

Lake Tahoe and Truckee River Watershed

2nd Annual Snapshot Day

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Lake Tahoe Environmental Education Coalition



California Environmental Protection Agency
LAHONTAN REGIONAL
WATER QUALITY CONTROL BOARD



Washoe-Storey Conservation District



May 4, 2002



Snapshot Day 2002 Photos



Team Leader Training



Stream Monitoring



Team Leader Training



Equipment Calibration



Equipment Calibration



Photo Documentation



Stream Monitoring



Photo Documentation

Introduction

The second annual Snapshot Day 2002 was held on May 4, 2002 in the Lake Tahoe and Truckee River watersheds. More than 310 committed citizen-volunteers, working closely with many water quality management agencies, participated in gathering water quality information in the form of visual assessments, photos, and water quality data at 117 locations (compared to 100 volunteers at 44 locations in 2001).

This collaborative effort was planned and coordinated by the Citizen Monitoring Working Group of the Lake Tahoe Environmental Education Coalition (LTEEC). The Citizen Monitoring Working Group includes independent citizens and representatives from non-profit organizations, agencies, and the academic community. Organizations involved in planning this event included:

- California State Water Resources Control Board (SWRCB)
- California Tahoe Conservancy
- Citizens at Fallen Leaf Lake
- Incline Village General Improvement District
- Lahontan Regional Water Quality Control Board (RWQCB)
- Lake Tahoe Community College
- Lake Tahoe Environmental Education Coalition (LTEEC)
- League to Save Lake Tahoe
- Marine Research and Education
- Nevada Division of Environmental Protection (NDEP)
- Sierra Nevada College
- Tahoe Regional Planning Agency (TRPA)
- Tahoe Resource Conservation District
- Truckee River Aquatic Monitors
- Truckee River Watershed Council
- U.S. Forest Service
- UC Davis Tahoe Research Group
- University of California Cooperative Extension
- University of Nevada Cooperative Extension
- University of Nevada Reno Electrical Engineering Department, and
- Washoe-Storey Conservation District.

The citizen-monitoring program of the California State and Regional Boards is the *Clean Water Team*, and the participating volunteers in the Lake Tahoe and Truckee River watersheds adopted that moniker as well. Volunteers from Lake Tahoe, Fallen Leaf Lake, Truckee and Reno joined together to make the Second Annual Snapshot Day event a watershed-wide effort.

What is Snapshot Day?

Snapshot Day is a one-day, volunteer-based event designed to collect watershed information during one moment in time. Volunteer “team leaders” are trained, and these leaders accompany teams of volunteers to various pre-determined sites to collect information relative to the health of our watersheds. The purpose of this effort is two-fold: to promote

environmental education and stewardship, and to collect valuable water quality information. While there is a great deal of high quality agency and university-sponsored monitoring taking place in the region, there is still insufficient information to adequately assess the status of all of the aquatic resources in the Truckee River and Lake Tahoe Basin watersheds. With proper training and quality assurance, community volunteers can help fill this void by providing valuable information for watershed management and pollution prevention.

Citizen Monitoring: The Clean Water Team

The mission of the Clean Water Team citizen monitors is to produce environmental information that is needed to protect the Truckee River and Lake Tahoe Basin watersheds and aquatic resources. Citizen monitoring will inform and engage the community in effective watershed stewardship. This team is one of the nine working groups of the Lake Tahoe Environmental Education Coalition whose goal is to support coordinated public outreach education efforts throughout the Tahoe Basin.

The goals of the Citizen Monitoring Working Group are:

- Identifying valued resources and watershed characteristics for setting management goals,
- Identifying physical watershed characteristics influencing pollutant inputs, transport and fate,
- Identifying the status and trends of chemical characteristics and biological resources in and around an aquatic environment,
- Screening for water quality problems,
- Identifying pollution sources and illegal activities (spills, wetland fill, diversions, discharges),
- Establishing trends in water quality for waters that would otherwise be un-monitored,
- Evaluating the effectiveness of restoration or best management practices,
- Evaluating the effect of a particular activity or structure,
- Evaluating the quality of water compared to specific water quality criteria, and
- Building awareness of water quality issues, aquatic resources and pollution prevention.

Citizen monitoring is designed to supplement existing agency monitoring efforts. The focus of the project is on habitat and chemical, physical and biological water quality measures that will identify the status of our aquatic resources. Citizen monitoring information is provided to the regulatory and resource management agencies, whose responsibility it is to protect water quality.

Methods

Citizen monitoring “team leaders” were provided training during the month prior to Snapshot Day. Team leader trainings covered descriptions and protocols for visual observations, photo-documentation, water quality field measurements (temperature, pH, conductivity, dissolved oxygen), and water sampling (grab samples). Each monitoring team leader had to attend at least one session.

Training for the Lake Tahoe watershed and Middle Truckee River watershed team leaders was led by Heather Segale, Lake Tahoe Environmental Education Coalition (LTEEC), Holly Sheradin, California State Water Resources Control Board (SWRCB), Rita Whitney, Tahoe Regional Planning Agency, and Jill Wilson, Lahontan Regional Water Quality Control Board (RWQCB). There were two training sessions at Lake Tahoe, one in South Lake Tahoe at the Lake Tahoe Community College and one in Incline Village at Sierra Nevada College. Training for the Lower Truckee River watershed team leaders was held at the Environmental Leadership office in Reno, Nevada, and led by Jason Kuchnicki of Nevada Department of Environmental Protection, Lovina New of Washoe-Storey Conservation District, and Sarah Tone of Environmental Leadership.

Visual observations and photo-documentation were performed according to the procedures provided by the SWRCB Clean Water Team. A standardized observation form, the *California Stream and Shore Walk Visual Assessment Form*, was used. A minimum of three photos was taken at each sampling site (bed conditions, view across stream and view upstream from the starting point). All stream-walks were initiated from a downstream position, traveling upstream.

There were a variety of instruments and kits used on Snapshot Day by the volunteers. The majority of the monitoring teams were assigned armored Envirosafe thermometers (alcohol filled, 0.5° C resolution) or hand-held digital thermometers (0.1° C resolution), non-bleeding Whatman pH indicator strips (0.5 pH unit resolution), hand-held Oakton TDS Tester Conductivity meters (10 μ S/cm resolution), and Chemet dissolved oxygen kits (colorimetric, indigo carmine dye reaction, 1 mg/L resolution below 6 mg/L and 2 mg/L resolution above 6 mg/L). Most of these instruments/kits were provided via funding from University of Nevada Reno (UNR) Electrical Engineering Department, with some other instruments/kits loaned from the California State Water Resources Control Board (SWRCB), Environmental Protection Agency, Lake Tahoe Community College (LTCC), and others. Some of the monitoring teams were equipped with higher resolution instruments provided by California SWRCB, Carson Valley Conservation District, Sierra Nevada College, Tahoe Regional Planning Agency (TRPA), Truckee River Aquatic Monitors, U. S. Forest Service, U.S. Geological Survey, UC Davis Tahoe Research Group, and Washoe County. Turbidity meters, to be used at two centralized drop off points, were supplied by the U.S. EPA and the U.S. Forest Service. All of the instruments and kits were calibrated and tested/standardized at a quality control session held on the eve of Snapshot Day.

All observations, photos, field measurements and samples were taken between 9:00 a.m. and 12:00 noon on May 4, 2002. All samples were kept chilled with ice or blue ice in coolers from the point of collection until analyzed. Coliform samples were collected in sterile Whirlpaks and nutrient and turbidity samples were collected in clean (acid rinsed) Nalgene plastic bottles. Samples were brought to three centralized locations, Lake Tahoe Community College, Sierra Nevada College and the Washoe-Storey Conservation District office. Coliform samples were then transported from these drop off points and delivered to the Lahontan Regional Water Quality Control Board laboratory within 4 hours of collection. The analysis procedure for fecal coliform was initiated within 6 hours of sample collection. (Note: Those samples not received within the permitted time period were excluded from analysis.) Turbidity samples were run on the afternoon of Snapshot Day along with replicate testing of field measurements such as pH and conductivity. Nutrient samples were kept refrigerated and then analyzed by High Sierra Lab (Lake Tahoe and Middle Truckee River samples) and Truckee Meadows Water Reclamation Facility (for the Lower Truckee River samples) within one week of sampling.

This year, Snapshot Day activities were expanded to include an optional “habitat assessment” component for interested volunteers. Habitat assessments provide an overview of physical conditions that are likely to affect stream organisms. Habitat assessment training, led by Jill Wilson of Lahontan RWQCB, was offered as an optional training at both North Shore and South Shore “team leader” training events. Using the *Habitat Features Checklist* (presented in The California Streamside Biosurvey: An Introduction to Using Aquatic Invertebrates as Water Quality Indicators, California State Water Resources Control Board, September 2001), volunteers were instructed to measure out a stream reach of 100 meters in length and evaluate various characteristics of the stream. Observational data include epifaunal substrate/available cover, embeddedness, velocity/depth regimes, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, vegetative protection, and riparian vegetative zone width. This procedure relies on some subjective evaluations and serves as an entry level to more extensive methods for measuring the biological health of a stream (i.e. streamside biosurvey procedure).

