CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

MONITORING AND REPORTING PROGRAM NO. R6T-2009-0024

UPDATED WASTE DISCHARGE REQUIREMENTS

FOR

THE RESORT AT SQUAW CREEK

Placer County

This Monitoring and Reporting Program (MRP) is established to assure optimal management of potential wastes from the golf course chemical application and irrigation practices. It is designed to track seasonal and long-term trends in transport of chemicals and associated transformation products to waters of the State. This includes potential waste discharges to surface waters and ground waters, whether originating from fertilizer, pesticides, herbicides, fungicides, petroleum products, or other factors related to golf course use and management, including sediment from accelerated erosion from anthropogenic sources.

Chemical use and irrigation shall conform to the Chemical Application Management Plan (CHAMP), as amended and approved by the Resort at Squaw Creek Technical Review Committee. Before implementing any change in golf course chemical and irrigation management, the Discharger shall notify the Executive Officer at least 60 days prior to any proposed changes to allow for the modification of the Monitoring and Reporting Program, if necessary.

At any time, upon the Executive Officer's own motion, or at the request of the Discharger, the Executive Officer may amend or modify this MRP in accordance with California Water Code Section 13267. Water Board staff will provide ten day notice (on the Water Board website) of any proposed changes unless changes are needed to confirm or investigate any imminent threats to drinking water supplies or aquatic habitat.

I. MONITORING

A. Erosion and Runoff Controls

The Dischargers shall inspect the facility site monthly during months in which ground cover by snow is not complete. The purpose of this investigation is to discover potential erosion and surface runoff problems on the project site so that corrective measures may be immediately

undertaken. Records of problems identified and corrective measures taken shall be kept at the facility.

This inspection shall include:

1. Infiltration Trenches (if applicable)

    a. Clogging of inlet pipes by debris
    b. Accumulation of sediment
    c. Disrepair of trenches
    d. Runoff movement into infiltration trenches
    e. Damage by vehicles

2. Drop Inlets

    a. Clogging by debris, ice, or sediment
    b. Runoff movement into the infiltration gallery
    c. Damage by vehicles or snow plow equipment

3. Drainage Collection System

    a. Clogging by debris, ice, or sediment
    b. Free movement of water through pipes, channels, and appurtenances
    c. Damage
    d. Eroding channels

4. Erosion Control

    a. Health and productive vegetation
    b. Gully or rill erosion on slopes
    c. Sediment buildup at toe slopes
    d. Vegetation damage by vehicles or heavy foot traffic
    e. Bare areas in need of revegetation
    f. Traffic and parking restrictions in place

5. Sedimentation Ponds/Storm Water Treatment Wetlands

    a. Eroding banks
    b. Accumulation of sediment or solid waste material
    c. Vegetative condition

B. <u>General Maintenance and Operations</u>

1. Maintenance and Hazardous Material Storage Areas

a. Evidence of spilled oil, gasoline, diesel fuel or any other hazardous materials
b. Damage to any hazardous material storage or containment structures
c. Spill absorbent material available

2. Chemical Use (Fertilizer and Pesticide, including herbicides and fungicides) and Irrigation

Records shall be kept on an ongoing basis of the following items:

a. Product Purchased

(1) Each type of product purchased
(2) Amount of each type of chemical purchased
(3) Place of purchase
(4) Date of arrival of chemicals purchased
(5) Onsite storage location of chemicals purchased
(6) Manufacturer's label and Material Safety Data Sheet (MSDS)

b. Chemical Application

(1) Types of chemical applied
(2) Locations of application
(3) Dates of application
(4) Amounts of application
(5) Method of application
(6) Name of person(s) responsible for application

C. Squaw Creek TMDL Monitoring

The Discharger is required to conduct monitoring as described in Sampling and Analysis Requirements Numeric Target Monitoring, Squaw Creek Total Maximum Daily Load for Sediment, Placer County, 3-19-08, Lahontan Regional Water Quality Control Board (Attachment 2). The numeric target monitoring must be conducted at three locations in Squaw Creek's meadow reach every two years on odd years, with the exception of the first sampling, which will occur in 2010. The scope of monitoring includes benthic macroinvertebrate biomonitoring and assessment of streambed characteristics such as median (D-50) particle size and percent sand and percent fines.

The four facilities required to perform this monitoring hold waste discharge requirements (WDRs) with sediment and erosion control provisions in the Squaw Creek watershed-Intrawest/Squaw Village Neighborhood Company, Placer County, the Resort at Squaw Creek, and the Squaw Valley Ski Corporation. A

coordinated monitoring effort is encouraged, as was discussed in the April 17, 2008 meeting between Water Board staff and the four dischargers. If a coordinated monitoring program is pursued, submission of one set of data will suffice to satisfy the reporting requirements of all four WDRs. There is no requirement for coordination, but the monitoring costs would be reduced overall if a coordinated monitoring program is implemented.

Monitoring is to commence in 2010, and is to be conducted every odd year thereafter. Sampling is to occur in late June or early July (approximately 6/20 - 7/10), in accordance with flow conditions specified in Attachment 2. Reports are due January 15 of every even year (approximately 6 months following the monitoring). If water temperature and flow conditions for monitoring cannot be met in any given year, sampling is to roll over to the following year. Rollover is to be cumulative—that is, if sampling is not done for several years, the total quantity of samples required during that period will be made up as soon as possible by annual sampling until the backlog is caught up.

