20th Annual Snapshot Day Report

A Lake Tahoe Basin and Truckee Watershed Citizen Monitoring Event

(May 16 & 30, 2020)

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

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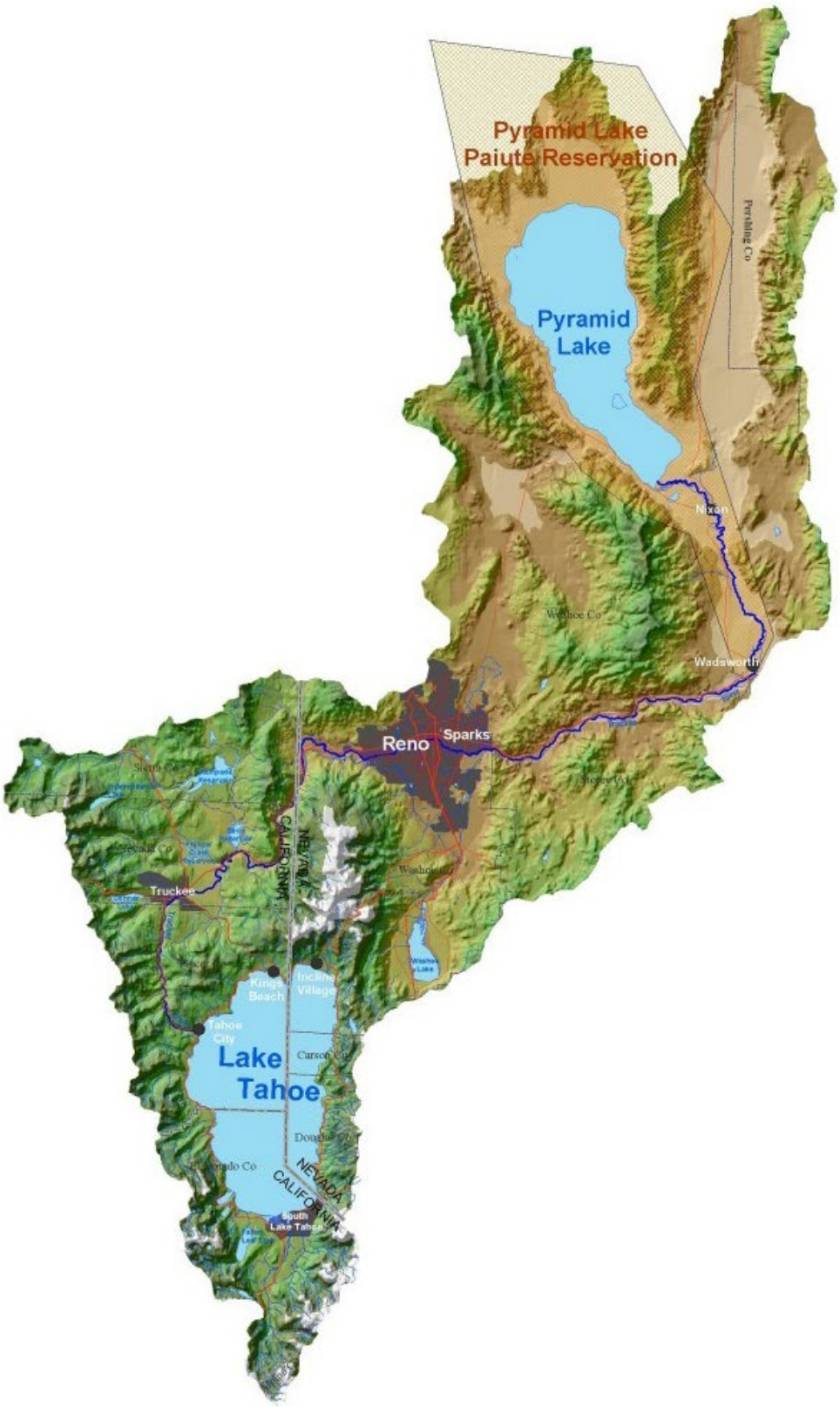


Introduction

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. 2020 was the 20th anniversary of Snapshot Day, however as with many other aspects, this was not a "normal" year due to the global pandemic. Volunteer capacity was greatly reduced, and thus the number of sites where monitoring was conducted was also lessened. In addition, the Lower Truckee Watershed did not participate in the 2020 event due to changes in staffing levels and priorities. 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 2020

2020 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. 2020 Snapshot Day's data analyses demonstrate good water quality overall for the Tahoe-Truckee watershed. Water quality parameters such as dissolved oxygen content were somewhat diminished from previous years, but most samples collected meet the standards set for the region.

In 2020, Snapshot Day reached its 20th 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 2020 was a collaborative effort between the North Shore Lake Tahoe, South Shore Lake Tahoe and the Middle Truckee River near the town of Truckee.

