

**WATER QUALITY CONTROL PLAN AMENDMENTS,
TOTAL MAXIMUM DAILY LOAD FOR SEDIMENT IN SQUAW CREEK**

California Regional Water Quality Control Board
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The Basin Plan language below will be added to Section 4.13 of the Basin Plan implementation chapter. 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.

Total Maximum Daily Load for Sediment, Squaw Creek, Placer County

Introduction: Squaw Creek is located in an 8.2 square mile alpine watershed about six miles northwest of Lake Tahoe in Placer County, between Tahoe City and Truckee. The creek is impaired due to sedimentation/siltation from historic and current watershed disturbance associated with land development. Land uses in the watershed are primarily for ski facilities, commercial and residential developments, and related infrastructure.

The purpose of this Total Maximum Daily Load (TMDL) is to ensure attainment of all sediment-related water quality standards, including narrative objectives related to protection of in-stream beneficial uses. The TMDL implementation program is based substantially on continuation and improvement of existing erosion control and monitoring programs currently conducted by Squaw Valley Ski Corporation, The Resort at Squaw Creek, and Intrawest Village at Squaw Valley - Phase I and II. One additional operational permit will be assigned to Placer County to control nonpoint source erosion and sediment delivery to Squaw Creek. Other individual or general Waste Discharge Requirements (WDRs) may be issued as warranted for construction-related or other land-disturbing activities to control sediment discharges to the creek. The Water Board staff report (Lahontan Regional Water Quality Control Board, 2006) provides the technical information supporting the regulatory elements of this TMDL.

Problem Statement: The focus of this TMDL is beneficial uses related to aquatic life and recreational activities (COLD, SPWN, REC-1, REC-2, WILD, MIGR, and COMM; see Chapter 2 of this Basin Plan), and water quality objectives for sediment, settleable materials, suspended sediment, turbidity and nondegradation (see Chapter 3 of Basin Plan). The magnitude and extent of the sedimentation impairment was determined based on regional bioassessment studies, where the abundance and diversity of benthic macroinvertebrates (aquatic organisms at least one-half millimeter in size) and substrate particle size were evaluated as measures of aquatic life health and stream channel conditions, respectively. Bioassessment data were composited into "biologic condition scores" to numerically quantify and compare the integrity of biologic communities at reference streams (physically comparable stream sites exhibiting conditions associated with minimally disturbed landscapes) and Squaw Creek. The biologic condition score is a numeric value based on an index of seven biologic metrics that are sensitive to changes in biological integrity caused by sedimentation.

Biologic condition scores calculated for Squaw Creek's meadow reach indicate degraded macroinvertebrate communities compared with reference streams. Stream channel substrate data collected from the Squaw Creek meadow reach showed smaller median particle size (referred to as D-50 particle size) and larger average percentages of fines and sand (defined as particles less than 3 millimeters in size) when compared to low gradient reference stream sites. Excessive fine particles deposited on the streambed can be detrimental to fish and invertebrates by increasing

embeddedness of gravels and decreasing interstitial spaces, leading to changes in species composition and diversity. Accelerated hillslope erosion from land disturbance related to development in naturally erosion-prone areas contribute to excess sediment delivery to the creek. Stream channel erosion, road sanding operations and naturally occurring erosion also contribute to sediment loading to the creek.

Desired Conditions: Indicators and targets (numeric targets) were selected to interpret the water quality standards and track the effectiveness of the TMDL. For the Squaw Creek TMDL, these include indicators of stream substrate quality (D-50 particle size and percentage of fines and sand), and a biological condition score selected to represent abundant and diverse benthic macroinvertebrate communities, based on data collected from regional reference streams. Because the aquatic life beneficial use is the most sensitive to excessive sedimentation, it is reasonable to assume that protection of the aquatic life beneficial use will ensure support of all beneficial uses potentially impacted by sedimentation. The numeric targets are shown in Table 4.13-SC-1 and will be included in future updates of monitoring programs for operational WDRs issued to dischargers in the watershed.