D. Sample Collection Procedures

Samples shall be collected by a person with at least two years of water quality monitoring experience. Water samples shall be taken in appropriate bottles which have been cleansed with a non-phosphorus detergent and triple rinsed with stream water prior to collecting the grab sample. Samples will be preserved in accordance with standard methods or approved EPA Methods until delivery to the laboratory for analysis.

A measurement or estimate-of the flow rate shall be made each time a surface water sample is taken. A measurement of the depth to groundwater shall be made each time a well sample is taken.

Turf (soil) samples shall be a soil plug cut from the representative green, tee or fairway. Turf (soil) samples shall be taken by a person with at least two years of soil sample extraction experience.

E. Groundwater Monitoring

1. Requirements of the Groundwater Sampling Program: (1) establish baseline conditions in early spring; (2) monitor the effects of chemicals applied during the active (summer) season; (3) determine residual effects once the active season has ceased; (4) build a database adequate to provide effective feedback for golf course chemical and irrigation management with respect to environmental protection; and (5) five shallow wells shall be monitored for dissolved chemical constituents. One upgradient well (Well 5-s), three mid-course wells (Wells 305, 306, and 322), and one downgradient well (Well 301). The thirty-two on-site wells (monitoring wells 301 through 332) will be monitored (if functional) for Static Water level, reported in feet above mean sea level, and monthly (May-October) maps of groundwater flow direction shall be prepared. Additionally, monitoring of shallow wells will act as sentinel wells for the deeper aquifer, which is used for local drinking water. The Water Board Executive Officer may impose additional monitoring requirements in deep aquifer wells or adjacent shallow wells, based on monitoring results.

2. Groundwater Sampling Schedule: Monthly monitoring from May through October (six months) is required to cover the active golf season.

3. Groundwater Chemical Analyses: The dissolved chemical constituents shall be determined on samples passed through a 0.45 micron or smaller pore size filter (not made of cellulose nitrate). Instead, dissolved Total Kjeldahl Nitrogen (TKN, composed of organic N plus ammonium) will be assessed to capture organic forms of fertilizer now commonly used, and often more mobile in percolating groundwater, such as urea-based and formaldehyde-based chemical fertilizers, as well as ammonium-based fertilizer. Additionally, dissolved total phosphorus (TP) will be assessed (composed of dissolved orthophosphate, polyphosphates, and organic phosphate forms).

4. Groundwater Sampling Methodology: Sampling of the groundwater monitoring wells shall be conducted pursuant to the schedule and frequencies shown in the table below, contained in the General Provisions for Monitoring and Reporting (Attachment 1), and according to provisions of the CHAMP.

All groundwater samples for dissolved chemical constituents shall be grab samples and shall be drawn and analyzed according to the following:

Parameter	Units	Frequency
Dissolved Total Kjeldahl Nitrogen	mg/L as N	Monthly (May –Oct)
Dissolved Nitrate/Nitrite-Nitrogen	mg/L as N	Monthly (May -Oct)
Dissolved Total Phosphorus	mg/L as P	Monthly (May –Oct)
Dissolved Ortho Phosphorus	mg/L as P	Monthly (May-Oct)
Constituents of Pesticides (only those used and following use for the remainder of the season)	ug/L	Monthly (May-Oct)

Additionally, thirty-two on-site wells (monitoring wells 301 through 332) will be monitored (if functional) for Static Water level, reported in feet above mean sea level, and monthly (May-October) maps of groundwater flow direction shall be prepared.

F. Surface Water Monitoring

1. Requirements of the Surface Water Sampling Program: The purpose of the surface water monitoring program is to assess impacts of applied chemicals on transport of these compounds into surface water.

2. Surface Water Sampling Schedule and Locations: Since an adequate database for surface monitoring of potential pollutants such as nutrients and pesticides does not exist for this site for the active golf season, monthly monitoring is required, May through October (up to six samples) during periods when discharge occurs from Pond A.

   Three locations shall be sampled: Station R-9 Squaw Creek at western boundary of Resort at Squaw Creek; Station R-5 Squaw Creek at Squaw Valley Road; and Station R-I0 Outflow from Pond A.

3. Surface Water Chemical Analyses: Chemical constituents to be measured are listed below (same as for groundwater).

All surface water samples shall be grab samples and shall be drawn and analyzed according to the following:

Parameter	Units	Frequency
Dissolved Total Kjeldahl Nitrogen	mg/L as N	Monthly (May – Oct)
Dissolved Nitrate/Nitrite Nitrogen	mg/L as N	Monthly (May – Oct)
Dissolved Total Phosphorus	mg/L as P	Monthly (May – Oct)
Dissolved OrthoPhosphorus	mg/L as P	Monthly (May – Oct)
Total Suspended Solids (TSS)	mg/L	Monthly (May – Oct)
Oil and Grease	mg/L	Monthly (May – Oct)
Constituents of Pesticides (only those used and following use for the remainder of the season)	ug/L	Monthly (May – Oct)

Sampling and analysis shall be done in accordance with the General Provisions for Monitoring and Reporting (Attachment 1).

