18th Annual Snapshot Day Report

A Lake Tahoe Basin and Truckee Watershed Citizen Monitoring Event

(May 18 & 19, 2018)

Water Boards | Tahoe Water Suppliers Association | TAHOE REGIONAL PLANNING AGENCY | KEEP TAHOE BLUE | ENVIRONMENTAL PROTECTION | foriver TRUCKEE RIVER WATERSHED COUNCIL

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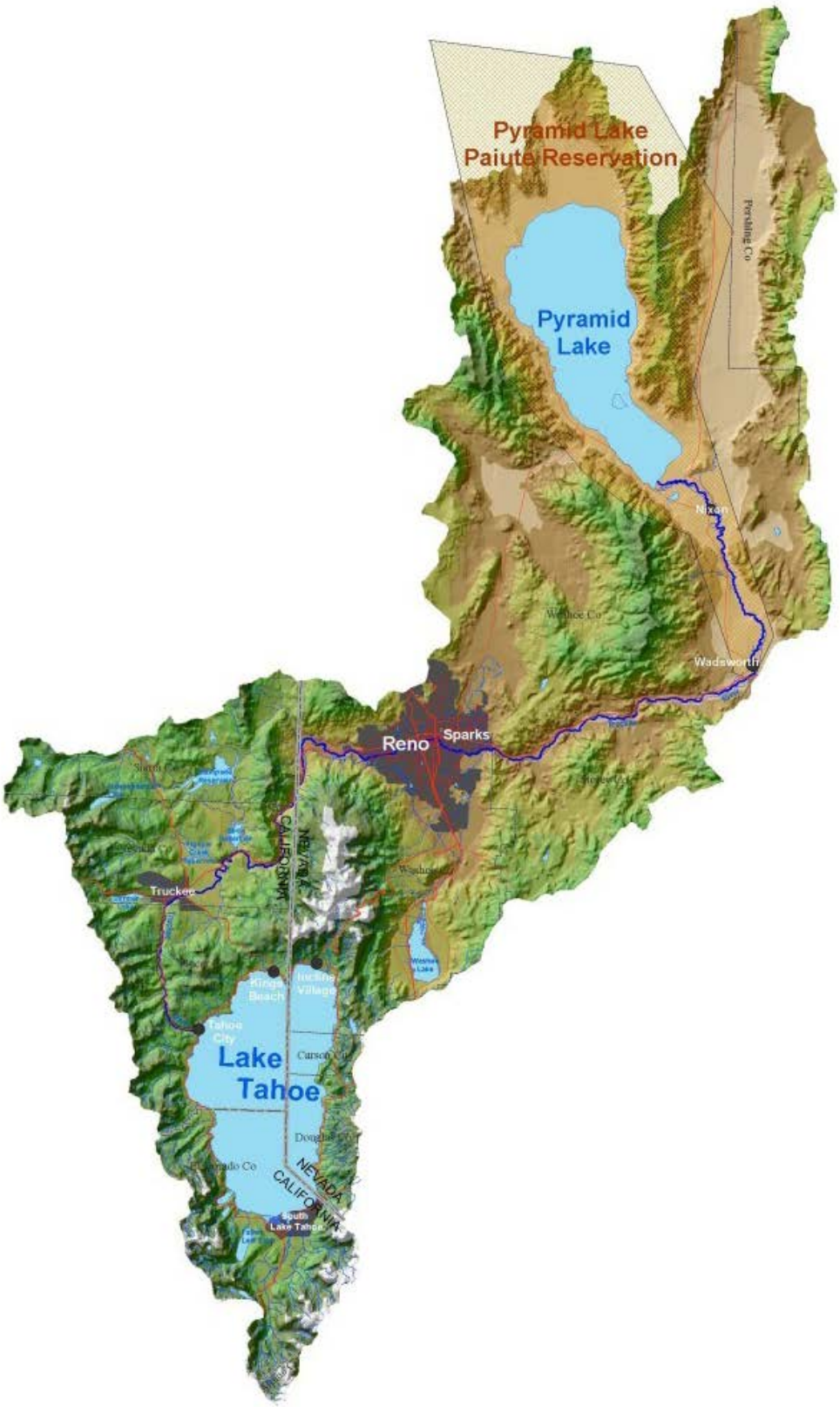


Introduction

What is Snapshot Day?

Snapshot Day is a one-day, volunteer-based event designed to collect data indicating watershed health at a single point in time. Volunteers trained as team leaders lead volunteer teams to various pre-determined sites to collect water quality data. The 18th Annual Snapshot Day was held on May 18 and 19, 2018, on the North Shore and South Shore, respectively. The sampling area included the Truckee River Watershed, from south of Lake Tahoe to the terminus at Pyramid Lake. Snapshot Day is sustained by support from dedicated staff, the funding of a few grants and donations, and by of hundreds of citizens who value the public involvement to protect the watershed they live in. It is important to note that citizen monitoring is designed to supplement existing agency monitoring efforts. All information is provided to the regulatory and resource management agencies whose responsibility it is to protect water quality in the Truckee River Watershed.

What are the objectives of Snapshot Day?

While there is a great deal of high-quality agency and university-sponsored monitoring taking place in the Tahoe-Truckee region, there is still insufficient information to assess the status of all aquatic resources in the Truckee River Hydrologic Unit, which includes the Lake Tahoe Basin and the Truckee River Watersheds. With proper training and quality assurance, community members can help fill this void by providing valuable information for watershed management and pollution prevention.

The primary goals of this effort are two-fold:

1. Promote environmental education and stewardship.
2. Collect valuable water quality information.

In regards to collecting water quality data, this effort aims to:

- Screen for water quality problems, including the identification of sources of pollution and detection of illegal activities (e.g., chemical spills, filling of wetlands, diversions, illicit discharges, destruction of stream environment zones (SEZs), non-compliance with ordinances or regulations in place to protect natural resources, etc.);
- Provide water quality data that may be compared to water quality standards set by the TRPA for the Tahoe Basin and the States of California and Nevada;
- Provide water quality data that may be used in status and trend analyses; and
- Provide some pre and post data for evaluating the effectiveness of restoration activities.

Snapshot Day 2018

2018 Event Summary

Snapshot Day provides an annual opportunity to highlight the contributions of citizen science to maintaining the environmental health of the Tahoe-Truckee region. 2018 Snapshot Day's data analyses demonstrate good water quality overall for the Tahoe-Truckee watershed. Water quality parameters such as turbidity and dissolved oxygen content were somewhat elevated from previous years, but most samples collected meet the standards set for the region.

In 2018, Snapshot Day reached its 18th anniversary. It remains one of the longest-running citizen watershed monitoring events on the West Coast of the United States. Snapshot Day continues to highlight successful engagement with the public in active watershed stewardship while providing valuable data to the responsible agencies. As previous data sets are compiled and data storage is improved, this program can show long-term trends and better assist agencies in watershed conditions analysis.

Volunteers and locations

Snapshot Day 2018 was a collaborative effort between the North Shore Lake Tahoe, South Shore Lake Tahoe, Middle Truckee River near the town of Truckee and Lower Truckee River from the Nevada Stateline to Pyramid Lake.

Volunteer and monitoring site locations are as follows:

Table 1: Volunteer and monitoring site location numbers.

	Volunteers	Locations
North Shore Lake Tahoe	20	15
South Shore Lake Tahoe	100	33
Middle Truckee River	26	25
Lower Truckee River	219	11
Totals for 2017	**365**	**84**

This collaborative effort was sponsored by the Incline Village General Improvement District, the Tahoe Water Suppliers Association, the League to Save Lake Tahoe, the Truckee River Watershed Council and the Nevada Division of Environmental Protection. For an expanded list of involved organizations, resource partners and education partners, please see **Appendix A**.

Snapshot Day is a bi-state event and as such falls under two statewide citizen monitoring programs: the California State Regional Water Quality Control Board's (SWQCB) *Clean Water Team*, (http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml) and the Nevada Division of Environmental Protection water and education outreach activities https://ndep.nv.gov/water/rivers-streams-lakes/water-education-and-outreach/snapshot-day. Through this bi-state collaborative, Snapshot Day can achieve a larger watershed approach to successful data collection.

In 2018, volunteers gathered data at a total of 84 locations throughout the Truckee River watershed from south of Lake Tahoe to its terminus at Pyramid Lake. A list of site names and codes can be found in **Appendix B**.

Lake Tahoe Tributaries, South Shore

- Angora Creek
- Burke Creek
- Cascade Creek
- Eagle Falls Creek
- Edgewood Creek
- Heavenly Creek
- Meeks Creek
- North Zephyr Creek
- Tahoe Keys Marina
- Tallac Creek
- Taylor Creek
- Upper Truckee River
- Trout Creek

Lake Tahoe Tributaries, North Shore

- Burton Creek
- Dollar Creek
- General Creek
- Griff Creek
- Hatchery Creek
- Homewood Creek
- Incline Creek
- Lake Forest Creek
- Madden Creek
- Marlette Creek
- Quail Lake Creek
- Secret Harbor Creek
- Snow Creek
- Third Creek

Truckee River Tributaries, Middle Truckee River

- Alder Creek
- Bear Creek
- Cold Stream
- Deep Creek
- Donner Creek
- East Martis Creek
- Main Stem, Truckee River
- Little Truckee River
- Martis Creek
- Pole Creek
- Prosser Creek
- Silver Creek
- Squaw Creek
- Trout Creek
- Union Valley Creek

Truckee River Tributaries, Lower Truckee River

- Alum Creek
- Galena Creek
- North Truckee Drain
- Main Stem, Truckee River (6 sites)
- Pyramid Lake
- Hunter Creek
- Thomas Creek
- White's Creek

Methods of Data Collection

All observations, photos, field measurements, and samples were taken on May 18 and 19, 2018 between 9 am and 12 pm; this maintains the 'Snapshot' aspect of the project. Any samples submitted past 1 pm are evaluated at that time to determine what the value is of samples submitted. Several lower Truckee River samples were taken on May 17, due to availability of access to sample locations on the Paiute Reservation; these samples are included in this report due to the significance of capturing the terminus of the watershed. Citizen monitoring team leaders are provided training before Snapshot Day each year. Team leader trainings cover protocols for visual observations, photo documentation, water quality field measurements and collecting water samples to be sent to a laboratory for analysis. Each volunteer team leader is required to attend at least one session before the field day. Training for the team leaders is usually taught by the coordinator for that region, with assistance as needed from the cooperating resource and regulatory agencies.

