24th Annual Tahoe-Truckee Snapshot Day

A Lake Tahoe Basin and Truckee River Watershed Citizen Science Water Quality Monitoring Event

May 11, 2024

Report Prepared By

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League to Save Lake Tahoe

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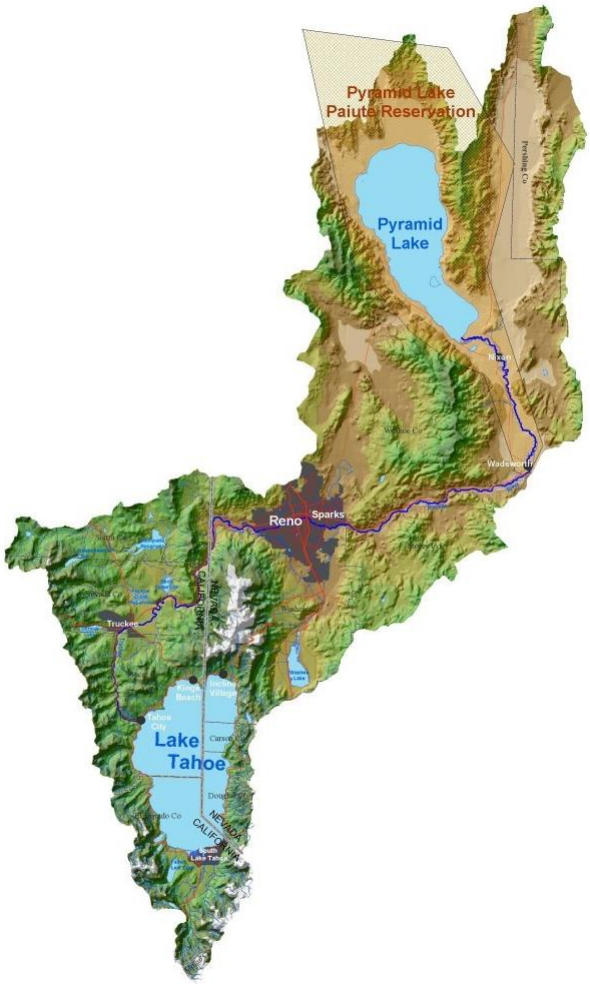

Figure 1: Truckee River Watershed from Lake Tahoe, CA to Pyramid Lake, NV

Introduction

What is Snapshot Day?

Snapshot Day is a one-day, volunteer-based event designed to collect data measuring the health of the Truckee River Watershed at a single point in time. Each year, on the day of the event, teams of trained volunteers span sites throughout the watershed to measure water quality indicators, record visual observations, and collect water samples for further lab testing.

Snapshot Day 2024 was the 24th recurrence of the event, which remains one of the longest-running citizen watershed monitoring efforts on the West Coast of the United States. The program is sustained by dedicated support staff and engaged volunteers, with funding acquired through several grants and donations.

What are the objectives of Snapshot Day?

The primary goals of Snapshot Day are two-fold:

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

While there is a great deal of high-quality agency- and university-sponsored monitoring throughout the Truckee River Hydrologic Unit, including the Lake Tahoe Basin and Truckee River Watershed, there are still information gaps. With proper training and quality assurance, community members can help fill this void by collecting data representing a “snapshot” of water quality in time.

Specifically, this effort aims to:

- Screen for water quality problems, including sources of pollution and detection of illegal activities (e.g., chemical spills, filling of wetlands, diversions, illicit discharges, destruction of stream environment zones, non-compliance with ordinances, etc.),
- Provide water quality data that may be compared to standards set by the Tahoe Regional Planning Agency and the states of California and Nevada,
- Provide water quality data that may be used in status and trend analyses, and
- Provide pre- and post-project data for evaluating the effectiveness of restoration activities.

It is important to note that citizen science events like Snapshot Day are designed to supplement existing agency monitoring efforts. Information gathered at Snapshot Day is provided to the regulatory and resource management agencies responsible for protecting water quality in the Truckee River Watershed upon request and results that indicate possible water quality issues are escalated and addressed accordingly.

Snapshot Day 2024

Snapshot Day provides an annual opportunity to engage citizen scientists in monitoring the environmental health of the Truckee River Watershed, including the Lake Tahoe Basin. Results from Snapshot Day 2024 demonstrate good water quality for the watershed and high volunteer engagement in the region.

Locations and participants

Snapshot Day 2024 was a collaborative effort between organizers and volunteers along the North and South Shores of Lake Tahoe and the Middle Truckee River. **Figure 2** displays the sites sampled in 2024 denoted by region.