G. Turf (Soil) and Carbon Filter Samples

Samples are to be taken from the following sources at the following locations:

Three greens carbon filter samples-(if water is present) -green No. 1, green No.7, and green No. 14;

Samples are to be analyzed according to the following schedule:

Parameter	Units	Frequency
Dissolved Total Kjeldahl Nitrogen	mg/L as N	Annual (June)
Dissolved Nitrate/Nitrite Nitrogen	mg/L as N	Annual (June)
Dissolved Total Phosphorus	mg/L as P	Annual (June)
Dissolved OrthoPhosphorus	mg/L as P	Annual (June)
Total Organic Carbon (TOC)	mg/L	Annual (June)
Herbicides and Fungicides	ug/L	April, May, June (if used)

Nine turf (soil) samples--green No.1, green No.7, green No. 14, tee No.1, tee No.7, tee No. 14, fairway No.1, fairway No.7, and fairway No. 14.

Turf soil samples are to be analyzed according to the following schedule:

Parameter	Units	Frequency
Herbicides and Fungicides (if use)	ug/kg	April, May, June

H. Analytical Capabilities

Because of the unique and often pristine nature of waters in the Lahontan Region in general, exceptional analytical capabilities for nutrients and contaminants are required to assure compliance with Lahontan Basin Plan Water Quality and Non-Degradation Objectives. Required analytical reporting limits are:

Constituent	Reporting Limit (RL)[1] mg/L
Total Dissolved Solids (TDS)	85
Chloride	3.0
Sulfate	25.0
Total Nitrogen (TN as N)	0.18
Total Kjeldahl Nitrogen (TKN)	0.13
Nitrate plus nitrite (as N)	0.05
Total Phosphorus (TP as P)	0.02
Total Iron	0.13
Grease and Oil, EPA 1644, no silica gel cleanup, or equivalent	2.0

Other Constituents:

Reporting Limits shall be at a minimum as sensitive as the more restrictive of those required for analysis of pollutants (40CFR136), or analysis of drinking water specified by the California Code of Regulations, Title 22, Division 4, Chapter 15; or 40 Code of Federal Regulations, Part 141.

II. REPORTING

The above data including sampling results and inspections shall be submitted to the Board in accordance with the schedule described below. The Discharger shall arrange and compile data in a concise form for quick review by Water Board staff.

Report	Frequency	Report Submittal Dates
Erosion and Runoff Controls[1]	Annual	December 15
Maintenance and Operation[1]	Annual	December 15

Water Quality Monitoring	Annual	December 15
Golf Course monitoring	Annual	December 15
Bioassessment Monitoring	Every Two Years	January 15 (even yrs)

1. Written summary of monthly inspections, problems identified, and corrective measures taken.

Beginning on **December 15, 2009**, and each December 15 thereafter, monitoring reports shall be submitted to the Board for the period of sample collection covering the previous May through October. Beginning January 15, 2010, and every two years thereafter, bioassessment reports shall be submitted. Additionally, any detection of pesticide or significant increase in chemical constituents found during monthly monitoring must be reported immediately on receipt of the laboratory report to Water Board staff electronically or by FAX.

Ordered by: Harold J. Singer Dated: May 13, 2009
HAROLD J. SINGER
EXECUTIVE OFFICER

ATTACHMENT:
A. General Provisions for Monitoring and Reporting. September 1, 1994
B. Sampling and Analysis Requirements Numeric Target Monitoring, Squaw Creek Total Maximum Daily Load for Sediment, Placer County, March 2008

ATTACHMENT A

ATTACHMENT A

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

GENERAL PROVISIONS
FOR MONITORING AND REPORTING

1. SAMPLING AND ANALYSIS

a. All analyses shall be performed in accordance with the current edition(s) of the following documents:

i. Standard Methods for the Examination of Water and Wastewater

ii. Methods for Chemical Analysis of Water and Wastes, EPA

b. All analyses shall be performed in a laboratory certified to perform such analyses by the California State Department of Health Services or a laboratory approved by the Regional Board Executive Officer. Specific methods of analysis must be identified on each laboratory report.

c. Any modifications to the above methods to eliminate known interferences shall be reported with the sample results. The methods used shall also be reported. If methods other than EPA-approved methods or Standard Methods are used, the exact methodology must be submitted for review and must be approved by the Regional Board Executive Officer prior to use.

d. The discharger shall establish chain-of-custody procedures to insure that specific individuals are responsible for sample integrity from commencement of sample collection through delivery to an approved laboratory. Sample collection, storage, and analysis shall be conducted in accordance with an approved Sampling and Analysis Plan (SAP). The most recent version of the approved SAP shall be kept at the facility.

e. The discharger shall calibrate and perform maintenance procedures on all monitoring instruments and equipment to ensure accuracy of measurements, or shall insure that both activities will be conducted. The calibration of any wastewater flow measuring device shall be recorded and maintained in the permanent log book described in 2.b, below.

f. A grab sample is defined as an individual sample collected in fewer than 15 minutes.

g. A composite sample is defined as a combination of no fewer than eight individual samples obtained over the specified sampling period at equal intervals. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling. The sampling period shall equal the discharge period, or 24 hours, whichever period is shorter.