Source Analysis: Sediment delivery from hillslope source categories was estimated based on studies conducted in primarily in 2000 and 2001. The estimated annual sediment load for the watershed during this time period is 37,900 tons per year. The contribution of sediment from hillslope sources is divided among categories as shown in Table 4.13-SC-2. The source analysis indicates that approximately 60 percent of the sedimentation affecting Squaw Creek is related to disturbance brought on by human activities.

Loading Capacity and Linkage Analysis: The sediment loading capacity of Squaw Creek is derived from mathematical comparisons of biologic conditions found in reference streams and Squaw Creek, and is set such that Squaw Creek will meet its water quality objectives and support beneficial uses. It is estimated that that a 25 percent reduction in the overall sediment loading of 37,900 tons per year is needed to protect beneficial uses. Therefore, the loading capacity is 28,425 tons per year.

Linkage between sediment delivery to the creek and impairment of aquatic life beneficial uses was based on USEPA guidance, best professional judgment, modeled loading estimates, and sediment-related in-stream physical habitat parameters that correlate with biologic conditions found in regional streams.

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 sediment load (i.e., the load capacity) is distributed among the existing controllable sediment source categories, future growth and a margin of safety.

There are currently no National Pollutant Discharge Elimination System (NPDES)-regulated point sources in the watershed; therefore, the wasteload allocation is zero. The allocations reflect conservative assumptions about the efficiency of Best Management Practices (BMPs) to control sedimentation. No reduction in sediment delivery from undisturbed lands was assigned. A

summary of the TMDL, allocations, and required load reductions is presented in Table 4.13-SC-3.

Because the load allocations are broad estimates, they are not appropriate for use as discharge specifications in WDRs/permits. Water Board staff expect dischargers to follow an iterative approach to implementing storm water pollution controls, including using data from the in-stream monitoring to guide hillslope activities accordingly.

Margin of Safety, Seasonal Variations and Critical Conditions: An explicit margin of safety is established by reserving (by not allocating) part of the total loading capacity, thereby requiring greater load reductions from existing and/or future source categories. An implicit margin of safety incorporates conservative assumptions in the TMDL analysis. The Squaw Creek TMDL includes both an implicit and explicit margin of safety.

Conservative assumptions were incorporated into data interpretations throughout the TMDL. The explicit margin of safety was established by reserving four percent of the loading capacity to offset uncertainties in the analysis. The TMDL also incorporates a monitoring and review program which allows for future management revisions if the Water Board finds that water quality objectives are not being met or that beneficial uses are not being protected. The TMDL takes into account seasonal variations and critical conditions to assure that the load allocations will support water quality standards over time. The Squaw Creek TMDL accounts for critical conditions by establishing targets based on net long term effects.

Implementation and Monitoring Plan: The Implementation Plan relies on compliance with the existing pollution controls in place in the watershed, and proposes additional actions to address sediment discharges that are not currently regulated. These controls include permitting authorities outlined in the Porter-Cologne Water Quality Control Act, such as NPDES permits, WDRs, waivers of WDRs and Basin Plan discharge prohibitions.

WDRs issued to existing dischargers in the watershed contain comprehensive requirements to control sediment dischargers. These water quality requirements specify that discharges must identify erosion control problems, propose projects to address the problem, and maintain those projects. Proposed WDRs/NPDES permits will follow the template set by the existing permits.

Implementation monitoring will focus on tracking compliance with existing and proposed regulatory actions, including installation and maintenance of BMPs to control sediment discharges, with a focus on control of fine sediment. Progress toward meeting the TMDL will be determined through monitoring of the in-stream physical and biological parameters identified in the numeric targets section. The monitoring and reporting programs for existing WDRs/permits in the watershed will be updated to require monitoring of these numeric targets, and any new operational permits will incorporate these monitoring parameters as well. Reporting and surveillance requirements provide the mechanism for the Water Board, dischargers, and public to determine if the Implementation Plan is achieving the TMDL, or if other actions are required. The monitoring requirements are presented in Tables 4.13-SC-4 and 4.13-SC-5.

Schedule of TMDL Attainment, Data Review and Revision: The estimated time frame for meeting the numeric targets and achieving the TMDL is 20 years. This estimate takes into consideration time for the significant temporal disparities between upland erosion control actions, sediment delivery, and the time needed for the target indicators to respond to decreased sediment loading.