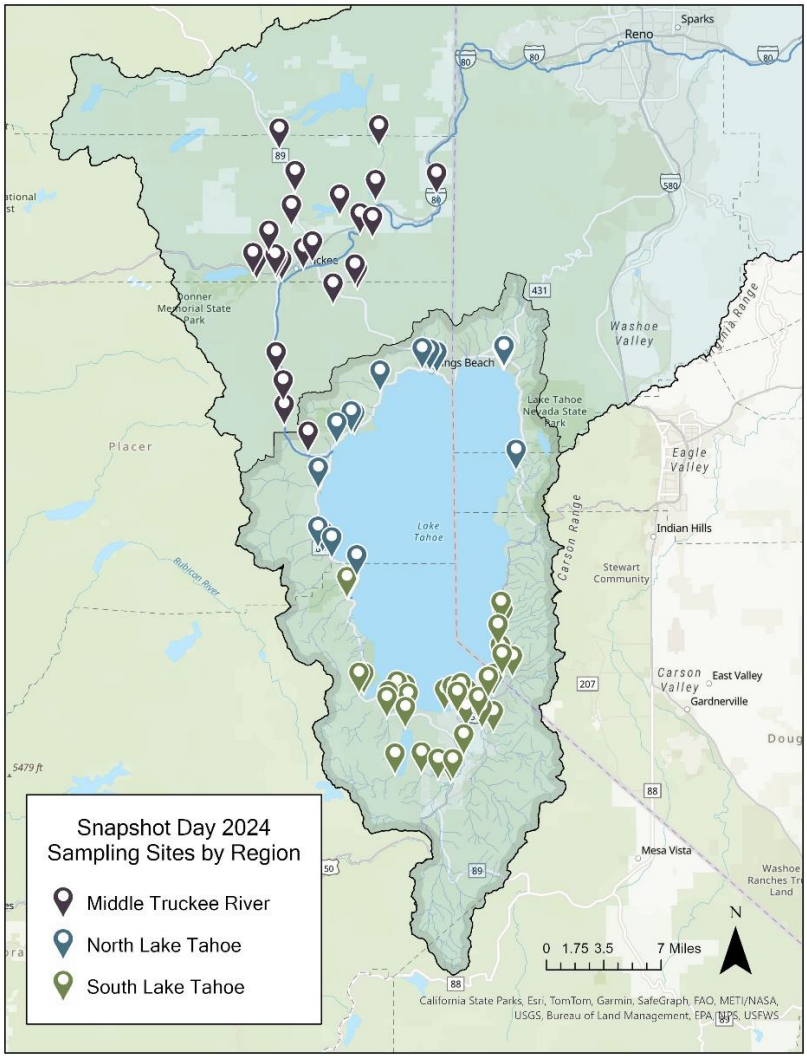

Figure 2: Sampling sites by region

In total, 157 participants collected data across 75 locations throughout the Truckee River Watershed. See **Table 1** for a summary of participant counts and sampling locations by region. Site names and codes can be found in **Appendix B**.

Table 1: Volunteer counts and monitoring site locations by region

Region	Participants	Locations
South Shore Lake Tahoe	100	34
North Shore Lake Tahoe	25	17
Middle Truckee River	32	24
Total	*157*	*75*

Snapshot Day 2024 was coordinated by the Incline Village General Improvement District, the League to Save Lake Tahoe, and the Truckee River Watershed Council. Please see **Appendix A** for an expanded list of organizations involved, resource partners, and education partners.

Methods of data collection

Snapshot Day team leaders are trained each year before the event to collect water quality data using monitoring instruments provided by the event organizers. Measurements taken in the field include water temperature, pH, dissolved oxygen, total dissolved solids, and electrical conductivity. Team leaders are also trained to collect water samples for additional lab testing.

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

Visual observations and photo documentation follow 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 apply to the region accurately. 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. Volunteers are encouraged to photograph as much as possible, especially team members in the field.

Monitoring results are compiled and available upon request from the coordination committee. The data set includes the volunteer field measurements and nutrient and bacteria analyses conducted by designated laboratories.

Water quality standards

Water bodies in the Truckee River Watershed are subject to federal and state water quality criteria as outlined by the U.S. Environmental Protection Agency and state regulatory bodies. Beyond these criteria, the Lake Tahoe Basin is subject to additional—and generally more stringent—water quality standards. These standards are defined and enforced by the states of Nevada and California, the Tahoe

Regional Planning Agency, and other local regulatory agencies**. Table 2** lists some of these standards for the Lake Tahoe Basin.

Table 2: Lake Tahoe region water quality standards

Parameter	**Standard**
Water temperature	Shall not exceed 15°C, surface waters of Fallen Leaf Lake (*Lahontan*)
pH	7.0 - 8.4 in Lake Tahoe; 6.5 - 8.5 for other surface waters of the Lahontan region (*Lahontan*)
Conductivity	Shall not exceed 95 µS/cm annual mean at 25°C at any location in Lake Tahoe (*Lahontan*)
Turbidity	Shall not exceed 3 NTU in shallow waters near tributaries or 1 NTU in shallow waters not directly influenced by stream discharges in Lake Tahoe (*Lahontan*)
Dissolved oxygen	Minimum of 4.0 mg/L and 30-day mean of no less than 6.5 mg/L for waters designated as "cold freshwater habitat" in the Lake Tahoe Basin (*Lahontan*)
Total dissolved solids	Shall not exceed an annual average value of 60 mg/L or 90th percentile value of 65 mg/L in Lake Tahoe (*Lahontan*)
Total nitrogen	Shall not exceed an annual average value of 0.15 mg/L in Lake Tahoe (*Lahontan*)
Total phosphorous	Shall not exceed an annual average value of 0.008 mg/L in Lake Tahoe (*Lahontan*)
Fecal coliform	Shall not exceed a log mean of 20/100 ml during any 30-day period, nor shall more than 10 percent of all samples collected during any 30-day period exceed 40/100 ml in Lake Tahoe (*Lahontan*)
E. coli	Single value shall not exceed 126 MPN/100mL in Lake Tahoe (*NAC*)
Algae	Waters shall not contain bio-stimulatory substances (nutrients) that cause algae to become a nuisance or to affect the water's beneficial uses (*Lahontan*)
Color	Waters shall be free of coloration that causes nuisance or adversely affects the water for beneficial uses (*Lahontan*)

For additional information on water quality objectives in California, please refer to the Lahontan Regional Water Quality Control Board (Lahontan) *Basin Plan*. For additional information on water quality objectives in Nevada, please refer to the Nevada Administrative Code (NAC) 445A.11704 – 445A.2234.

While these water quality standards provide a helpful benchmark for comparison when evaluating Snapshot Day data, it's important to remember that Snapshot Day measurements reflect a single moment in time and do not necessarily represent average conditions.

Event context: Water Year 2024

Snapshot Day took place on May 11, 2024, just one week before peak flow conditions were measured along the Upper Truckee River in South Lake Tahoe (U.S. Geological Survey, 2024). Agency-sponsored precipitation and streamflow monitoring provides additional context on Snapshot Day conditions.

During Water Year 2024 (October 2023 through September 2024), the California-Nevada region received near-normal precipitation, meaning totals within 30% of a "normal" year (National Integrated Drought Information System, 2024). While the year began drier than average, large storms in the Sierra Nevada Mountains during February and March contributed to higher snowpack levels. On April 1, snowpack in the Sierra Nevada was above normal, with the Truckee River Watershed reporting 118% of its median snow water equivalent, 1991-2020 as shown in **Figure 3** (U.S. Department of Agriculture, 2024).