2. OPERATIONAL REQUIREMENTS

a. Sample Results

Pursuant to California Water Code Section 13267(b), the discharger shall maintain all sampling and analytical results including: strip charts; date, exact place, and time of sampling; date analyses were performed; sample collector's name; analyst's name; analytical techniques used; and results of all analyses. Such records shall be retained for a minimum of three years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge, or when requested by the Regional Board.

b. Operational Log

Pursuant to California Water Code Section 13267(b), an operation and maintenance log shall be maintained at the facility. All monitoring and reporting data shall be recorded in a permanent log book.

3. REPORTING

a. For every item where the requirements are not met, the discharger shall submit a statement of the actions undertaken or proposed which will bring the discharge into full compliance with requirements at the earliest time, and shall submit a timetable for correction.

b. Pursuant to California Water Code Section 13267(b), all sampling and analytical results shall be made available to the Regional Board upon request. Results shall be retained for a minimum of three years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge, or when requested by the Regional Board.

c. The discharger shall provide a brief summary of any operational problems and maintenance activities to the Board with each monitoring report. Any modifications or additions to, or any major maintenance conducted on, or any major problems occurring to the wastewater conveyance system, treatment facilities, or disposal facilities shall be included in this summary.

d. Monitoring reports shall be signed by:

i. In the case of a corporation, by a principal executive officer at least of the level of vice-president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge originates;

ii. In the case of a partnership, by a general partner;

iii. In the case of a sole proprietorship,by the proprietor; or

iv. In the case of a municipal, state or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee.

e. Monitoring reports are to include the following:

i. Name and telephone number of individual who can answer questions about the report.

ii. The Monitoring and Reporting Program Number.

iii. WDID Number.

f. Modifications

This Monitoring and Reporting Program may be modified at the discretion of the Regional Board Executive Officer.

4. NONCOMPLIANCE

Under Section 13268 of the Water Code, any person failing or refusing to furnish technical or monitoring reports, or falsifying any information provided therein, is guilty of a misdemeanor and may be liable civilly in an amount of up to one thousand dollars ($1,000) for each day of violation.

ATTACHMENT B

ATTACHMENT B

SAMPLING AND ANALYSIS REQUIREMENTS

NUMERIC TARGET MONITORING

SQUAW CREEK TOTAL MAXIMUM DAILY LOAD FOR SEDIMENT,
PLACER COUNTY

Lahontan Regional Water Quality Control Board
2501 Lake Tahoe Boulevard
South Lake Tahoe, California 96150
530.542.5400

Contact Person:

Anne Holden
Engineering Geologist
aholden@waterboards.ca.gov
530.542.5450

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1. DATA COLLECTION SUMMARY

The following shall be collected synoptically (i.e., at the same time) at each site, and on a biennial schedule (i.e., once every two years):

- General sampling site information (date, time, weather, conditions)
- Global Positioning System (GPS) coordinates of site locations
- Site photographs
- Water chemistry data
    - Temperature, dissolved oxygen, pH, conductivity
- Physical habitat data
    - Substrate particle size, water depth, stream width, current velocity
- Benthic macroinvertebrate samples