Site Locations

Volunteers gathered data at 117 locations, including multiple reaches within some streams, in the Lake Tahoe and Truckee River watersheds (see maps in appendix) as follows:

Lake Tahoe (On Lake):

- Lake Tahoe at Sand Harbor
- Lake Tahoe at Thunderbird Lodge
- North Shore Lake Tahoe Near Dollar Point Outfall #58
- North Shore Lake Tahoe Near Sunnyside
- North Shore Lake Tahoe Near Tahoe City Outfall #65
- North Shore Lake Tahoe Near Watson Creek
- South Shore Lake Tahoe at Edgewood Creek
- South Shore Lake Tahoe Near Zephyr Creek

Lake Tahoe Tributaries, North Shore:

- Barton Creek
- Blackwood Creek
- Burnt Cedar Creek
- Burton Creek
- Carnelian Bay Creek
- Carnelian Canyon Creek
- Culvert at Coon Street Beach Ramp
- Dollar Creek
- First Creek
- General Creek
- Griff Creek
- Hatchery Creek
- Homewood Creek
- Incline Creek
- Lake Forest Creek
- Logan House Creek
- Madden Creek
- Marlette Creek

- McKinney Creek
- North Logan House Creek
- Quail Creek
- Rosewood Creek
- Second Creek
- Snow Creek
- Tahoe State Park Discharge
- Third Creek
- Third Creek, at Highway 431
- Tunnel Creek
- Watson Creek
- Wood Creek
- Wood Creek, at Highway 431

Lake Tahoe Tributaries, South Shore:

- Angora Creek, Highway 50
- Angora Creek, Lake Tahoe Blvd.
- Angora Creek, Washoe State Park Meadow
- Bijou Creek
- Burke Creek
- Cascade Creek
- Cold Creek, above Pioneer Trail
- Cold Creek, below Pioneer basin
- Cove East
- Echo Creek
- Edgewood Creek
- Fallen Leaf Lake
- Glen Alpine Creek
- Heavenly Creek
- Heavenly Creek Tributary
- Lonely Gulch Creek
- Meeks Creek
- North Zephyr Creek
- Saxon Creek
- South Zephyr Creek
- Tahoe Keys Lagoon at Brook Drive
- Tahoe Keys Lagoon at Emerald Drive
- Tallac Creek
- Taylor Creek
- Trout Creek, Black Bart Bridge
- Trout Creek, LTCC
- Trout Creek, North of Pioneer
- Trout Creek, South of Pioneer
- Upper Truckee River, Brook Drive
- Upper Truckee River, Christmas Valley
- Upper Truckee River, Elks Club
- Upper Truckee River, Mosher Reach

Truckee River Watershed – Middle Truckee River:

- Alder Creek
- Bear Creek
- Boca Tributary
- Bronco Creek
- Cabin Creek
- Coldstream
- Davies Merrill Creek
- Deer Creek
- Donner Creek
- Granite Flat Campground
- Independence Creek
- Lower Trout Creek
- Mainstem Truckee River
- Mainstem Truckee River, Granite Flat Campground
- Mainstem Truckee River, I80 Corridor
- Martis Creek
- Perazzo Meadow
- Pole Creek
- Prosser Creek
- Sagehen Creek
- Silver Creek
- Squaw Creek
- Truckee River
- Truckee River, Town of Truckee
- Union Creek
- Upper Little Truckee
- Upper Trout Creek (Town of Truckee)

Truckee River Watershed – Lower Truckee River:

- Alum Creek
- Davis Creek
- Dog Creek
- Dry Creek
- Galena Creek
- Hunter Creek
- Musgrove Creek
- Steamboat Creek, Andrew Lane
- Steamboat Creek, Clean Water Way
- Steamboat Creek, Geiger Grade
- Thomas Creek
- Truckee River, Glendale Park
- Truckee River, Idlewild
- Truckee River, Nixon Bridge
- Truckee River, Pearson Dam
- Truckee River, Vista Blvd.
- White's Creek

Beneficial Uses of the State's Waters

Water quality standards are established to protect beneficial uses of each State's waters. The most common beneficial uses include drinking water, recreation and fisheries. When a water quality standard is established, the first step is to identify the beneficial uses sensitive to the parameter. Then criteria are established based on the levels needed to protect the sensitive uses.

In many Sierra streams, propagation of cold-water fish (i.e. trout or salmon) is a designated beneficial use of the water. In such streams, numerical and narrative water quality standards generally are set at levels that will "support the beneficial use" of a cold water fishery. Such streams generally require cooler temperatures (ranges adequate for Rainbow trout survival shown below) and higher dissolved oxygen content than water in streams and lakes that do not have cold-water fishery as a designated beneficial use. Cold-water fish also require habitat characteristics that promote spawning (clear gravel beds, riffles and pools) and adequate food sources such as macroinvertebrates (mayfly, nymphs, stonefly nymphs, and caddisfly larvae). Such characteristics can be monitored, but they do not usually have numeric standards. Some of the volunteers completed a *Habitat Features Checklist* to examine these characteristics.

General EPA Temperature Ranges for Rainbow Trout

Species	Growth	Maxima	Spawning*	Embryo Survival**
Rainbow Trout	19°C (66 °F)	24°C (75 °F)	9°C (48 °F)	13°C (55 °F)

* The optimum or mean of the range of spawning temperatures reported for the species.

** The upper temperature for successful incubation and hatching reported for the species.

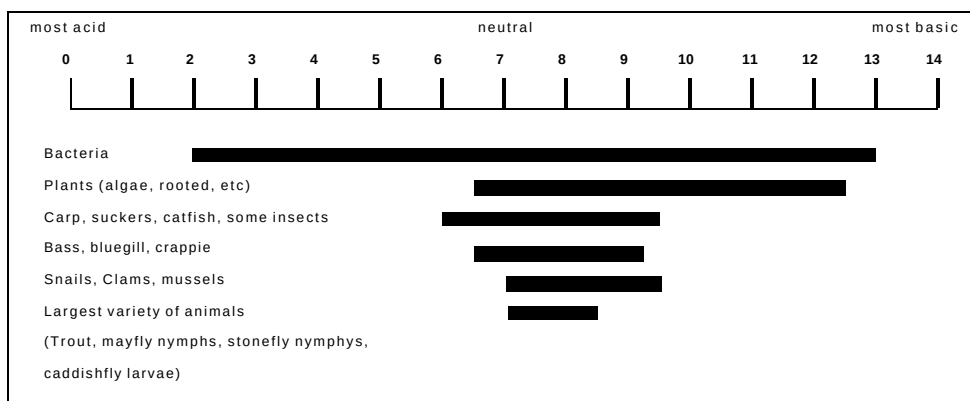
Adapted from EPA's Draft Volunteer Stream Monitoring: A Methods Manual .

Results

Water temperature ranged from 2.5 to 17.5 ° C. The highest measured temperatures were at Alum Creek (17.5 ° C), White's Creek (14.5 ° C), Truckee River on reach #4 and #5 (both 14° C), and the Tahoe Keys Lagoon on reach #1 and #2 (13.5° C and 14° C respectively). It should be mentioned that Alum Creek, White's Creek, and the Truckee River locations are all outside the Tahoe Basin in Reno, Nevada, at a much lower elevation than most of the other sites, and in a high desert environment where one would expect slightly higher temperatures. Generally, cooler water temperatures are considered better habitat for aquatic life in mountain streams and lakes (see also Beneficial Uses of the State's Waters, above). Cold water holds more oxygen, an essential ingredient for fish and invertebrates. Higher temperatures can occur as a result of low flow (shallow) conditions and/or a lack of canopy (tree) cover along stream banks.

For most measured sites **pH values** were within the range of 6.5 to 8.5, which is typical of fresh water streams or lakes in the Sierras. In fresh water, pH in the range of 6.5 to 8.5 should protect most organisms. In the Lower Truckee River watershed, there were several sites with pH values as low as 5 (including Davies Merrill Creek, Galena Creek, Truckee River reach #1 and #3, and Steamboat Creek reach #1), however, the range of pH tolerated by organisms varies, as can be seen in this chart.

pH Ranges that Support Aquatic Life



pH ranges that support aquatic life.

Dissolved oxygen measurements ranged between 1 and 13 mg/L. Cold, clean water usually has levels of dissolved oxygen averaging above 6.0 mg/L, and single-measurement levels below 5 mg/L are considered dangerous for (cold water) aquatic life. While water quality objectives for dissolved oxygen will vary from region to region, waters that support coldwater fishes usually require that dissolved oxygen concentration shall not fall below 6 to 8 mg/L (while for waters that support warm water fishes, the objective requires that the dissolved oxygen concentration shall not fall below 5 to 6 mg/L). Seven sites had oxygen levels below 6.0 mg/L. These were at Boca Tributary, White's Creek (1 mg/L), Pole Creek (4.5 mg/L), Upper Little Truckee (5 mg/L), Angora Creek (5.5 mg/L), Rosewood Creek (5.5 mg/L) and Steamboat Creek (5.8 mg/L).