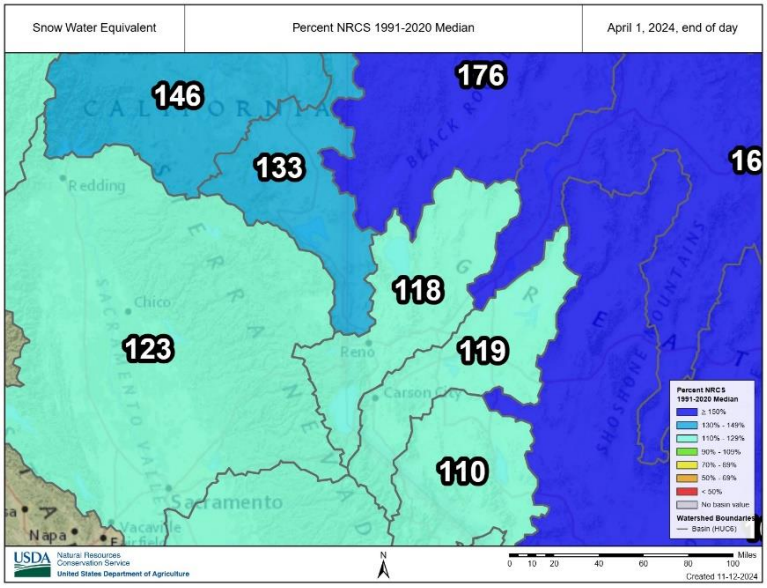

Figure 3: Snow water equivalent on April 1, 2024
Source: USDA National Water and Climate Center

In the Western U.S., most streamflow originates as snow. During years with higher snowpack and above-average precipitation, streams are likely to flow at higher rates (U.S. Department of Agriculture, Natural Resources Conservation Service [NRCS], n.d.). Streamflow measures the volume of flowing water in a system, typically reported in cubic feet per second. Streamflow can significantly impact water quality: Low flow conditions can contribute to elevated water temperatures, decreased dissolved oxygen availability, and increased likelihood of algal blooms. High flow conditions can contribute to erosion and excess sediment transfer. Streamflow conditions can also impact habitat for aquatic organisms, including fish, and may affect their ability to reproduce.

Figures 4 and **5** show streamflow data collected in May 2024 by the U.S. Geological Survey at two separate monitoring locations: along the Upper Truckee River in South Lake Tahoe, California and along the Truckee River near Truckee, California. The blue line represents measurements from May 2024, while the yellow triangles represent the median value from 50+ years of historical data at that site. The figures show that streamflow hovered near or above historical measurements in May.

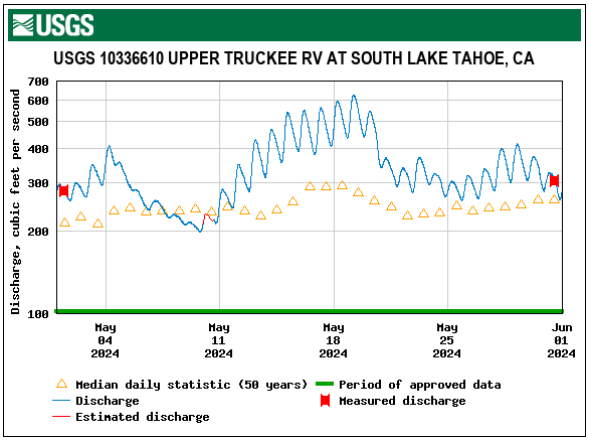

Figure 4: Streamflow along the Upper Truckee River, May 2024
Source: USGS National Water Information System

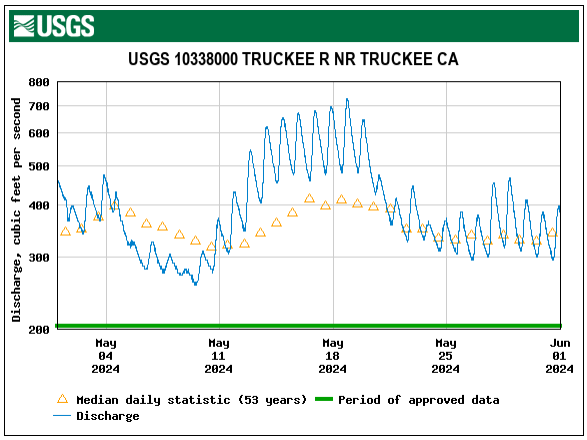

Figure 5: Streamflow along the Truckee River, May 2024
Source: USGS National Water Information System

Results

This section provides an overview of the data collected during Snapshot Day 2024, from in-field measurements and lab results. Where possible, the data are plotted by sampling region (Middle Truckee River, North Lake Tahoe, and South Lake Tahoe) with maximum and/or minimum values highlighted for each region.

Water temperature

Water temperature is a key indicator of aquatic ecosystem health. In mountain streams and lakes, cooler water is considered a better habitat for aquatic life, as cooler temperatures are associated with more dissolved oxygen, an essential ingredient for fish and invertebrates. Higher temperatures can result in increased solubility of metals and other toxins and may promote algal blooms.

Factors that affect water temperature include flow conditions (where low-flow or shallow conditions result in higher temperatures) and surrounding vegetation (where canopy cover provides shade, reducing solar heating and resulting in lower temperatures).

In many Sierra streams, the propagation of cold-water fish (e.g., trout or salmon) is a designated "beneficial use" of the water. In such streams, water quality standards are set at levels that will support that beneficial use, typically requiring cooler temperatures and higher dissolved oxygen levels

compared to habitats not designated for use as cold-water fisheries. As an example, one study found that the upper limit for survival and growth of Lahontan cutthroat trout—a federally threatened species native to the Truckee River—was between 22°C and 24°C, with complete mortality within two days at 28°C (Dickerson & Vinyard, 1999).

During Snapshot Day 2024, 74 sites were sampled for water temperature, 73 (or 99%) of which recorded temperatures below 15°C, the maximum surface temperature for Fallen Leaf Lake. The lowest recorded temperature was 3.1° C (38° F) at Bear Creek in the Middle Truckee River region. The highest was 15.1° C (59° F) recorded at Bijou Creek in South Lake Tahoe. **Figure 6** displays the distribution of water temperature measurements across the three sampling regions, with the minimum and maximum values for each region noted by tributary name.