Volunteer and monitoring site locations are as follows:

Table 1: Volunteer and monitoring site location numbers.

	Volunteers	Locations
North Shore Lake Tahoe	9	8
South Shore Lake Tahoe	40	27
Middle Truckee River	5	23
Totals for 2017	**54**	**58**

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

In 2020, volunteers gathered data at a total of 58 locations throughout the Truckee River watershed from south of Lake Tahoe to the Nevada State line. A list of site names and codes can be found in **Appendix B**.

Lake Tahoe Tributaries, South Shore

- Angora Creek
- Bijou Creek
- Burke Creek
- Cascade 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
- General Creek
- Griff Creek
- Hatchery Creek
- Lake Forest Creek
- Rosewood Creek
- Tahoe City Urban Ditch

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

Methods of Data Collection

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 of the stream walk upstream. 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 prior to 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.

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).

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**.

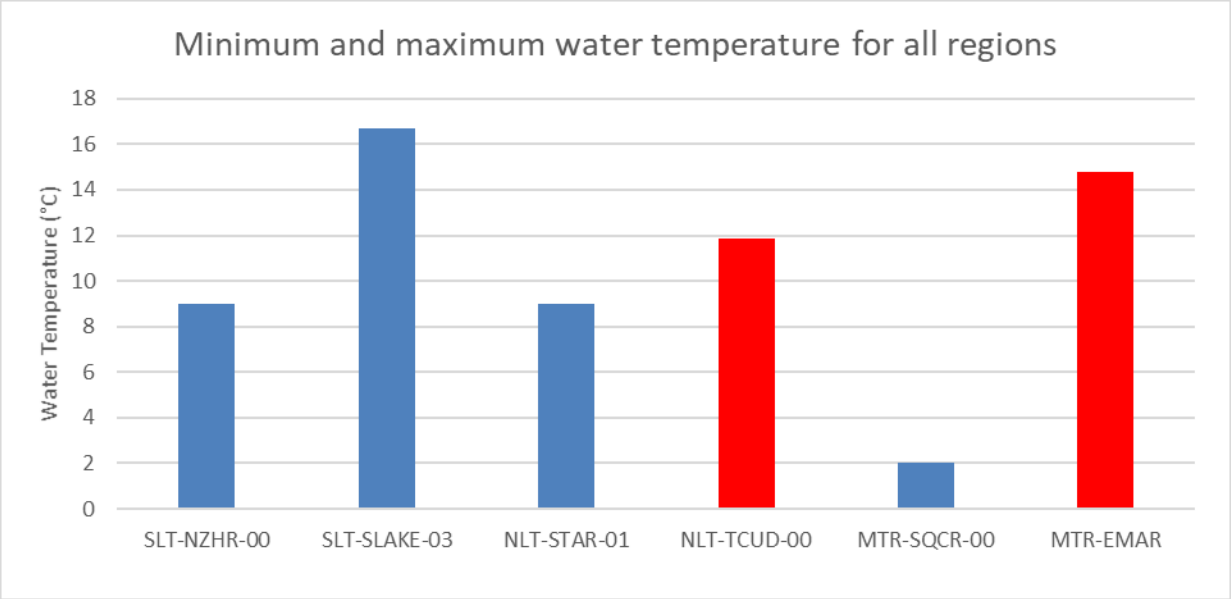
Water temperature

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/or 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 2020, 58 sites were sampled for water temperature. The lowest recorded temperature from Snapshot Day 2016 was 2°C at the Squaw Creek sampling location in the Middle Truckee watershed. The highest recorded temperature was 16.7°C at Timber Cove Beach in South Lake Tahoe. Figure 1 below represents the lowest and highest temperatures for each of the three regions sampled during the 2020 event. The high temperature noted above was collected from Lake Tahoe, however site locations where data was collected from tributary streams did not exceed 15.6°C, the maximum optimal temperature for rainbow trout.

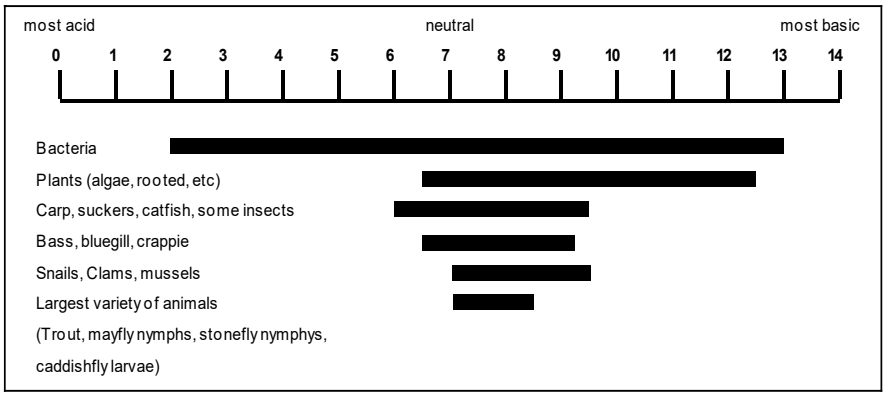
Figure 2: The maximum and minimum results recorded for water temperature.



