution of collected shoreline sediment samples. These studies indicate shoreline erosion contributes less than one percent of the basin-wide fine sediment particle and total nitrogen loads and approximately four percent of the basin-wide total phosphorus load.

Table 5.18-1. Pollutant Loading Estimates by Pollutant Source Category.

Source Category		Total Nitrogen (metric tons/year)	Total Phosphorus (metric tons/year)	Number of Fine Sediment Particles ($x10^{18}$)
Upland Runoff	**Urban (Developed)**	63	18	348
	Forest (Undeveloped)	62	12	41
Atmospheric Deposition	**(wet + dry)**	218	7	75
Stream Channel Erosion		2	<1	17
Groundwater		50	7	0
Shoreline Erosion		2	2	1
TOTAL		**397**	**46**	**481**

Loading Capacity: UC Davis developed the Lake Clarity Model to predict Secchi depth changes over time in response to fine sediment particle and nutrient load changes. The model includes hydrodynamic, plankton ecology, water quality, particle dynamics, and lake optical property sub-models. As mentioned in the problem statement, Lake Clarity Model results indicate current deep water transparency measurements are primarily driven by the concentration of suspended fine sediment particles. Based on Lake Clarity Model findings, a combined load reduction from all sources, basin-wide, of 65 percent of fine sediment particles, 35 percent of phosphorus, and 10 percent of nitrogen will be needed to meet the deep water transparency water quality standard.

TMDL and Allocations: The TMDL is the sum of wasteload allocations for point sources, load allocations for nonpoint sources, and a margin of safety. The allowable fine sediment particle and nutrient load are allocated to the major pollutant load sources: atmospheric deposition, urban (developed) upland runoff, forest (undeveloped) upland runoff, and stream channel erosion.

The basin-wide load reduction needs were determined using the Lake Clarity Model and reflect the 1967-1971 average annual Secchi depth of 29.7 meters as the loading capacity, resulting in TMDL attainment over about 65 years. Load reduction expectations for the pollutant sources are based on the Pollutant Reduction Opportunity Analysis, the Integrated Water Quality Management Strategy Project Report, and the best professional judgment of the Regional Board.

Tables 5.18-2, 5.18-3, and 5.18-4 show the respective allowable load allocations for fine sediment particles, total nitrogen, and total phosphorus by source category, listed as a percent reduction from the established baseline load. Each milestone represents five-year implementation phases. Standard attainment is expected following 65 years of implementation.

Because there are no explicit load reduction requirements assigned to groundwater and shoreline erosion sources of fine sediment particles, total nitrogen and total phosphorus, the Regional Board is implicitly allowing these sources to continue at their present baseline conditions.

Daily Load Analysis: Throughout the TMDL analysis pollutant loads have been expressed on an average annual basis. The United States Environmental Protection Agency (US EPA) requires that allowable load allocations also be expressed as daily loads.

Following EPA guidelines described in the *Options for Expressing Daily Loads in TMDLs* (US EPA 2007), the Regional Board has developed daily load estimates for the Lake Tahoe TMDL as a function of total hydraulic inflow. The Lake Tahoe Watershed Model analysis provided daily output of simulated daily loads, supplying the needed daily data sets. Tables 5.18-5, 5.18-6, and 5.18-7 list ranges of total hydraulic inputs to Lake Tahoe, (expressed in liters per second) and an associated range of pollutant concentrations. Because the majority of the pollutant loads discharged to Lake Tahoe are carried by upland runoff, the derived daily load estimates are for upland runoff and stream channel erosion sources. The daily load estimate for the atmospheric source may be estimated by dividing the average annual pollutant loading estimate by 365 days.

Although the daily load estimates for each pollutant are required by EPA, the average annual load expression remains a more useful and appropriate management tool for the Lake Tahoe basin. The deep water transparency standard is based on average annual conditions and the most meaningful measure of Lake Tahoe's transparency is generated by averaging the Secchi depth data collected during a given year. The modeling tools used to predict load reduction opportunity effectiveness as well as the lake's response are all driven by annual average conditions. An emphasis on average annual fine sediment particle and nutrient loads also addresses the hydrologic variability driven by inter-annual variability in precipitation amounts and types. Average annual estimates also provide a more consistent regulatory metric to assess whether urban implementation partners are meeting established load reduction goals. Finally, by emphasizing annual average conditions rather than instantaneous concentrations, implementers will have the incentive to focus action on the areas of greatest pollutant loads to cost effectively achieve required annual reduction requirements.

Table 5.18-2. Fine Sediment Particle Load Allocations by Pollutant Source Category.

	Baseline Load		Milestone Load Reductions												Standard Attainment
	Basin-Wide Load (Particles/yr)	% of Basin-Wide Load	5 yrs	10 yrs	15 yrs	20 yrs	25 yrs	30 yrs	35 yrs	40 yrs	45 yrs	50 yrs	55 yrs	60 yrs	65 yrs
Forest Upland	4.1E+19	9%	6%	9%	12%	12%	13%	14%	15%	16%	17%	18%	19%	20%	20%
Urban Upland	3.5E+20	72%	10%	21%	34%	38%	41%	45%	48%	52%	55%	59%	62%	66%	71%
Atmosphere	7.5E+19	16%	8%	15%	30%	32%	35%	37%	40%	42%	45%	47%	50%	52%	55%
Stream Channel	1.7E+19	3%	13%	26%	53%	56%	60%	63%	67%	70%	74%	77%	81%	85%	89%
Basin Wide Total	4.8E+20	100%	10%	19%	32%	35%	38%	42%	44%	47%	51%	55%	58%	61%	65%

Table 5.18-3. Total Nitrogen Load Allocations by Pollutant Source Category.

	Baseline Load		Milestone Load Reductions												Standard Attainment
	Basin-Wide Nitrogen Load (MT/yr)	% of Basin-Wide Load	5 yrs	10 yrs	15 yrs	20 yrs	25 yrs	30 yrs	35 yrs	40 yrs	45 yrs	50 yrs	55 yrs	60 yrs	65 yrs
Forest Upland	62	18%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Urban Upland	63	18%	8%	14%	19%	22%	25%	28%	31%	34%	37%	40%	43%	46%	50%
Atmosphere	218	63%	0%	0%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%
Stream Channel	2	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Basin Wide Total	345	100%	2%	3%	4%	5%	6%	6%	7%	7%	8%	8%	9%	9%	10%

Table 5.18-4. Total Phosphorus Load Allocations by Pollutant Source Category.

	Baseline Load		Milestone Load Reductions												Standard Attainment
	Basin-Wide Phosphorus Load (MT/yr)	% of Basin-Wide Load	5 yrs	10 yrs	15 yrs	20 yrs	25 yrs	30 yrs	35 yrs	40 yrs	45 yrs	50 yrs	55 yrs	60 yrs	65 yrs
Forest Upland	12	32%	1%	1%	1%	2%	1%	1%	2%	2%	2%	2%	2%	3%	3%
Urban Upland	18	47%	7%	14%	21%	23%	26%	28%	31%	33%	36%	38%	41%	44%	46%
Atmosphere	7	18%	9%	17%	33%	36%	39%	42%	45%	48%	51%	53%	56%	58%	61%
Stream Channel	1	3%	8%	15%	30%	32%	34%	36%	38%	40%	42%	44%	46%	48%	51%
Basin Wide Total	38	100%	5%	10%	17%	19%	22%	24%	26%	28%	30%	32%	33%	34%	35%

Table 5.18-5. Fine Sediment Particle Daily Loading Estimate

Flow Range	Associated Flow (Liters/Second)			Pollutant Concentration (Number of Particles/L)		
Percentile	Mean	Min	Max	Mean	Min	Max
0-10	1375.7	1011.6	1588.1	6.6E+07	2.1E+07	5.8E+08
10-20	1763.1	1588.7	1950.2	1.0E+08	1.7E+07	9.4E+08
20-30	2211.6	1950.5	2522.4	2.1E+08	1.9E+07	1.1E+09
30-40	2858.7	2523.8	3245.2	3.1E+08	3.1E+07	1.5E+09
40-50	3853.9	3246.4	4585.4	3.8E+08	3.1E+07	1.9E+09
50-60	5541.2	4591.3	6688.8	4.7E+08	4.2E+07	2.7E+09
60-70	8640.3	6696.0	11006.6	5.7E+08	5.3E+07	4.6E+09
70-80	14260.5	11022.9	18204.7	6.0E+08	7.2E+07	2.6E+09
80-90	24350.5	18209.9	34290.9	5.9E+08	1.2E+08	2.6E+09
90-100	60418.5	34368.2	165776.2	7.9E+08	2.7E+08	3.5E+09

Table 5.18-6. Total Phosphorus Daily Loading Estimate

Flow Range	Associated Flow (Liters/Second)			Pollutant Concentration (mg/L)		
Percentile	Mean	Min	Max	Mean	Min	Max
0-10	1375.7	1011.6	1588.1	0.041	0.031	0.097
10-20	1763.1	1588.7	1950.2	0.044	0.027	0.133
20-30	2211.6	1950.5	2522.4	0.055	0.019	0.170
30-40	2858.7	2523.8	3245.2	0.064	0.023	0.214
40-50	3853.9	3246.4	4585.4	0.069	0.022	0.224
50-60	5541.2	4591.3	6688.8	0.075	0.025	0.229
60-70	8640.3	6696.0	11006.6	0.078	0.029	0.320
70-80	14260.5	11022.9	18204.7	0.073	0.034	0.202
80-90	24350.5	18209.9	34290.9	0.067	0.035	0.208
90-100	60418.5	34368.2	165776.2	0.062	0.036	0.185

Table 5.18-7. Total Nitrogen Daily Loading Estimate

Flow Range	Associated Flow (Liters/second)			Pollutant Concentration (mg/L)		
Percentile	Mean	Min	Max	Mean	Min	Max
0-10	1375.7	1011.6	1588.1	0.10	0.06	0.70
10-20	1763.1	1588.7	1950.2	0.13	0.05	1.06
20-30	2211.6	1950.5	2522.4	0.23	0.05	1.36
30-40	2858.7	2523.8	3245.2	0.32	0.05	1.58
40-50	3853.9	3246.4	4585.4	0.38	0.06	1.64
50-60	5541.2	4591.3	6688.8	0.44	0.07	1.80
60-70	8640.3	6696.0	11006.6	0.43	0.07	1.81
70-80	14260.5	11022.9	18204.7	0.36	0.08	1.85
80-90	24350.5	18209.9	34290.9	0.28	0.08	1.81
90-100	60418.5	34368.2	165776.2	0.23	0.09	1.55

Margin of Safety: A Margin of Safety is included in a TMDL to account for any lack of knowledge and uncertainties inherent to the TMDL development process. Uncertainty is an expression commonly used to evaluate the confidence associated with sets of data, approaches for data analysis, and resulting interpretations. Determining uncertainty is notably difficult in studies of complex ecosystems when data are extrapolated to larger scales or when project specific data do not exist and best professional judgment, based on findings from other systems, must be employed. The Regional Board addressed uncertainty within the Lake Tahoe TMDL by using:

1. A comprehensive science program and science-based analysis developed to (a) enhance monitoring to fill key knowledge gaps and (b) develop pollutant loading and lake response modeling tools specifically for Lake Tahoe to help reduce estimate uncertainty.