Attainment of the biologic health target will be evaluated by the rolling average of biologic condition scores calculated from three consecutive sampling events. For example, if numeric target sampling begins in 2006, biologic condition data will be collected in 2006, 2008 and 2010. These data will be assessed in 2010 by averaging all biologic condition scores for each site collected over this period. Data collected in 2012 will be added to the dataset, and an average value for biologic condition scores collected in 2008, 2010 and 2012 will be calculated, and so on. The biologic condition target will be met when the rolling average for three consecutive 3-sampling event datasets meets or exceeds 25.

Progress toward meeting the physical habitat numeric targets will be evaluated by assessing the data trend for each indicator (decreasing trend for percent fines and sand, and increasing trend for median (D-50) particle size. Data assessment will begin after three sampling events have occurred. For example, if numeric target sampling commences in 2006, data will be collected in 2006, 2008, and 2010; therefore, in 2010, the data trend will be evaluated. Each subsequent sampling event's data will be added to the dataset for purposes of trend evaluation.

Permit compliance status will be assessed quarterly, using the Water Board's permit compliance tracking database currently in place, and through semi-annual field inspections. Permit compliance for the purposes of TMDL attainment refers only to those permit conditions specific to erosion and sedimentation control. Compliance information will be taken into account when assessing the need for any revisions to targets or TMDL implementation. During the 10-year data review (the halfway point estimated for TMDL attainment), staff shall examine all data trends to determine the need for revision of the TMDL, numeric targets, allocations, or implementation plan. Revisions to the WDRs, NPDES permits, or other regulatory actions shall be made as warranted to ensure that applicable water quality objectives and beneficial uses are attained.

Table 4.13-SC-1
Indicators and Targets for Squaw Creek TMDL

Indicator	Target Value	Notes
Biologic Health: Biologic Condition Score, calculated from Index of Biologic Integrity.	Biologic condition score of 25 or more when meadow reach stream flows are continuous. Applies to the meadow reach of Squaw Creek.	Represents desired biologic integrity of stream, protective of aquatic life uses. Target value based on regional reference stream biologic conditions.
Physical Habitat: Median (D-50) Particle Size	Increasing trend in D-50 value approaching 40 millimeters (mm) or greater. Applies to the meadow reach of Squaw Creek.	Represents desired substrate conditions for aquatic life. Target value based on regional reference stream substrate conditions.
Physical Habitat: Percent Fines and Sand	Decreasing trend in percent fines and sand value approaching 25% cover of the stream bottom or less. Applies to the meadow reach of Squaw Creek.	Represents desired substrate conditions for aquatic life. Target value based on regional reference stream substrate conditions.

Table 4.13-SC-2
Sediment Delivery Estimates, Squaw Creek Watershed
(Rounded to nearest 100 tons)

Sediment Source Category	Annual Sediment Delivery (Tons/year)	Percent of Total Annual Sediment Delivery
Dirt Roads	9,300	25%
Dirt Roadcuts	900	2%
Road Traction Sand	300	1%
Residential/Commercial Areas	200	1%
Graded Ski Runs	9,000	24%
Alluvial Channel Erosion	4,300	11%
Undisturbed Areas	14,000	37%
<i>Uncontrollable Sources*</i>	16,100	42%
<i>Controllable Sources</i>	21,800	58%
Total Annual Sediment Delivery**	37,900	100%

*This is considered the best estimate of current naturally occurring sediment delivery. The estimate shown includes 50 percent (rounded to 2,100 tons/year) of the annual channel bank contribution and 100 percent (14,000 tons/year) of sediment delivery from undisturbed areas.

**This estimate adds to 37,900 tons/year because the alluvial channel erosion estimate was distributed equally between the "controllable" and "uncontrollable" sediment source categories. The estimate of one-half of 4,300 tons/year (2,150 tons/year) was rounded down to 2,100 tons/year.