Conductivity measurements ranged from 10-743 $\mu\text{S}/\text{cm}$ (micro Siemens per centimeter, the units used for conductivity measurements in fresh water). Conductivity is used as an indicator of dissolved solids (e.g., minerals or salts), with higher levels associated with degraded water quality. The numeric value of total dissolved solids (TDS) is roughly 65% of the numeric value of conductivity measurements. TDS are measured in milligrams per liter (mg/L) which are equivalent to parts per million (ppm). Conductivity will vary with water source: ground water, water drained from agricultural fields, municipal wastewater, or rainfall. Therefore, conductivity can indicate groundwater seepage or a sewage leak.

Thirty-five sites had measurements $\geq$ (greater than or equal to) 100 $\mu\text{S}/\text{cm}$ while only five sites had measurements $\geq$ (greater than or equal to) 300 $\mu\text{S}/\text{cm}$. The sites with elevated conductivity measurements, along with the corresponding TDS measurements, are Alum Creek (743 $\mu\text{S}/\text{cm}$, 483 mg/L), Steamboat Creek reach #2 (738 $\mu\text{S}/\text{cm}$, 480 mg/L), Steamboat Creek reach #3 (661 $\mu\text{S}/\text{cm}$, 430 mg/L), White's Creek (557 $\mu\text{S}/\text{cm}$, 362 mg/L), and Bijou Creek (325 $\mu\text{S}/\text{cm}$, 211 mg/L). It is worth noting that most of these higher conductivity measurements were from the

Lower Truckee River watershed, with the exception of Bijou Creek. There was also a very high conductivity reading in the Heavenly Creek tributary follow-up sampling of 480 $\mu\text{S}/\text{cm}$ (312 mg/L).

Acceptable Ranges for Water Conductivity

Water Type	Conductivity $\mu\text{S}/\text{cm}$ (micro Siemens per centimeter)
Distilled Water	0.5 - 3.0
Melted snow	2 - 42
Potable water in U.S.	30 - 1500
Irrigation Supply Water	< 750

Turbidity is a measure of the amount of suspended particles in the water. Algae, suspended sediment, organic matter and some pollutants, can cloud the water making it more turbid. Suspended particles diffuse sunlight and absorb heat, which can increase temperature and reduce light available for algal photosynthesis. If the turbidity is caused by suspended sediment, it can be an indicator of erosion, either natural or man-made. High sediment loads can clog the gills of fish, foul gravel beds and smother fish eggs and benthic insects. The sediment can also carry pathogens, pollutants and nutrients.

The U.S. Environmental Protection Agency's recommended criteria for turbidity in streams in Eco-Region II (forested mountains in the western U.S.), is 1.3 NTU (Nephelometric Turbidity Units) or less. Higher NTU levels indicate poorer water clarity. Valid turbidity data was determined for 108 sites, 53 of which had levels ≥ 1.3 NTU. The four most turbid sites were all located in the Lower Truckee River watershed: Steamboat Creek #3 (12 NTU), Lower Truckee River #2 (9 NTU), and Lower Truckee River #3 and #5 (7 NTU). Within the Tahoe Basin, the most turbid sites were Heavenly Creek Tributary (6.8 NTU), Snow Creek (6.1 NTU), Bijou Creek (5.1 NTU), and Heavenly Creek (4.3 NTU).

Another way of measuring **water clarity**, primarily in lakes, bays and harbors, is by determining the transparency of the water using a Secchi disk. Some Secchi disk measurements were made on Snapshot Day. Additional Secchi disc measurements were made as part of the North American Secchi Dip-In, during July of 2002. In some cases, in shallow water, the Secchi disc could be seen all the way to the bottom and those results are not presented here. In locations where there was deep water or turbid conditions, the Secchi disk results are given below:

Secchi Depth Measurements

Date	Location	Secchi depth in meters
May 4	North Lake Tahoe (near Dollar Point)	21.0
May 4	South Lake Tahoe (near Edgewood Creek)	21.0
May 4	Fallen Leaf Lake	16.4
July 24	Marlette Lake	8.5
July	Pyramid Lake	7.5
July 14	Angora Lake	5.9
July 26	Spooner Lake	3.2
July 11	Tahoe Keys Marina	2.5

Of the above results, the worst readings were from Tahoe Keys Marina and Spooner Lake, where the Secchi depth measurements (the point at which the disk was no longer visible) were only 2.5 and 3.2 meters below the surface. These measurements do not meet the EPA's recommended minimum criteria for Secchi depths in lakes in Eco-Region II, which is 4.5 meters.

Stream flow data was obtained from USGS gauging stations, which corresponded to many of the Snapshot Day monitoring sites. Even though the Snapshot Day was held one month earlier in 2002 than in 2001 to better capture a spring runoff, the flows were still relatively low this year due to lower precipitation (snow pack) conditions. Average snow pack as of the *May 2002 NRCS Water Supply Outlook Report* for the Lake Tahoe Basin was 67 percent, with the Truckee River at 77 percent, and the Carson River at 69 percent. Reported stream flow forecasts was 61 percent of average in the Lake Tahoe Basin, 62 percent of average for the Truckee River and 53 percent of average for the Carson River. Low flow conditions can have an impact on several water quality parameters such as dissolved oxygen, conductivity, temperature, and algae growth.

Visual observations at most of the study locations were indicative of generally good water quality conditions. There were, however, a few locations that did exhibit indications of some water quality degradation. Three out of 95 valid responses observed oil at the endpoint. Dry Creek and Bijou Creek were observed with a slick while Donner Creek was observed to have tar on the banks/bed. In two locations, Bijou Creek and Steamboat Creek #3, turbidity was reported as "murky" (can't see bottom in 4 inches or less). Litter was high (11-25 pieces) to dense (greater than 50 pieces) at 13 out of 111 sites with valid responses. These locations were Bijou Creek, Heavenly Creek Tributary, Kings Beach Drainage, Rosewood Creek, Third Creek at Highway 431, Tahoe State Park Discharge, Tunnel Creek, I80C, Sagehen Creek #7, Middle Truckee River, Dry Creek, Lower Truckee River #Q1, and White's Creek.

Twelve locations (starting and/or ending points) had **algae** covering 25 percent or more of the streambeds or shores. These locations included Angora Creek reach #3, Tahoe Keys Lagoon #1, Meeks Creek, First Creek, Truckee River at I80 Corridor, Truckee River "TROI", and Steamboat Creek reach #3 (25 to 50 percent). The worst locations for reported algae were Bijou Creek, Trout Creek, Camelian Canyon Creek, Dry Creek, and White's Creek, with algae observations exceeding 50 percent coverage of the surveyed reach or shore.

Valid **coliform bacteria** data was developed for 44 sites. Fecal coliform bacteria are a group of bacteria that are mostly found in the feces of warm-blooded animals, including humans, pets, livestock, beaver, and birds. *E. Coli* is a common type of fecal coliform bacteria. Of these 44 sites, none had fecal coliform levels in excess of 40 CFU/100 ml (CFU/ 100 ml are colony forming units, roughly equivalent to the number of bacteria cells, in 100 ml of sample water).

Seventy samples were analyzed for **nutrient concentrations**. One of those nutrients was ammonia. **Ammonia** is a reduced, toxic form of nitrogen and is usually associated with the decomposition of organic matter and wastes. Only five samples had ammonia nitrogen concentrations >10 µg/L (micrograms per liter, equivalent to parts per billion). These samples were from Heavenly Creek Tributary #2 (52 µg/L), Lower Truckee River Q3 (47 µg/L), Lower Truckee River Q2 (27 µg/L), Musgrove Creek (25 µg/L) and Tahoe State Park Discharge (13 µg/L).

In terms of **total nitrogen** (ammonia + nitrite + nitrate nitrogen), the EPA's recommended criterion for streams in Eco-Region II is 100 µg/L. Total inorganic nitrogen was calculated by adding the laboratory results for ammonia and nitrate. Four of the samples tested exceeded that level for total nitrogen. These sites were Steamboat Creek #3 (514 µg/L), Heavenly Creek Tributary (455 µg/L), Tahoe State Park Discharge (272 µg/L), and Squaw Creek (114 µg/L).

Nitrogen in the form of ammonia, nitrite or nitrate is a nutrient that stimulates the growth of algae in streams and lakes. Algae include benthic forms, attached to the rocks and sediment of the streambeds (as observed by the monitors), as well as phytoplankton. Phytoplankton are microscopic single cell algae that drift in the water and that can cause the water to have a green color. Benthic algae and phytoplankton are essential components to the ecosystem, but in relatively large concentrations these organisms are known to reduce water clarity, or reduce oxygen levels during the evening. One cause for decreasing clarity in Lake Tahoe is an increase in phytoplankton populations as a result of increasing nutrient concentrations.