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.

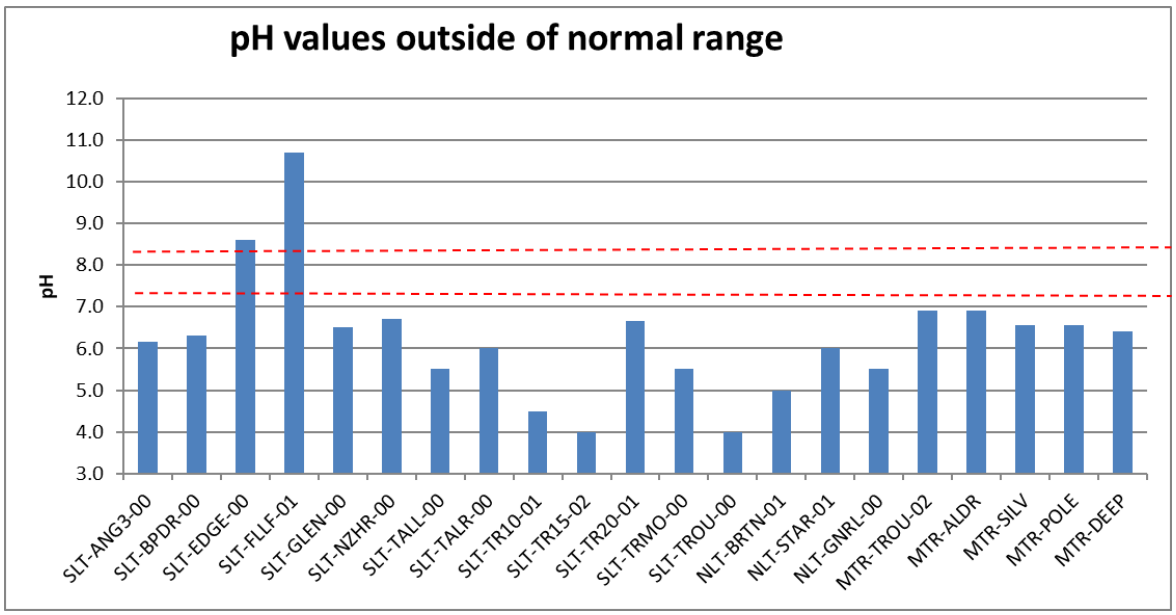
Figure 3: pH range that supports aquatic life



pH ranges that support aquatic life.

Water in California within the Lake Tahoe Basin should not be below 7 or above 8.4. The Regional Water 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 optimal range for aquatic life.



Both the lowest and highest pH levels measured at Snapshot Day 2020 were recorded in South Lake Tahoe. Sites at both Trout Creek and in the Main-stem of the Truckee River reported a low pH of 4, while a site location at Fallen Leaf reported a high pH of 10.7. Of the 58 sites that took pH readings, 19 sites had a pH below the optimal range and 2 sample sites 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.

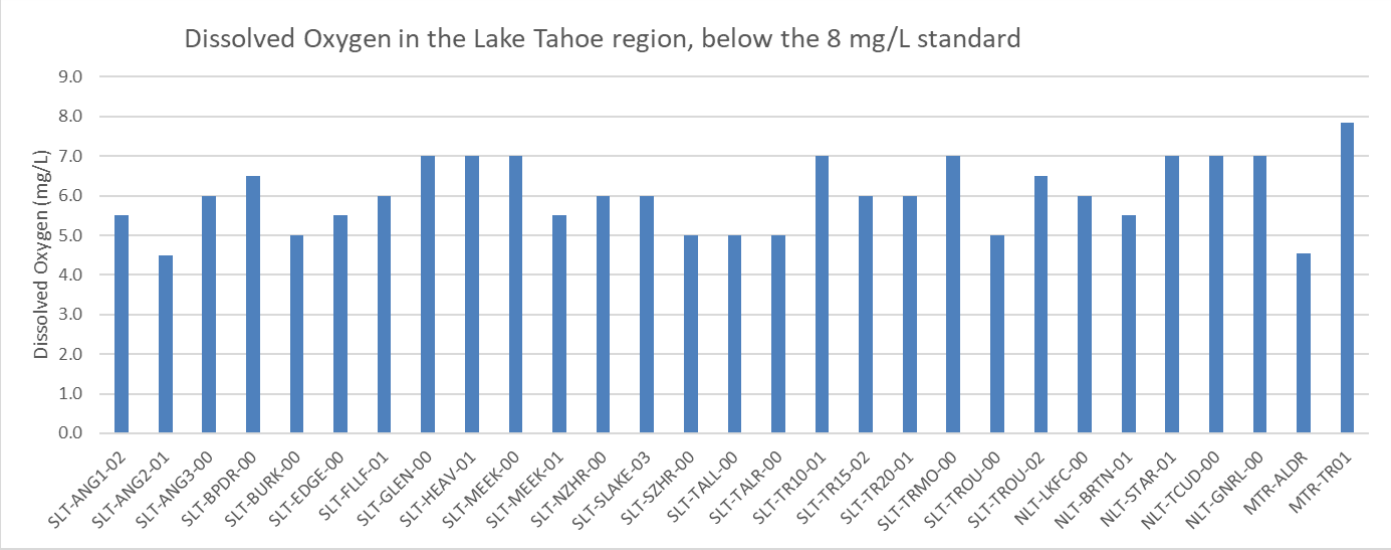
Low dissolved oxygen concentrations are typically the result of:

- 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.

Two sites reported dissolved oxygen content of 4.5 mg/L: Angora Creek in South Lake Tahoe and Alder Creek in the Middle Truckee watershed. The highest recorded dissolved oxygen content was 7.8 mg/L, collected at Trout Creek in the Middle Truckee watershed. Approximately half of the 58 sites sampled had a reading below 8.0 mg/L and seven sites were recorded at 5 mg/L or less.

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



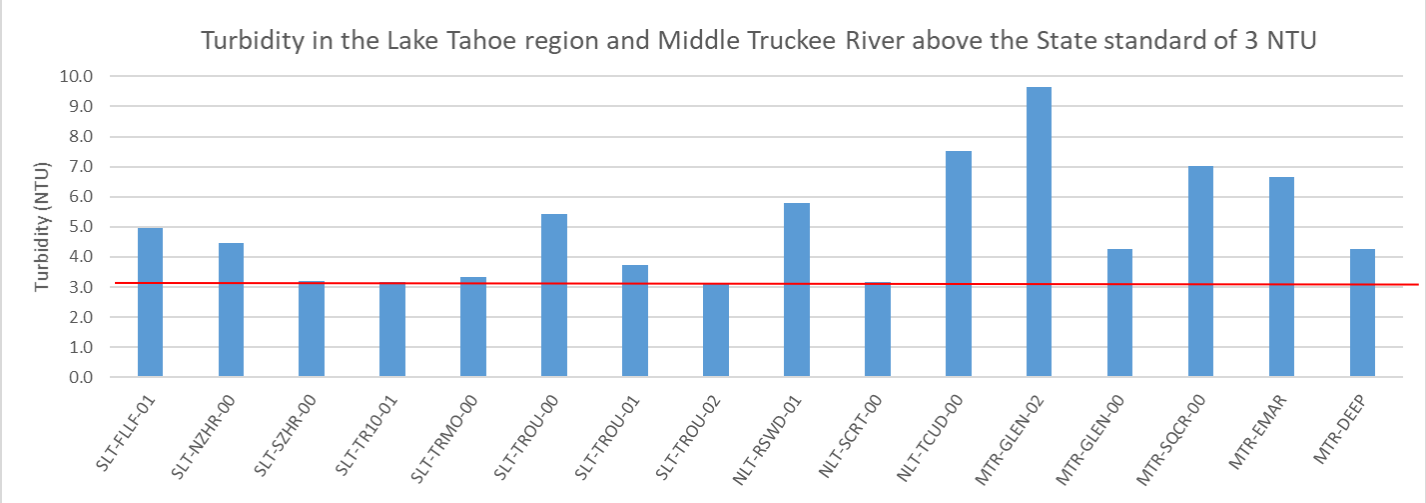
Turbidity

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.

Almost 1/3 of the total sites monitored exhibited turbidity levels above the 3 NTU standard established by the U.S. EPA. The highest turbidity reading for the 2020 Snapshot Day event was 9.7 NTU from Union Creek in Glenshire, in the Middle Truckee River region.

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



Stream Flow

Stream flow is the measure of the volume of water that is flowing, which varies with precipitation. Stream flow can have 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. Stream flow conditions can also impact fish habitat and other aquatic organisms and may affect the ability to spawn and/or reproduce.