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. Monitoring results are compiled in **Appendix B**, which includes both the field measurements collected by volunteers and nutrient and bacteria analyses conducted by designated laboratories.

Visual observations and photo documentation are performed in accordance with procedures developed by the California State Water Resources Control Board Clean Water Team. The standardized observation form, the *California Stream and Shore Walk Visual Assessment Form*, has been slightly revised to better apply to the region. At least three photos are taken at each sampling site: streambed conditions; view across the stream, and view upstream from the starting point. However, volunteers are encouraged to photograph as much as possible, especially of team members in the field.

A variety of instruments and kits are used on Snapshot Day by the volunteers. Much of the equipment has been purchased through the years with grants or donations; the remainder of the equipment is borrowed each year from various partners. All the instruments and kits are calibrated and tested at a quality control session held before the event. For additional information on the monitoring equipment used see **Appendix C**.

Water Quality Standards

The U.S. EPA has recommended criteria for nutrients and turbidity. Nevada, California and the Tahoe Regional Planning Agency have specific water quality standards and indicators generally more stringent in certain watersheds and creeks, such as the Tahoe Basin than elsewhere in the Truckee River Watershed. **Table 2** lists some of these standards for the Tahoe Basin. The selected standards shown in **Table 3** are from the Nevada Division of Environmental Protection for the Lower Truckee River Watershed.

Table 2: 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)
Conductivity	Shall not exceed 95 µS/cm 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” (Lahontan Region, CA)
Turbidity	Shallow water shall not exceed 3 NTU near tributaries and 1 NTU not directly influenced by streams (TRPA)
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 annual concentration in May is 0.087 mg/L but the maximum allowable is a mean of no more than 0.21 mg/L (Lahontan Region, CA).
Soluble inorganic Nitrogen	Mean of no more than 0.06 mg/L for most tributaries to Lake Tahoe, Nevada side of Lake Tahoe (NDEP)
Total Phosphorous	Annual average of no more than 0.05 mg/L for most tributaries, Nevada side of Lake Tahoe and no more than 0.008 mg/L for most tributaries, California side of Lake Tahoe. Maximum allowable for California side is 0.018 mg/L (Lahontan Region, CA).
Soluble Reactive Phosphorous	Annual average of no more than 0.007 mg/L (combination of organic and inorganic) for Lake Tahoe, Nevada side (NDEP) and 0.009 mg/L for Lake Tahoe, California side (Lahontan Region, CA).
Fecal Coliform	Log mean of 20 CFU (30-day period) and maximum of 40 CFU (Lahontan Region, CA).

Table 3: Nevada water quality standards for the Truckee River and Pyramid Lake (S.V. = single value)

Parameter	Truckee River at Idlewild (LTR-IDL)	Truckee River at Wadsworth (LTR-WADS)	Truckee River at the Pyramid Lake Paiute Reservation
Temperature	≤13ºC (month dependent)	≤14ºC (month dependent)	S.V. ≤14ºC (month dependent) this S.V. is Apr-Jun
Dissolved Oxygen	≥5 mg/L (April-October)	≥5 mg/L (April-October)	S.V. ≥6.0 mg/L (Nov-Jun)
pH	6.5-9.0 S.V.	6.5-9.0	6.5-9.0 S.V.
Chlorides	≤250 mg/L S.V.	≤250 mg/L	≤250 mg/L S.V.
Total Phosphates	Annual average ≤ 0.10 mg/L	Annual average ≤ 0.05 mg/L	Annual average ≤ 0.05 mg/L
Ortho-phosphate	≤0.05 mg/L S.V.	N/A	N/A
Nitrate	≤2.0 mg/L S.V.	≤2.0 mg/L	≤2.0 mg/L S.V.
Nitrite	≤0.04 mg/L S.V.	≤0.04 mg/L	≤0.04 mg/L S.V.
Total Nitrogen	N/A	≤1.2 mg/L	≤1.2 mg/L S.V.
Turbidity	≤10 NTU S.V.	≤10 NTU	≤10 NTU S.V.
Fecal coliform	≤1000 No./100ml S.V.	≤1000 No./100ml	≤1000 No./100ml S.V.
E. coli	≤410 No./100ml single value or ≤126 No./100ml annual geometric mean	≤410 No./100ml single value or ≤126 No./100ml annual geometric mean	≤410 No./100ml single value or ≤126 No./100ml annual geometric mean

For additional information on water quality objectives in California, refer to the Lahontan Regional Water Quality Control Board (Lahontan) *Basin Plan* at the following website:
www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml

For additional information on water quality standards in Nevada refer to the following website:
www.leg.state.nv.us/NAC/NAC-445A.html#NAC445ASec11704

Data Results

This section gives an overview of the parameters measured and the data results. All the measured parameters are discussed, and some of the high and low measurements are highlighted for each of the measured parameters. Specific sites in figures are referred to by code, which can be cross-referenced by site names in **Appendix B**.

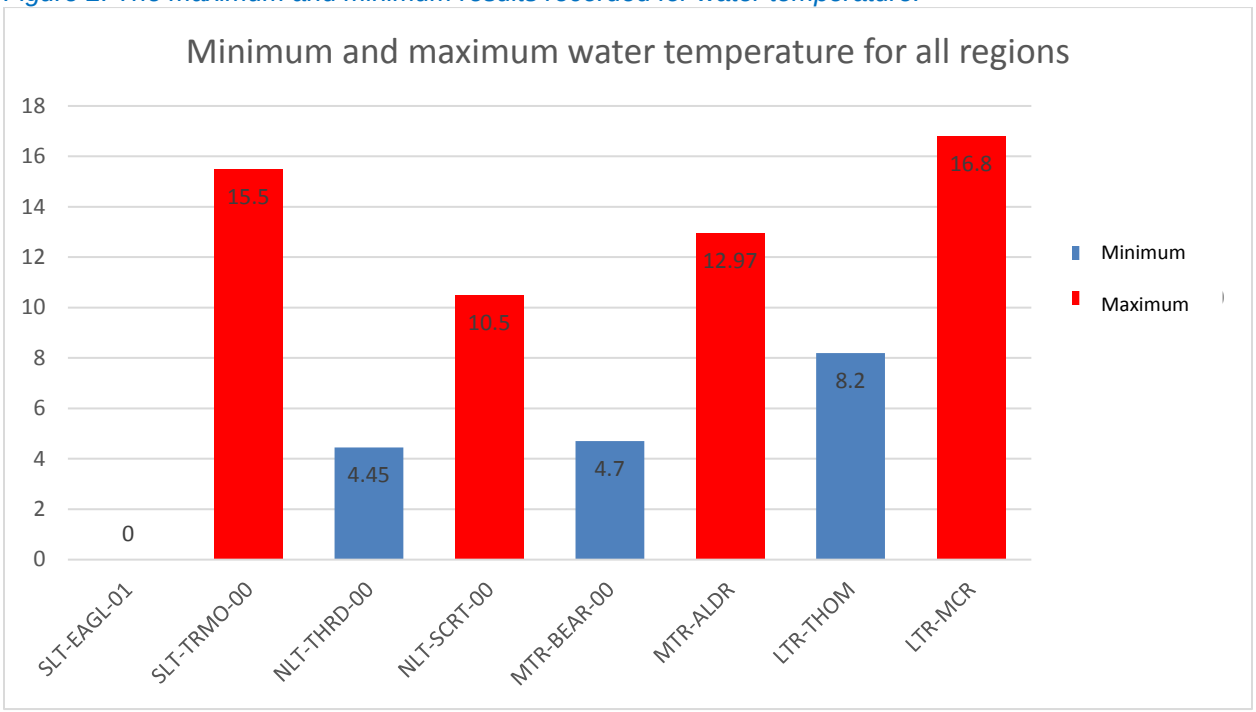
Water temperature

Cooler water temperatures are considered better habitat for aquatic life in mountain streams and lakes since colder water contains more dissolved oxygen, an essential ingredient for fish and invertebrates. Higher temperatures promote nutrient solubility and can occur because of low-flow (shallow) conditions, and a lack of canopy (vegetation) cover along stream banks, which acts to shade and thus prevent solar heating of the water.

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 and higher dissolved oxygen content than water in streams and lakes that do not have "cold-water fishery" as a designated beneficial use. Rainbow trout prefer water temperatures between 12.8°C and 15.6°C and the upper incipient lethal temperature (temperature at which 50% of the population survives 60 days) is 14.3°C.

In 2018, 82 sites were sampled for water temperature. The lowest recorded temperature from Snapshot Day 2018was 0.0°C at the Eagle Falls sampling location in South Lake Tahoe. The highest recorded temperature was 16.8°C in the Lower Truckee River segment at the McCarran Rach sample site on the Truckee River. Figure 1 below represents the lowest and highest temperatures for each of the four regions sampled during the 2018 event. One of the sites monitored during the 2018 Snapshot Day event exceeded 15.6°C, the maximum optimal temperature for rainbow trout. In the Truckee river sample sites 30 locations, had temperatures below 12.8°C, the minimum optimal temperature range for rainbow trout.