Phosphorous is another nutrient that stimulates algal growth. Ten of the samples (out of 68) were above the 50-µg/L standard for **total phosphorous** (Nevada total phosphorous standard for tributaries to Lake Tahoe). Sixteen of the samples were above the more stringent California state standard of 30-µg/L total phosphorous for tributaries to Lake Tahoe. These Lake Tahoe standards will certainly be more stringent than those in lower elevation watersheds; however, they provide a cutoff point to make a comparison. The sites with total phosphorous values greater than 30 µg/L included Steamboat Creek #2 (250 µg/L), Third Creek (210 µg/L), Steamboat Creek #3 (190 µg/L), Dry Creek (160 µg/L), South Zephyr Creek (157 µg/L), White's Creek (90 µg/L), Heavenly Creek (84 µg/L), Hatchery Creek at Star Harbor (64 µg/L), Thomas Creek (60 µg/L), Alum Creek (60 µg/L), Heavenly Creek Tributary (44 µg/L), Steamboat Creek #1 (40 µg/L), Musgrove Creek (40 µg/L), Hunter Creek (40 µg/L), Lake Forest Creek (37 µg/L), Cold Creek #1 (34 µg/L), Martis Creek (30 µg/L), Snow Creek (30 µg/L), and Dollar Creek (30 µg/L).

Phosphorus pollution has been identified as a serious problem contributing to the degradation of water quality in Lake Tahoe. Sediment entering streams and the lake from human caused erosion of soil along roads, or from residential or commercial properties, is a common source of phosphorous.

When phosphorous is in the form of orthophosphate molecules it is considered “**soluble reactive phosphorous**,” the form of phosphorous that stimulates algae to grow. Eighteen of the samples (out of 60) were above the EPA’s recommended criteria for streams in Eco-Region II, which is 8.75 µg/L for soluble reactive phosphorous. These sites were Hatchery Creek at Star Harbor (51 µg/L), Lower Truckee River Q4 (37 µg/L), Lower Truckee River Q5 (27 µg/L), Lake Forest Creek (26 µg/L), Heavenly Creek Tributary (19 µg/L), Lower Truckee River Q3 (19 µg/L), Davis Merrill Creek (17 µg/L), Lower Truckee River Q2 (13 µg/L), Carnelian Canyon Creek (12 µg/L), Snow Creek (12 µg/L), Lower Truckee River Q1 (12 µg/L), Cold Creek #2 (11 µg/L), Heavenly Creek (11 µg/L), Burton Creek (11 µg/L), Dollar Creek (11 µg/L), Tahoe State Park Discharge (11 µg/L), Marlette Creek (9 µg/L), and Martis Creek (9 µg/L).

The Lake Tahoe Environmental Education Coalition, Tahoe Regional Planning Agency, Truckee River Watershed Council and Washoe-Storey Conservation District store all of the data and photos electronically. As soon as the California SWRCB database is available for use, all visual assessment data, water quality data, and site photographs will be made available for viewing on the internet. A summary of the field and laboratory data is available in the Appendix to this report. A separate *Snapshot Day 2002 Data Appendix* is also available upon request.

Discussion

It is important to remember that the measurements made on Snapshot Day were designed to represent a single point in time and do not necessarily represent average conditions. Still, it is interesting to compare the results with some applicable standards. As mentioned in the results, the U.S. EPA has recommended criteria for nutrients, Secchi depth, and turbidity. These and other EPA recommended water quality criteria are considered by the states when developing their own water quality standards. State standards related to Lake Tahoe are generally the most stringent of the Tahoe-Truckee region. When general EPA criteria are not available, these Tahoe standards were used as a point of reference.

In California, the Lahontan RWQCB water quality standards are composed of the beneficial uses and objectives described in the Basin Plan. The Lahontan Basin Plan is approved by the U.S. EPA, and includes many watershed specific standards. The Basin Plan takes into account the natural background levels of certain constituents. For example, concentrations of dissolved solids and nutrients are relative to natural geologic conditions; in other words, some water bodies have naturally higher levels of these substances. Likewise, the State of Nevada’s Division of Environmental Protection has water quality standards that are specific to certain watersheds and their beneficial uses.

Some of the standards require complex calculations. For example, one must consider the temperature and pH of a water sample when determining the allowable concentrations of ammonia. While a full discussion of all of the standards is not within the scope of this report, the following table provides some relatively simple examples, mostly paraphrased, for a few of the standards:

Examples of Lake Tahoe Water Quality Standards

Parameter	Standard
Temperature	Shall not exceed 15° C, surface waters of Fallen Leaf Lake (CA)
pH	7.0 - 8.4 in Lake Tahoe (CA and NV)
TDS	Shall not exceed 60 mg/L average in Lake Tahoe (CA and NV)
Dissolved Oxygen	Mean no less than 6.5 and minimum of 4.0 mg/L for Lahontan waters designated as "cold freshwater habitat" (CA)
Turbidity	Shallow water shall not exceed 3 NTU near tributaries and 1 NTU not directly influenced by streams (TRPA)
Secchi Depth	December-March average of not less than 33.4 meters for Lake Tahoe (TRPA), and a mean of 18.5 meters for Fallen Leaf Lake (Lahontan Region, CA)
Algae	Lahontan RWQCB waters shall not contain biostimulatory substances (nutrients) that cause algae to become a nuisance or to affect the water's beneficial uses (CA)
Total Nitrogen	Mean of no more than 190 µg/L (CA)
Inorganic Nitrogen	Mean of no more than 25 µg/L for most tributaries to Lake Tahoe, Nevada side of Lake Tahoe (TRPA)
Total Phosphorous	Annual average of no more than 50 µg/L for most tributaries, Nevada side of Lake Tahoe (NV) and no more than 30 µg/L for most tributaries, California side of Lake Tahoe (CA)
Soluble Phosphorous	Mean of no more than 7 µg/L for Lake Tahoe, Nevada side (TRPA)
Fecal Coliform	Log mean of 20 CFU (30 day period) and maximum of 40 CFU, (Lahontan Region, CA)

For full and more detailed information on water quality objectives in California refer to the Lahontan Regional Water Quality Control Board *Basin Plan* at the following website: <http://www.swrcb.ca.gov/rwqcb6/> and select "Available Documents." For water quality standards in Nevada see the following website: <http://ndep.state.nv.us/nac/445a119.pdf> or visit the NDEP Bureau of Water Quality Planning website at <http://ndep.state.nv.us/bwqp/stdsw.htm>. For the Tahoe Regional Planning Agency (TRPA) water quality standards, see the following website: <http://www.trpa.org/Documents.htm> and select "Environmental Threshold Carrying Capacities."

The results and data gathered from the 2002 Snapshot Day were once again interesting, and in many cases different from the 2001 data. One way in which our 2002 monitoring results were similar to those of 2001 was that at the majority of all Lake Tahoe and Truckee River sites, the observed quality of the water was good to excellent. We can be thankful for that.

Snapshot Day 2002 was held a month earlier than the previous year to try to capture more of the spring snowmelt or "runoff." During this time period, streams generally experience higher than average flows. By holding the event in May, it was anticipated that certain constituents (e.g. fecal coliform) might be less concentrated because of increased runoff. However, there was the possibility of capturing other constituents (e.g. phosphorous) at more concentrated levels due to an increased loading of sediment to the streams. Higher flows can contribute to increased erosion, higher loading of sediment into the streams, and ultimately increased levels of phosphorous.

The majority of sites had nitrate and phosphorous within the TRPA surface discharge standards (total nitrogen of no more than 500 µg/L and total phosphorous of no more than 100 µg/L for surface water runoff which directly enters Lake Tahoe). However, there were a few notable outliers. The following sampling sites stood out for visual sightings of oil, very low dissolved oxygen, high conductivity and turbidity, low Secchi disk readings, elevated total nitrogen, total phosphorous and soluble reactive phosphorus concentrations:

- Based on visual assessment data, Dry Creek and Bijou Creek were found to have an oil slick, while Donner Creek was observed to have tar on the banks/bed. These warrant further investigation.
- Boca Tributary (Middle Truckee River) and White's Creek at Thunderbolt Drive (Lower Truckee River) had dissolved oxygen measurements of only 1 mg/L.
- The Bijou Creek sample in South Lake Tahoe has also raised concern due to the high conductivity (325 µS/cm) results. This area has possible golf course drainage mixing with parking lot runoff, and it discharges directly to the lake. This area will continue to be monitored.
- The samples taken near the Heavenly Valley Ski area (listed as Heavenly Creek Tributary) and then downstream in Heavenly Creek had high turbidity measurements of 6.78 and 4.31 NTU's respectively. The Heavenly Creek Tributary and Heavenly Creek also had high total phosphorous values of 44 µg/L and 84 µg/L respectively. In addition, the Heavenly Creek Tributary had a high conductivity reading of 480 µS/cm when sampled during this follow-up visit. The drainage area below the Heavenly parking lot is a focus of concern for the Lahontan RWQCB and Heavenly Resort, as well as for nearby residents. In fact, concerned local citizens brought information and photos of this area to the TRPA offices for further investigation. A follow-up visit revealed a rental property in the area with illegal parking in a very wet dirt area adjacent to the paved driveway. A complaint was filed with the TRPA Compliance Division and new parking barriers have been installed alongside the driveway to prohibit offsite parking and improve the condition of the property and local watershed.
- Spooner Lake and Tahoe Keys Marina did not meet the EPA's recommended minimum criteria for Secchi depths in lakes in Eco-Region II with measurements of 3.2 meters and 2.5 meters, respectively.
- "Hot spots" for elevated total nitrogen values included Steamboat Creek #3, Heavenly Creek Tributary, Tahoe State Park Discharge and Squaw Creek. Most notably, the drainage swale near the Safeway store in Tahoe City (listed as Tahoe State Park Discharge) also had the highest nitrate value in the Lake Tahoe Basin with 259 micrograms per liter. These areas will continue to be monitored.
- Third Creek had the highest total phosphorous (210 µg/L) in the Tahoe Basin, second only to Steamboat Creek in the Lower Truckee River Watershed (250 µg/L). South Zephyr Creek also had higher than acceptable total phosphorous of 157 µg/L. Other "hot spots" for elevated total phosphorous included Steamboat Creek #2 (250 µg/L),

Steamboat Creek #3 (190 µg/L), and Dry Creek (160 µg/L) in the Lower Truckee River watershed. These sites will continue to be monitored.