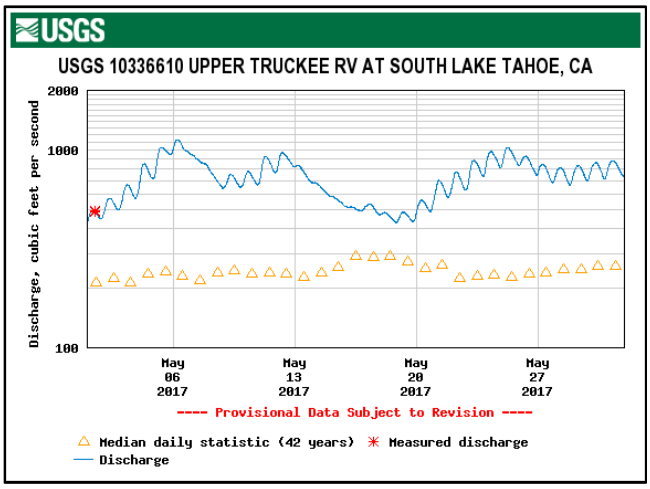
The water year of 2020 (Oct. 2019-Oct. 2020) was an extremely dry year, with most of the region experiencing 65% or less of the average snowpack, which greatly effects the amount of runoff from tributary streams as well as the water levels in the multiple reservoirs that serve as the primary water source for the greater Reno/Sparks area.

The graphs below show stream flow data collected by the U.S. Geological Survey (USGS) at two separate monitoring locations: a) Upper Truckee River upstream of Lake Tahoe; and b) Middle Truckee River at the Town of Truckee. Data presented illustrates the 2020 flow levels compared to an extremely wet year of 2017.

With the likelihood of the Lake Tahoe and Truckee region entering another drought cycle in 2021,fish and other aquatic life will be affected by low-water conditions, which unfortunately is becoming more common within the region.

Figure 7: Stream flow data from the Upper Truckee River above Lake Tahoe, California, during the month of May for the years of 2017 and 2020 respectively.

Upper Truckee River:



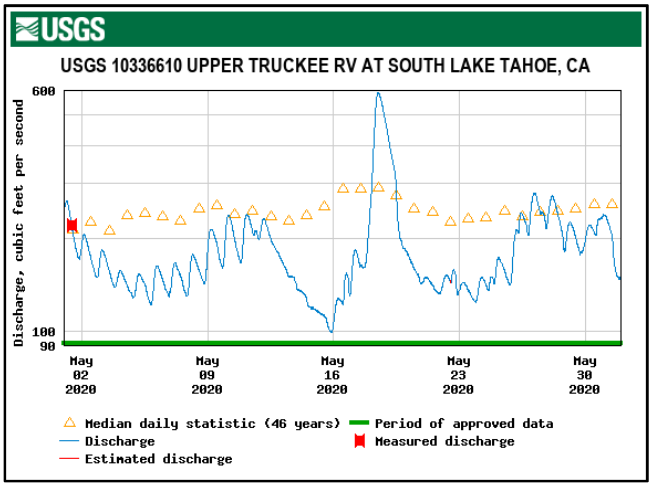
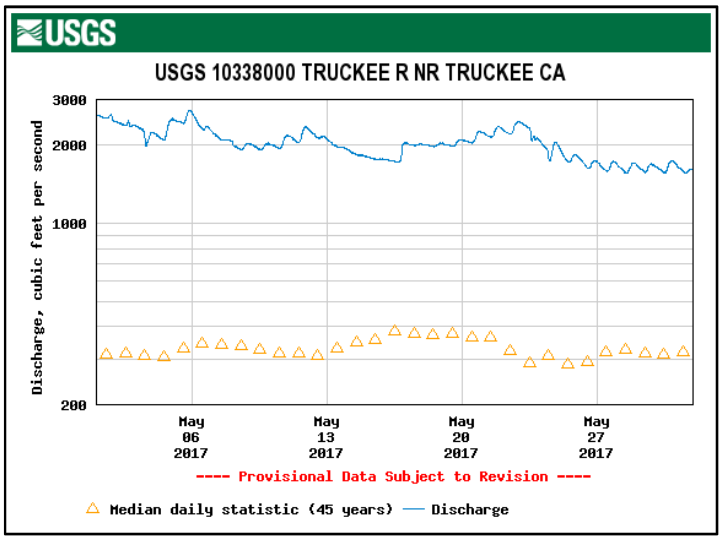
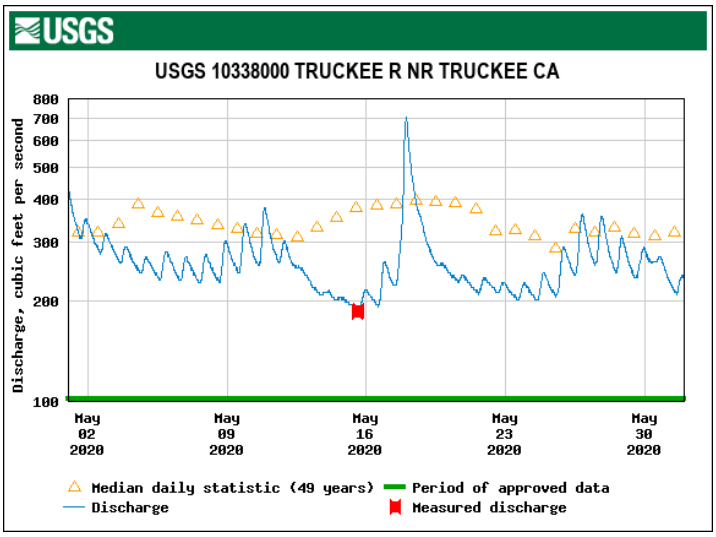