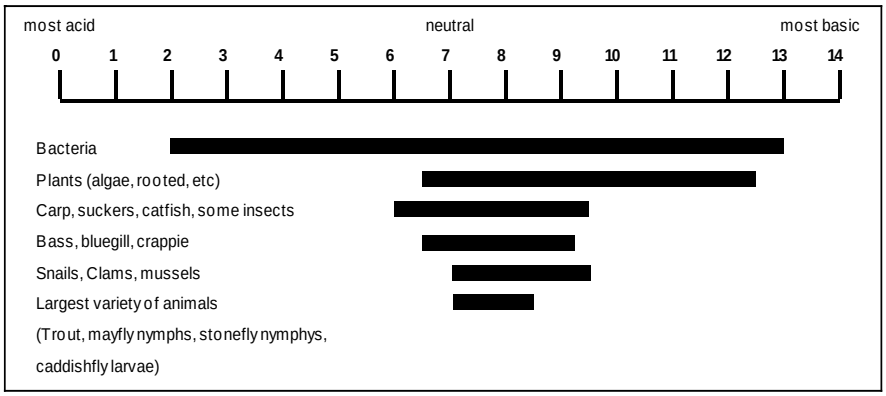
Figure 2: The maximum and minimum results recorded for water temperature.



pH

pH is a measurement of the degree to which water is “acidic” or “basic.” pH is measured on a scale of 0 (very acidic) to 14 (very basic) with 7 in the middle as “neutral.” Most aquatic life prefers a pH close to 7. **Figure 3** displays the pH ranges that support aquatic life.

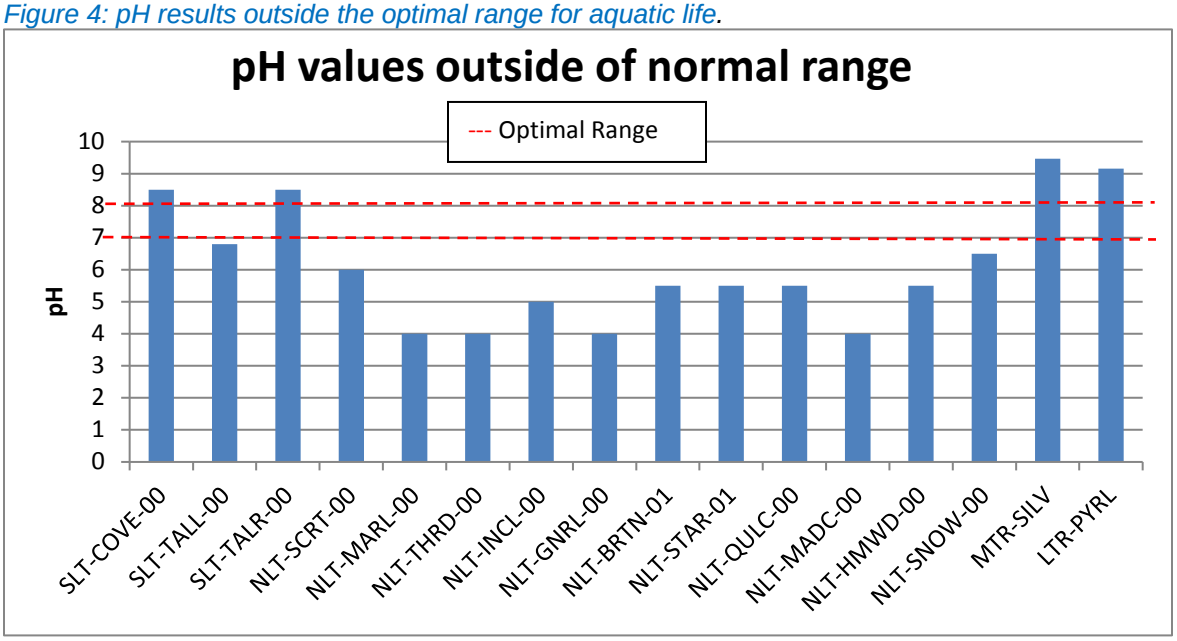
Figure 3: pH range that supports aquatic life



pH ranges that support aquatic life.

Water in California within the Lake Tahoe Basin should not be below 7 or above 8.4. Water within the Nevada Truckee Region should not be below 6.5 or above 9.0. The Regional Board recognizes that some waters of the Region may have natural pH levels outside the 7.0 to 8.5 range, and this is commonly found in the tributaries to Lake Tahoe.

Figure 4: pH results outside the optimal range for aquatic life.



The lowest pH level measured at Snapshot Day 2018 was recorded in North Lake Tahoe, while the highest level was recorded in the Middle Truckee River region. The lowest pH recorded was 4.0 found at four locations Marlette Cree, Third Cree, General Creek, and Madden Creek. The highest pH recorded in the Lake Tahoe region was 9.47 at the Silver Creek above 89 sites. In the Lower Truckee region, one site was measured at 9.1 pH, above the established range in Nevada. Of the 84 sites that took pH readings, 12 sites had a pH below the optimal range, and four-sample site had a pH value above the optimal range.

Dissolved Oxygen (DO)

Dissolved oxygen is a measure of the amount of gaseous oxygen (O_2) dissolved in water. Dissolved oxygen is necessary to support aquatic life. Stress occurs in aquatic life, especially fish when dissolved oxygen levels drop too low.

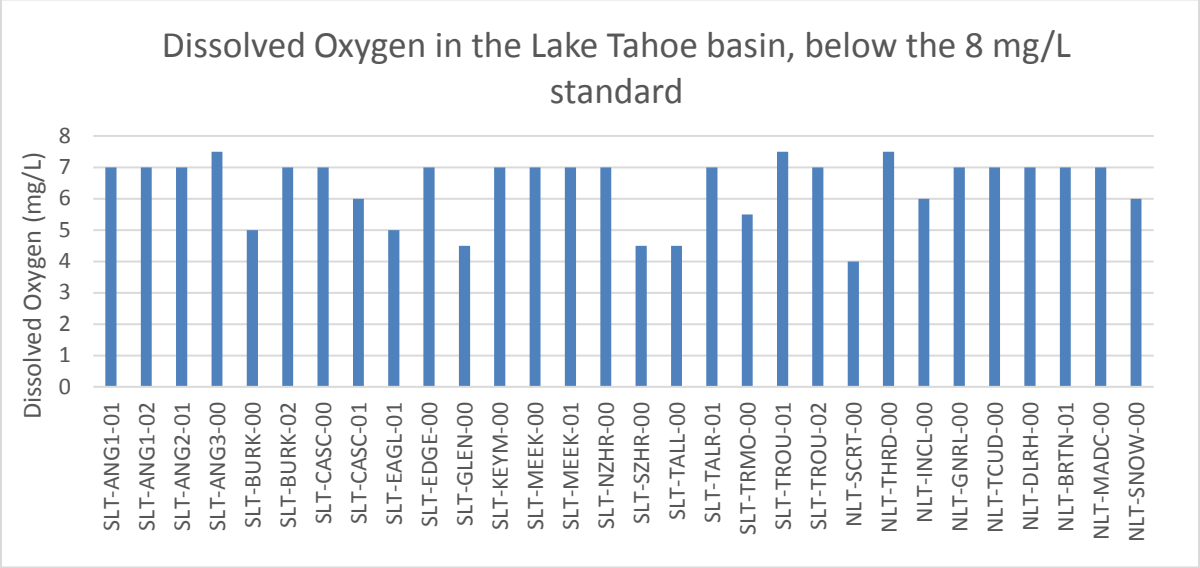
Low dissolved oxygen concentrations are typically the result of:

- Warming water: warmer water can dissolve and hold less oxygen than cooler water.
- Excess nutrients: too many nutrients in the water can fuel algae and bacteria growth which consume oxygen upon decay.
- Slow or stagnant water: movement allows for oxygen and water to mix; slow or stagnant water thus has less dissolved oxygen than water in motion.

Water quality objectives for dissolved oxygen vary from region to region; most waters within the Lake Tahoe Basin have a dissolved oxygen concentration standard of at least 8.0 mg/L. Waters of the Truckee River have a dissolved oxygen standard of 5.0 mg/L or 6.0 mg/L depending on the reach of the river. Measurements below 5 mg/L are considered dangerous for cold water aquatic life.

The lowest dissolved oxygen content measured at Snapshot Day 2018 was 4 mg/L at Secret Harbor Creek in the North Lake Tahoe region. The highest recorded dissolved oxygen content was greater than 12 mg/L at the Ski Run Marina site in the South Lake Tahoe Region. Dissolved oxygen content was measured at 84 sites. In the Lake Tahoe Basin and Middle Truckee River watershed, 40 of the 73 sites had a reading below 8.0 mg/L, and four sites were below 5 mg/L. In the Lower Truckee River portion of the watershed, six of the 11 sites tested below the 8.0 mg/L standard and zero sites tested below 5 mg/L.

Figure 5: Dissolved oxygen concentrations that were measured below 8mg/L.