2. More than 150 conservative, implicit assumptions in the loading, load reduction, lake response, and load allocation analyses when necessary to address modeling uncertainty or limited input data.

Future Growth Potential: The potential for future growth in the Tahoe basin remains limited. As of 2009, a total of 4,841 parcels in the Tahoe basin were undeveloped and may become eligible for future development. Assuming that the 4,841 undeveloped lots have an average size of 0.25 acres and that each lot will be developed, these parcels would comprise 1210 total acres of additional developed land. Coverage on the highest capability land is limited to 30 percent (TRPA 1987, Section 20.3.A). This means that a maximum of 373 acres would be made impervious. Active conservation efforts, such as the California Tahoe Conservancy urban lot program and the Forest Service Burton-Santini acquisition program are expected to prevent a number of the lots in question from being developed by converting the private lots to public open space. Retiring these lots from development potential reduces the potential total new coverage.

Analysis conducted during Lake Tahoe TMDL development indicates that a complete, worst-case build-out scenario of remaining parcels could potentially increase fine sediment particle loading by up to two percent. Given the inherent uncertainty in the watershed modeling analysis and the conservative assumptions of the worst-case build out scenario, the potential pollutant load increase associated with future development will likely be less than the worst-case estimate.

Any activity, such as new development, re-development, or other land disturbing management actions, has the potential to increase localized (i.e. on a parcel scale) pollutant loading. To ensure that future growth does not increase pollutant loads, the City of South Lake Tahoe, El Dorado County, and Placer County must reduce fine sediment particle, total nitrogen, and total phosphorus loads as described in Tables 5.18-2, 5.18-3, and 5.18-4 from the established baseline condition. A municipality must annually demonstrate on a catchment (i.e. sub-watershed) basis that no increased loading in fine sediment particle, total nitrogen, and total phosphorus will result from any land disturbing activity permitted in the catchment. Efforts to eliminate the increased loads from these land disturbing activities will not be counted towards the annual load reduction requirements.

Implementation Plan

The Lake Tahoe TMDL Implementation Plan is a summary of programs the various funding, regulatory, and implementing agencies may take to reduce fine sediment particle, phosphorus, and nitrogen loads to Lake Tahoe to meet established load reduction milestones.

The Regional Board evaluated load reduction opportunities for all pollutant sources as part of the Pollutant Reduction Opportunity Report (Lahontan and NDEP 2008a) and found that the most cost effective and efficient load reduction options for the forested upland, stream channel erosion, and atmospheric deposition sources are consistent with existing programs. The Pollutant Reduction Opportunity Report concluded that continued implementation of measures to address disturbances in undeveloped areas, control eroding stream banks, and reduce atmospheric deposition are critical to meeting required load reductions. Therefore, a regulatory policy that maintains the current implementation approaches for these source categories is appropriate to meet TMDL load allocations.

The most significant and currently quantifiable load reduction opportunities are within the urban uplands source. Because urbanized areas discharge the overwhelming bulk of the average annual fine sediment particle load reaching Lake Tahoe, much of the load reductions must be accomplished from this source. Even if it were feasible to completely eliminate the fine sediment particle load from the other three sources, the transparency standard would never be met.

Consequently, the Lake Tahoe TMDL implementation plan emphasizes actions to reduce fine sediment particle and associated nutrient loading from urban stormwater runoff. Due to the magnitude of both the pollutant source and related control opportunities, the Regional Board has devoted time and resources to develop detailed tools and protocols to quantify, track, and account for pollutant loads associated with urban runoff.

The following sections briefly describe the implementation approaches for each of the four major pollutant source categories. Due to the relative magnitude of the pollutant source and the importance of reducing loads from the developed upland area, the most detailed policy and regulatory changes are for managing urban stormwater.

The tools for estimating the expected average annual fine sediment particle load reduction associated with actions to address stream channel erosion, atmospheric deposition, and forest upland sources are less advanced than the methods to estimate urban upland control measure effectiveness. Acknowledging the science that indicates that stream channel erosion, atmospheric deposition, and forest upland sources contribute less pollutants overall (especially fine sediment particles) to Lake Tahoe, coupled with the high cost of developing estimation and tracking tools, the Regional Board has not developed detailed load reduction estimation, accounting, and tracking procedures for these sources. The Regional Board will, however, require responsible entities to report on load reduction activities to ensure ongoing implementation of forest, stream channel, and atmospheric load reduction efforts.

Urban Runoff: Through stormwater NPDES permits that regulate runoff discharges from the City of South Lake Tahoe, El Dorado and Placer Counties, and the California Department of Transportation, the Regional Board will specify load allocations and track compliance with required load reduction milestones.

The Lake Tahoe TMDL expresses load allocations for the urban upland source as percent reductions from a basin-wide baseline load. The baseline basin-wide pollutant loads for the TMDL reflect conditions as of water year 2003/2004 (October 1, 2003 – September 30, 2004). To translate basin-wide urban runoff load allocations into jurisdiction-specific load allocations for municipalities and state highway departments, the Regional Board will require those agencies to conduct a jurisdiction-scale baseline load analysis as the first step in the implementation process. For each five year milestone, jurisdiction-specific load reduction requirements will be calculated by multiplying the urban uplands basin-wide load reduction percentage by each jurisdiction’s individual baseline load.

To ensure comparability between the basin-wide baseline load estimates and the jurisdiction-scale baseline load estimates for urban runoff, municipalities and the state highway department must use a set of standardized baseline condition values that are consistent with those used to estimate the 2003/2004 basin-wide pollutant loads. Specifically, baseline load estimate calculations must reflect infrastructure, land development conditions, and operations and maintenance practices representative of those implemented in October 2004.

The Lake Clarity Crediting Program provides a system of tools and methods to allow urban jurisdictions to link projects, programs, and operations and maintenance activities to estimated pollutant load reductions. In addition to providing a consistent method to track compliance with stormwater regulatory measures, the Lake Clarity Crediting

Program provides specific technical guidance for calculating jurisdiction-scale baseline load estimates.

Forest Uplands: Forest uplands comprise approximately 80 percent of the land area within the Lake Tahoe basin. Fine sediment particles from this source category most often originate from discrete disturbed areas such as unpaved roads, ski runs, and recreation areas in forested uplands.

The United States Forest Service Lake Tahoe Basin Management Unit (LTBMU), California Department of Parks and Recreation, California Tahoe Conservancy (CTC), and other public land managers implement watershed management programs on their lands. As part of these watershed management programs, land managers maintain existing facilities (including unpaved roads and trails), restore disturbed lands, implement and maintain stormwater treatment facilities for all paved/impervious surfaces, prevent pollutant loading from fuels management work, and take other actions to reduce fine sediment particle, total nitrogen, and total phosphorus loads. These agencies are responsible for implementing forest fuels reduction projects to reduce the threat of wildfire in the Lake Tahoe basin. These projects must include best management practices and appropriate monitoring to ensure fuels reduction efforts do not increase fine sediment particle and nutrient loads and must comply with any applicable state or federal permits regulating stormwater discharges from roads created for silvicultural activities.

The California Department of Forestry and Fire Protection is responsible for regulating forest practices on private forest lands and works directly with Regional Board staff to minimize the water quality impacts associated with vegetation management. The Emergency California-Nevada Tahoe Basin Fire Commission Report (May 2008) provides guidance to the Regional Board and the Tahoe Regional Planning Agency to facilitate projects that address Lake Tahoe's wildfire vulnerability.

The Ninth Circuit federal Court of Appeals has found that "stormwater runoff from logging roads associated with silviculture that is collected in a system of ditches, culverts, and channels and is then discharged into streams and rivers" is not exempt from the National Pollutant Discharge Elimination System permitting process because it is considered a point source discharge of stormwater "associated with industrial activity" (Northwest Environmental Defense Center v. Brown, 2010 WL 3222105 (2010)). If, in conformance with this decision, the Water Board reclassifies a portion of the forest load allocation as a waste load allocation, such a regulatory shift would not change the implementation approach.

The forest upland load reductions are expected to be accomplished through continued implementation of existing watershed management programs described above. The Regional Board will require forest management agencies to track and report load increases and load reduction activities to assess whether required basin-wide forest load reductions are occurring. Some activities, including fuels reduction and associated administrative road construction, have the potential to increase pollutant loading at a project scale. Forest management agencies responsible for these actions must demonstrate that other project activities, including restoration efforts and temporary and/or permanent best management practices, will be implemented to compensate for any anticipated project-scale loading increase. These agencies must ensure that no increased loading occurs on a sub-watershed or catchment scale and that the basin-wide fine sediment particle, total nitrogen, and total phosphorus load from the forest uplands is reduced as required by Tables 5.18-2, 5.18-3, and 5.18-4.