Figure 8: Stream flow data from the Middle Truckee River at the Town of Truckee, California, during the month of May for the years of 2017 and 2020 respectively.

Middle 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.

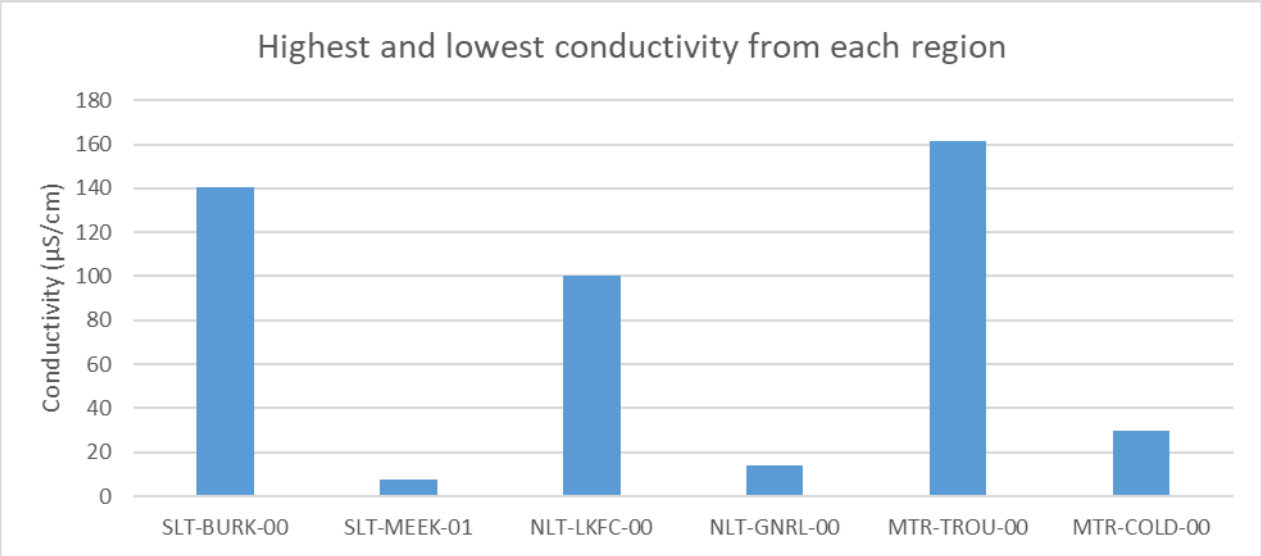
Electrical conductivity is also sensitive to flows – at high flows, the charged particles that make up conductivity are diluted, and so measured conductivity should be lower. At low flows, the particles are more concentrated, and conductivity measurements will often be higher. Primary sources of charged 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 waste waters 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 58 sample sites for Snapshot Day 2020. The lowest conductivity recorded was 7.8 µS/cm, measured at Meeks Creek in South Lake Tahoe. The highest conductivity recorded was 162 µS/cm at Trout Creek in the Middle 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 2020 by region.