- The Star Harbor/Hatchery Creek area near Tahoe City continues to be an area of concern based on 2001 fecal coliform results as well as 2002 soluble reactive phosphorus values. It is also noted that Hatchery Creek at Star Harbor had the highest soluble reactive phosphorus (SRP) value of all samples with a value of 51 µg/L and a high total phosphorous of 64 µg/L. This area will continue to be monitored.
- None of the sites tested on May 4, 2002 had elevated fecal coliform levels. In 2001, the higher than expected coliform bacteria results for three sites resulted in follow-up sampling activities, and eventually a violation issued from TRPA and Lahontan RWQCB for one of these instances. In 2002, the bacteria counts taken during the Snapshot Day event were all within acceptable ranges.

Due in part to Snapshot Day efforts, several areas are now on the “radar screen” for agencies and local jurisdictions to implement water quality improvements based on the sampling information gathered by volunteers. Further volunteer monitoring of these sites would be appropriate.

Conclusion

Snapshot Day was not only successful in engaging the public in active watershed stewardship, but it also provided much valuable data to the responsible agencies. The second annual event broadened the scope to include the entire watershed and provide a collaborative effort from Lake Tahoe to Truckee to Reno. We hope to continue to build on this effort by encouraging continued monitoring throughout the year, during runoff events, and on Snapshot Day 2003!

It is our hope that this annual event will stimulate interest and excitement for water quality monitoring throughout the region. The Snapshot Day event provides a focal point for the Clean Water Team’s efforts. As momentum continues to grow for water quality monitoring in the region, the Clean Water Team will be seeking volunteers willing to make an annual commitment to monitor a specific field site on a monthly basis, to focus on certain hotspots identified by other studies and research, or to sample water quality at the peaks of storm events. Monthly data will be analyzed to reveal and document impacts on the watershed. They can also be used by agencies, local landowners, and other stakeholders to collaborate, problem-solve, and ultimately protect the watersheds we live in.

For more information about how to get involved with water quality monitoring activities contact the following agencies:

- *Lake Tahoe Basin* – Contact Heather Segale, Lake Tahoe Environmental Education Coalition, (775) 832-4138 or Rita Whitney, Tahoe Regional Planning Agency, (775) 588-4547, ext. 258
- *Fallen Leaf Lake* – Grant Adams, Fallen Leaf Lake Research, (530) 541-8535

- *Incline Village* – Contact Sarah Tone, Incline Village GID Waste Not/Incline Village Clean Water Team, (775) 831-8603
- *Middle Truckee River (Tahoe City to Nevada State Line)* – Contact Beth Christman, Truckee River Watershed Council, (530) 550-8760
- *Lower Truckee River (Nevada Stateline to Pyramid Lake)* – Contact Jenny Francis, Washoe-Storey Conservation District, (775) 322-9935

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2002 Snapshot Day “Clean Water Team” Sponsors:

California State Water Resource Control Board
California Tahoe Conservancy
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Lahontan Regional Water Quality Control Board
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Lake Tahoe Environmental Education Coalition (LTEEC)
League to Save Lake Tahoe
Marine Research & Education, Inc.
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Tahoe Basin AmeriCorps
Tahoe Regional Planning Agency
Tahoe Research Group
Tahoe Resource Conservation District
Truckee River Watershed Council

University of California Cooperative Extension
University of Nevada Cooperative Extension
University of Nevada Reno Electrical Engineering Department
USDA Forest Service
Washoe-Storey Conservation District
Waste Not, Incline Village General Improvement District

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Rita Whitney (Tahoe Regional Planning Agency)
Jill Wilson (Lahontan RWQCB and Truckee River Aquatic Monitors)

Equipment:

California State Water Resource Control Board
Carson River Wranglers
Carson Valley Conservation District
Desert Research Institute
Environmental Protection Agency
Lahontan Regional Water Quality Control Board
Lake Tahoe Community College
Lake Tahoe Environmental Education Coalition (LTEEC)
Sierra Nevada College
Tahoe Regional Planning Agency
Truckee River Aquatic Monitors
United States Geological Survey
University of Nevada, Reno
USDA Forest Service

Washoe County

Laboratory Analysis (Nutrients and Bacteria):

Lahontan Regional Water Quality Control Board
Mark Palmer/High Sierra Water Lab
Truckee Meadows Water Reclamation Facility

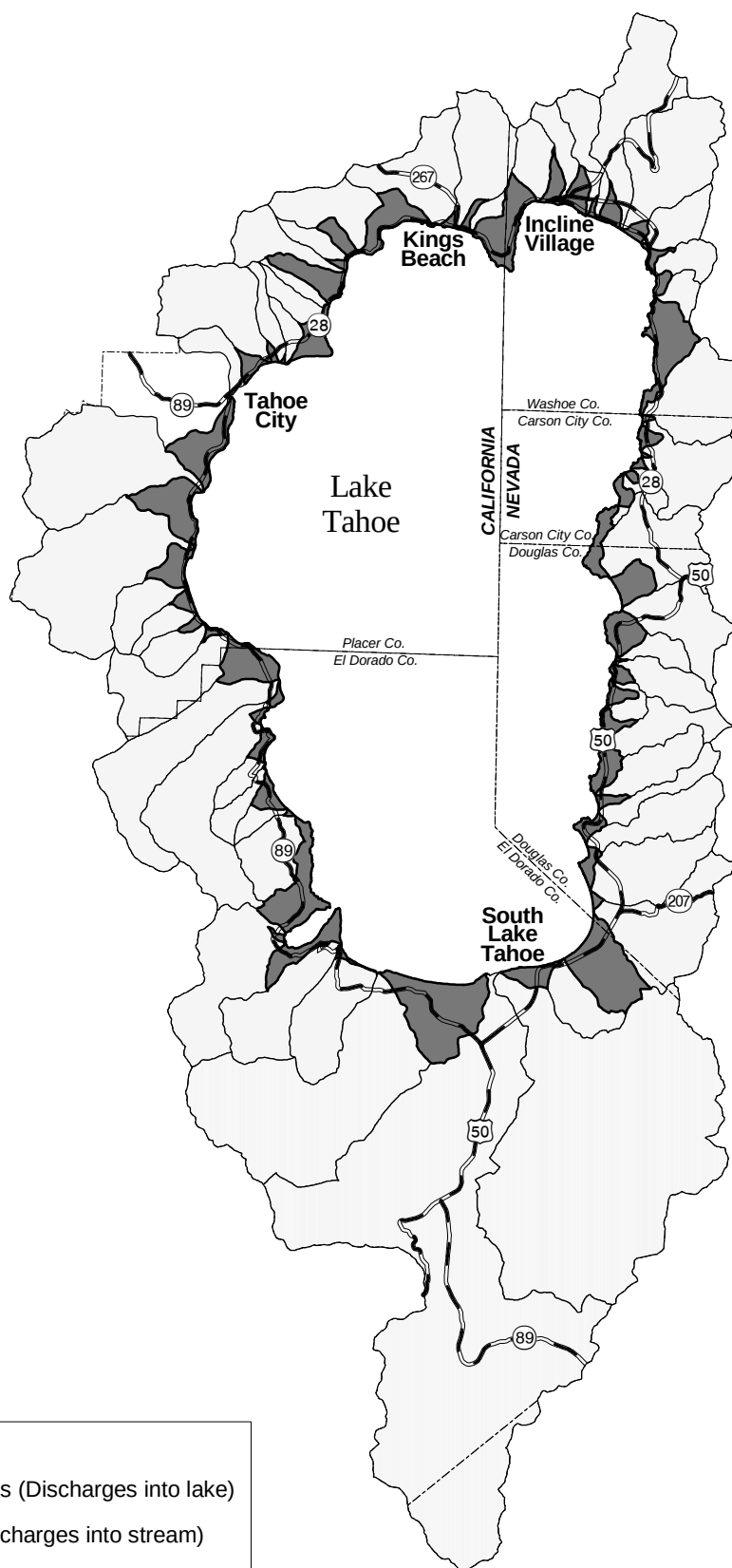
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Appendices

Lake Tahoe Watershed Map
Middle Truckee River Sub-Basin Map
Lower Truckee River Watershed Map
2002 Summary of Field and Lab Data

Note: Data collected as part of the Snapshot activities is available electronically. Contact Heather Segale, Lake Tahoe Environmental Education Coalition, University of Nevada Cooperative Extension, (775) 832-4138 or segaleh@unce.unr.edu or visit <http://www.lteec.org>.