Stream Channel Erosion: Fine sediment from stream channel erosion represents four percent of the total final sediment loading to Lake Tahoe. Less than three percent of the annual total nitrogen and total phosphorus loading to the lake comes from stream channel erosion. The Upper Truckee River, Blackwood Creek, and Ward Creek contribute 96 percent of the basin-wide total for fine sediment from stream channel erosion. The LTBMU and CTC are implementing SEZ restoration projects on Blackwood Creek and Ward Creek. The CTC, City of South Lake Tahoe, CA State Parks, and the LTBMU have plans to restore reaches of the Upper Truckee River. Pollutant control opportunities for these waterways include site-specific stream bank stabilization and ecosystem restoration to prevent pollutant loading to Lake Tahoe from stream channels. These projects are expected to achieve the needed pollutant load reductions from this source category.

Atmospheric Deposition: Atmospheric deposition contributes the majority of the nitrogen and approximately 16 percent of the fine sediment particle load that reaches the lake. The TMDL implementation plan emphasizes reducing atmospheric deposition of fine sediment particles and associated phosphorus by addressing dust sources from paved and unpaved roadways and other unpaved areas within the developed and undeveloped landscape. TRPA programs for reducing emissions from residential wood burning are also expected to provide some particle reduction from this source.

Control measures for reducing dust in developed areas (such as street sweeping, and construction site good housekeeping practices) are the same as measures taken to reduce fine sediment particles in urban stormwater runoff. Similarly, some actions taken to control runoff from unpaved roadways (such as armoring unpaved roads with gravel or asphalt) within the forested uplands may reduce dust from these areas. Although allocations for atmospheric pollutant loads are independent of forest and urban upland allocations, load reduction actions taken to control surface runoff pollutants are expected to achieve the required atmospheric fine sediment particle and phosphorus load reductions. Other than supporting research to confirm that actions taken to reduce fine sediment particles in runoff effectively reduce atmospheric pollutant loads, the Regional Board does not expect to track and account for atmospheric load reductions on a jurisdiction scale.

The atmospheric deposition of total nitrogen must be reduced by two percent over 65 years to achieve the deep water transparency standard. Mobile sources (vehicle emissions) are the main source of the atmospheric nitrogen load. The Tahoe Regional Planning Agency's air quality and regional transportation plans, which contain requirements to reduce vehicle emissions and comply with health-based air quality standards, are being relied on and are expected to attain the needed two percent nitrogen reduction within 65 years.

Future Needs: Research and monitoring efforts are underway to improve scientific understanding of pollutant loading and load reduction options. Specific projects include an effort to better quantify water quality benefits beyond reducing bed and channel erosion associated with stream restoration, a project to provide more quantitative information on the effects of various forest management actions and association mitigation measures, and ongoing atmospheric deposition monitoring. These projects and others will help determine whether more specific load and load reduction estimation efforts will be needed in the future to better quantify the benefits of air quality, stream channel, and forest management programs.

Schedule of TMDL Attainment, Data Review, and Revision: The estimated timeframe to achieve the TMDL required load reductions and meet the numeric target and is 65 years. The Lake Clarity Model showed that basin-wide loads of fine sediment particles, nitrogen, and phosphorus must be reduced by 65 percent, 10 percent, and 35 percent, respectively, to attain the numeric target of 97.4 feet average annual Secchi depth. Since the greatest reductions must occur in fine sediment particle loads, an implementation plan that achieves, on average over the entire implementation plan time frame, a one percent load reduction of fine sediment particles per year is reasonable. Though the first 20-year implementation phase is expected to achieve roughly one-half of the needed 65 percent total load reduction in fine sediment particle load, this load reduction would only improve the transparency by about ten feet, which is about one-third of the progress to the numeric target. Each successive 20-year implementation phase is expected to achieve roughly ten more feet of transparency improvement towards the numeric target, adding up to about 65 years for complete implementation to achieve the numeric target. The 65-year schedule also assumes that the rate of achieving load reductions is expected to decrease over time after the first 20-year phase as load reduction opportunities become increasingly scarce and likely more difficult to attain.

The TMDL attainment estimate considers the temporal disparities between pollutant release, sediment and nutrient delivery, and the time needed for the target indicators to respond to decreased source loading. Funding constraints may affect the pace of certain implementation actions. The Regional Board expects all implementing agencies to pursue both self-funded and external funding sources. Should funding and implementation constraints impact the ability to meet load reduction milestones the Regional Board may consider amending the implementation and load reduction schedules.

Progress toward meeting the targets will be evaluated by the Regional Board in periodic milestone reports. The implementation schedule for the Lake Tahoe TMDL to make needed changes in urban stormwater policy and implementation actions is shown in Table 5.18-8.

Table 5.18-8. Lake Tahoe TMDL Urban Upland Implementation/Reporting Schedule

Action	Schedule***	Responsible Party
Submit Pollutant Load Reduction Plans or equivalent to Regional Board describing how 5-year load reduction requirements will be met	The first plan must be submitted no later than two years after TMDL approval*. Future plans must be submitted no less than six months prior to the expiration of the applicable municipal NPDES stormwater permit	El Dorado County Placer County California Department of Transportation City of South Lake Tahoe
Submit jurisdiction-specific 2004 baseline load estimates for fine sediment particles, phosphorus, and nitrogen to the Regional Board for review/approval**	No later than two years after TMDL approval*	
Reduce and maintain pollutant loads of fine sediment particles, total phosphorus, and total nitrogen as specified in Tables 5.18-2, 5.18-3, and 5.18-4	Achieve the percent reduction specified no later than each respective 5-year milestone following TMDL approval*	

*TMDL approval is the date the USEPA approves the Lake Tahoe TMDL.

**The baseline load estimates must be calculated using either the Pollutant Load Reduction Model, or an equivalent method acceptable to the Regional Board that uses a continuous hydrologic simulation process (or other modeling method that demonstrably produces similar results), incorporates stormwater discharge characteristics from established land uses, includes the effectiveness of stormwater treatment best management practices, and accounts for the changes in roadway and stormwater treatment facility condition.

***These due dates are not imposed by virtue of the Basin Plan. The due dates will be established in Regional Board orders consistent with the schedule noted herein.

The Regional Board will annually track actions taken to reduce loads from the major pollutant sources: urban uplands, forest uplands, atmospheric deposition, and stream channel erosion. If agencies responsible for implementing programs to reduce pollutant loads from the atmospheric, forest, and stream channel erosion sources fail to take needed actions to reduce loads from those three sources in accordance with the load allocation schedule, then the Regional Board will evaluate the need for more targeted regulatory action.

Adaptive Management: The Regional Board is committed to operating a TMDL Management System throughout the implementation timeframe of the TMDL. The Management System framework will support regular assessments of relevant research and monitoring findings. Based on Management System findings, the Regional Board may consider reopening the TMDL to adjust load reduction milestones and/or the TMDL implementation approach if needed. Following the first fifteen year implementation period of this TMDL, the Regional Board will evaluate the status and trend of the lake's deep water transparency relative to the load reductions achieved. The Regional Board, in partnership with implementation, funding, and regulatory stakeholders, anticipates conducting this adaptive management process as needed to ensure the deep water transparency standard will be met by year 65.

The Regional Board evaluated the anticipated changes in temperature and precipitation associated with global climate change. An extensive review of available literature and climate change model results concluded that by the year 2050, Lake Tahoe basin temperatures may increase by up to two degrees Celsius and average annual precipitation may decrease by approximately ten percent. This shift may influence local stormwater hydrology and stormwater dischargers may need to adjust future stormwater practices to ensure management measures are sufficient to meet the load reduction requirements described in Tables 5.18-2, 5.18-3, and 5.18-4.

Monitoring Plan: The Regional Board expects funding, implementing, and regulatory agencies to assist in developing a comprehensive TMDL monitoring plan within the first two years following TMDL adoption by USEPA. Once developed, the monitoring program will assess progress of TMDL implementation and provide a basis for reviewing, evaluating, and revising TMDL implementation actions as needed. The following sections describe both ongoing and anticipated monitoring activities for each of the major pollutant sources and tributary and in-lake monitoring efforts.

Urban Upland

In 2007 the Tahoe Science Consortium began planning a Lake Tahoe Regional Stormwater Monitoring Program (RSWMP) to better understand local urban runoff conditions, evaluate the impact of erosion control and stormwater treatment efforts, and coordinate and consolidate an urban stormwater monitoring work. The RSWMP has been organized in three phases. The first phase, completed in 2008, focused on collaboratively framing the elements of a comprehensive stormwater monitoring program. The framework includes relevant agency, implementer and science considerations, an outline of the required elements for a monitoring program, the design for structural (administrative) elements, and goals and objectives for a sustainable program. Identified monitoring goals include (1) monitoring to quantify load reduction progress at a subwatershed scale; (2) data collection to support improvements in best management practice design, operation, and maintenance; and (3) efforts to identify and quantify specific sources of urban stormwater pollutants to refine load reduction model input parameters.

The second phase of RSWMP will build on the conceptual framework by designing a specific monitoring program that will include: a quality assurance project plan; specific monitoring goals and data quality objectives; monitoring design specifications; detailed sampling and analysis plan; stormwater database development, data management and analysis details; organizational structure of RSWMP; operational costs; funding arrangements; agency roles and responsibilities; and internal and external peer-review processes.

The last RSWMP phase will be the funding and implementation of the actual stormwater monitoring program. This phase includes selecting monitoring sites and equipment, and developing the detailed processes and protocols for reporting monitoring results. Since the RSWMP will largely provide information for the local municipal jurisdictions and state transportation agencies to meet regulatory or other monitoring needs, RSWMP participation or implementation of an equivalent monitoring program is expected to be a condition of NPDES municipal stormwater permits.