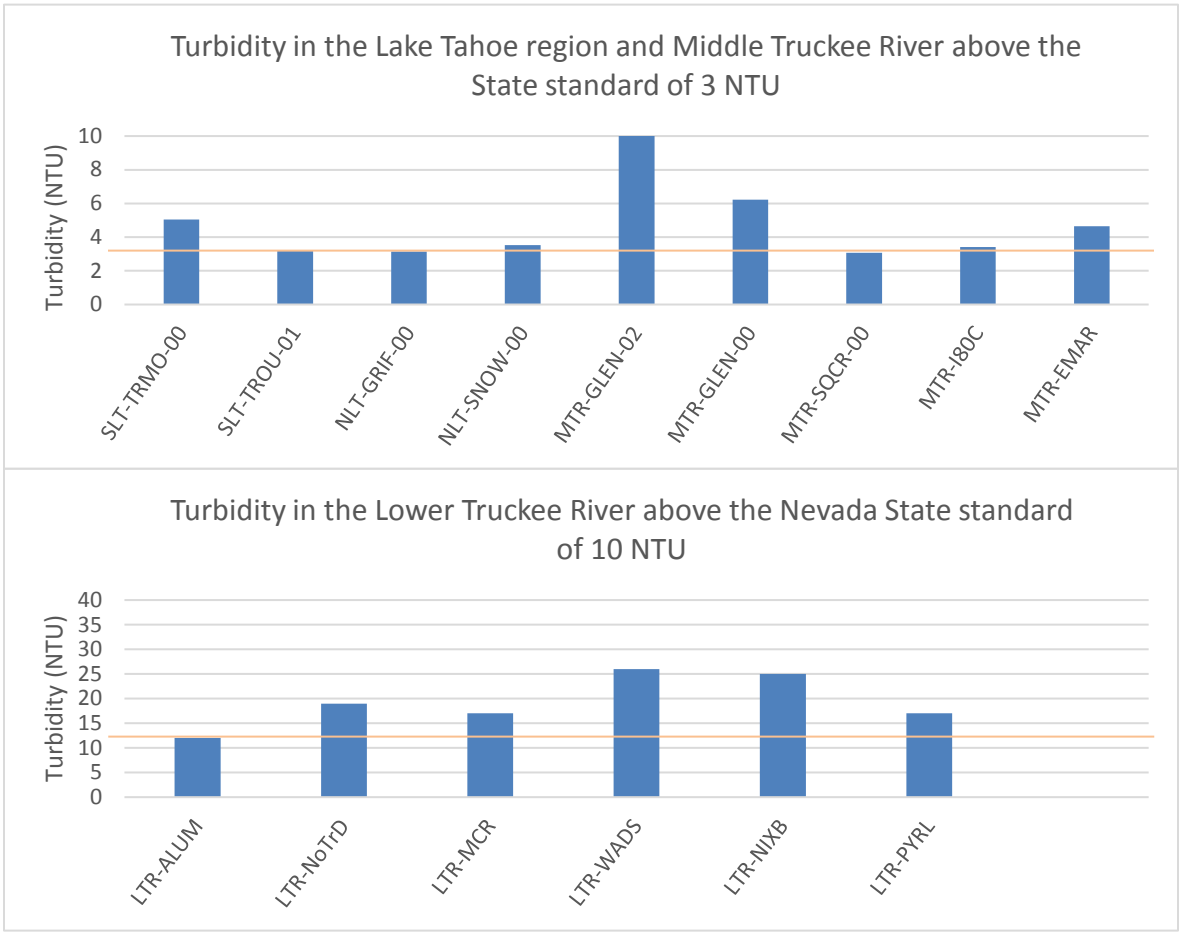
Turbidity

Turbidity is a measure of the number of suspended particles in the water column. Turbidity is measured in NTUs (Nephelometric Turbidity Units); high NTU levels indicate poor water clarity, low NTU levels indicate high clarity. Algae, suspended fine sediment particles, organic matter and some pollutants can cloud the water making it more turbid. High sediment loads can clog the gills of fish, negatively affect gravel beds and smother fish eggs and benthic invertebrates. The sediment can also carry pathogens, pollutants, and nutrients that affect Lake Tahoe's water quality.

The U.S. EPA's recommended criteria for turbidity in streams in Eco-Region II (forested mountains in the western U.S.), is at or below 1.3 NTU. The California portion of the Truckee River Watershed is located within this Eco-Region; however, the State of Nevada outside of the Tahoe Basin is located right outside this Eco-Region. The TRPA and Lahontan have a nearshore turbidity standard of 1-3 NTUs (measured by monthly means) in Lake Tahoe. The standard for the Lower Truckee River and associated tributaries in the State of Nevada is 10 NTU.

Most turbidity samples from Snapshot Day 2018 were indicative of good water quality. For the Lake Tahoe region and the Middle Truckee River, 73 samples were analyzed for turbidity, and nine sites had a reading above three NTU. The highest turbidity reading for these two regions for the 2018 Snapshot Day event was 10.83 NTU from Upstream of Glenshire Pond. In the Lower Truckee region (Nevada) 11 samples were analyzed for turbidity and six sites had a reading above 10 NTU, with the highest being, the main stem of the Truckee River at the Wadsworth with a reading of 26 NTU at this site.

Figure 6: Turbidity readings that did not meet state or regional NTU standards



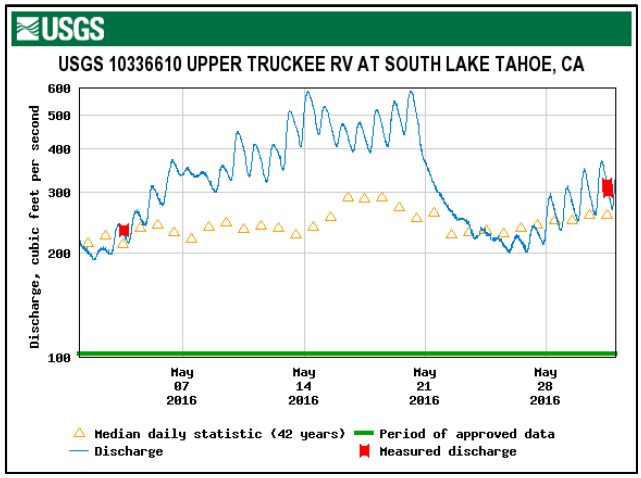
Streamflow

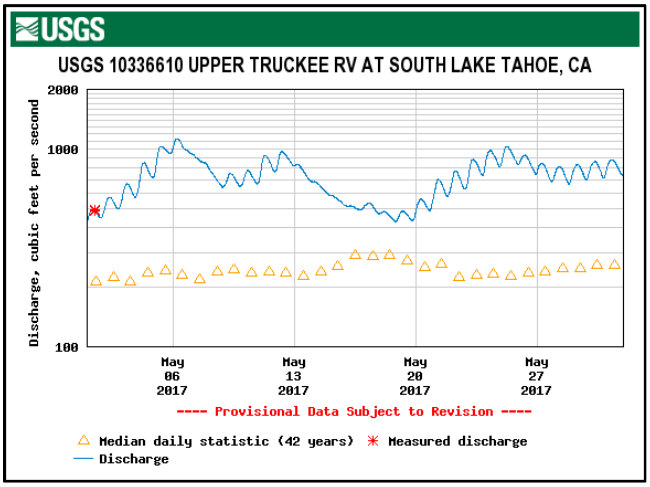
Streamflow is the measure of the volume of water that is flowing, which varies with precipitation. Streamflow can have a significant impact on water quality; during low flow conditions high water temperature, low levels of dissolved oxygen and elevated presence of toxins can all be exacerbated. During high flow conditions, the likelihood of increased erosion and excess transfer of sediment can be of concern. Streamflow conditions can also impact fish habitat and other aquatic organisms and may affect the ability to spawn and reproduce. The water year of 2017 (Oct. 2016-Oct. 2017) was noted as the wettest year on record in terms of overall precipitation; thus the flows observed on Snapshot Day 2017 were extremely high and often with very turbulent conditions.

The graphs below show streamflow data collected by the U.S. Geological Survey (USGS) at three separate monitoring locations: a) Upper Truckee River above Lake Tahoe, b) Middle Truckee River at the Town of Truckee, and c) Lower Truckee River in Reno. Data presented illustrates the varying flow conditions over a three-year timeframe from when the region was experiencing an average precipitation year in 2016 and extremely wet conditions in 2017, and average precipitation year in 2018.

Figure 7: Streamflow data from the Upper Truckee River above Lake Tahoe, California, during the month of May for the years of 2016, 2017 & 2018 respectively.

Upper Truckee River:





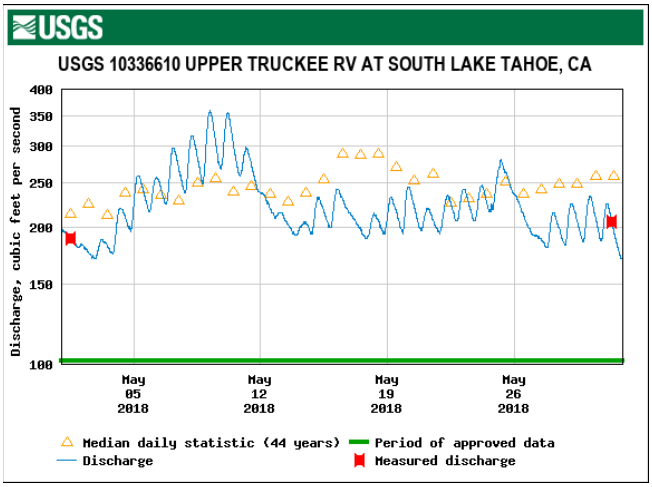
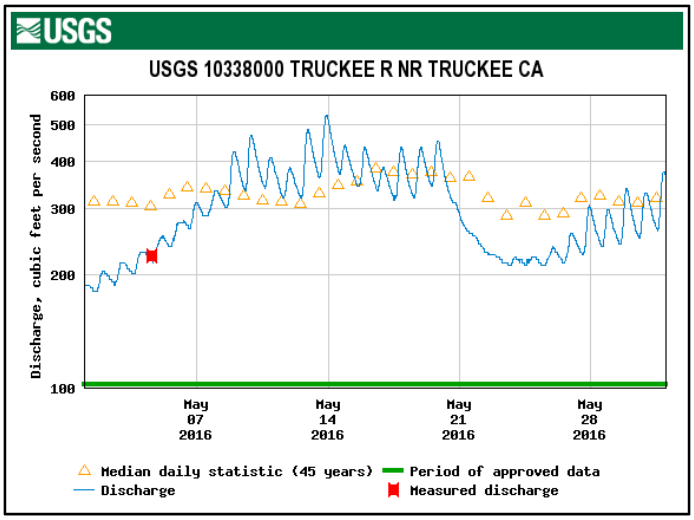
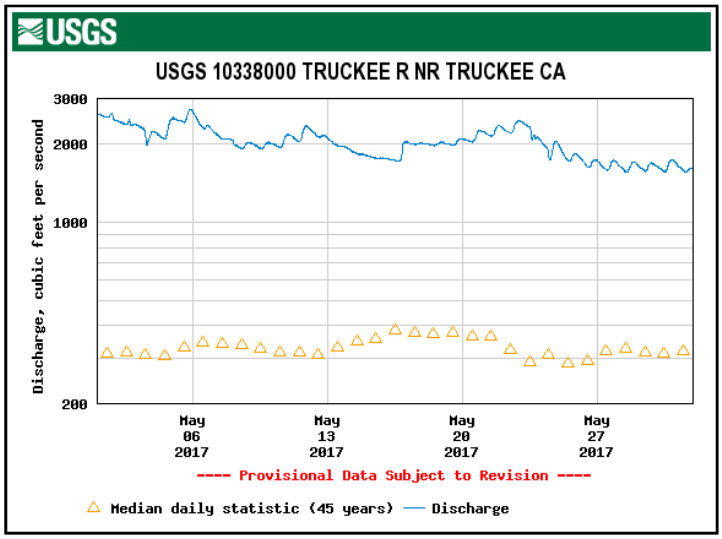


Figure 8: Streamflow data from the Middle Truckee River at the Town of Truckee, California, during the month of May for the years of 2016, 2017 & 2018 respectively.