2. SAMPLING LOGISTICS

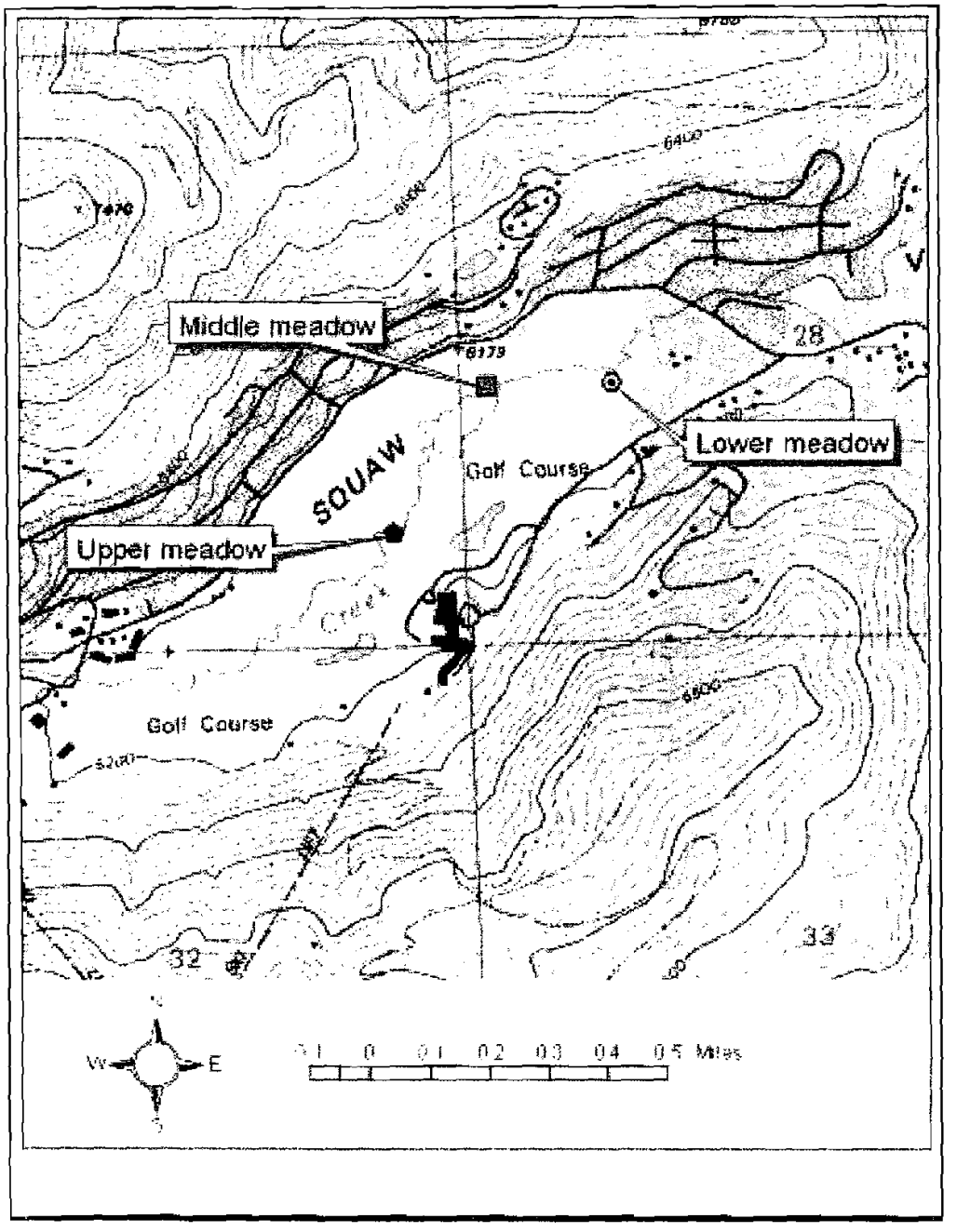
Sample Locations

Bioassessment sampling locations shall duplicate the three sites in the low gradient meadow reach of Squaw Creek sampled in 2000 and 2001 for the Squaw Creek TMDL bioassessment study (Herbst 2002). The UTM coordinates (datum: NAD 1927) for each site established by Herbst are provided in Table 1. The coordinates were recorded at the downstream end of each 150-meter sampling reach. Figure 1 shows the general sampling site locations.

Table 1. Sampling site coordinates. Datum is NAD 1927.

Location	Northing	Easting
Squaw Creek **Upper meadow**	4342814	740091
Squaw Creek **Middle meadow**	4343185	740287
Squaw Creek **Lower meadow**	4343245	740475

Figure 1: Squaw Creek meadow reach numeric target monitoring locations



Sampling Frequency

Sampling shall be conducted once every two years, beginning in 2009.

Sampling Period (also called "Index Period")

Sampling shall occur between the months of June and August, after peak snowmelt flows have subsided, when flows in the meadow reach are continuous and riffle habitat at the sampling sites is present. Target flow conditions are when the high-discharge snowmelt period is over, but before baseflows become so low that no riffle habitat is present. Avoid sampling when flow may be strongly influenced by precipitation, because sudden flow increases may affect local community composition (SWAMP 2007).

Sampling Equipment

(Adapted from Herbst 2001 and 2002, and SWAMP 2007)

- Multi-parameter probe or individual probes (for field measurements of dissolved oxygen, temperature, conductivity, pH)
- Current meter (for stream discharge)
- D-frame kick net (250-micron mesh size)
- BioQuip forceps
- White sorting pan (enamel or plastic)
- 100% ethanol and rose bengal stain
- Sample jars (250 ml or 500 ml)
- Buckets (2) and aquarium nets (fine mesh)
- Meter stick or other graduated rod (for measuring depth and pebble counts)
- Meter tape (50 meters on a reel)
- Data collection sheets/fieldbook
- Flags/flagging Tape
- Camera
- GPS unit
- Small metric ruler or gravelometer for substrate measurements

3. FIELD PROCEDURES

(Adapted from Herbst 2001 and 2002, and SWAMP 2007)

Prepare Sampling Location

1. Define sampling reach

Each sampling site is a 150-meter reach along an approximation of the thalweg (i.e., deepest part) of the channel. To the extent possible, this measurement should be made by following along the bank contours of the channel, laying out the meter tape. This may require crossing the channel or even walking in the stream if bank vegetation cover is too dense – but this should be avoided or kept to an absolute minimum to avoid

disturbance of benthic habitat. Lay out the 150-meter reach starting at zero at downstream end of reach.

2. Record reach information

Once the 150-meter reach is delineated, record GPS UTM coordinates and datum at the bottom end of the reach. Record date, time, sampling staff, site name (i.e., Squaw Creek upper, middle or lower meadow) and general weather conditions, as well as any other conditions that may influence bioassessment sampling (i.e., recent high flows, scouring events, other stream disturbances, etc.).

3. Take photographs

Photos shall be taken at 0 meters (m) looking upstream, 50 m looking upstream, 100 m looking upstream and 150 m looking downstream. For all photos, record site, date, and transect location of photo (e.g., 0 m looking upstream).

4. Define riffle-pool areas

Over the 150-meter reach, record along the meter tape (to the nearest meter) where erosional and depositional habitat types begin and end – riffles and pools, respectively. This provides an indication of the distribution and length of these major geomorphic features within each reach. The position of these habitat features shall also be used to determine where the benthic invertebrate samples are to be collected by using a random number table (0-150). Specifically, after recording the riffle ranges, select random numbers until five of the random numbers correspond with the riffle ranges, and then sample at those locations. Any habitat not assigned to the riffle-pool categories may be recorded as transitional "glide" or "run" habitat type.