Atmospheric Deposition

UC Davis scientists regularly measure atmospheric deposition of nitrogen (nitrate, ammonium and total Kjeldahl nitrogen) and phosphorus (soluble reactive phosphorus, total dissolved phosphorus and total phosphorus). The atmospheric deposition monitoring is expected to continue and several research studies, focused on fine sediment particles, are anticipated to be completed by 2011. The results from these studies will fill knowledge and data gaps in fine sediment particle deposition on Lake Tahoe, including better estimates of loading from atmospheric deposition. To assess project effectiveness for reduction of fine sediment particles by individual atmospheric source, targeted air quality control monitoring should be conducted in association with selected project implementation.

Forest Upland

The stream monitoring network will play a key role in evaluating load reduction from these land-uses, while management practice effectiveness will be assessed on a project basis. Monitoring is needed to ensure forest management actions, including fuels reduction efforts, are evaluated at either the project and/or sub-basin level to determine whether the measures are reducing fine sediment particle and nutrient loading.

Responsible parties will be required to document and report previous year activities that may have increased or reduced pollutant loads and describe how the reported loading assessment was determined. Forest management agencies will also be required to annually submit plans for next year’s management activities that are expected to influence fine sediment particle, total nitrogen, and total phosphorus loading rates. The anticipated activities are expected to include, but not be limited to; fuel reduction projects, BMPs on unpaved roads and trails, ski area revegetation, routine BMP maintenance, and effective road decommissioning.

Stream Channel Erosion

Similar to the forest upland monitoring approach, the relative impact of restoration activities will be evaluated on a project basis. Responsible agencies are encouraged to use permanent survey markers and monitor changes in stream cross-sections in relation to erosion or aggregation of sediment for stream reaches of interest.

Research projects have been funded to assess the benefits stream restoration project components that reconnect the stream to its natural floodplain in reducing fine sediment particles and nutrients. The Water Board anticipates that these efforts will provide consistent protocols useful for quantifying the load reductions from certain streams under specified flow conditions.

Tributary Monitoring

Stream water quality monitoring and suspended sediment load calculations are regularly done as part of the Lake Tahoe Interagency Monitoring Program (LTIMP). LTIMP is a cooperative program including both state and federal partners and is operationally managed by the United States Geological Survey, UC Davis – Tahoe Environmental Research Center, and the Tahoe Regional Planning Agency. LTIMP was formed in 1978 and one of its primary objectives is to monitor discharge, nutrient load, and sediment loads from representative streams that flow into Lake Tahoe. Cumulative flow from these monitored streams comprises about 50 percent of the total discharge from all tributaries. Each stream is monitored on 30 - 40 dates each year and sampling is largely based on hydrologic events. Nitrogen and phosphorus loading calculations are performed using the LTIMP flow and nutrient concentration database. This data is stored on the USGS website at http://wdr.water.usgs.gov/.

Lake Monitoring:

Lake sampling is done routinely at two permanent stations. At the Index Station (location of the Lake Tahoe Profile or LTP), samples are collected between 0 - 105 meters in the water column at 13 discrete depths. This station is the basis of the > 40 year continuous data set and monitoring is done on a schedule of 25-30 times per year. The Deep Water Station has been operational since 1980 and has been valuable for comparison with the Index Station. At this location, samples are taken down a vertical profile to the bottom of the lake (0 - 450 meters) at 11 discrete depths on the order of once per month. Sampling along the complete vertical depth profile allows for the analysis of whole-lake changes. In addition, the lake monitoring program also includes phytoplankton and zooplankton taxonomy and enumeration, algal growth bioassays (using natural populations), and periphyton (attached) algae. Much of this monitoring is summarized in a report entitled, *Tahoe: State of the Lake Report* published by UC Davis (UC Davis - TERC 2009).

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B. Proposed Changes to Existing Basin Plan Language

The following changes are to be made in to the sections designated in the "Location" column. Deletions are shown in ~~strikethrough~~, additions underlined.

Location	Text
pg. 3-9, column 1, pgph.1	**Transparency:** For Lake Tahoe, the annual average deep water transparency as measured by the Secchi ~~secchi~~ disk ~~transparency~~ shall not be decreased below 29.7 meters, the levels recorded in 1967-71. ~~based on a statistical comparison of seasonal and annual mean values.~~ ~~*The "1967-71 levels" are reported in the annual summary reports of the "California-Nevada-Federal Joint Water Quality Investigation of Lake Tahoe" published by the California Department of Water Resources.*~~
pg. 4-4, column 1, pgph. 3	Some of the water quality control programs for the Lahontan Region do have specific compliance deadlines, which are discussed later in this Basin Plan. ~~For example, the control measures for the Lake Tahoe Basin which are discussed in Chapter 5 are to be implemented over a 20-year period (through 2007) to ensure attainment of objectives.~~ For example, the Lake Tahoe TMDL includes 5-year load reduction requirements for the four major pollutant source categories.
pg. 4.3-1, column 2, pgph. 3	Nutrients and fine sediment particles from stormwater are considered a major source of pollution to Lake Tahoe. Fine sediment particles are defined as inorganic particles less than 16 micrometers in diameter. The Lake Tahoe TMDL has identified urban stormwater runoff as the largest source of these pollutants and the TMDL implementation plan emphasizes urban runoff treatment. ~~Deicing compounds are of special concern in the Lake Tahoe/Truckee region because the death of roadside vegetation due to salt impacts can increase erosion, and thus sediment and nutrient loading, to sensitive surface waters. Few quantitative data are available on concentrations of heavy metals and other toxic pollutants in stormwater in these areas.~~
pg. 4.3-3, column 1, pgph. 4	"Areawide treatment systems" for municipal stormwater which involve combinations of infiltration, retention and detention basins, and natural and artificial wetlands, are being proposed in the Lake Tahoe Basin (see Chapter 5). ~~Their ability to meet effluent limitations has not yet been demonstrated.~~ In some states, wastewater treatment plants similar to those used for domestic wastewater have been constructed to treat stormwater.
pg. 4.3-3, column 1, pgph. 5	***Use of Wetlands for Stormwater Treatment*** Natural and artificial wetlands are employed elsewhere in the U.S. for treatment of municipal wastewater and acid mine drainage. Large scale wetland treatment systems for urban runoff are in service in ~~coastal areas of~~ California. The use of "Stream Environment Zones" for removal of fine sediment particles and nutrients from stormwater in the Lake Tahoe Basin is an important part of that area's water quality program (see Chapter 5). In general, wetlands slow the flow of stormwater, allowing time for settling out of fine sediment particles, adsorption of dissolved constituents onto soils, and uptake of nutrients by soil microorganisms and rooted vegetation (see "Wetlands Protection" in Section 4.9 of this Chapter for a more detailed discussion of wetland functions)

pg. 4.3-4, column 2, pgph. 1	Because of the extraordinary resource values of Lake Tahoe, and the threat to its water quality posed by stormwater discharges containing sediment and nutrients, the State Board determined in 1980 that municipal stormwater was a significant source of pollutants and directed that stormwater NPDES permits should be issued to local governments. Municipal stormwater NPDES permits have been issued to the portions of Placer and El Dorado Counties within the Lake Tahoe Basin, and to the City of South Lake Tahoe, even though their populations are less than 100,000. ~~A special set of surface runoff effluent limitations applies to stormwater discharges in the Lake Tahoe Basin (see Chapter 5).~~
pg. 4.3-7, column1, pgph. 5	~~Only one set of general stormwater effluent limitations has been adopted in the Lahontan Region: the "Tahoe Regional Runoff Guidelines" (see Chapter 5). As more information becomes available about surface runoff quality in different areas, the Regional Board should consider adopting other effluent limitations for specific areas or types of stormwater discharges.~~
pg. 4.3-11, column1, pgph.2	The Tahoe Regional Planning Agency has recognized the importance of ~~windblown sediment~~ airborne fine sediment particulates in nutrient loading to Lake Tahoe, and has called for increases in the rate of BMP retrofit, and additional controls on offroad vehicle use, to reduce wind erosion and aerial deposition from disturbed areas.
pg. 4.8-4, column 1, pgph. 2	~~At least three alternate deicers have been explored: calcium magnesium acetate, potassium acetate, and magnesium chloride with corrosion inhibitors. These products have shown some promise, but further study is required. The cost to switch to an alternate deicer will be significant. The road departments are unwilling to make the switch unless an alternate deicer is demonstrably better environmentally, will not require too much adjustment on the part of the maintenance crews and equipment, and will actually do an effective and predictable job when applied.~~
pg. 4.8-4, column 2, pgph. 3	~~In the Lake Tahoe Basin, all governmental agencies assigned to maintain roads are required to bring all roads in the Lake Tahoe Basin into compliance with current "208" standards. within a specified time schedule. That is, all existing~~ Existing facilities ~~must~~ should be retrofitted to treat ~~handle the~~ stormwater runoff ~~from the 20-year, 1-hour storm,~~ and to restabilize all eroding slopes in a manner consistent with the pollutant load reduction requirements described by the Lake Tahoe TMDL. ~~The twenty-year time frame for this compliance process ends in 2008.~~
pg. 4.9-27, column 1, pgph. 1	Examples of both of these categories of restoration are found in the Lahontan Region. To prevent pollutant loading into Lake Tahoe, waste discharge prohibitions have been implemented and many millions of dollars have been spent on slope stabilization, revegetation and other remedial erosion control measures (see "Stormwater Runoff, Erosion, and Sedimentation" section in this Chapter). The clarity, nutrient levels and both phytoplankton and periphyton productivity in Lake Tahoe are carefully monitored. Transport of fine sediment particles to the lake, identified by the Lake Tahoe TMDL as a primary cause of deep water transparency decline, has been monitored since 2005 and will continue to be assessed. To prevent nutrient loading into Eagle Lake (Lassen County), waste discharge prohibitions are also implemented. The prolific growth of aquatic weeds in Twin Lakes of the Mammoth Lakes Basin often results in a weed harvest.