Middle Truckee River:





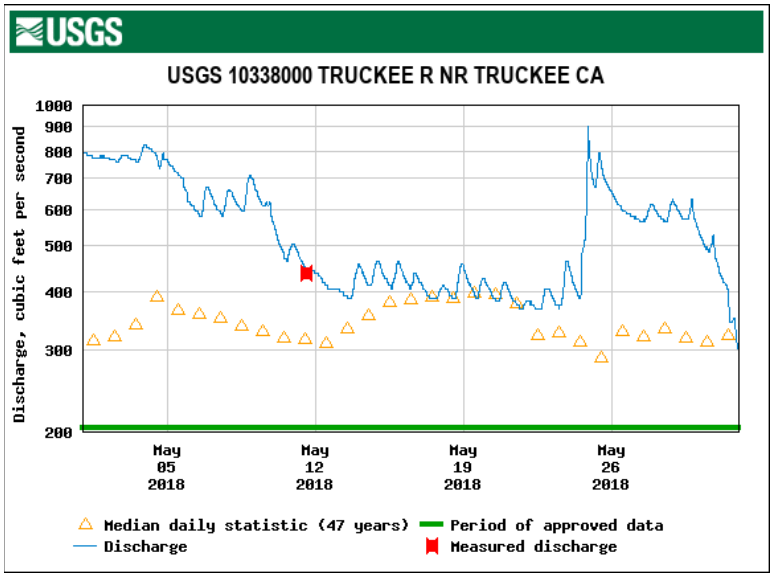
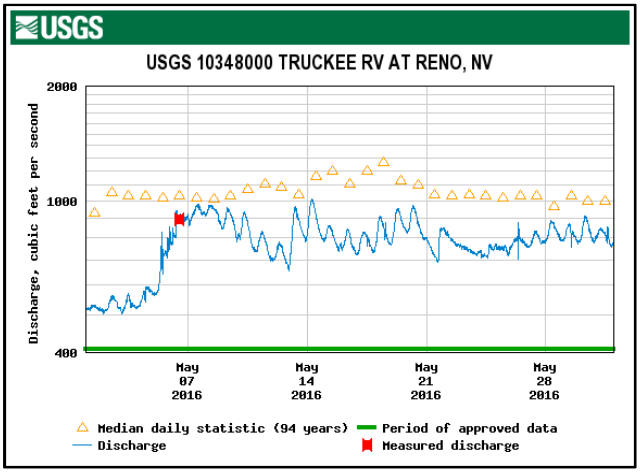
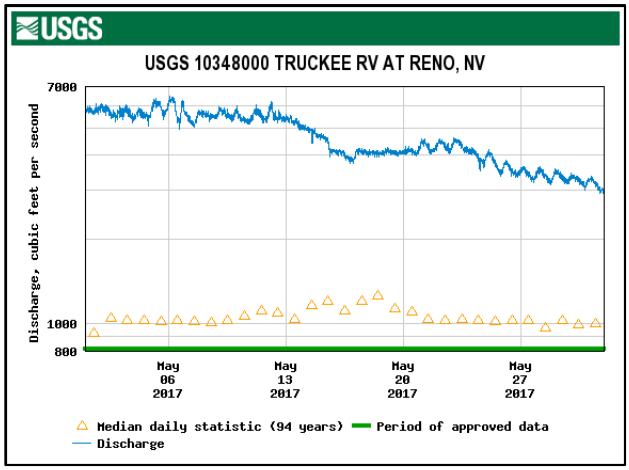
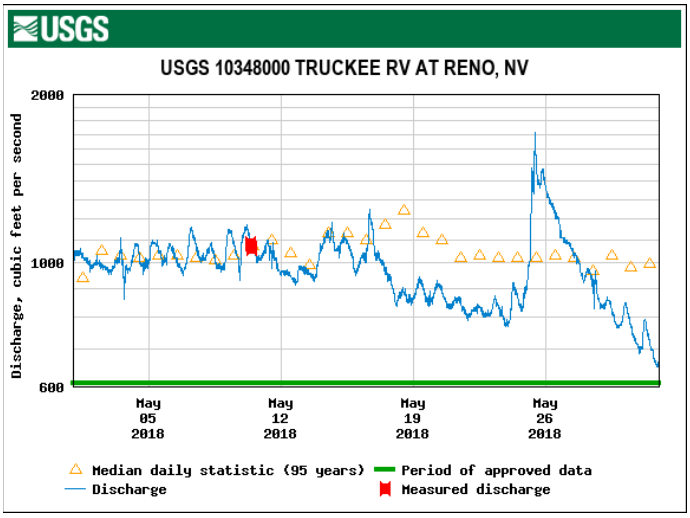


Figure 9: Streamflow data from the Lower Truckee River at Reno, Nevada, during the month of May for the years of 2015, 2016 & 2017 respectively.

Lower Truckee River:







Conductivity

Conductivity is a measure of water's ability to pass an electric current. In water, conductivity is affected by the presence of inorganic dissolved solids such as chloride, nitrate, calcium, sulfate, and others. Conductivity in rivers and streams is mainly influenced by the geology through which the water flows.

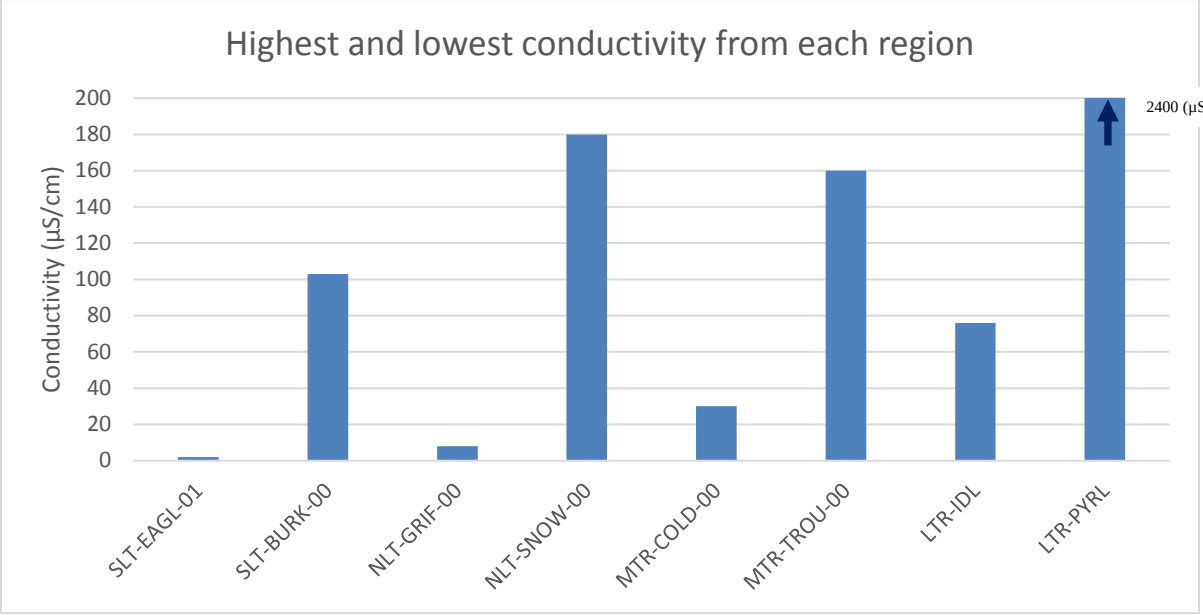
Electrical conductivity is also sensitive to flows – at high flows, the charged particles that makeup conductivity are diluted, and so measured conductivity should be lower. At low flows, the particles are more concentrated, and conductivity measurements will often be higher. Primary sources of charged particles in the Truckee River watershed are road sands, road de-icers, and natural sources. Typically, urban areas or sites adjacent to high traffic roads will show higher electrical conductivity readings.

Abrupt changes in conductivity may indicate that new water sources or wastewaters are being diverted into a stream or river. Acceptable ranges for water conductivity are dependent on the water type. **Table 4** displays acceptable conductivity ranges for several water types. Conductivity was measured at 84 sample sites for Snapshot Day 2018. The lowest conductivity recorded was two µS/cm, measured at Eagle Falls in South Lake Tahoe. The highest conductivity recorded was 2,400 µS/cm at Pyramid Lake, Nevada in the Lower Truckee watershed.

Table 4: Acceptable conductivity for different water types.