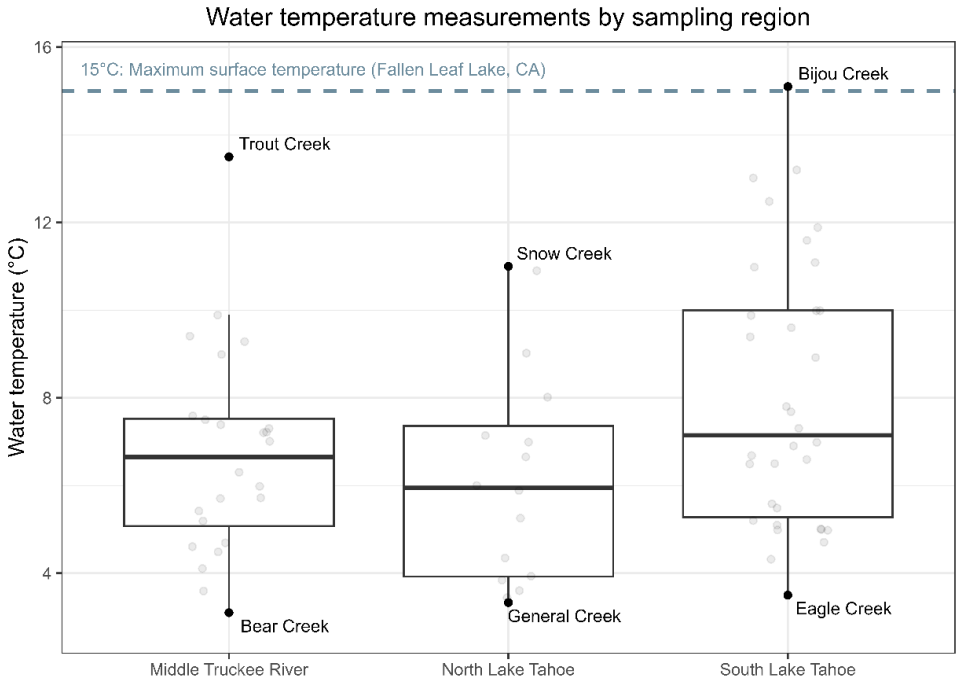

Figure 6: Water temperature

pH

pH measures the degree to which a sample is acidic or basic. pH is measured on a scale from 0 (very acidic) to 14 (very basic), with 7 considered neutral. Most aquatic life prefers a pH close to 7. **Figure 7** displays the pH ranges that support aquatic life.

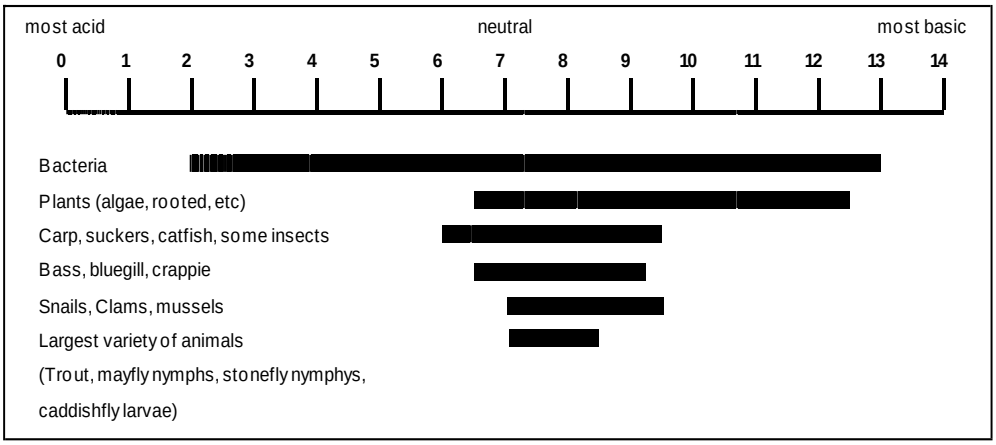

Figure 7: pH ranges that support aquatic life

According to standards set by the Lahontan Regional Water Quality Control Board, pH should fall between 6.5 - 8.5 for surface waters of the Truckee River Hydrologic Unit and 7.0 - 8.4 within Lake Tahoe. The Board recognizes that some waters may have natural pH levels outside of that range.

During Snapshot Day 2024, 72 sites were sampled for pH. Of those measurements taken, 63 (88%) were within the Truckee Hydrologic Unit range of 6.5 - 8.5, and 59 (82%) were within the Lake Tahoe range of 7.0 - 8.4. The lowest recorded pH measurement was 6.0, recorded at two sites in North Lake Tahoe: Third Creek and Barton Creek. The highest measurement was 9.15, recorded at Edgewood Creek in South Lake Tahoe. **Figure 8** displays the distribution of pH measurements by sampling region.

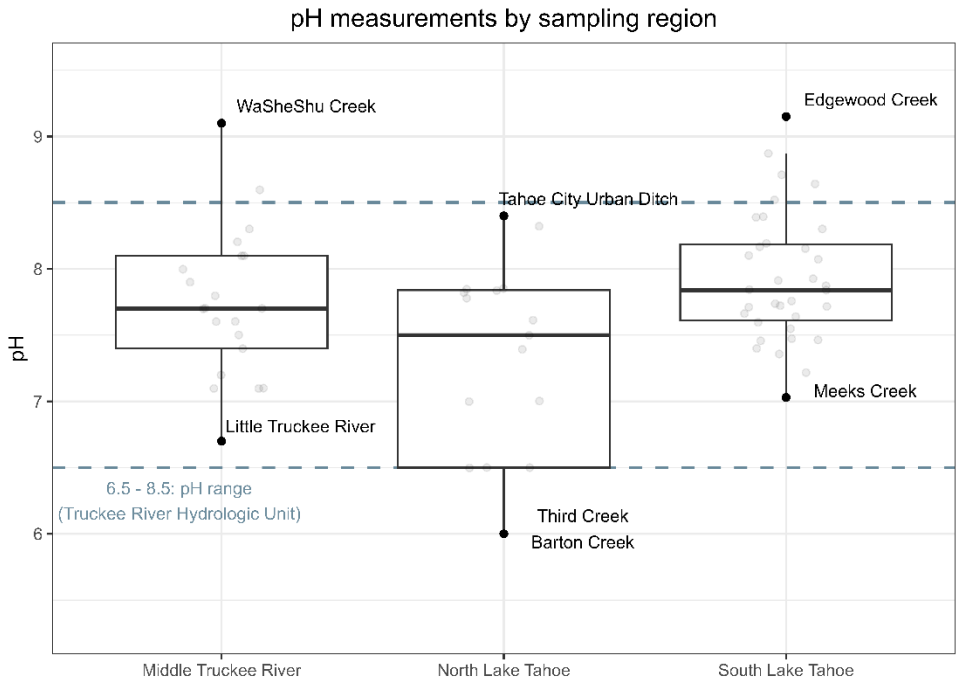

Figure 8: pH

Dissolved oxygen

Dissolved oxygen is a measure of the amount of gaseous oxygen (O_2) dissolved in water, typically expressed in milligrams per liter (mg/L). Dissolved oxygen is required to support aquatic life; when dissolved oxygen levels drop, many aquatic species—particularly fish—can become stressed and unable to reproduce or perform other necessary functions.