pg. 4.9-32, column 1, pgph. 4	Atmospheric deposition is considered a significant part of the nitrogen budget of Lake Tahoe. Precipitation chemistry in the Lake Tahoe Basin has been monitored on an ongoing basis since the early 1980s. Direct ~~wet and dry~~ deposition on the Lake has ~~have~~ also been studied by the University of California Tahoe Environmental Research Center and the California Air Resources Board (CARB). Studies by these groups, as reported in the Lake Tahoe TMDL Technical Report, indicate that 69 percent of nitrogen deposition on Lake Tahoe originates locally, with the remaining 31 percent coming from regional sources. Combined, these sources annually contribute an estimated 218 metric tons of total nitrogen to Lake Tahoe. ~~Research Group~~. ~~The relative importance of long distance transportation of nitrogen oxides from outside of the Lake Tahoe Basin and of nitrogen oxide from vehicle and space heater emissions within the Basin has not been conclusively established.~~ Atmospheric deposition is also a key source of fine sediment particle deposition to the lake. The Lake Tahoe TMDL estimates that approximately 16 percent of Lake Tahoe's total fine sediment particle load is from atmospheric deposition. Over 70 percent of this atmospheric particulate load is from in-basin sources. The primary in-basin source of fine sediment particles is dust from paved and unpaved roads and construction sites, and other disturbed land.
pg. 4.9-33, column1, pgph. 1	~~In order to reduce transport of airborne nutrients from upwind areas, the 208 Plan commits TRPA to work with California legislators "to encourage additional research into the generation and transport of nitrogen compounds, to require regular reports on the subject from the CARB, and to provide incentives or disincentives to control known sources of NO_X emissions upwind from the Tahoe Region. TRPA shall actively participate in the review and comment on draft air quality control plans from upwind areas to encourage additional NO_X control measures." TRPA is also committed to further monitoring of the nature and extent of transport of airborne nutrients into the Lake Tahoe region.~~
pg. 4.11-5, column 1, pgph. 3	In the Lake Tahoe Basin, Regional Board staff may apply ~~the local~~ stormwater effluent limitations to nutrient discharges from dredged material dewatering and settling areas (see "Stormwater" section of this Chapter; see also Chapter 5). In other watersheds, effluent limitations for such operations should reflect the characteristics of the slurry, and receiving water standards. In all cases, the Regional Board may require additional site-specific analysis of the material proposed to be dredged (e.g., analysis of the proportion of colloidal material or silt to sand) and may require additional mitigation as necessary.

pg. 5-1, column 1, pgph. 1	Since the 1960s, Lake Tahoe has become impaired by declining deep water transparency and increasing phytoplankton productivity due to increased fine sediment particles and nutrient loading attributable to human activities (Figures 5-1 and 5-2). Fine sediment particles are defined as sediment particles less than 16 microns in diameter. Further increases in algal growth could change the clear blue color of the Lake. Algal growth is fed by nitrogen and phosphorus. Phosphorus sorbed to fine sediment particles is responsible for the majority of Lake Tahoe's phosphorus load. Under federal and state antidegradation regulations and guidelines, no further degradation of Lake Tahoe can be permitted. Attainment of ~~clarity~~ deep water transparency and productivity standards requires control of nutrient and fine sediment particle loading, which in turn requires (1) export of domestic wastewater and solid waste from the Lake Tahoe watershed, (2) restrictions on new development and land disturbance, and (3) remediation of a variety of point and nonpoint source problems related to past human activities in the Tahoe Basin. This Chapter summarizes a variety of control measures for the protection and enhancement of Lake Tahoe which in many cases are more stringent than those applicable elsewhere in the Lahontan Region.
pg. 5-2, column 1, pgph. 1	Development practices and ongoing soil disturbing land uses that ~~which~~ may have little impact elsewhere can cause severe erosion in the Tahoe Basin, increasing fine sediment particle, nitrogen and phosphorus ~~and nutrient~~ loads to Lake Tahoe. ~~Relatively small nutrient loadings can seriously affect Lake Tahoe's water quality.~~ The level of algal growth in the lake is limited by the availability of nutrients; the concentration of nutrients in the lake at present is extremely low. The primary source of additional ~~nutrients~~ phosphorus is erosion resulting from land development and ongoing soil disturbance associated with land management practices. Lake Tahoe has historically been considered nitrogen limited. Recent bioassays indicate that phosphorus is also becoming limiting in some situations. It is important to control **all** controllable sources of both nitrogen and phosphorus. Development and ongoing soil disturbances damage vegetation and soils, and creates impervious surface coverage which interferes with natural nutrient and fine sediment particle removal mechanisms. Other sources of nutrients include fertilizers, sewer exfiltration and sewage spills, and leachate from abandoned septic systems, and atmospheric deposition. Fine sediment particles are independently responsible for approximately two thirds of the lake's deep water transparency loss. The mechanism for transparency loss from fine sediment particles is the scattering of light in the water column. This contrasts with deep water transparency loss due to light absorption caused by enhanced phytoplankton productivity.
pg. 5-2, column 1, pgph. 2	Phytoplankton productivity in Lake Tahoe increased more than ~~200~~ 420 percent, and deep water transparency ~~clarity~~ decreased by ~~22~~ 31 percent, between 1968 and ~~1991~~ 2007. (Water quality standards for clarity and phytoplankton productivity are based on 1968-1971 levels.) Increased growth of attached algae in nearshore waters ~~has been~~ may be linked to the level of onshore development. The Regional Board is committed to ongoing investigation of Lake Tahoe's nearshore water quality and to taking regulatory actions needed to improve nearshore conditions. Pollutant load reduction actions taken to implement the Lake Tahoe TMDL are anticipated to improve the nearshore environment by decreasing pollutant loads entering the lake. Additional analysis, however, is needed to determine whether different resource management actions are needed to address the nearshore condition. While targeted load reduction

	actions may or may not immediately address localized pollutant discharges to the nearshore, long term, basin-wide pollutant load reduction efforts are expected to improve the nearshore condition. The Regional Board will evaluate results of ongoing research related to nearshore conditions and take appropriate actions if necessary to improve nearshore conditions.
pg. 5-2, column 2, pgph. 1	~~Although recent changes in the water quality of Lake Tahoe are drastic, they do not reflect the *full* impact of the increases in erosion rates caused by recent development. There is a long lag time between disturbances in the Basin and the complete expression of their impacts on Lake Tahoe. Increased nutrient loading rates exert their full effect through a gradual buildup of nutrient concentrations over many years. Thus, preventing future increases in erosion rates will not be enough to protect the water quality of Lake Tahoe. A major reduction in the quantities of nutrients reaching Lake Tahoe is required.~~
pg. 5-2, column 2, pgph. 3	The water quality control program for the Lake Tahoe Basin treats erosion and surface runoff (stormwater) as different facets of the same problem. Reducing nutrient and fine sediment particle loads will require both remedial measures to correct existing erosion/runoff problems and strict controls on future development. The principal control measures are: • Large-scale erosion remediation, stormwater treatment, ~~remedial erosion~~ and drainage control ~~(Capital Improvement Program)~~ and SEZ restoration projects.
pg. 5-4, column 1, pgph. 1	All landowners are expected to implement and maintain BMPs. ~~over the 20-year lifetime of the 208 Plan.~~
pg. 5-5, column 1, pgph. 4	Lake Tahoe is listed as a “Water Quality Limited Segment” under Section 303(d) of the federal Clean Water Act. ~~When better information becomes available on sediment and nutrient budgets for Lake Tahoe, and on the efficiency of Best Management Practices, the Regional Board will use this information, and estimates of expected water quality improvements due to the control measures outlined in this Chapter, to establish Total Maximum Daily Loads (TMDLs) of pollutants to Lake Tahoe.~~ Section 303(d) requires Total Maximum Daily Loads (TMDLs) to be set for Water Quality Limited Segments in order to ensure the attainment of surface water quality standards. The Lake Tahoe TMDL (Chapter 5.18) addresses Lake Tahoe’s deep water transparency by identifying the causes of transparency decline, estimating the magnitude of the major pollutant sources, and assessing the Lake’s assimilative capacity. The Lake Tahoe TMDL also describes an implementation plan for reducing pollutant loading to Lake Tahoe and provides a timeline for accomplishing needed pollutant load reductions. A TMDL must be adopted as a Basin Plan amendment, and must be approved by the USEPA. (See Chapter 4 for additional information on TMDLs).