LEGEND

- Intervening Zones (Discharges into lake)
- Watersheds (Discharges into stream)
- State Highways

Data provided by TRPA



Scale in Miles

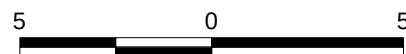


Figure 1
LAKE TAHOE BASIN
WATERSHEDS AND INTERVENING ZONES

MIDDLE TRUCKEE RIVER SUB-BASIN MAP

(4/17/02)

SIERRA COUNTY

NEVADA COUNTY

PLACER COUNTY

-  Lakes
-  I-80
-  Highway 267
-  Truckee River
-  County Boundaries
-  1 Upper Little Truckee Basin
-  2 Davies-Merrill Creek Basin
-  3 Boca Complex
-  4 I-80 Corridor
-  5 Mystic Canyon Basin
-  6 Bronco Creek Basin
-  7 Independence Lake Basin
-  8 Sagehen Creek Basin
-  9 Prosser Basin & Reservoir
-  10 Alder Creek Basin
-  11 Trout Creek Basin
-  12 Truckee Town Corridor
-  13 Glenshire/Union Valley Basin
-  14 Juniper Creek Basin
-  15 Gray Creek Basin
-  16 Donner Lake Basin
-  17 Cold Stream Canyon Basin
-  18 Cabin Creek Basin
-  19 Big Chief Corridor
-  20 Martis Creek Basin
-  21 Deep Creek Basin
-  22 Pole Creek Basin
-  23 Silver Creek Basin
-  24 Deer Creek Basin
-  25 Squaw Creek Basin
-  26 Bear Creek Basin
-  27 Tahoe City Basin
-  Watershed boundary

2 0 2 4 Miles



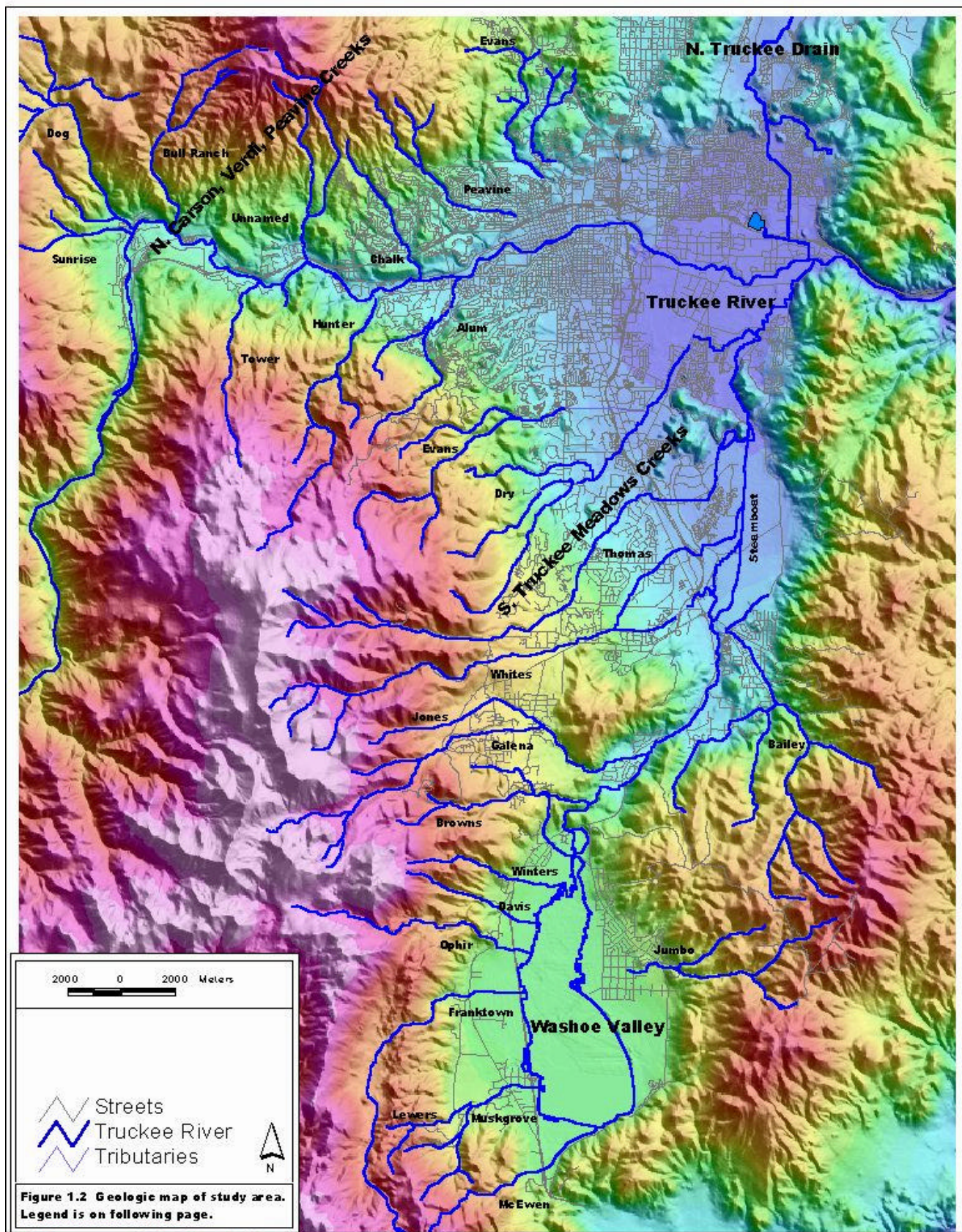
TRUCKEE RIVER WATERSHED COUNCIL
PO Box 8568 * Truckee, CA 96161
530-550-8760 * www.truckeeriverwc.org

Special thanks to the Lahontan Regional Water Quality
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Geologic Map of Lower Truckee River Watershed