5. Establish transects

Establish fifteen transects, spaced at 10-meter intervals, over the length of the 150-meter sampling reach. Mark transects with surveyor's flags or similar, along a single bank.

Measure and Record Water Chemistry Data

At the top end of the reach, where no instream habitat has been disturbed by the sampling crew, measure and record ambient water chemistry data (i.e., pH, dissolved oxygen, temperature, conductivity).

Collect Benthic Macroinvertebrate Samples

Macroinvertebrate samples shall be collected before recording physical habitat data. Samples shall be collected as composites of 3 kick samples across 5 randomly selected

riffle habitats; therefore, each sampling site will have 5 replicate samples collected for laboratory analyses.

Benthic Macroinvertebrate Sampling Procedure

(Adapted from Herbst 2001, Appendix 2-2)

Select 5 riffles from a random number table (as described above in the subsection titled "Define riffle-pool areas") along the 150-meter reach. Use the D-framed net (250-micron mesh size) to collect kick samples at ¼, ½ and ¾ of the stream width. (Always start at the location furthest downstream and work up.) When selected riffles are wide enough, collect the 3 samples for each composite along a transect that is perpendicular to the stream (i.e., across the stream in a side-by-side manner). For selected riffles that are too narrow to collect all 3 samples along a perpendicular transect, collect the 3 samples one above the other (starting from downstream) as described further, below. Kick an area approximately 30 x 30 cm directly upstream of the net (a square area with sides equal to net width). Continue this kick for about 10-15 seconds, then rub the rocks by hand for an additional 10-15 seconds (total 20-30 seconds at each of 3 positions = 1 to 1.5 minutes). If shallow enough, just use hands for the full time, rather than kicking. After each sample position, remove large rocks or wood debris after washing them in the current into the net.

For streams less than 1-2 meters wide, take 2 kick samples from both sides of the stream with one sample just above and mid-stream, or collect all 3 samples singly (one above another) starting at the random number location (instead of taking all 3 across the stream when widths are greater than 1- 2 meters). Keep in mind that the goal is to sample across different microhabitat types in the stream including varied depth, current, and substrate types; the three composited samples should represent the variety of riffle habitat present. One or two samples may be used to comprise a composite if samples are dense with debris. The label should then indicate the number of kicks used (i.e., 1 or 2); assume 3 if not noted on label. If riffle habitat is not available across the entire line of each transect, select representative locations to collect the needed composite sample.

Quickly dip the net into the stream to consolidate the material to the bottom of the D-framed net. Pick out any remaining large debris being sure to retain any attached insects. Invert the net into a bucket that is 1/4 to 1/3 full of water. Shake out the net to collect all the debris and insects (do not dip in bucket water since insects will adhere). Dip net into the stream again to consolidate remaining contents and flick inverted net into the bucket.

Elutriate (pour off lighter material) with a swirling motion into the other bucket five times. Use only a small volume of water in each elutriation so the receiving bucket does not overflow. Only rocks and sand should be left in the original bucket. Empty these rocks into a shallow white pan (or closely examine the bottom of the bucket). Search for cased caddisflies/snails and add to sample if found (they are heavier and may not pour off).

Strain collected material through a fine mesh aquarium net supported on one bucket (this may also serve as elutriation since some sand usually remains). Empty contents of aquarium net into a sample container. Use BioQuip forceps to scrape any remaining debris into vial. Fill container with ethanol to preserve the captured organisms. Fill to a level that just covers the amount of debris. Add 5 ml of rose bengal stain. Label sample jar as shown below, and move on to next sample.

Label Sample Jars

Record stream name, site name, date, and replicate number. The label shall also indicate the number of kicks used (i.e., 1 or 2) if fewer than 3; assume 3 if not noted on label.

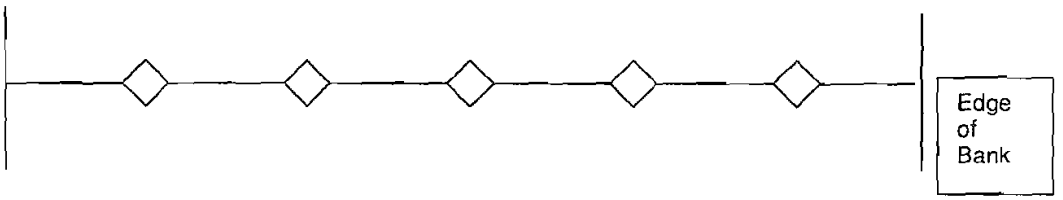
Collect Physical Habitat Data: Percent Fines and Sand, D-50 Particle Size

(From Herbst 2001 and 2002, and SWAMP 2007)

Physical habitat data shall be collected at 5 equidistant points along each of the 15 established transects. Current velocity shall be measured at one selected representative transect at each reach.

1. Measure and record stream width (wetted perimeter) at transect location. Each transect is then visually divided into 5 equally spaced points (visualize the mid-point as 3, and equally divide the left and right sides into points 1 and 2 and points 4 and 5). (Figure 2).

Figure 2. Spacing of transect points.



2. At each of the 5 points along the transect, lower a graduated rod (e.g., meter stick or similar) through the water column perpendicular to both the flow and the transect to objectively select the particle located at the tip of the rod.