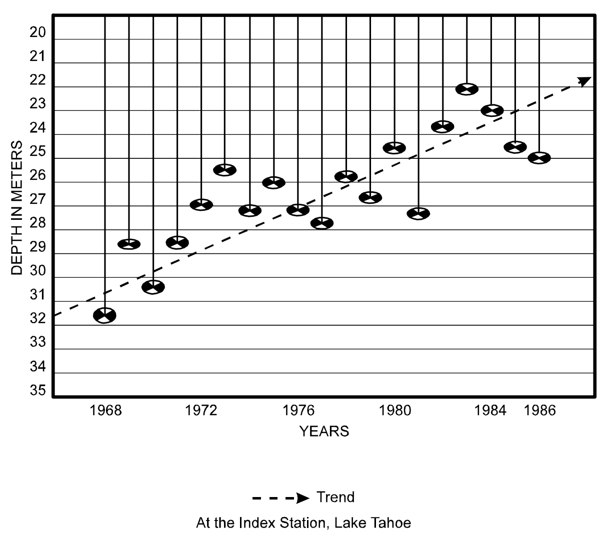
pg. 5-5, column 2, pgph. 2	The water quality control programs for the Lake Tahoe Basin ~~which~~ are outlined below (including major ~~remedial~~ erosionremediation/stormwater control and SEZ restoration programs) ~~are expected to be implemented over a 20-year period ending in 2007~~. Implementation ~~will~~ involves coordinated actions by state, federal, regional, and local agencies, and by private landowners. ~~TRPA projects attainment of all water quality standards for Lake Tahoe and its tributaries by that date~~.
pg. 5-6, column 2, pgph. 1	The ~~control measures~~ load reduction requirements set forth in this Chapter have been determined to be the **minimum** needed to prevent further degradation of Lake Tahoe due to sediment and nutrient loading, and to ensure eventual attainment of deep water transparency ~~clarity~~ and productivity standards. Additional controls on fine sediment particles and nutrient loading may need to be developed in the future to offset the impacts of unforeseen factors such as ~~the mortality of forest trees due to drought-related stresses in the late 1980s and early 1990s~~ wildfire and climate change.
pg. 5-7, figure 5-1 **Delete**	**Figure 5-1** **ANNUAL AVERAGE SECCHI DISK DEPTH** 

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Figure 5-1

Annual Average Secchi Disk Depth
At the Index Station, Lake Tahoe
(UC Davis, 2010)

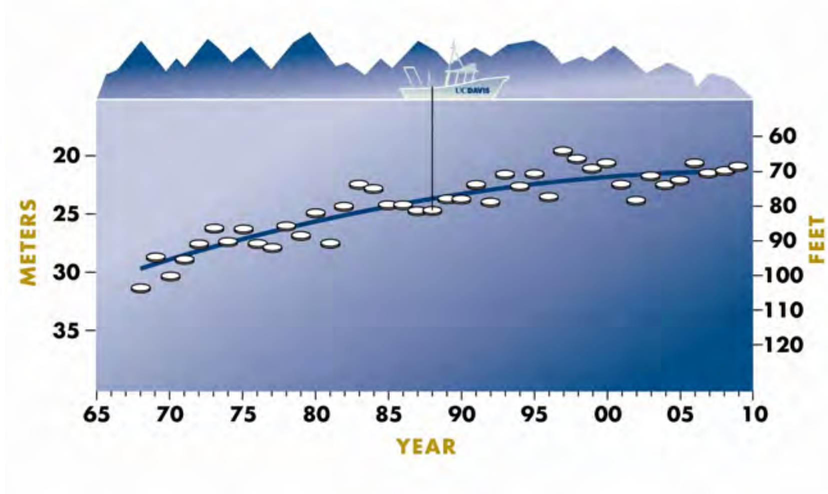

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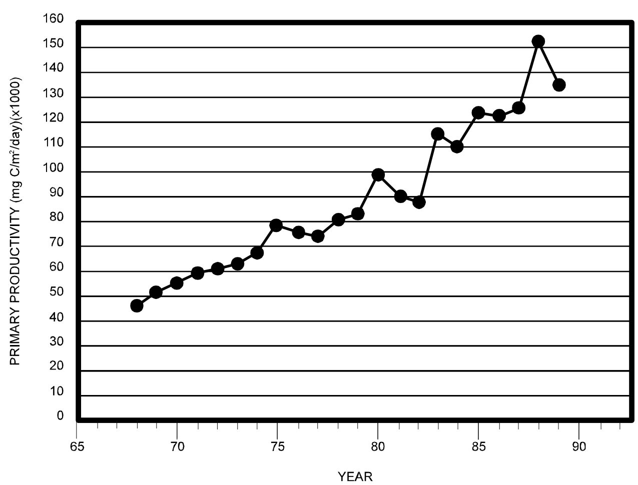
Figure 5-2
PRIMARY PRODUCTIVITY

At the Index Station, Lake Tahoe



At the Index Station, Lake Tahoe

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Figure 5-2

PRIMARY PRODUCTIVITY
At the Index Station, Lake Tahoe
(UC Davis, 2010)

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	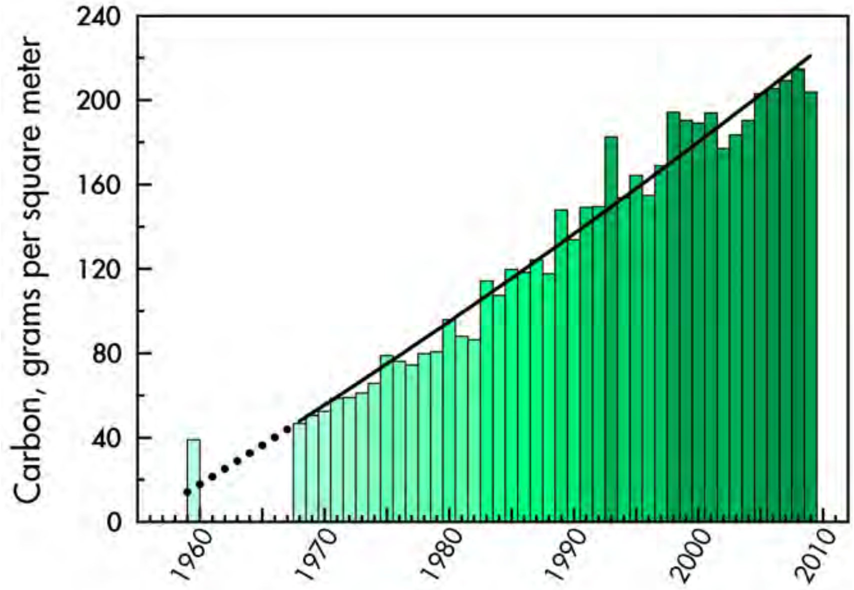
pg. 5-11, Table 5-1	Programs implemented jointly by ~~Regional Board,~~ TRPA, USFS, local governments, other parties. Similar programs are implemented in Nevada by TRPA, USFS, and local governments ~~and Nevada Division of Environmental Protection~~. Regional Board and TRPA programs have different jurisdictional boundaries in California. ~~20 year implementation schedule for 208 Plan, ending in 2007. Other compliance schedules for specific types of activities.~~
pg. 5.1-9, column 2, pgph. 6	**Transparency** For Lake Tahoe, the annual average ~~secchi~~ Secchi disk deep water transparency shall not be decreased below 29.7 meters, the levels recorded in 1967-71. ~~based on a statistical comparison of seasonal and annual mean values.~~ ~~*The "1967-71 levels" are reported in the annual summary reports of the "California-Nevada-Federal Joint Water Quality Investigation of Lake Tahoe" published by the California Department of Water Resources.*~~
pg. 5.6-1, column 1, pgph. 1	Surface runoff from urban areas is the principal controllable source of pollutants affecting Lake Tahoe, contributing fine sediment particles and nutrients to the lake. Development and continued soil disturbance associated with developed land ~~of the watershed~~ has greatly accelerated natural erosion rates, increased stormwater runoff intensity, and increased fine sediment particle and nutrient loading in stormwater. Disturbance of soils and vegetation, particularly in Stream Environment Zones, has reduced the natural treatment capacity for nutrients and fine sediment particles in stormwater.

pg. 5.6-1, column 1, pgph.	The 208 Plan (Vol. I, page 91) states that management practices to control elevated levels of runoff from existing development should be geared toward treatment of runoff waters through the use of natural and artificial wetlands as close to the source of the problem as possible. Management practices should also infiltrate runoff to negate the effects of increased impervious coverage and drainage density. Management practices should ensure that snow disposal does not harm water quality, and that snow removal from unpaved areas does not expose soils to runoff and further disturbance, contributing to sediment and nutrient loading to receiving waters. This section focuses on effluent limitations, Lake Tahoe TMDL stormwater requirements, stormwater permits and areawide stormwater treatment systems.
pg. 5.6-1, column 1, pgph. 4 to pg. 5.6-2 column 1, pgph. 2	***Effluent Limitations*** In 1980, the State Board adopted an earlier version of the stormwater effluent limitations set forth in Table 5.6-1. The Regional Board uses these effluent limitations in discharge permits for stormwater. Effluent limitations for additional pollutants, especially for toxic substances, may be necessary to ensure compliance with receiving water standards. The "design storm" for stormwater control facilities in the Lake Tahoe Basin is the 20-year, 1-hour storm; however, containment of a storm of this size does not necessarily ensure compliance with effluent limitations, or receiving water quality standards. The 208 Plan incorporates the State Board's 1980 effluent limitations, and TRPA has adopted them as regional "environmental threshold carrying capacity standards" for ground water, with the addition of the following provision: *"Where there is a direct and immediate hydraulic connection between ground and surface waters, discharges to groundwater shall meet the guidelines for surface discharges."* TRPA has also adopted the following environmental threshold standard related to surface runoff: Numerical standard Achieve a 90 percentile concentration value for dissolved inorganic nitrogen of 0.5 mg/l, for dissolved phosphorus of 0.1 mg/l, and for dissolved iron of 0.5 mg/l in surface runoff directly discharged to a surface water body in the Basin. Achieve a 90 percentile concentration value for suspended sediment of 250 mg/l. Management standard Reduce total annual nutrient and suspended sediment loads as necessary to achieve loading thresholds for tributaries and littoral and pelagic Lake Tahoe. (The latter standard refers to other TRPA environmental threshold standards which involve reductions in nutrient loading from all sources.) Table 5.6-1 includes revisions of the 1980 limitations. The Lahontan Regional Board applies the numbers in Table 5.6-1 on a site- or project-specific basis in response to identified erosion or runoff problems. Monitoring through 1988 showed that urban runoff exceeds the limitations for discharge to surface waters in more than 90 percent of the samples taken (208 Vol. 1 page 262).