Low dissolved oxygen concentrations can result from the following conditions:

- Excessively warm water: Warmer water dissolves and holds less oxygen than cooler water.
- Excess nutrients: Too many nutrients in the water can fuel algae and bacteria growth which consume dissolved oxygen as they decay.
- Slow or stagnant water: Movement allows oxygen and water to mix; slow or stagnant water therefore has less dissolved oxygen than water in motion.

Dissolved oxygen standards vary from region to region. Most waters within the Truckee River Hydrologic Unit are subject to a dissolved oxygen standard of at least 7.0 mg/L. In the Lake Tahoe Basin, waters designated “cold water habitat” should meet a 30-day average of at least 6.5 mg/L and an instantaneous concentration of at least 4.0 mg/L.

In 2024, 71 Snapshot Day sites were sampled for dissolved oxygen. Of the sites sampled, 58 (82%) recorded values at or above 7.0 mg/L, the Truckee River Hydrologic Unit standard. All sites sampled for dissolved oxygen recorded values above 4.0 mg/L, the 1-day sampling minimum for cold water habitat in the Lake Tahoe Basin. The lowest dissolved oxygen measurement was 5.0 mg/L, recorded at three

sites in South Lake Tahoe: at Glen Alpine Creek and two sites along Meeks Creek. The highest was 11.0 mg/L, recorded at four sites in South Lake Tahoe and three sites in North Lake Tahoe. **Figure 9** displays the distribution of dissolved oxygen measurements by sampling region.

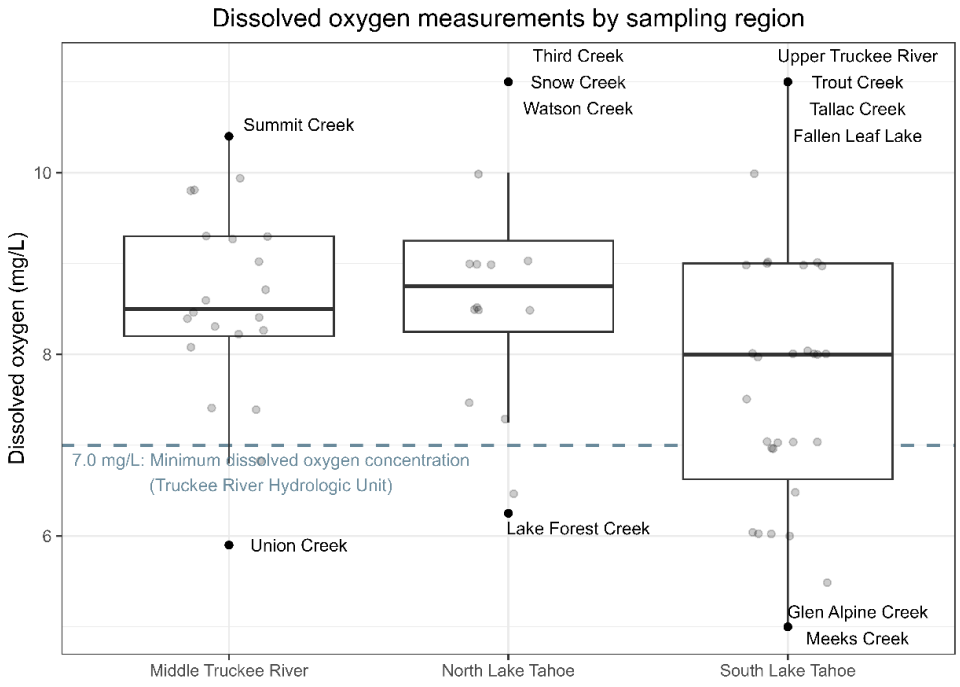

Figure 9: Dissolved oxygen

Conductivity

Conductivity is a measure of the ability of water to pass an electric current, often expressed as microSiemens per centimeter (µS/cm). In water, conductivity is affected by the presence of inorganic dissolved solids such as chloride, nitrate, calcium, sulfate, and others. In rivers and streams, a key factor that affects conductivity is the geology through which the water flows. Conductivity is also sensitive to flow rates: At high flows, the charged particles that facilitate electrical current are diluted, so conductivity measurements may drop. At low flows, charged particles are more concentrated, so conductivity measurements are often higher.

Abrupt or significant changes in conductivity can be an indicator of new discharges into the water, like wastewater or other inputs. In the Truckee River Watershed, primary sources of charged particles include road sands, road deicers, and natural sources. Typically, sampling sites in urban areas or adjacent to high-traffic roads show higher electrical conductivity readings. Acceptable ranges for water conductivity are dependent on the water type. **Table 4** displays acceptable conductivity ranges for several water types. In Lake Tahoe, the maximum conductivity standard is 95 µS/cm, evaluated as an annual mean.

Table 4: Acceptable conductivity ranges for different water types

Water type	Conductivity (µS/cm)
Distilled water	0.5-3.0
Melted snow	2.0-42
Potable water	30-1500
Irrigation supply water	< 750

In 2024, electrical conductivity was measured at 55 Snapshot Day sites. Conductivity was not measured at the North Lake Tahoe sites. Of the sites measured, 42 (76%) recorded values below 95 µS/cm, the maximum standard for waters in Lake Tahoe, evaluated as an annual mean. The lowest conductivity measurement was 10 µS/cm, recorded at two sites in South Lake Tahoe: Eagle Creek and Glen Alpine Creek. The highest measurement was also recorded in South Lake Tahoe: 340 µS/cm at Bijou Park Drainage. **Figure 10** displays the distribution of conductivity measurements across two sampling regions.