3. Measure the depth from the water surface to the top of the particle and record to the nearest centimeter.

4. Remove the particle from the streambed, then measure and record the length of its intermediate axis to the nearest millimeter, and assign to one of the size classes listed below. Alternatively, size may be estimated using descriptions listed below (SWAMP 2007). Record size class using codes listed in the far right column of Table 2.

Table 2. Substrate size descriptions and size class codes.

Substrate	Size (Herbst 2002)	Description (from SWAMP 2007)	Size Class Code
Fines	< 1 mm	Not gritty	F
Sand	1-3 mm	Gritty to ladybug	S
Gravel	3-65 mm (6.5 cm)	Ladybug to marble to tennis ball	G
Cobble	6.5 cm to 25 cm	Tennis ball to basketball	C
Boulder (or bedrock)	>25 cm (10 inches)	Bigger than basketball	B

5. Select one representative transect at each reach to record current velocity. At 60 percent depth, measure the current velocity at each point along the selected transect. Record current meter type used and units. Discharge is calculated as the sum of one-fifth the stream width times the depth and current velocity measured at each of the five transect points.

Stream velocity, depth, and substrate size shall be recorded and reported using the template provided in Attachment 1 (from Herbst 2001, Appendix 1-7, pp. 2-3), or an equivalent method, and stream discharge (width x depth x velocity) shall be reported for each reach. Substrate data shall be entered into the Excel spreadsheet template provided in Attachment 2, and provided to Water Board staff in that electronic format, including values for the D-50 (median) particle size and "percent fines plus sand" calculated for each reach according to the methods and formulas in Attachment 2.

4. LABORATORY ANALYSIS

Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrate Samples

(Adapted from Herbst 2001 and 2002)

Subsample Counts:
Each subsample shall have a minimum organism count of 250. Complete counts shall be performed for any and all subsamples taken. (Average counts will be in the 300-500 range.)

Sample Splitting:
Samples may be split to acquire subsamples using either the grid-tray method or a rotating drum (i.e., Folsom) plankton splitter. Additional background information about the performance characteristics of these and other procedures is available in Herbst and Silldorff (2004).

Sample Identification:
Sorted specimens shall be identified, assigned, and reported using the taxonomic levels shown in Attachment 3 (Calculator for Squaw Cr Biological Targets). Each identification

shall have a taxonomic certainty rating of "1," "2," or "3" assigned to it, to assist in evaluating any problems with taxonomy that may arise (see taxa record sheets in Herbst 2001, Appendix 1-3, for an example template). Life stage(s) and observations of identifying traits or specimen condition shall also be recorded and reported along with the other results.

5. CALCULATION OF COMPONENT METRICS AND THE "BIOLOGICAL CONDITION SCORE" (BCS)

The BCS's seven component metrics (i.e., Biotic Index, Taxa Richness, EPT Diversity Index, %EPT of Total, Number of Sensitive Taxa, % Tolerant Taxa, R-50 Index) shall be calculated using the methods in Attachment 3 ("Calculator for Squaw Cr Biological Targets"). Following calculation of the seven component metrics, the BCS shall be calculated by summing the component metric scores derived using the values in Attachment 3, (from: Herbst 2002, p. 9, table titled "Biological Condition Scores Assigned to Metric Value Ranges").

6. QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

The discharger shall prepare and/or make available to its relevant staff and/or consultants a Quality Assurance Project Plan (QAPP) that addresses the required bioassessment monitoring. The QAPP should follow USEPA guidance and requirements as found in *USEPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, EPA/240/B-01-003, March 2001), and *USEPA Guidance for Quality Assurance Project Plans* (EPA QA/G-5, EPA/240/R-02/009, December 2002). Upon request from the discharger, the Water Board's Executive Officer or Quality Assurance Officer may override any USEPA quality assurance requirements and/or guidance that are deemed inapplicable and/or unnecessary for this project. Any such deviations must be approved in writing and in advance by Water Board staff. An umbrella document, such as a Quality Assurance Management Plan or other project or program quality assurance document, may be used to meet this requirement if the umbrella document covers all relevant aspects of the required bioassessment sampling.

The QAPP (or umbrella document) shall include, or be supplemented to include, a specific requirement for external quality assurance checks (i.e., verification of taxonomic identifications and correction of data where errors are identified). External QA checks shall be performed on: (1) all uncertain taxa; <u>and</u> (2) one macroinvertebrate sample per calendar year in which sampling occurs for this project, or ten percent of the samples per year (whichever is greater). QA samples shall be randomly selected. The external QA checks shall be paid for by the discharger, and performed by the California Department of Fish and Game's Aquatic Bioassessment Laboratory. An alternate laboratory with equivalent or better expertise and performance may be used for the external QA checks if approved in advance by the Water Board's QA Officer or Executive Officer.

7. DATA REPORTING

The discharger shall provide, within one year of each sample date, electronic copies (in Microsoft Excel® format) of:

- Spreadsheet with substrate size calculation formulas, providing values for the D-50 particle size and "percent fines plus sand", calculated according to the methods and formulas contained in Attachment 2. (This reporting requirement can be satisfied by completing and submitting the spreadsheet provided in Attachment 2.)
- All raw bioassessment data (i.e., all data for all 5 replicates for each site) in spreadsheet format, reported using the taxonomic levels in Attachment 3. (Note: Deviation from the taxonomic levels in Attachment 3 is not acceptable, since any such deviation could affect the component metrics and final BCS score.) This shall include a separate column of data for each of the five replicates, and a "total" column that sums (composites) the data for all five replicates. (This reporting requirement can be satisfied by completing and submitting the spreadsheet provided in Attachment 3.)
- Metric calculation spreadsheet showing values for the seven BCS component metrics and the final BCS score calculated according to the formulas in Attachment 3. (This reporting requirement can be satisfied by completing and submitting the spreadsheet provided in Attachment 3.)