2002 Snapshot Day Data All Summary Data

Watershed ID (NLT, SLT, MTR, LTR)	Stream ID	Stream Name	Air		Water		pH	Dissolved Oxygen		Conductivity		Turbidity		Fecal Coliform		Ammonia NH4 (3)	Nitrate NO3 (3)	Soluble Reactive Phos. SRP (3)	Total Phos. TP (3)
			Air Temp Units	Water Temp Units	Water Temp Units	Water Temp Units		Dissolved Oxygen Units	Conductivity Units	Conductivity Units	Turbidity Units	Turbidity Units	(2)						
TAH	NLAKE1	Lake Tahoe Near Dollar Point	--	--	8.5	C	7.0	10.0	mg/L	100	uS	0.2	NTU	--	--	--	--	--	--
TAH	NLAKE2	Lake Tahoe Near Sunnyside	--	--	7.0	C	7.0	10.8	mg/L	100	uS	0.4	NTU	--	--	--	--	--	--
TAH	NLAKE3	Lake Tahoe Near Tahoe City Outfall #65	--	--	7.5	C	7.0	10.1	mg/L	100	uS	0.3	NTU	--	--	--	--	--	--
TAH	NLAKE4	Lake Tahoe Near Watson Creek	--	--	8.5	C	7.0	10.3	mg/L	90	uS	0.3	NTU	--	--	--	--	--	--
TAH	SLAKE1	Lake Tahoe Near Zephyr Creek	--	--	--	--	--	--	--	120	uS	1.4	NTU	--	5	2	5	22	22
TAH	SLAKE2	Lake Tahoe at Edgewood Creek	--	--	--	--	--	--	--	100	uS	0.1	NTU	--	2	3	1	6	6
TAH	ESLTL	Lake Tahoe at Thunderbird Lodge	--	--	--	--	7.0	--	--	80	uS	0.3	NTU	--	--	--	--	--	--
TAH	SAND	Lake Tahoe at Sand Harbor	9.0	C	9.5	C	7.0	9.0	mg/L	100	uS	--	--	0	--	--	--	--	--
SLT	FLLF	Fallen Leaf Lake	16.8	C	7.6	C	7.1	9.9	mg/L	16	uS	0.1	NTU	0	2	2	1	4	4
SLT	ANG1	Angora Creek	--	--	--	--	6.8	--	--	10	uS	0.2	NTU	--	2	4	1	10	10
SLT	ANG2	Angora Creek	18.0	C	5.0	C	--	5.5	mg/L	30	uS	0.6	NTU	2	5	5	3	14	14
SLT	ANG3	Angora Creek (exclude)	C	6.0	C	6.5	--	--	--	40	uS	0.6	NTU	2	--	--	--	--	--
SLT	BJCR	Bijou Creek	19.0	C	--	--	8.0	--	--	325	uS	5.1	NTU	--	--	--	--	--	--
SLT	BURK	Burke Creek	15.5	C	11.0	C	--	--	--	160	uS	0.7	NTU	11	2	3	3	23	23
SLT	CASC	Cascade Creek	11.5	C	8.9	C	--	9.0	mg/L	12	uS	0.2	NTU	--	--	--	--	--	--
SLT	COLD1	Cold Creek 1	16.0	C	4.5	C	--	12.8	mg/L	40	uS	1.9	NTU	2	1	24	7	34	34
SLT	COLD2	Cold Creek 2	16.0	C	5.4	C	--	11.2	mg/L	40	uS	1.8	NTU	0	5	22	11	29	29
SLT	COVE	Cove East	10.0	C	13.0	C	6.5	8.0	mg/L	145	uS	1.2	NTU	0	1	3	1	16	16
SLT	ECHO	Echo Creek	--	--	--	--	--	9.0	mg/L	10	uS	0.1	NTU	--	--	--	--	--	--
SLT	EGDE	Edgewood Creek	9.0	C	11.0	C	--	10.0	mg/L	120	uS	1.8	NTU	0	1	2	4	27	27
SLT	ELKS	Upper Truckee at Elks Club	14.0	C	4.0	C	6.5	--	--	20	uS	0.6	NTU	1	3	13	1	13	13
SLT	GLNA	Glen Alpine Creek	9.2	C	4.1	C	6.1	10.8	mg/L	13	uS	0.1	NTU	0	--	--	--	--	--
SLT	HEAV1	Heavenly Creek	--	--	--	--	--	--	--	50	uS	4.3	NTU	0	2	4	11	84	84
SLT	HEAV2	Heavenly Creek Tributary	11.0	C	8.0	C	6.5	8.0	mg/L	--	--	6.8	NTU	0	52	403	19	44	44
SLT	KEYS1	Tahoe Keys Lagoon	10.0	C	13.5	C	--	8.0	mg/L	135	uS	1.3	NTU	11	2	1	1	14	14
SLT	KEYS2	Tahoe Keys Lagoon	9.0	C	14.0	C	--	--	--	122	uS	1.0	NTU	0	1	3	1	16	16
SLT	LGR	Upper Truckee River	10.0	C	3.5	C	7.0	--	--	30	uS	0.1	NTU	--	--	--	--	--	--
SLT	MEEK	Meeks Creek	15.0	C	10.0	C	--	10.0	mg/L	--	--	0.2	NTU	0	1	4	1	10	10
SLT	MOSH	Upper Truckee, Mosher	14.5	C	5.5	C	--	9.5	mg/L	30	uS	1.6	NTU	--	--	--	--	--	--
SLT	NZHR	North Zephyr Creek	8.5	C	4.5	C	6.5	--	--	110	uS	1.0	NTU	--	--	--	--	--	--
SLT	SAXN	Saxon Creek	16.0	C	4.0	C	6.5	--	--	40	uS	1.1	NTU	--	--	--	--	--	--
SLT	SZHR	South Zephyr Creek	--	--	--	--	7.0	--	--	110	uS	0.7	NTU	--	6	4	6	157	157
SLT	TALL	Tallac Creek	16.0	C	5.3	C	--	9.0	mg/L	--	--	0.3	NTU	0	3	7	1	10	10
SLT	TALR	Taylor Creek	14.0	C	4.0	C	--	10.0	mg/L	--	--	0.1	NTU	0	3	7	1	5	5
SLT	TCCC1	Trout Creek, LTCC	11.5	C	5.0	C	--	9.5	mg/L	40	uS	1.9	NTU	3	--	--	--	--	--
SLT	TCCC2	Trout Creek, Black Bart Bridge	11.5	C	5.5	C	--	6.5	mg/L	40	uS	1.6	NTU	--	1	8	5	29	29
SLT	TCSF	Trout Creek, South of Pioneer	--	--	--	--	--	10.0	mg/L	40	uS	1.2	NTU	--	--	--	--	--	--
SLT	TROU	Trout Creek, North of Pioneer	--	--	--	--	--	10.0	mg/L	40	uS	1.3	NTU	--	--	--	--	--	--
SLT	XMAS	Upper Truckee River, Christmas Valley	15.0	C	3.0	C	--	--	--	10	uS	0.3	NTU	0	1	12	4	15	15

2002 Snapshot Day Data All Summary Data

Watershed ID (NLT, SLT, MTR, LTR)	Stream ID	Stream Name	Air		Water		Dissolved		Conductivity		Turbidity		Fecal Coliform (2)	Amonia NH4 (3)	Nitrate NO3 (3)	Soluble Reactive Phos. SRP (3)	Total Phos. TP (3)
			Air Temp Units	Temp Units	Water Temp Units	pH	Dissolved Oxygen	Oxygen Units	Conductivity Units	Conductivity Units	Turbidity (1)	Turbidity Units					
NLT	BART	Barton Creek	21.0	C	7.7	C	7.0	7.0	mg/L	50	uS	3.3	NTU	--	--	--	--
NLT	BCDC	Burnt Cedar Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NLT	BKWD	Blackwood Creek	12.0	C	5.0	C	7.0	--	--	50	uS	0.6	NTU	0	4	36	5
NLT	BRTN	Burton Creek	7.0	C	5.0	C	6.5	--	--	40	uS	0.9	NTU	0	3	2	11
NLT	CACN	Camellian Canyon Creek	9.5	C	5.4	C	7.0	8.0	mg/L	110	uS	3.0	NTU	11	4	2	12
NLT	CBRC	Camellian Bay Creek	--	--	--	--	6.5	--	--	40	uS	2.2	NTU	--	--	--	--
NLT	COON	Culvert at Coon Street Beach Ramp	--	--	--	--	7.5	--	--	170	uS	1.7	NTU	--	--	--	--
NLT	DLRH	Dollar Creek	--	--	--	--	6.5	(exclude)	mg/L	70	uS	3.8	NTU	2	3	5	11
NLT	FRST	First Creek	8.6	C	4.8	C	7.0	10.0	mg/L	70	uS	2.5	NTU	--	--	--	--
NLT	GNRL	General Creek	3.5	C	3.5	C	6.1	--	--	20	uS	1.0	NTU	0	2	6	2
NLT	GRIF	Griff Creek	--	--	--	--	7.0	--	--	55	uS	2.8	NTU	--	2	4	5
NLT	HMWD	Homewood Creek	--	--	--	--	6.5	--	--	45	uS	0.6	NTU	--	2	18	7
NLT	INCL	Incline Creek	15.0	C	6.0	C	--	11.0	mg/L	80	uS	3.4	NTU	--	--	--	--
NLT	LHCR	Logan House Creek	10.8	C	3.7	C	8.0	9.7	mg/L	113	uS	0.8	NTU	--	3	17	3
NLT	LKFC	Lake Forest Creek	--	--	--	--	7.0	--	--	110	uS	1.8	NTU	6	4	21	26
NLT	MADL	Madden Creek	--	--	--	--	6.5	--	--	50	uS	0.4	NTU	--	--	--	--
NLT	MARL	Marlette Creek	--	--	--	--	7.0	--	--	65	uS	1.4	NTU	0	4	25	9
NLT	MKNY	McKinney Creek	7.0	C	3.3	C	6.6	--	--	20	uS	1.0	NTU	--	2	50	1
NLT	NHLC	N. Logan House Creek	15.4	C	5.1	C	7.8	10.3	mg/L	85	uS	2.7	NTU	--	--	--	--
NLT	QULC	Quail Creek	--	--	--	--	6.3	--	--	30	uS	0.4	NTU	--	2	63	1
NLT	RSWD	Rosewood Creek	--	--	--	--	7.0	5.5	mg/L	--	--	2.2	NTU	9	2	6	4
NLT	SECD	Second Creek	--	--	--	--	7.0	--	--	70	uS	3.1	NTU	--	--	--	--
NLT	STAR	Hatchery Creek	19.0	C	6.0	C	7.0	7.0	mg/L	100	uS	2.4	NTU	--	6	4	51
NLT	THRD	Third Creek	6.0	C	2.5	C	7.4	--	--	70	uS	1.8	NTU	--	3	6	6
NLT	THRD431	Third Creek, 431	--	--	--	--	7.0	--	--	45	uS	0.9	NTU	--	--	--	--
NLT	THSP	Tahoe State Park Discharge	18.0	C	5.0	C	8.0	10.0	mg/L	180	uS	3.2	NTU	1	13	259	11
NLT	SNOW	Snow Creek	--	--	--	--	6.3	--	--	130	uS	6.1	NTU	3	4	3	12
NLT	TUNN	Tunnel Creek	14.0	C	4.0	C	0.0	7.0	mg/L	60	uS	0.3	NTU	--	--	--	--
NLT	WATS	Watson Creek	14.7	C	6.4	C	7.0	--	--	70	uS	1.0	NTU	--	--	--	--
NLT	WOOD	Wood Creek	8.5	C	3.0	C	7.0	--	--	50	uS	2.0	NTU	--	--	--	--
NLT	WOOD431	Wood Creek, 431	--	--	--	--	7.0	--	--	50	uS	3.1	NTU	--	--	--	--