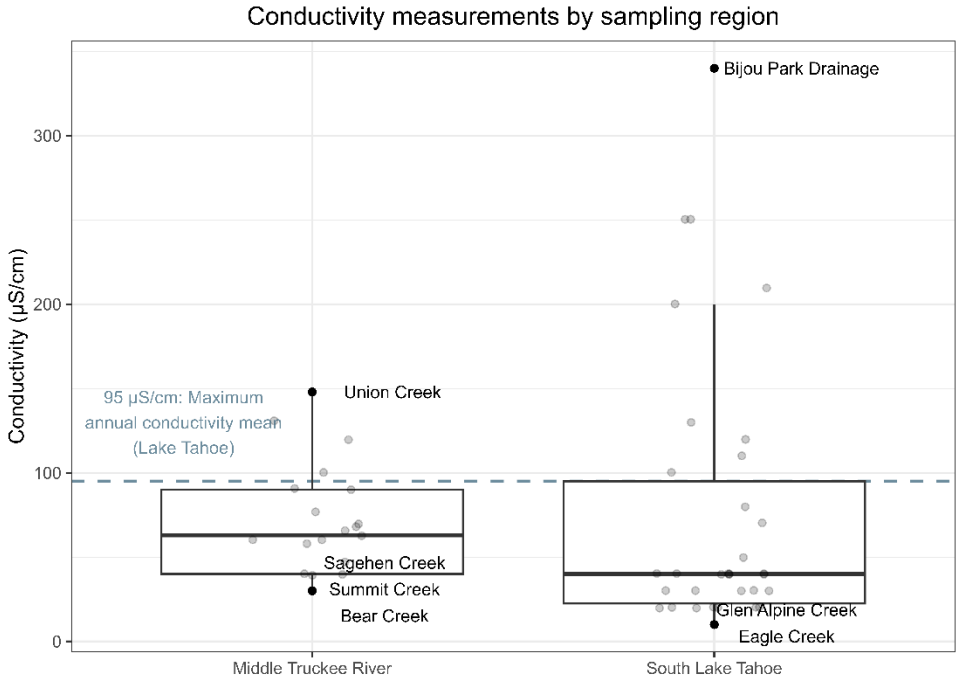

Figure 10: Conductivity

Turbidity

Turbidity is a measure of suspended particles in the water column—one way to express water clarity. Turbidity is measured in nephelometric turbidity units (NTU), where lower values indicate clearer water and higher values indicate cloudier water. Besides visually clouding the water, 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 water quality.

There is considerable variability in turbidity standards throughout the Truckee River Watershed. The California portion of the watershed is in the U.S. EPA's Eco-Region II (forested mountains in the western U.S.). According to the EPA's recommended criteria, turbidity for streams in this region should be at or below 1.3 NTU. Eco-Region II does not include the region of Nevada just outside of the Tahoe Basin. Within the Tahoe Basin, TRPA and Lahontan Water Board use a nearshore turbidity standard of 1-3 NTU (evaluated with monthly mean values). Outside of the Basin, the Lower Truckee River and associated tributaries in Nevada have a turbidity standard of 10 NTU.

At Snapshot Day 2024, turbidity was measured at 74 sites. Of the sites measured, 60 (81%) recorded values at or below 3 NTU, the maximum standard within the Lake Tahoe Basin. The lowest recorded measurement was 0.244 NTU at Eagle Creek in South Lake Tahoe. The highest measurement was 5.73 NTU recorded at Rosewood Creek in North Lake Tahoe. **Figure 11** displays the distribution of turbidity measurements by sampling region.

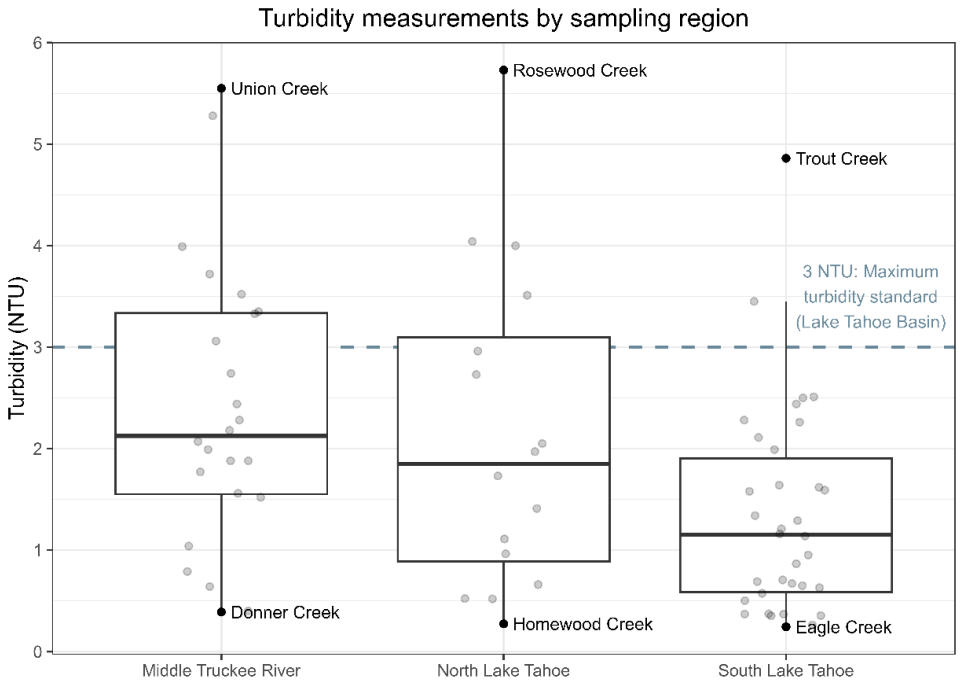

Figure 11: Turbidity

Nutrients

Nutrients are an essential part of aquatic systems. At stable levels, nutrients support the growth of plants and algae that form the base of the aquatic food web. At elevated levels, nutrients can become a problem for aquatic systems. Through a process called eutrophication, excess nutrients can cause harmful levels of biological growth, sometimes leading to diminished oxygen supplies and the appearance of harmful algal blooms.

Two of the most important nutrients monitored in aquatic systems are nitrogen and phosphorous, typically measured in milligrams per liter (mg/L). Nitrogen and phosphorous occur in aquatic environments in a variety of forms described below.