Water Type	**Conductivity** µS/cm (micro Siemens per centimeter**)**
Distilled Water	0.5 - 3.0
Melted snow	2 - 42
Potable water in the U.S.	30 - 1500
Irrigation Supply Water	< 750

Figure 10: Highest and lowest conductivity values from Snapshot Day 2018 by region.



Fecal Coliform Bacteria

Coliform bacteria are found in the feces of warm-blooded animals, including humans, pets, livestock, beavers and birds. Fecal coliform is measured in colony forming units (CFUs) counted per 100 milliliters of water (CFU/100ml). CFUs are roughly equivalent to the number of bacteria cells. The Lahontan standard for fecal coliform is 20 counts per 100 ml for a single occurrence based on a logarithmic mean of 5 samples taken within 30 days. By using 20 cfu/100 ml as guidance for a tolerable threshold of coliform, we can determine if that threshold is exceeded for the Tahoe/Truckee regions.

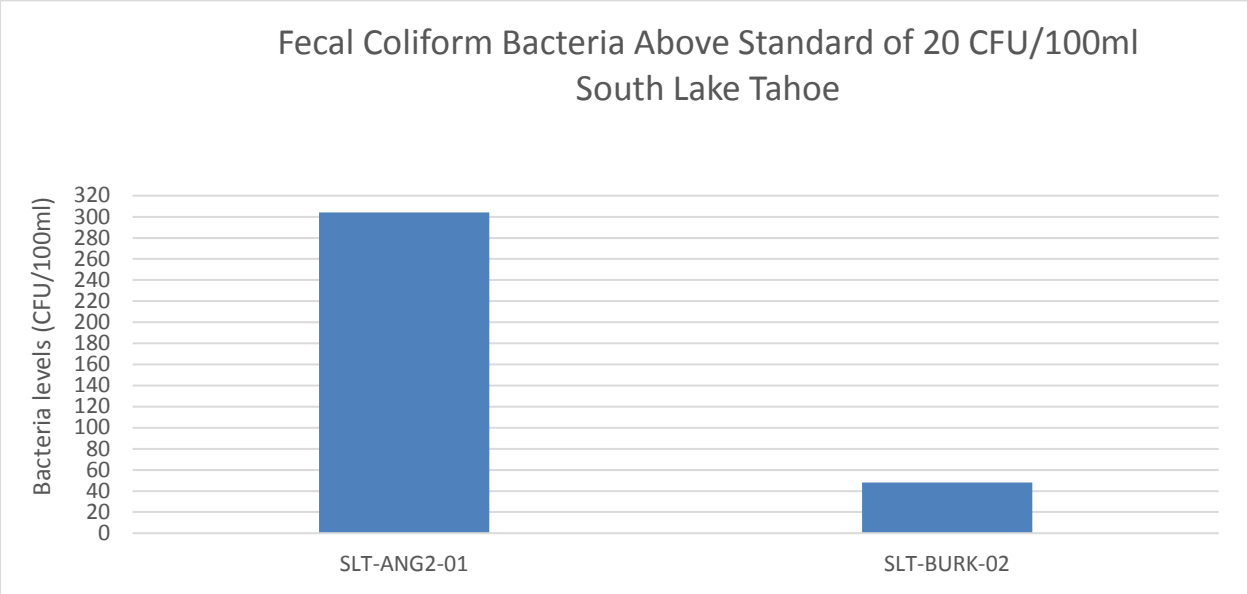
The standards for the Lower Truckee River in Nevada are significantly higher than the Lahontan standards. Standards for the Lower Truckee River for fecal coliform are established at ≤1000 No./100ml. Standards for E. coli are established at ≤410 No./100ml. No sites monitored in the Lower Truckee exceeded the established standards for either fecal coliform or E. coli.

Escherichia coli (E. coli) is the major species in the fecal coliform group. Of the five general groups of bacteria that comprise the total coliforms, only E. coli is generally not found growing and reproducing in the environment. Consequently, E. coli is considered to be the species of coliform bacteria that is the best indicator of fecal pollution and the possible presence of pathogens. As a result, testing for coliform bacteria can be a reasonable indication of whether other pathogenic bacteria are present.

Fecal coliform was measured at 67 locations on Snapshot Day 2018. Ten of these samples had readings greater than 20 CFU/100ml. Thirty-five samples had zero bacteria recorded. Two sample locations form the Lower Truckee region had fecal coliform readings of greater than 600 CFU/100ml at the Truckee Drain.

Escherichia coli (E. coli) was analyzed at 44 snapshot day locations in 2018. Nineteen samples had no E.coli. South Lake Tahoe had two samples that had E.coli results greater than 20 CFU/100 ml, with 42CFU/100ml at Angora Creek at Washoe meadows, and 37 CFU/100ml at Burke Creek. For the lower Truckee River, the Wadsworth location had an E. coli result greater than the 410 CFU/100ml standard, with 1274 CFU/100ml.

Figure 11: Fecal coliform bacteria counts above 20CFU/100ml standard – Lake Tahoe Region.



Nutrients

Sixty-six water samples collected at Snapshot Day 2018 were analyzed for nitrogen and phosphorus, which are of most concern for algal growth and water clarity. Along with excess algae growth, nutrient concentrations that are too high can lead to odors, discolored waters, loss of clarity and nighttime oxygen depletion.

The most accurate comparison of nutrient concentrations is to compare the highest concentrations, as the detection limits for the various regions are different for each region; therefore, the lowest concentrations are inconsistent. The highest levels of nitrogen were detected at Pyramid Lake in the Lower Truckee River and the Glenshire Pond site in the Middle Truckee measuring 1.5 and 0.40 mg/L in Total Kjeldahl Nitrogen, respectively. Total Kjeldahl Nitrogen maximum levels in the two Lake Tahoe Regions were 0.40mg/L at the South Zephyr Creek site in South Lake Tahoe and 0.34 mg/L at he Tahoe City Urban Ditch site in North Lake Tahoe. The highest levels of phosphorus were detected at Pyramid Lake and the Glenshire Pond site in the Middle Truckee measuring 0.78 and 0.08 mg/L in Total Phosphorus, respectively. Lake Tahoe samples were analyzed for Orthophosphate, and the maximum levels for each region were 0.02 at Burton Creek on the North Shore and 0.02 at Ski Run Marina on the South Shore.

Average results from the 2018 Snapshot day sampling are provided in the figures below. All Ammonia analysis in Lake Tahoe were non-detect, as well as Nitrite and Total nitrogen analysis in the lower Truckee River. Lake Tahoe samples were not analyzed for Nitrate and Total Phosphorus. The Middle Truckee river region did not analyze samples for Orthophosphate. Discrepancies in sample analysis throughout the regions attributed to laboratory availability.

Figure 12: Highest levels of nitrogen recorded in each region.

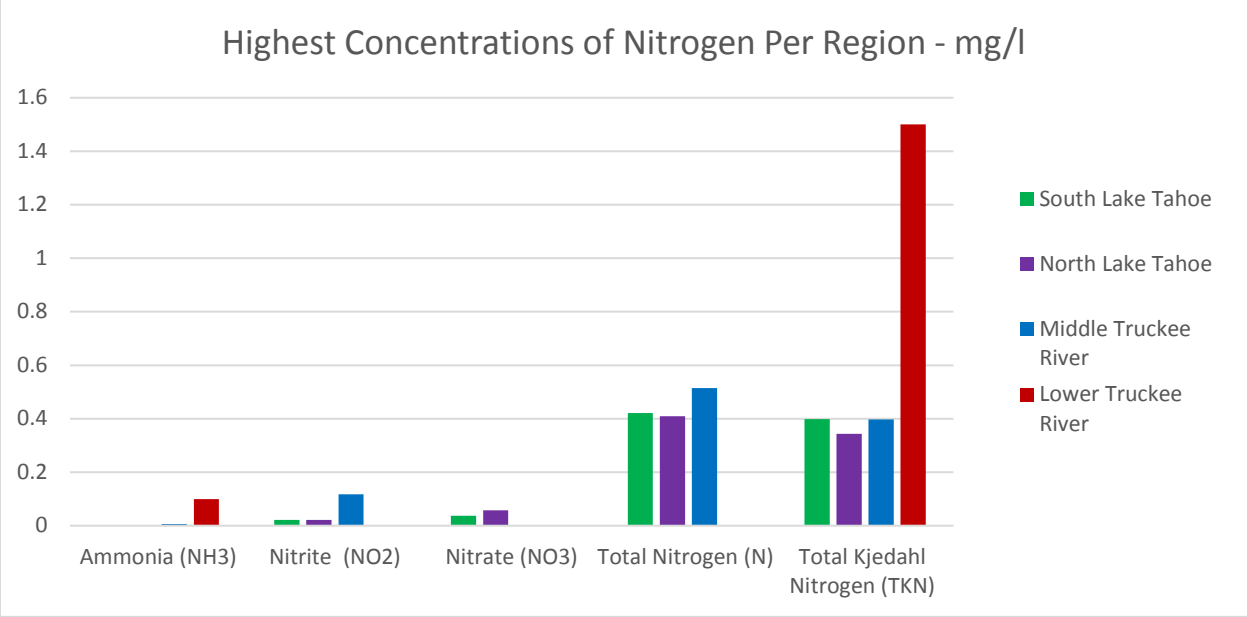


Figure 13: Average concentrations of nitrogen recorded in each region.