pg. 5.6-1, Add new sections between existing “Effluent Limits” and “Stormwater Permit” sections	**Stormwater Management and the Lake Tahoe TMDL** The goal of the Lake Tahoe TMDL is to protect the lake and achieve the deep water transparency standard. To this end, the TMDL identifies the maximum annual average amounts of fine sediment particles, nitrogen, and phosphorus that the lake can assimilate and meet the deep water transparency standard. The amount of fine sediment particles is quantified by particle number, while nitrogen and phosphorus are quantified by mass. The largest source of fine sediment particles is runoff from developed urban lands, which contribute an estimated 72 percent of the fine sediment particle load to Lake Tahoe. Consequently, the Lake Tahoe TMDL implementation strategy emphasizes actions to reduce fine sediment particle loads from urban stormwater runoff. Municipal stormwater permits issued to the City of South Lake Tahoe, the Counties of El Dorado and Placer, and to the California Department of Transportation will include enforceable load reduction requirements linked to TMDL allocation milestones. In accordance with NPDES permitting requirements, each jurisdiction will be required to develop, implement, and maintain a Pollutant Load Reduction Plan (PLRP) to guide stormwater activities and project implementation. The PLRP shall describe how the municipality plans to achieve required pollutant load reductions for each five year permit term. **Sustainable Development Practices** State Water Resources Control Board Resolution No. 2008-0030 highlights the importance of implementing stormwater management techniques that maintain or restore the natural hydrologic functions of a site by detaining water onsite, filtering pollutants, and infiltrating runoff from impervious surfaces. Such measures have been, and continue to be, the foundation of stormwater management policy in the Lake Tahoe basin. Infiltration is the most effective method for controlling urban stormwater runoff volumes and reducing associated pollutant loads. Infiltrating stormwater through soil effectively removes fine sediment particles and reduces nutrient concentrations. Additionally, infiltration reduces the volume of stormwater thereby reducing its erosive effects. Consequently, infiltration remains the preferred method for urban stormwater treatment and all new development projects, existing development retrofit projects, and roadway runoff treatment projects should first evaluate and implement all opportunities to infiltrate stormwater discharges from impervious surfaces. **Municipal and Public Roadway Stormwater Treatment Requirements** Municipal jurisdictions and state highway departments must meet load reduction requirements specified by the Lake Tahoe TMDL (Tables 5.18-2, 5.18-3, and 5.18-4). These agencies will likely consider a variety of different design storms, alternative treatment options, and roadway operations practices, and local ordinances to reduce average annual pollutant loads from selected areas to meet waste load allocation requirements. The Lake Tahoe TMDL requires Lake Tahoe basin municipalities and the California

	Department of Transportation to develop and implement comprehensive Pollutant Load Reduction Plans (PLRPs) describing how proposed operations and maintenance activities, capital improvements, facilities retrofit projects, ordinance enforcement, and other actions will meet required pollutant load reduction requirements. PLRPs provide responsible jurisdictions the opportunity to prioritize pollutant load reduction efforts and target sub-watersheds that generate the highest annual average pollutant loads. The Water Board developed the Lake Clarity Crediting Program to establish protocols for tracking and accounting for load reductions. The Lake Clarity Crediting Program links actions to improve urban stormwater quality to expected fine sediment particle and nutrient loads and provides the flexibility for the discharger to maximize pollutant load reduction opportunities. **New Development, Redevelopment, and Private Property BMP Stormwater Treatment Requirements** For new development and re-development projects and private property Best Management Practice retrofit efforts, project proponents shall first consider opportunities to infiltrate stormwater runoff from impervious surfaces. At a minimum, permanent stormwater infiltration facilities must be designed and constructed to infiltrate runoff generated by the 20 year, 1-hour storm which equates to approximately one inch of runoff over all impervious surfaces during a 1-hour period. Where conditions permit, project proponents should consider designing infiltration facilities to accommodate runoff volumes in excess of the 20 year, 1-hour storm to provide additional stormwater treatment. Runoff from parking lots, retail and commercial fueling stations, and other similar land uses may contain oil, grease, and other hydrocarbon pollutants. Project proponents designing treatment facilities for these areas may be required to include pre-treatment devices to remove hydrocarbon pollutants prior to infiltration or discharge. Where a risk of hydrocarbon spills exist, project proponents must include contingency plans to prevent and facilities to sequester spills to avert groundwater pollution. Runoff from parking lots, retail and commercial fueling stations, and other similar land uses may contain oil, grease, and other hydrocarbon pollutants. Project proponents designing treatment facilities for these areas must include pre-treatment devices to remove hydrocarbon pollutants prior to infiltration or discharge and contingency plans to prevent spills from polluting groundwater. Infiltrating runoff volumes generated by the 20 year, 1-hour storm may not be possible in some locations due to shallow depth to seasonal groundwater levels, unfavorable soil conditions, or other site constraints such as existing infrastructure or rock outcroppings. For new development or redevelopment projects, site constraints do not include the existing built environment. In the event that site conditions do not provide opportunities to infiltrate the runoff volume generated by a 20 year, 1-hour storm, project proponents must either (1) meet the numeric effluent limits in Table 5.6-1, or (2) document coordination with the local municipality or state highway department to demonstrate that shared stormwater treatment facilities treating private property discharges and public right-of-way stormwater are sufficient to meet the municipality's average annual fine sediment and

<table>
<tr><td></td><td>nutrient load reduction requirements.</td></tr>
<tr><td>pg. 5.7-13, column 1, pgph. 1</td><td>Ground water contributes an estimated 13 percent of the annual nutrient loading to Lake Tahoe, but is assumed to contribute no fine sediment particles to the lake. ~~Although data are limited, research to date indicates that ground water nutrient loading represents a substantial contribution to Lake Tahoe.~~ Loeb (1987) found ground water concentrations of nitrate in three watersheds to be lowest (by a factor of two to ten) in areas farthest upgradient from Lake Tahoe and to increase downgradient toward the lake. This corresponds to the degree of land disturbance. The TMDL relies on findings of the Army Corps of Engineers (ACOE) Groundwater Evaluation report (2003). The study divided the Tahoe basin watershed into five ground water basins, and also analyzed the average nutrient concentrations of land use types based on ground water monitoring wells (Table 5.7-5). Findings by the ACOE study supports previously asserted hypotheses that urbanization ~~Urbanization~~ can significantly increase nitrate concentration in ground water through fertilizer addition, ~~irrigation,~~ sewer line exfiltration, ~~sewage spills,~~ infiltration of urban runoff, and leachate from abandoned septic systems. Future development and/or continued soil disturbance in already developed areas may ~~will~~ increase nutrient transport in ground water by removing vegetation which normally recycles nutrients in the watershed. Although ground water disposal of stormwater is generally preferable to surface discharge because it provides for prolonged contact with soils and vegetation which remove nutrients, infiltration of urban stormwater in areas with high groundwater tables may be undesirable because of possible contamination of drinking water supplies from toxic runoff constituents.</td></tr>
<tr><td>INSERT PAGE 5.7-21, new, Table 5.7-5</td><td>TABLE 5.7-5

Average nutrient concentrations of groundwater wells based on land-use types (USACE 2003)

<table>
<tr><th>Land-use</th><th>Nitrogen Ammonia + Organic Dissolved (mg/L)</th><th>Nitrogen Nitrite plus Nitrate Dissolved (mg/L)</th><th>Total Dissolved Nitrogen (mg/L)</th><th>Dissolved Orthophosphorus (mg/L)</th><th>Total Dissolved Phosphorus (mg/L)</th></tr>
<tr><td>Residential</td><td>0.26</td><td>0.37</td><td>0.63</td><td>0.081</td><td>0.11</td></tr>
<tr><td>Commercial</td><td>0.16</td><td>0.51</td><td>0.67</td><td>0.092</td><td>0.12</td></tr>
<tr><td>Recreational</td><td>0.40</td><td>1.2</td><td>1.6</td><td>0.073</td><td>0.10</td></tr>
<tr><td>Ambient</td><td>0.16</td><td>0.11</td><td>0.27</td><td>0.040</td><td>0.049</td></tr>
</table></td></tr>
<tr><td>pg. 5.10-1, column 2, pgph. 3</td><td>Current levels of consumptive water use in the Lake Tahoe Basin are unknown. Most water use is currently not metered. State law (AB 2572) enacted in 2004 requires all water suppliers to install water meters on all customer connections by January 1, 2025.

New residential construction has occurred since 1982, but conservation efforts (e.g., landscape watering restrictions and requirements for ultra-low flow toilets) have increased due to drought conditions. ~~TRPA predicts that there will be a 27% increase~~</td></tr>
</table>

	~~in population of the Lake Tahoe Basin between 1987 and 2007, but has not estimated ultimate buildout.~~ As of 2010 there are fewer than 5000 private, undeveloped, potentially buildable parcels throughout all jurisdictions in the Lake Tahoe Basin. At the highest rate of residential building allowed by TRPA, 294 building allocations per year, these parcels could be built in 16 years. ~~Assuming that the Individual Parcel Evaluation System will permit development of some land capability Class 1, 2, and 3 lots which were not considered buildable under the 1980 Lake Tahoe Basin Water Quality Plan, it is possible that water use at buildout could exceed the Interstate Water Compact limits. The 208 Plan (Vol. I, page 307) states that the "range of ultimate demand for water supply on the California side would be approximately 21,600 to 24,200 afa."~~
pg. 5.12-1, column 1, pgph. 1	The ~~208 Plan (TRPA 1988, Vol. I, page 88)~~ Lake Tahoe TMDL concluded ~~that limited information indicates~~ that all roads, regardless of jurisdiction, ~~components of the highway transportation system~~ have ~~serious~~ significant impacts on water quality. Roads ~~also~~ increase impervious surface, decrease infiltration, intensify ~~magnifying~~ surface runoff and often direct~~ing~~ it toward surface waters. The application and subsequent pulverization of traction abrasive material during the winter months can also adversely affect water quality.
pg. 5.12-2, column 2, pgph. 3	Effective street ~~Street~~ and parking lot sweeping are among the most important maintenance control measures for onsite problems. ~~The revised BMP for street sweeping discusses the efficiency of different types of sweepers and requires sweeping at least once a year.~~ Street sweeping with high efficiency sweepers (capable of removing particles 10 microns and less) removes many fine sediment particles that could be potentially entrained in urban runoff and reduces the amount of material that can become airborne. Sweeping following traction abrasive application can also prevent abrasive material from being pulverized into finer sediment particles. Fine sediment particles are the largest single contributor to impairment of lake clarity, and controlling these pollutants at the source can improve the effectiveness of downstream treatment facilities. The reduction in dissolved nutrients from sweeping will be minor, but the reduction in particulate bound nutrients from street sweeping will be comparable to the reduction in suspended sediments. Street and parking lot sweeping also helps prevent clogging of infiltration facilities.
pg. 5.12-3, column 2, pgph. 3	~~All governmental agencies responsible for road maintenance are required to bring all roads in the Lake Tahoe Basin into compliance with 208 Plan standards within the 20-year implementation schedule of that plan (by 2007). That is, all existing facilities must be retrofitted to handle the stormwater runoff from the 20-year, 1-hour storm, and to restabilize all eroding slopes.~~