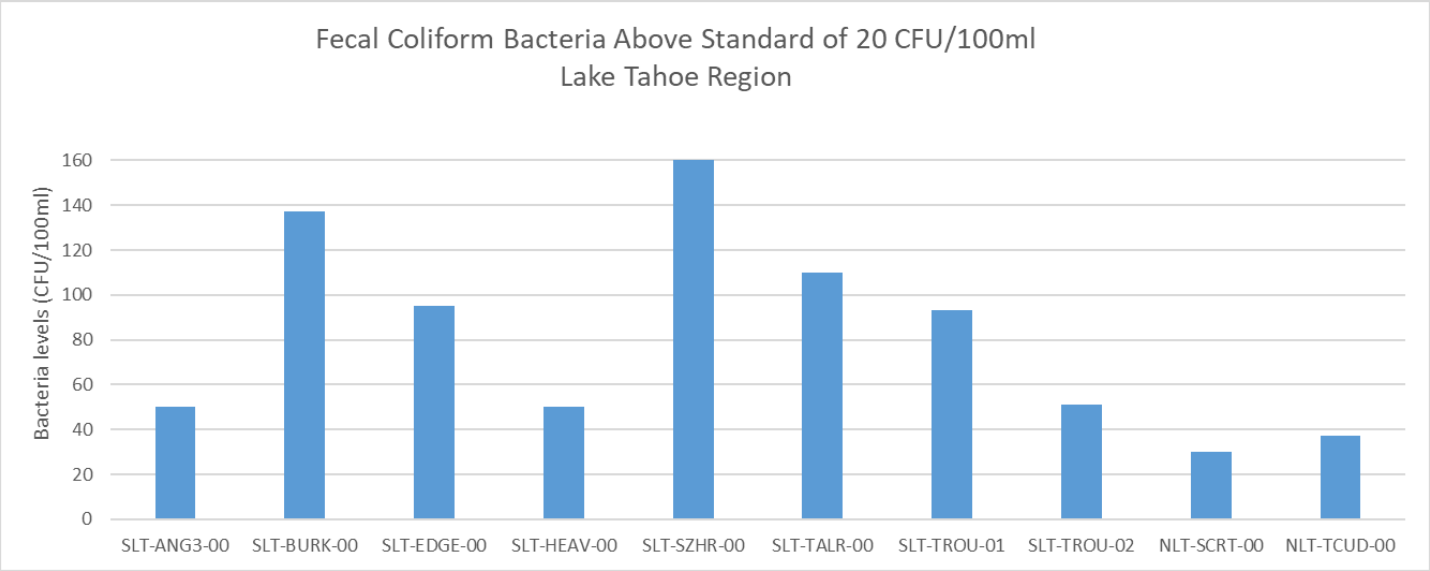
Fecal Coliform Bacteria

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.

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 49 locations at Snapshot Day 2020. Ten of these samples had readings greater than 20 CFU/100ml. Seventeen samples had zero bacteria recorded.

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



** The Tahoe City Urban Ditch located in the North Lake Tahoe Region was also measured for E.Coli and had too many CFU to count, so is not depicted in Figure 11.*

Nutrients

Nitrogen

Nitrogen stimulates algal growth, which in turn can lead to eutrophication in aquatic systems. The most common source of nitrate is runoff from fertilized areas such as lawns or other landscaped areas. Nitrate (a sub-component of nitrogen) is also a byproduct of septic systems – it is a naturally occurring chemical left after the decomposition of human (and other animal) waste.

Phosphorus

Excess phosphorus also stimulates high amounts of algal growth in aquatic systems. Phosphorus is naturally present in the environment, in granitic and volcanic rocks which are both found throughout the Tahoe Truckee watershed. Anthropogenic sources include various soaps and detergents, fertilizers, and other household chemicals.

In 2020 the types of nutrients analyzed varied substantially amongst the participating entities. The inconsistency of data collection makes an accurate comparison difficult throughout the watershed. The following information provides a summary of where the highest concentrations of nutrients that were analyzed were located per region.

Ammonia (NO3)

The highest levels of ammonia (NO3) were detected at a site along Donner Creek located just below the Donner Lake dam measuring 0.23mg/L. All sites where ammonia was analyzed in Lake Tahoe measured 20mg/L by comparison.

Total Nitrogen (TN)

The highest level of Total Nitrogen in South Lake Tahoe was located at a site along the main-stem of the Upper Truckee River near Elks Club Drive measuring 0.243 mg/L. In the Middle Truckee watershed, the highest level of Total Nitrogen was located at Union Valley Creek, measuring 0.372 mg/L. North Lake Tahoe did not analyze for Total Nitrogen.

Phosphorus – Orthophosphates (PO4) & Total Phosphorus (TP)

The highest concentration of Orthophosphates in the Lake Tahoe region was located at Meeks Creek at a site upstream of of Highway 89, measuring 0.032 mg/L. Orthophosphates were not analyzed in the Middle Truckee watershed, however Total Phosphates were analyzed for this region with the highest concentration being the upper end of Martis Creek with a measurement of 0.046 mg/L. Total Phosphate was not analyzed in the Lake Tahoe region during the 2020 Snapshot Day.

Visual Observations

Visual observations are also collected as a component of Snapshot Day monitoring. Visual observations included cloud cover, precipitation, wind, water clarity, in-stream flow, sample color, sample odor and other items observed in the samples. This information helps to provide context to the water quality parameters that are being monitored and allows for identification of potential causes of degraded water quality (ie presence of urban development)

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 exist within all regions of the watershed (upper, middle & lower). These land-use conditions can have a significant impact on water quality and should continue to be monitored to assess the condition of the watershed and to ensure local waterbodies are meeting the regional and state standards. While the Lower Truckee River region was not represented at Snapshot Day2020, event coordinators are seeking a new group to coordinate those sites in 2021 and beyond.