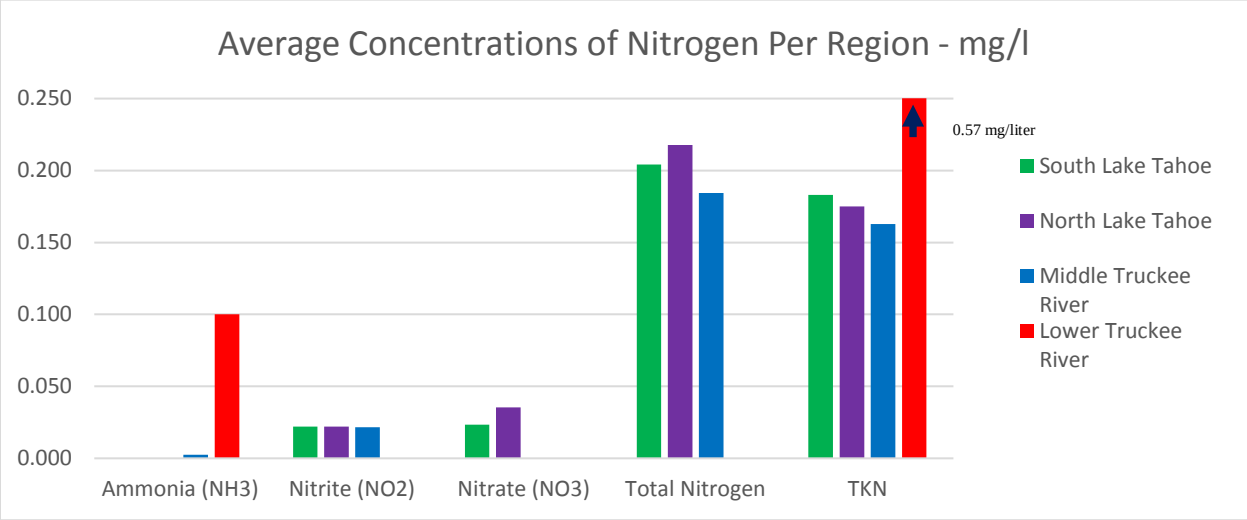


Figure 14: Highest concentrations of phosphorus recorded in each region.

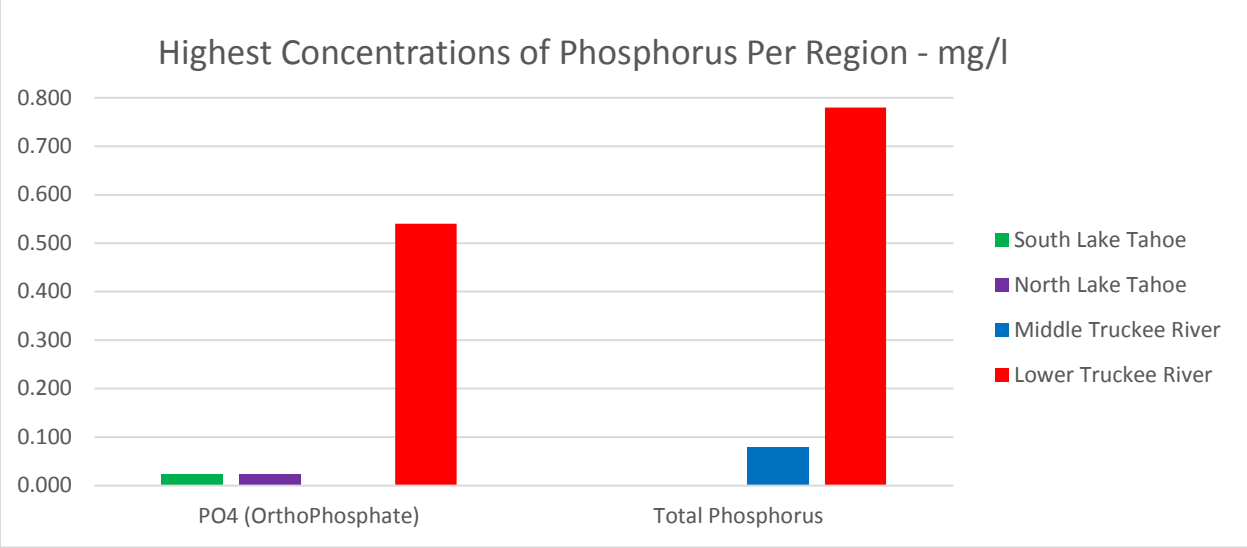
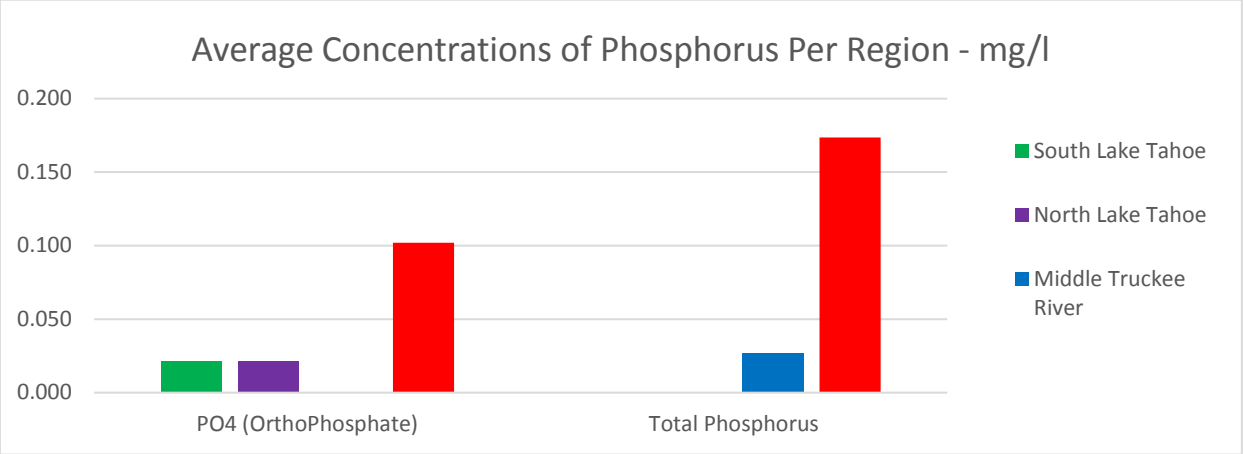


Figure 15: Average concentrations of phosphorus recorded in each region.



Visual Observations

Visual observations were recorded at 73 of the 82 sample sites from Snapshot Day 2018. Visual observations included cloud cover, precipitation, wind, water clarity, in-stream flow, sample color, sample odor and other items observed in the samples.

Table 5: Number of monitored sites given the sample odor classification.

Sample odor

None	Fresh algae	Chlorine	Rotten eggs	Sewage	Other
70	4	1	0	0	1

Table 6: Number of monitored sites with the presence of the objects noted.

Other presence

Algae or other water plants	Oily Sheen	Foam or suds	Litter or trash	Other
31	1	10	10	4

Discussion

Compared to many other watersheds in the nation, data collected within the Truckee River watershed is indicative of good overall water quality. The Truckee River watershed is fed by mountain streams and snowmelt conditions with heavily forested headwaters and urban concentrations (Reno/Sparks) located in the lower portion of the watershed. The presence of concentrated urban development and high amounts of impervious surface areas increases urban runoff into the watershed. These land-use conditions can have an impact on water quality as is reflected in the much higher concentrations of nitrogen and phosphorous in the lower Truckee watershed as compared to the headwaters region.

The data collected for Snapshot Day 2018 shows approximately 22% of the sites monitored have elevated levels of turbidity down from 30% in 2017. Additionally, 57% of the samples taken have dissolved oxygen results below the standard. Data collected show that at least a portion of the sites monitored is not meeting the standards set by the Lahontan Water Board (California) or the Nevada Department of Environmental Protection (Nevada). See tables two and three for California and Nevada standards. The increase in turbidity levels could be attributed to seasonal snowmelt condition when more particulate matter is expected to move through the watershed. Overall, the dissolved oxygen content was not far below the established standard of 8 mg/land is not a cause for concern. The North Shore Lake Tahoe region had several low pH readings which a likely influenced by inconsistent results from aging pH strips. These sites will be monitored during the next sampling event.

As previous data sets from the past 18 years are compiled and data storage is improved, this program will have the ability to show long-term trends and better assist agencies. It has been funded primarily through local, state and private agencies. The extensive event coordination is partner-driven, and participation from an almost entirely volunteer basis is exceptional. The collaboration and continued dedication of those involved, from dedicated staff to engaged volunteers, makes Snapshot Day a success each year. The ongoing success of this type of event exemplifies the value of citizen science and shows how community members can provide invaluable data collection and learn about their watershed at the same time.

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

- *North Lake Tahoe/Incline Village:* Sarah Vidra (775) 832-1284; Incline Village GID Waste Not
- *South Lake Tahoe:* Emily Frey (530) 541-5388; League to Save Lake Tahoe
- *Middle Truckee River (Tahoe City to Nevada State Line)*: Eben Swain, (530) 550-8760, x7; Truckee River Watershed Council
- *Lower Truckee River (Nevada Stateline to Pyramid Lake)*: Patricia Tierney, (775) 687-9454; Nevada Division of Environmental Protection

References

Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregion II, U.S. Environmental Protection Agency, December 2000

California State Water Resources Control Board Clean Water Team website: http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml

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Standard Methods for Water and Wastewater Collection, 21st Edition, 2007

The California Streamside Biosurvey: An Introduction to Using Aquatic Invertebrates as Water Quality Indicators, California State Water Resources Control Board, September 2001

Water Quality Control Plan for the Lahontan Region, California Regional Water Quality Control Board, Lahontan Region, 1993 Revision

Water Supply Outlook, Natural Resource Conservation Service website, www.nrcs.us.gov

Appendices

Appendix A – Resource Partners

2018 Snapshot Day sponsors

- California State Water Resource Control Board
- Lahontan Regional Water Quality Control Board
- Lake Tahoe Community College
- League to Save Lake Tahoe
- Nevada Division of Environmental Protection
- Nevada Division of State Lands
- Nevada State Health Laboratory
- Pyramid Lake Paiute Tribe
- Tahoe Environmental Research Center
- Tahoe Regional Planning Agency
- Tahoe Water Suppliers Association
- Truckee River Watershed Council
- United States Geologic Survey
- Waste Not, Incline Village General Improvement District