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Watershed ID (NLT, SLT, MTR, LTR)	Stream ID	Stream Name	Air		Water		pH	Dissolved Oxygen		Conductivity		Turbidity		Fecal Coliform (2)	Amonia NH4 (3)	Nitrate NO3 (3)	Soluble Reactive Phos. SRP (3)	Total Phos. TP (3)
			Air Temp Units	Temp Units	Water Temp Units	Temp Units		Dissolved Oxygen Units	Units	Conductivity Units	Units	Turbidity (1) Units	Turbidity Units					
MTR	DEER	Deer Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MTR	ALDR	Alder Creek	14.0	C	5.5	C	8.0	11.4	mg/L	24	uS	1.7	NTU	0	4	37	5	14
MTR	BEAR	Bear Creek	12.0	C	4.0	C	--	--	--	40	uS	0.4	NTU	0	2	58	3	8
MTR	BIGC	Mainstem Truckee River	11.0	C	5.4	C	6.5	9.0	mg/L	80	uS	0.8	NTU	1	4	26	4	11
MTR	BOCA	Boca Tributary	8.0	C	5.0	C	7.5	0.9	mg/L	110	uS	1.2	NTU	--	--	--	--	--
MTR	BROC	Bronco Creek	23.5	C	8.0	C	7.0	--	--	80	uS	1.3	NTU	0	4	14	5	18
MTR	CABN	Cabin Creek	13.0	C	5.3	C	6.5	8.0	mg/L	40	uS	0.7	NTU	--	--	--	--	--
MTR	COLD	Coldstream	16.0	C	4.4	C	--	--	--	40	uS	0.5	NTU	--	3	7	5	11
MTR	DMCB	Davies Merrill Creeks	--	--	--	--	7.0	--	--	90	uS	2.3	NTU	0	3	2	17	28
MTR	DONN	Donner Creek	10.0	C	4.0	C	--	7.0	mg/L	100	uS	0.5	NTU	0	3	8	3	10
MTR	GLEN	Union Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MTR	I80C	Mainstem Truckee	10.5	C	7.0	C	7.0	9.0	mg/L	70	uS	1.7	NTU	1	4	10	3	16
MTR	INDE	Independence Creek	26.0	C	--	--	--	--	--	40	uS	0.7	NTU	--	--	--	0	0
MTR	MART	Martis Creek	19.0	C	6.5	C	6.5	9.0	mg/L	90	uS	2.3	NTU	2	1	9	9	30
MTR	POLE	Pole Creek	(exclude)	--	(exclude)	--	7.0	4.5	mg/L	60	uS	0.6	NTU	--	--	--	--	--
MTR	PROS	Prosser Creek	15.5	C	5.0	C	7.8	11.2	mg/L	23	uS	1.4	NTU	1	1	9	2	15
MTR	SAGE7	Sagehen Creek	--	--	--	--	--	--	--	--	--	--	--	--	1	4	3	13
MTR	SAGE1	Sagehen Creek	--	--	--	--	--	--	--	--	--	1.9	NTU	--	--	--	--	--
MTR	SAGE10	Sagehen Creek	19.0	C	5.0	C	--	--	--	--	--	--	--	--	--	--	--	--
MTR	SAGE2	Sagehen Creek	--	--	--	--	--	--	--	--	--	--	--	0	--	--	--	--
MTR	SAGE5	Sagehen Creek	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MTR	SAGE9	Sagehen Creek	--	--	4.5	C	--	--	--	--	--	--	--	--	--	--	--	--
MTR	SLVR	Silver Creek	(exclude)	--	(exclude)	--	6.5	7.0	mg/L	80	uS	1.6	NTU	2	--	--	--	--
MTR	SQCR	Squaw Creek	15.0	C	5.0	C	7.0	--	--	70	uS	0.7	NTU	0	1	113	1	6
MTR	TOWN	Truckee River	7.7	C	5.1	C	--	9.0	mg/L	70	uS	0.7	NTU	--	2	19	2	13
MTR	TROI	Truckee River	11.4	C	9.6	--	--	--	--	70	uS	0.4	NTU	--	3	2	2	7
MTR	TROU-L	Lower Trout Creek	12.0	C	7.0	C	6.5	9.0	mg/L	120	uS	1.4	NTU	1	2	2	8	21
MTR	TROU-U	Upper Trout Creek	--	--	--	--	6.5	--	--	110	uS	1.0	NTU	--	3	8	2	12
MTR	ULTB	Upper Little Truckee	18.0	C	8.0	C	8.0	5.0	mg/L	35	uS	1.1	NTU	1	3	8	2	12

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Watershed ID (NLT, SLT, MTR, LTR)	Stream ID	Stream Name	Air Temp Units	Air Temp	Water Temp Units	Water Temp	pH	Dissolved Oxygen Units	Dissolved Oxygen	Conductivity Units	Conductivity	Turbidity Units (1)	Turbidity Units (2)	Fecal Coliform (2)	Anonia NH4 (3)	Nitrate NO3 (3)	Soluble Reactive Phos. SRP (3)	Total Phos. TP (3)
LTR	ALCR	Alum Creek	16.5	C	17.5	C	7.0	9.6	mg/L	743	uS	5.0	NTU	--	ND	0	--	60
LTR	DACR	Davis Creek	--	--	7.0	C	5.0	--	--	115	uS	1.0	NTU	--	ND	27	--	0
LTR	DOCR	Dog Creek	--	--	11.0	C	6.5	7.0	mg/L	196	uS	1.0	NTU	--	ND	22	--	20
LTR	DRCR	Dry Creek	20.0	C	5.0	C	7.0	12.0	mg/L	193	uS	6.0	NTU	--	--	--	--	160
LTR	GACR	Galena Creek	14.0	C	7.1	C	5.6	11.7	mg/L	112	uS	2.0	NTU	--	ND	17	--	20
LTR	HUCR	Hunter Creek	18.5	C	9.2	C	7.6	10.5	mg/L	140	uS	3.0	NTU	--	ND	17	--	40
LTR	MUCR	Musgrove Creek	18.5	C	10.0	C	6.0	--	--	144	uS	2.0	NTU	--	25	ND	--	40
LTR	Q1	Truckee River	23.0	C	9.0	C	5.0	8.0	mg/L	100	uS	6.0	NTU	--	ND	ND	12	--
LTR	Q2	Truckee River	24.0	C	12.0	C	6.0	--	--	106	uS	9.0	NTU	--	27	26	13	--
LTR	Q3	Truckee River	--	--	--	--	5.0	--	--	156	uS	7.0	NTU	--	47	11	19	--
LTR	Q4	Truckee River	16.5	C	14.0	C	7.9	8.5	mg/L	146	uS	6.0	NTU	--	8	29	37	--
LTR	Q5	Truckee River	18.5	C	14.0	C	8.1	9.3	mg/L	136	uS	7.0	NTU	--	ND	21	27	--
LTR	SMBT1	Steamboat Creek	17.0	C	3.0	C	5.5	5.8	mg/L	189	uS	2.0	NTU	--	ND	65	--	40
LTR	SMBT2	Steamboat Creek	20.0	C	8.0	C	7.0	8.0	mg/L	738	uS	3.0	NTU	--	ND	17	--	250
LTR	SMBT3	Steamboat Creek	--	--	9.0	C	8.2	--	--	661	uS	12.0	NTU	--	6	508	--	190
LTR	THCR	Thomas Creek	--	--	7.0	C	6.0	7.0	mg/L	102	uS	5.0	NTU	--	ND	40	--	60
LTR	WHCR	White's Creek	21.0	C	11.0	C	6.5	1.0	mg/L	84	uS	3.0	NTU	--	ND	17	--	20
LTR	WHCR2.1	White's Creek	23.0	C	14.5	C	6.5	6.0	mg/L	557	uS	1.0	NTU	--	ND	6	--	90
Average			14.3	C	7.0	C	6.8	8.6	mg/L	104	uS	1.9	NTU	2	5	32	7	35
Minimum Value			3.5	C	2.5	C	5.0	0.9	mg/L	10	uS	0.1	NTU	0	1	0	1	0
Maximum Value			26.0	C	17.5	C	8.2	12.8	mg/L	743	uS	12.0	NTU	11	52	508	51	250

Notes:
 "Exclude" is used to represent data that has been thrown out for quality assurance purposes.
 "ND" is used to represent "not detectable" by equipment limits.

Note 1: Turbidity (NTU) lab analysis conducted at the four collection sites (Sierra Nevada College, Lake Tahoe Community College, Truckee and Washoe-Storey Conservation District).
 Note 2: Fecal Coliform analysis conducted at Lahontan Regional Water Quality Control Board. Value represents number of colonies per 100 mL. Coliform value of zero is equal to "Non-Detect" less than one.
 Note 3: Lake Tahoe and Middle Truckee River Watershed nutrient analysis conducted by High Sierra Water Lab. Concentrations in Parts Per Billion (PPB).
 Note 4: Lower Truckee River Watershed nutrient analysis conducted by Truckee Meadows Water Reclamation Facility. Concentrations in Parts Per Billion (PPB).