The data collected for Snapshot Day 2020 shows approximately 50% of the sites monitored have elevated levels of pH and low levels of dissolved oxygen. Data collected show that at least a portion of the sites monitored are not meeting the standards set by the Lahontan Regional Water Quality Control Board (California). The biggest concern of the data collected in 2020 was the high number of sites that depicted low or reduced levels of dissolved oxygen. With over half of the sites monitored showing levels below the 8mg/L standard, this is cause for concern for fish and other aquatic organisms. The low water levels in 2020 show an expected increase in water temperature and pH levels and subsequent decrease in dissolved oxygen. If this trend continues into the future, we will likely see a substantial increase in algal blooms, as well as increased degradation of viable aquatic habitat that supports spawning and reproductive capacity of the organisms dependent on our streams, lakes and waterways.

As previous data sets from the past 20 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

References

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Appendices

Appendix A – Resource Partners

2020 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)
- Emily Fray (League to Save Lake Tahoe)
- Sarah Vidra (Incline Village General Improvement District)
- Joe Hill (Incline Village General Improvement District)

Organizations hosting Snapshot Day 2020

- Incline Village General Improvement District
- League to Save Lake Tahoe
- Truckee River Watershed Council
- Tahoe Water Suppliers Association
- Lahontan Regional Water Quality Control Board
- U.S. Geological Survey, Carnelian Bay Field Station
- Lake Tahoe Community College

Laboratory Analyses (Nutrients and Bacteria)

- South Lake Tahoe Public Utility District
- 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, Emily Frey
- Tahoe Environmental Research Center
- Truckee River Watershed Council, Eben Swain
- United States Geological Survey, Paul Honeywell

Resource Partners

- U.S. Geological Survey
- Great Basin Institute
- City of South Lake Tahoe
- Incline Village General Improvement District

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- Ann Liston, Tahoe Environmental Resource Coalition, for hosting equipment calibration
- Soroptimist International of the Tahoe Sierra, for funding the event
- 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 above Lake Tahoe Blvd.	SLT-ANG1-02
Angora at Washoe Meadows	SLT-ANG2-01
Angora at Truckee Confluence	SLT-ANG3-00
Bijou Park Drainage at Mouth (Ski Run Pipe)	SLT-BPDR-00
Burke at Mouth	SLT-BURK-00
Cove East	SLT-COVE-00
Edgewood at Mouth	SLT-EDGE-00
Fallen Leaf Lake	SLT-FLLF-01
Glen Alpine at Fallen Leaf Lake	SLT-GLEN-00
Heavenly at Trout Creek Confluence	SLT-HEAV-00
Heavenly below Pioneer Trail	SLT-HEAV-01
Keys West Channel	SLT-KEYS-00
Meeks at Mouth	SLT-MEEK-00
Meeks at Meadow	SLT-MEEK-01
North Zephyr	SLT-NZHR-00
Timber Cove	SLT-SLAKE-03
South Zephyr	SLT-SZHR-00
Tallac at Mouth	SLT-TALL-00
Taylor at Mouth	SLT-TALR-00
U. Truckee below Lake Tahoe Blvd.	SLT-TR10-01
U. Truckee at Airport	SLT-TR15-02
U. Truckee at Elks Club	SLT-TR20-01
U. Truckee at Mouth	SLT-TRMO-00
Trout at Mouth	SLT-TROU-00
Trout at UTR/Bellevue	SLT-TROU-01
Trout at Grinding Stone	SLT-TROU-02
North Lake Tahoe	
Rosewood Creek abv Third	NLT-RSWD-01
Secret Harbor Creek at mouth	NLT-SCRT-00
Lake Forest Creek at mouth	NLT-LKFC-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
Griff Creek at mouth	NLT-GRIF-00
General Creek at mouth	NLT-GNRL-00

Middle Truckee River	
ACOE boundary @ lahontan	MART-01
Prosser Creek below dam	PROS-01
Downstream of dam	DONN-03
Cold Stream Canyon Basin	COLD-00
Donner @ confluence	DONN-00
Donner Creek @ 89	DONN-01
Tahoe Donner Clubhouse	TROU-02
Upstream of Glenshire Pond	GLEN-02
Union Valley Creek	GLEN-00
LTR below boca dam	BOCA-00
LTR @ Boyington	BOCA-01
Prosser Creek @89	PROS-02
Bear Creek - west of confluence w Truckee	BEAR-00
Squaw - west of confluence w/ Truckee	SQCR-00
Truckee river in Town	TOWN
Alder Creek	ALDR
East Martis @ Bridge	EMAR
Mainstem below Tahoe dam	TR01
Silver Creek above 89	SILV
Trout Creek @ mouth	TROU-00
Pole Creek above 89	POLE-00
Deep Creek above 89	DEEP

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. 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. Middle Truckee River samples are sent to High Sierra Labs for analysis.