Nitrogen

Total nitrogen

Total nitrogen is a measure of all forms of nitrogen in a system. Total nitrogen was measured at 65 Snapshot Day sites. Of the sites measured, 40 (62%) recorded values below 0.15 mg/L, the maximum standard for Lake Tahoe (evaluated as an annual mean). The highest measurement was 0.999 mg/L, recorded at Lake Tahoe at Timber Cove in South Lake Tahoe. The lowest was 0.081 mg/L at Donner Creek at Highway 89 in the Middle Truckee River region. **Figure 12** displays the distribution of total nitrogen measurements by sampling region.

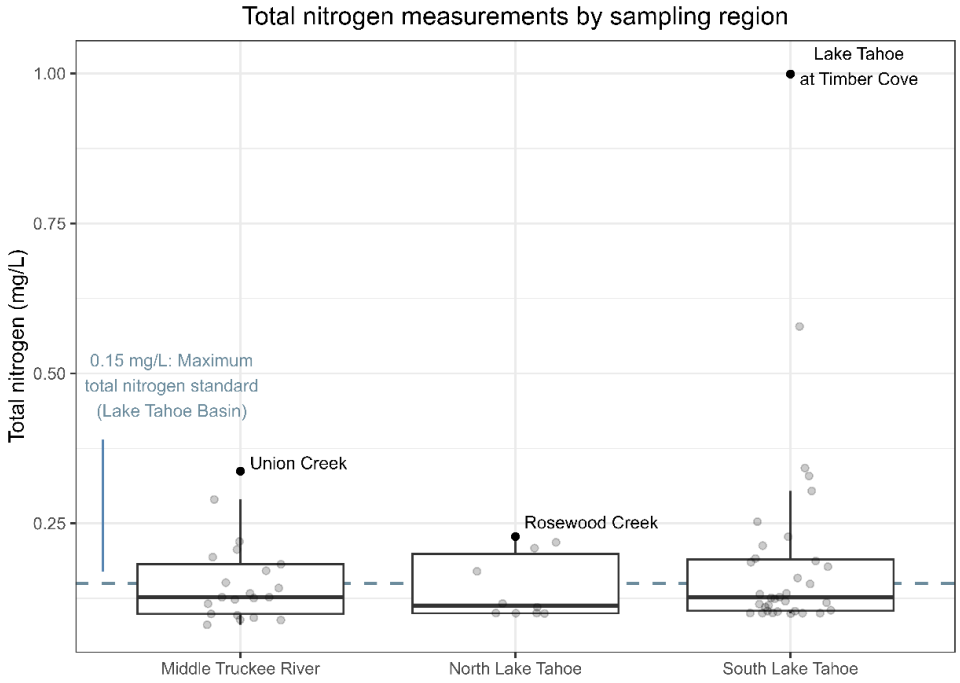

Figure 12: Total nitrogen

Ammonia

Ammonia is a measure of inorganic forms of nitrogen and can be used to monitor possible discharges into a water body, including sewage and road runoff.

Ammonia was measured at 21 Snapshot Day sites, all within the Middle Truckee River region. Of the sites sampled, 19 (90%) measured 0.02 mg/L, one measured 0.08 mg/L (Prosser Creek), and one measured 0.015 mg/L (Alder Creek).

Nitrate and nitrite

Nitrate and nitrite are both measures of inorganic nitrogen. They can be used to monitor inputs to water systems, including urban and agricultural runoff.

Nitrate was measured at 65 Snapshot Day sites across all sampling regions. The maximum measurement was 0.104 mg/L, recorded at Tahoe City Urban Ditch in North Lake Tahoe. The minimum was 0.002 mg/L at Martis Creek in the Middle Truckee River region. **Figure 13** displays the distribution of nitrate measurements by sampling region.

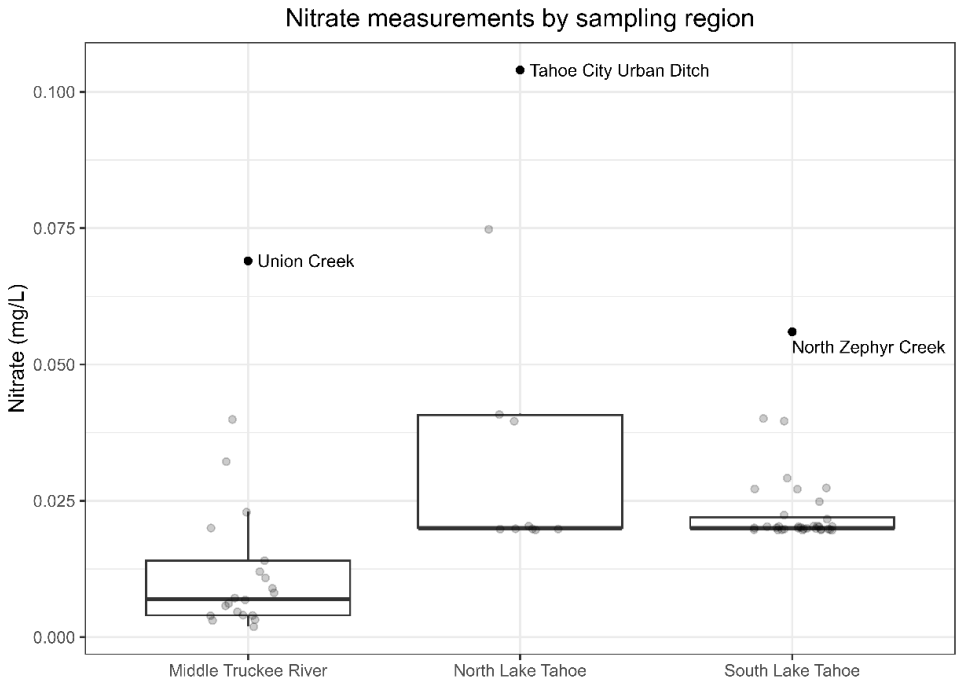

Figure 13: Nitrate

Nitrite was measured at 44 Snapshot Day sites and was not measured in the Middle Truckee River region. All sites sampled for nitrite measured <0.02 mg/L, the minimum detection level for this indicator.

Total Kjeldahl nitrogen

Total Kjeldahl nitrogen is a measure of dissolved ammonia plus organic nitrogen. It can be used to measure organic nitrogen inputs from sources like manure and wastewater treatment plants.