Table 4.13-SC-3
TMDL, Allocations and Percent Reductions Needed by
Sediment Source Category

Sediment Source Category	Annual Sediment Delivery (Tons/year)	Percent Reduction Required	Load Allocation* (Tons/year)
Dirt Roads	9,300	60%	3,700
Dirt Road Cuts	900	50%	450
Road Traction Sand	300	25%	200
Residential/Commercial Areas	200	25%	150
Graded Ski Runs	9,000	50%	4,500
Alluvial Channel Erosion (50 percent of the total load from channel bank erosion is assumed to be controllable)	2,100	10%	1,900
<i>Total Controllable Sources</i>	<u>21,800</u>	<u>50%</u>	<u>10,900</u>
Alluvial Channel Erosion (50 percent of the total load from channel bank erosion is assumed to be naturally occurring)	2,100	0%	2,100
Undisturbed Areas	14,000	0%	14,000
<i>Total Uncontrollable Sources</i>	<u>16,100</u>	<u>0%</u>	<u>16,100</u>
Total Existing Sediment Load	37,900	Load Allocation to Existing Sources	27,000
Overall Reduction Needed to Achieve TMDL	25%	Load Allocation to Future Growth	150
TMDL = Load Allocations (existing and future sources) + MOS	28,425	Load Allocation to Margin of Safety (4%)	1,275
		Total Load Allocations	28,425

* Allocations to existing sources rounded to nearest 50 tons.

Table 4.13-SC-4
Numeric Target Monitoring Plan and Compliance Schedule

Indicators and Target Values	Monitoring Specifications	Responsible Monitoring Parties	Schedule
<p>Biologic Health Indicator: Biologic condition score, based on bioassessment data. Target Value: Biologic condition score of 25 or greater.</p> <p>Physical Habitat Indicator: D-50 Particle Size. Target Value: Increasing trend approaching 40 mm or greater.</p> <p>Physical Habitat Indicator: Percent fines and sand. Target Value: Decreasing trend approaching 25 percent.</p>	<ol style="list-style-type: none"> 1. Establish 3 sampling sites (upper, middle, and lower) on the meadow reach of Squaw Creek 2. Conduct bioassessment sampling and calculate biologic condition score using Herbst (2002) protocol. 3. Analyze D-50 particle size and percent fines and sand using Herbst protocol. 4. All sampling protocols will be specified in WDRs. 	<ul style="list-style-type: none"> • SVSC (existing permit) • Resort at Squaw Creek (existing permit) • Village at Squaw Valley (existing permit) • Placer County (anticipated permit) 	<ol style="list-style-type: none"> 1. Water Board to add monitoring requirements to existing WDR Monitoring & reporting programs of permitted dischargers no later than six months after final approval of TMDL. 2. Water Board to issue WDRs/permit for Placer County stormwater discharges no later than six months after final approval of TMDL. 3. Each regulated discharger to conduct sampling individually or as agreed to cooperatively. 4. Numeric target sampling shall be conducted once every two years between the months of July and September when flow in the meadow reach is continuous. 5. Progress toward attainment of the physical habitat targets to be evaluated by trend assessment, beginning after 3 consecutive sampling events have been completed. Trend assessment will be based on all monitoring data for each physical habitat indicator. 6. Attainment of the biologic condition score target will be assessed using 3-(sampling) event rolling average datasets. The biologic condition target will be met when the rolling average for three consecutive 3-event datasets meets or exceeds 25.

Table 4.13-SC-5
Monitoring of Sediment Control Actions⁽¹⁾

Monitoring Parameter	Responsible Monitoring Party	Monitoring Schedule
Compliance with all sediment-related permit requirements, including discharge specifications, BMP installation and maintenance, general requirements and prohibitions, monitoring, and reporting.	Water Board staff	Assess permit compliance quarterly using Water Board's permit tracking database currently in place. Assessment of numeric target data (collected as specified in permits) will occur according to schedule outlined in Table 4.13-SC-4, above.
Facilities inspections to ensure permit compliance.	Water Board staff	Water Board staff to inspect all facilities twice annually.
TMDL data review and assessment.	Water Board staff	As outlined in Schedule of TMDL Attainment, Data Review and Revision , above.

(1) Requirements may already be satisfied under existing WDRs.