pg. 5.12-4, column 1, pgph. 1	~~Specific CIP projects are proposed in Volume IV of the revised 208 Plan. California CIP projects are summarized in Tables 5.12-1 through 5.12-4. The systems proposed are source controls, which incorporate the methods presented in the Handbook of Best Management Practices (208 Plan, Vol. II). Detailed facilities planning will be required to determine exactly what systems will be put on the ground. Completion of these projects is essential if the load of sediment and nutrients causing deterioration of Lake Tahoe is to be reduced. The cost of completing all erosion and urban runoff control projects will be approximately $300 million in 1988 dollars, requiring development of a phased program for completion. The total cost of projects to be implemented in California is estimated at $204.7 million (1988 dollars), including $18 million for Caltrans projects, $58.9 million for City of South Lake Tahoe projects, $49.8 million for El Dorado County projects, and $78 million for Placer County projects. The CIP incorporates the watershed restoration priorities of the USFS, Lake Tahoe Basin Management Unit, by reference.~~
pg. 5.12-4, column 1, INSERT New pgph	Building on the capital improvement program (CIP) established with the original Regional Plan, the TRPA developed the Environmental Improvement Program (EIP) in conjunction with the 1997 Lake Tahoe Presidential Forum. Much of the TRPA Regional Plan has focused on ensuring there are no environmental impacts relating to future growth. However, there remains a considerable amount of environmental degradation that is a result of historic development and land use patterns. The EIP is aimed at addressing environmental degradation, attainment of the TRPA Thresholds and compliance with the Tahoe Regional Planning Compact. The EIP is a cooperative effort to preserve, restore and enhance the unique natural and human environment of the Lake Tahoe Region. The EIP defines restoration needs for attaining environmental goals, and through a substantial investment of resources, increases the pace at which the TRPA Environmental Thresholds will be attained. The EIP also includes a global climate change component consistent with TRPA Regional Plan policies that address strategies for reducing greenhouse gases.
pg. 5.12-5, Table 5.12-1	~~Table 5.12-1~~
pg. 5.12-6, Table 5.12-2	~~Table 5.12-2~~
pg. 5.12-7 and 5.12-8, Table 5.12-3	~~Table 5.12-3~~
pg. 5.12-9, Table 5.12-4	~~Table 5.12-4~~
5.16-3, column 1, pgph. 1	~~As noted in Chapter 4 of this Basin Plan, wet~~ Wet and dry atmospheric deposition of nutrients, fine sediment particles, and acids onto surface waters is an issue of concern throughout the Sierra Nevada. ~~Atmospheric deposition is considered a significant part of the nitrogen budget of Lake Tahoe.~~ Atmospheric nutrients and fine sediment particles are important considerations for Lake Tahoe because of the lake's large surface area in relation to the size of its watershed, and the long residence time of lake waters (about 700 years). ~~Precipitation chemistry in the Lake Tahoe Basin has been~~

	~~monitored on an ongoing basis since the early 1980s. Direct wet and dry deposition on the Lake have also been studied by the University of California Tahoe Research Group~~. The Lake Tahoe TMDL concluded that atmospheric deposition contributes an estimated 63 percent of total average annual nitrogen to the lake. Atmospheric deposition also contributes an estimated 16 percent of the average annual fine sediment particle load and about 18 percent of the average annual total phosphorus load. ~~. The relative importance of long distance transportation of nitrogen oxides from outside of the Lake Tahoe Basin and of nitrogen oxides from vehicle and space heater emissions within the Basin has not been conclusively established. Atmospheric nutrients are important considerations for Lake Tahoe because of the lake's large surface area in relation to the size of its watershed, and the long residence time of lake waters (about 700 years).~~ Precipitation chemistry in the Lake Tahoe Basin has been monitored on an ongoing basis since the early 1980s. Direct deposition on the lake has also been studied by the University of California Tahoe Environmental Research Center and by the California Air Resources Board's (CARB) Lake Tahoe Atmospheric Deposition Study (LTADS). Studies by these groups, as reported in the Lake Tahoe TMDL Technical Report, indicate that about 69 percent of nitrogen deposition on Lake Tahoe originates locally, with the remaining 31 percent coming from regional sources. Combined, these sources contribute an estimated 218 metric tons of total nitrogen to Lake Tahoe, most of it in the form of NO_x and NH_3 (ammonia). Similarly, an estimated 71 percent of the annual total phosphorus deposition of around 6 metric tons is from local sources. Road dust is the primary contributor. Atmospheric deposition is also a key source of fine sediment particle deposition to the lake. The Lake Tahoe TMDL Technical Report establishes that about 16 percent of Lake Tahoe's total fine sediment particle load is from atmospheric sources. Over 70 percent of this particulate deposition is from in-basin sources. The primary in-basin sources of fine sediment particles are dust from paved and unpaved roadways, dust from construction sites and other unpaved surfaces, and organic soot from residential wood burning.
pg. 5.17-1, column 1, pgph. 1	Monitoring of Lake Tahoe, its tributary surface and ground waters, and pollutant sources such as atmospheric deposition and stormwater is a very important part of the implementation program. Long-term monitoring of an "Index Station" in Lake Tahoe by the University of California at Davis Tahoe Environmental Research Center ~~Research Group~~ has documented the ~~trends in clarity~~ deep water transparency and primary productivity measurements shown in Figures 5-1 and 5-2. Further long-term monitoring is essential to document progress toward attainment of the water quality standards for these parameters, which are based on 1968-71 figures.
pg. 5.17-1, column 1, pgph. 2	Monitoring and special studies have been carried out in the Tahoe Basin by a variety of agencies (including the U.S. Forest Service's Lake Tahoe Basin Management Unit, the California Department of Water Resources, the University of Nevada at Reno, and the U.S. Geological Survey)~~, but long-term records are available only for Lake Tahoe and a few tributary streams~~. For example, the U.S. Forest Service's Lake Tahoe Basin Management Unit monitors a variety of land use activities on National Forest lands. In response to the recommendations of the 1980 *Lake Tahoe Basin Water Quality*

	Plan, special studies were carried out on sewer exfiltration into ground water, nearshore phytoplankton and periphyton productivity in Lake Tahoe, and atmospheric deposition. The *Water Quality Management Plan for the Lake Tahoe Region* ("208 Plan," Volume I) contains a summary of the results of water quality monitoring and special studies through 1988. The State Board organized the Lake Tahoe Interagency Monitoring Program (LTIMP) in 1979; annual reports of this program have been published by the University of California at Davis Tahoe Environmental Research Center. ~~The U.S. Forest Service's Lake Tahoe Basin Management Unit monitors a variety of land use activities on National Forest lands.~~ ~~The Tahoe Research Group is using data from the Interagency Monitoring Program to construct a model of the nutrient budget of Lake Tahoe.~~ Monitoring data from the LTIMP program was used to develop and calibrate the Watershed Model and Lake Clarity Model for the Lake Tahoe TMDL. The Lake Clarity Model bundles five models: a particle fate model, an optical model, an ecological model, a thermodynamic model, and a hydrodynamic model. These two models, coupled with targeted pollutant source analysis studies, provided the framework for the Lake Tahoe TMDL.
pg. 5.17-1, column 2, pgph. 2	The Lake Tahoe TMDL effort addressed research needs identified by the 208 Plan. These needs included details of Lake Tahoe's nutrient budget and the nutrient inputs and outputs of the watershed and the airshed. Ongoing research needs include, but are not limited to, better understanding of the effectiveness of SEZ restoration projects and stormwater treatment techniques, improved quantification of atmospheric deposition processes and control measures, and work to clarify the link between development, pollutant sources, and their effect on nearshore water quailty. ~~The 208 Plan identifies future research needs including details of Lake Tahoe's nutrient budget, the nutrient inputs and outputs of the watershed and the airshed, and the effectiveness of BMPs and other control measures. Specifically, research needs have been identified in the following areas: (1) development of a database on the treatment of runoff in natural and artificial wetlands and SEZs, (2) the quantity and quality of urban runoff and the contributions of urban runoff to Lake Tahoe's nutrient budget, (3) effectiveness of erosion and runoff control projects, (4) transport of airborne nutrients, particularly nitrogen, from upwind areas into the Tahoe Region, (5) effects of fertilizer use on water quality and effectiveness of fertilizer management programs, and (6) effectiveness of Stream Environment Zone restoration projects and techniques.~~
pg. 5.17-1, column 2, pgph. 3	~~Regional Board staff have been carrying out a stormwater monitoring program for remedial erosion control projects which were implemented with State Assistance Program (SAP) funding. Results will be used to evaluate the success of the projects. Several other studies of the effectiveness of BMPs for erosion/stormwater control in the Lake Tahoe Basin were in progress in 1993. Additional needs for monitoring and research in the Lake Tahoe Basin identified by Regional Board staff include: (1) further study of the role of ground water in nutrient loading to Lake Tahoe, (2) baseline biological monitoring in all types of water bodies, (3) monitoring of priority pollutants in surface runoff, and sediment sampling in marinas for priority pollutants and tributyltin, and (4) follow-up on the shoreline erosion study which began in the 1980s.~~