Citizen Monitoring Working Group Snapshot Day Planning Committee

- Eben Swain (Truckee River Watershed Council)
- Mary Kay Wagner (Nevada Division of Environmental Protection)
- Savannah Mendoza (League to Save Lake Tahoe)
- Sarah Vidra (Incline Village General Improvement District)
- Joe Hill (Incline Village General Improvement District)
- Madonna Dunbar (Tahoe Water Suppliers Association)
- Adam Jensen (Tahoe Regional Planning Agency)

Organizations hosting Snapshot Day 2017

- Incline Village General Improvement District
- League to Save Lake Tahoe
- Nevada Division of Environmental Protection
- Truckee River Watershed Council
- Tahoe Water Suppliers Association
- Lahontan Regional Water Quality Control Board
- Nevada Division of State Lands
- Pyramid Lake Paiute Tribe
- University of Nevada, Reno, Electrical Engineering Department
- U.S. Geological Survey, Carnelian Bay Field Station
- Lake Tahoe Community College

Laboratory Analyses (Nutrients and Bacteria)

- South Lake Tahoe Public Utility District
- Nevada State Health Laboratory
- Lahontan Regional Water Quality Control Board Laboratory
- United States Geologic Survey
- Incline Village General Improvement District
- High Sierra Water Lab

Equipment and Contact

- California State Water Resource Clean Water Team, Erick Burres
- Incline Village General Improvement District, Sarah Vidra
- League to Save Lake Tahoe, Savannah Mendoza
- Nevada Division of Environmental Protection, Mary Kay Wagner
- Tahoe Environmental Research Center
- Truckee River Watershed Council, Eben Swain
- United States Geological Survey, Paul Honeywell

Education Partners

- Alpine Academy
- Dilworth Middle School
- Galena High School
- High Desert Montessori
- Lake Tahoe Boys and Girls Club
- Lake Tahoe Community College
- Mountain View Montessori
- Natchez Elementary School
- Pyramid Lake High School
- Reed High School
- Spanish Springs High School
- TRiO Upward Bound
- Washoe County Online School

Resource Partners

- Desert Research Institute
- Nevada Division of Environmental Protection
- U.S. Geological Survey
- Great Basin Institute
- WET Laboratory
- Washoe County School District
- Sierra Nevada Journeys
- City of Sparks Public Works
- City of Reno Public Works
- City of South Lake Tahoe
- Incline Village General Improvement District
- Stantec
- The Nature Conservancy
- Nevada Dept. of Wildlife
- Nevada Dept. of Transportation
- Truckee Meadows Water Authority
- Pyramid Lake Environmental Staff
- Waste Management

Special thanks to

- Anne Liston, UC Davis-Tahoe Environmental Research Center, for hosting Calibration Day
- Bruce Warden, Lahontan, for bacteria and turbidity analysis
- Nevada Division of Environmental Protection, for funding nutrient analysis for the Lower Truckee River monitoring sites
- Nevada Division of State Lands, for funding nutrient analysis
- Nevada State Health Lab, for Lower Truckee River laboratory analyses
- Paul Honeywell, U.S. Geologic Survey, Truckee CA office, for coordinating bacterial analysis
- Kristine Lebo, IVGID, for turbidity analysis
- Scott Valentine, Lake Tahoe Community College, for hosting the South Lake Tahoe event
- Soroptimist International of the Tahoe Sierra, for funding the event
- Truckee Meadows Water Reclamation Facility, for nutrient analysis, Lower Truckee River
- Waterman's Landing, for hosting the North Lake Tahoe event
- Terry Powers, South Tahoe Public Utility District for nutrient analyses
- **And all the volunteers that make Snapshot Day possible!**

Appendix B – Site names and codes

Snapshot Day site and site code are listed below.

South Lake Tahoe	
Angora Creek at View Circle	SLT-ANG1-01
Angora Creek above Lake Tahoe Blvd	SLT-ANG1-02
Angora Creek at Upper Truckee Confluence	SLT-ANG2-00
Angora Creek at Washoe Meadows	SLT-ANG2-01
Burke Creek at mouth	SLT-BURK-00
Burke Creek below Hwy 50	SLT-BURK-02
Cascade Creek at mouth	SLT-CASC-00
Cascade Creek above Hwy 89	SLT-CASC-01
Cove East	SLT-COVE-00
Eagle Falls at mouth	SLT-EAGL-00
Eagle Falls above Hwy 89	SLT-EAGL-01
Edgewood Creek at mouth	SLT-EDGE-00
Fallen Leaf Lake	SLT-FLLF-01
Heavenly Creek at Trout Creek Confluence	SLT-HEAV-00
Tahoe Keys East Channel	SLT-KEYM-00
Tahoe Keys West Channel	SLT-KEYS-00
Meeks Creek at mouth	SLT-MEEK-00
Meeks Creek at Meadow	SLT-MEEK-01
North Zephyr Creek at mouth	SLT-NZHR-00
Ski Run Marina	SLT-SLAKE-1
Timber Cove	SLT-SLAKE-3
South Zephyr Creek	SLT-SZHR-00
Tallac Creek at mouth	SLT-TALL-00
Tallac Creek above Hwy 89	SLT-TALL-01
Taylor Creek at mouth	SLT-TALR-00
Taylor Creek above Hwy 89	SLT-TALR-02
Upper Truckee River below Lake Tahoe Blvd	SLT-TR10-01
Upper Truckee River at airport	SLT-TR15-02
Upper Truckee River at Elks Club Road	SLT-TR20-01
Upper Truckee River at mouth	SLT-TRMO-00
Trout Creek at Confluence with UTR	SLT-TROU-01
Trout Creek at Grinding Stone	SLT-TROU-02

North Lake Tahoe	
Marlette Creek at mouth	NLT-MARL-00
Secret Harbor Creek at mouth	NLT-SCRT-00
Wood Creek at Lakeshore	NLT-WOOD-01
Mill Creek blw Lakeshore Dr	NLT-MILL-01
Snow Creek at mouth	NLT-SNOW-00
Griff Creek at mouth	NLT-GRIF-00
Brockway Creek	NLT-BROC-00
Burton Creek at Star Harbor	NLT-BRTN-01
Hatchery Creek at Star Harbor	NLT-STAR-01
Tahoe City Urban Ditch at lake	NLT-TCUD-00
Lake Forest Creek at mouth	NLT-LKFC-00,02
Dollar Creek at mouth	NLT-DLRH-00
Quail Lake Creek at mouth	NLT-QULC-00
Homewood Creek at mouth	NLT-HMWD-00
Madden Creek at mouth	NLT-MADC-00
Middle Truckee River	
Prosser Creek @89	PROS-02
Alder Creek	ALDR
Union Valley Creek	GLEN-00
Upstream of Glenshire Pond	GLEN-02
Cold Stream Canyon Basin	COLD-00
ACOE boundary @ Lahontan	MART-01
Donner Creek @ 89	DONN-01
Downstream of dam	DONN-03
Tahoe Donner Clubhouse	TROU-03
Trout Creek @ mouth	TROU-00
Donner @ confluence	DONN-00
Pole Creek	POLE
Truckee @ Floristen	I80C
Truckee River Below Tahoe Dam	TR01
Silver Creek above 89	SILV
Deep Creek above 89	DEEP
Truckee River in Town	TOWN
Prosser Creek below dam	PROS-01
LTR below Boca dam	BOCA-00
LTR @ Boyington	BOCA-01
East Martis @ Bridge	EMAR
Squaw - west of confluence w/ Truckee	SQCR
Bear Creek - west of confluence w Truckee	BEAR

Lower Truckee River	
Galena Creek	LTR-GALE
Thomas Creek	LTR-THOM
White's Creek	LTR-WHIT
Hunter Creek	LTR-HUNT
Dry Creek	LTR-DRY
Steamboat Creek @ Rhodes	LTR-STEA-02
Alum Creek	LTR-ALUM
No. Truckee Drain	LTR-NoTrD
Truckee River @ McCarran Ranch	LTR-MCR
Truckee River@ Wadsworth	LTR-WADS
Truckee River ab Nixon Bridge	LTR-NIXB
Pyramid Lake	LTR-PYRL

Appendix C – Monitoring equipment

Most monitoring teams are assigned the following field instruments:

- Armored Envirosafe thermometers (alcohol filled, 0.5° C resolution);
- Standard pH indicator strips (0.5 pH unit resolution) or handheld Hannah pH meters (0.02 unit resolution);
- Handheld Oakton TDS Tester Conductivity meters (10 µS/cm resolution or Oakton Conductivity Low+ meters 1 µS/cm resolution); and
- Chemetrics 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)

Turbidimeters, used at the staging locations, were supplied by Truckee River Watershed Council, the Tahoe Regional Planning Agency and the Lahontan Regional Water Quality Control Board.

Nutrient and bacteria samples are kept chilled with ice or blue ice in coolers from the point of collection until arrival at the lab for analysis. Bacteria samples are collected in sterile Whirl-packs; nutrient and turbidity samples are collected in clean plastic bottles.

Bacteria samples are then transported from drop off points at Lake Tahoe and Truckee to either the Lahontan Water Quality Lab in South Lake Tahoe or the U.S. Geologic Survey in Truckee. Bacteria samples collected from the Lower Truckee River are transported to the Nevada State Health Laboratory. The need for multiple labs for such a large area is to ensure sample analysis within the allotted 4-hour holding time. Quality assurance is comparable as each lab uses the same method, SM9222 from Standard Methods for Water and Wastewater Analysis, 21 Edition, 2007.

Nutrient samples collected within the Lake Tahoe Basin are delivered to South Tahoe Public Utility District in South Lake Tahoe within the allotted hold time. Lower Truckee River nutrient samples are taken to the Nevada State Health Lab for analysis. Middle Truckee River samples are processed in-house by the Truckee River Watershed Council.