The discharger shall also provide, concurrently with the data described above, in both hardcopy and electronic (i.e., Adobe PDF) formats, a brief interpretive report including:

- A narrative summary of the results (including calculated Biological Condition Score, D-50 particle size, and "percent fines plus sand") for each site and date, with a tabular comparison of the most recent scores to the TMDL targets and any and all previous monitoring scores (i.e., to clearly display and briefly summarize the trends in target values over time compared to the numeric targets).
- Photocopies of field data sheets and field notes
- Site photographs
- Results of the external QA checks and any action(s) taken to resolve any discrepancies encountered during the QA process.

8. SAMPLE PRESERVATION AND ARCHIVING

Definitions: The "original sample material" is that material (i.e., macroinvertebrates, organic material, gravel, etc.) remaining after the subsample has been removed for identification. The "remaining subsampled material" is that material (i.e., organic material, gravel, etc.) that remains after the organisms to be identified have been removed from the subsample for identification. (Generally, no macroinvertebrates are present in the remaining subsampled material, but this needs to be verified via QA

completeness checks, according to the lab's QAPP.) The "identified organisms" are those organisms within the subsample that are specifically identified and counted.

The original sample material shall be stored in 70 percent ethanol and retained by the discharger until: 1) all QA analyses specified herein and in the relevant QA plan are completed; and 2) any data corrections and/or re-analyses recommended by the external QA laboratory have been implemented. The remaining subsampled material shall be stored in 70 percent ethanol and retained until completeness checks have been performed according to the relevant QA plan. The identified organisms shall be stored in 70 percent ethanol, in separate glass vials for each of the five replicates for each site for each sample date. The discharger shall preserve and retain these identified organisms until the Regional Board's Executive Officer accepts in writing the fifth biennial monitoring report (i.e., If monitoring commences in 2009, and is conducted every other year, in 2011, 2013, 2015, and 2017, the identified organisms shall be preserved and retained by the discharger as described above until the ten-year report on the 2017 results is accepted in writing by the Executive Officer).

The external QA samples shall be stored in 70 percent ethanol in separate glass vials for each final ID taxon. (For example, a sample with 45 identified taxa would be archived in a minimum of 45 vials, each containing all individuals of the identified taxon.) Each of the vials containing identified organisms shall be labeled with taxonomic information (i.e., taxon name, organism count) and collection information (i.e., site name/site code, waterbody name, date collected, method of collection). These samples shall be transmitted to the external QA laboratory, and once returned by the external QA laboratory shall be archived (i.e., retained) by the discharger for the same duration as the other identified organisms.

All archived samples shall be checked at least once per year and "topped off" with ethanol to prevent desiccation, and shall be relinquished to the Water Board upon request by any Water Board staff.

9. ATTACHMENTS

1. *Appendix 1-7.pdf* from Herbst (2001), "Stream Form" (3 pages)

2. *D-50 calculation template.xls* (Excel spreadsheet template for calculating and reporting D-50 particle size and "percent fines plus sand")

3. *Squaw_permit_attachment_3_Calculator_for_Squaw_Cr_Biological_Targets.xls* (Example Excel spreadsheet template for calculating individual component metrics of the Biological Condition Score)

10. REFERENCES

Herbst, D.B. 2001. *Quality Assurance Project Plan – Aquatic invertebrate bioassessment monitoring in the Eastern Sierra Nevada*, Sierra Nevada Aquatic Research Laboratory and Lahontan Regional Water Quality Control Board. Download at: http://www.waterboards.ca.gov/lahontan/water_issues/projects/quality_assurance_project_plan/index.shtml

Herbst, D.B. 2002. *Development of Biological Water Quality Targets for Assessment of Total Maximum Daily Load (TMDL) of Sediment in the Squaw Creek Watershed (Placer County, California).* Final Report to Lahontan Regional Water Quality Control Board for Contract #9-118-160-0. April 16, 2002. 39 pp. Download at: http://www.waterboards.ca.gov/lahontan/water_issues/programs/swamp/docs/herbst_scb_2002.pdf.

Herbst, D.B., and E.L. Silldorff. 2004. *Performance of Different Bioassessment Methods from California: Side-by-Side Comparisons of Field, Laboratory and Analysis Procedures for Streams of the Eastern Sierra Nevada.* Final Report to the Lahontan Regional Water Quality Control Board for Contract #9-191-160-0. November 26, 2004. 51 pp. Download at: http://www.waterboards.ca.gov/lahontan/water_issues/programs/swamp/docs/herbst_silldorff_methods_comparison_2004.pdf

Surface Water Ambient Monitoring Program (SWAMP). 2007. *Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California.* California State Water Resources Control Board, Sacramento, CA. February 2007. 48pp. Download at: http://www.waterboards.ca.gov/swamp/docs/phab_sopr6.pdf