Total Kjeldahl nitrogen was measured at 65 Snapshot Day sites across all sampling regions. The highest measurement was 0.974 mg/L, recorded at Lake Tahoe at Timber Cove in South Lake Tahoe. The lowest was 0.073 mg/L at Donner Creek at Highway 89 in the Middle Truckee River region. **Figure 14** displays the distribution of total Kjeldahl nitrogen measurements by sampling region.

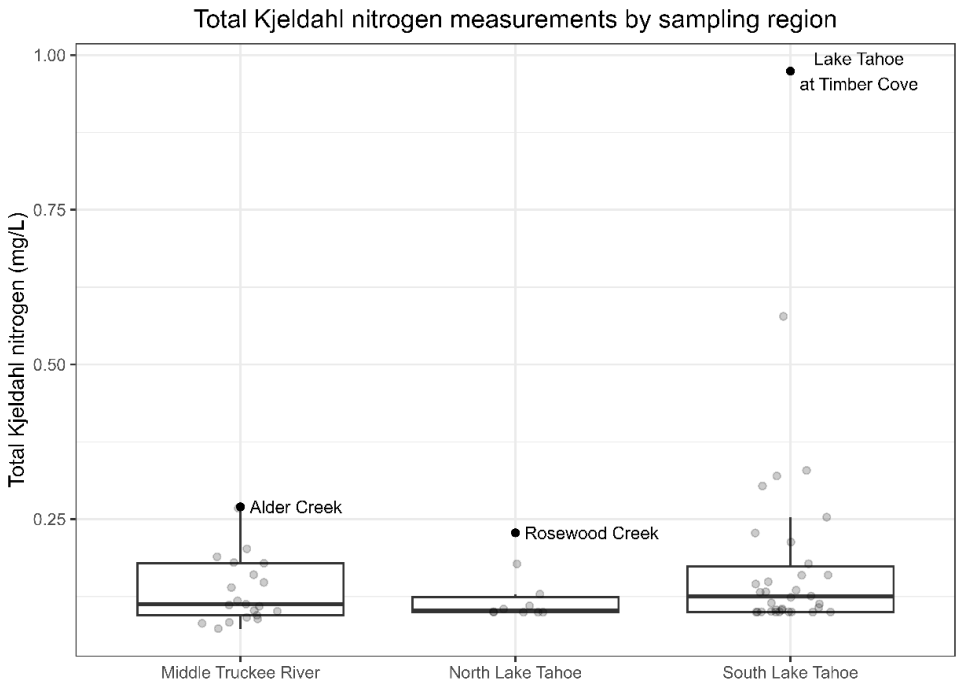

Figure 14: Total Kjeldahl nitrogen

Phosphorous

Total phosphorous

Total phosphorous is a measure of all forms of phosphorous in a system.

Total phosphorous was measured at 21 Snapshot Day sites, all within the Middle Truckee River region. The highest measurement was 0.043 mg/L, recorded at Union Creek below Glenshire. The lowest was 0.009 mg/L at the Truckee River near Tahoe City. **Figure 15** displays the distribution of total phosphorous measurements in the Middle Truckee River region.

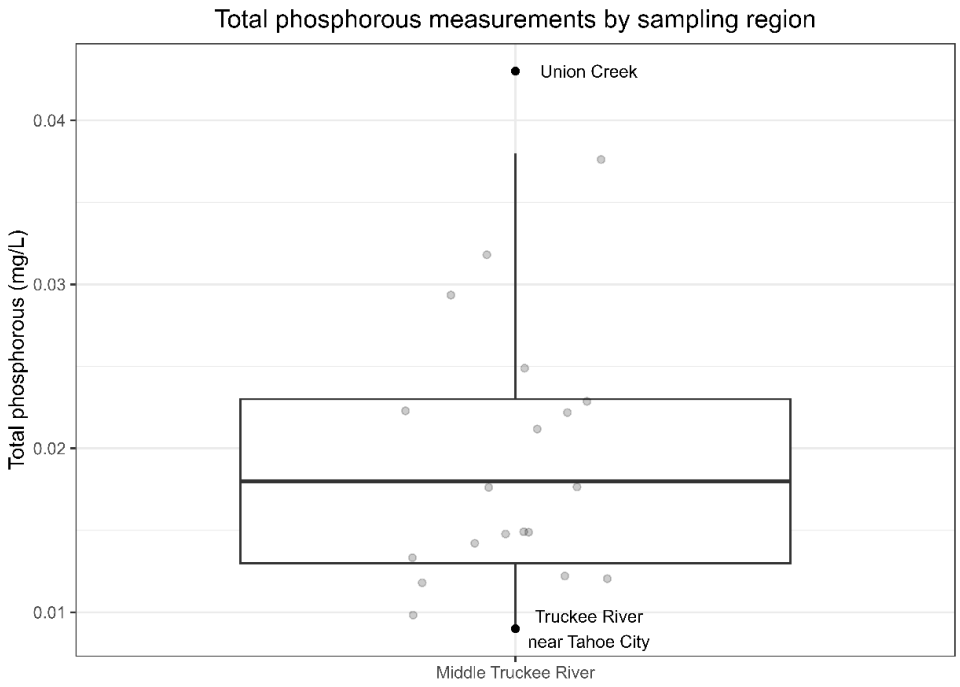

Figure 15: Total phosphorous

Orthophosphate

Orthophosphate is a measure of inorganic phosphorous, useful for monitoring inputs including urban and agricultural runoff.

Orthophosphate was measured at 44 Snapshot Day sites. Orthophosphate was not measured in the Middle Truckee River region. All but one site measured <0.02 mg/L, the minimum detection level for this indicator. Barton Creek in North Lake Tahoe measured 0.034 mg/L.

Bacteria

Total coliform

Total coliform is a measure of a collection of different bacteria. These bacteria are commonly found in the natural environment and are typically harmless, but elevated levels may indicate contamination. Fecal coliform is a subgroup of total coliform and was not measured at Snapshot Day 2024.

Total coliform was measured at 51 Snapshot Day sites and reported using the Most Probable Number (MPN) per 100mL. Total coliform was not measured in the Middle Truckee River region. The highest measurement was >2419 MPN/100mL, the maximum detection level for this indicator, recorded at Brockway and Snow Creek in North Lake Tahoe and at Tallac Creek in South Lake Tahoe. The lowest measurement was 7.4 MPN/100mL at Fallen Leaf Lake in South Lake Tahoe. **Figure 16** displays the distribution of total coliform measurements for two sampling regions.

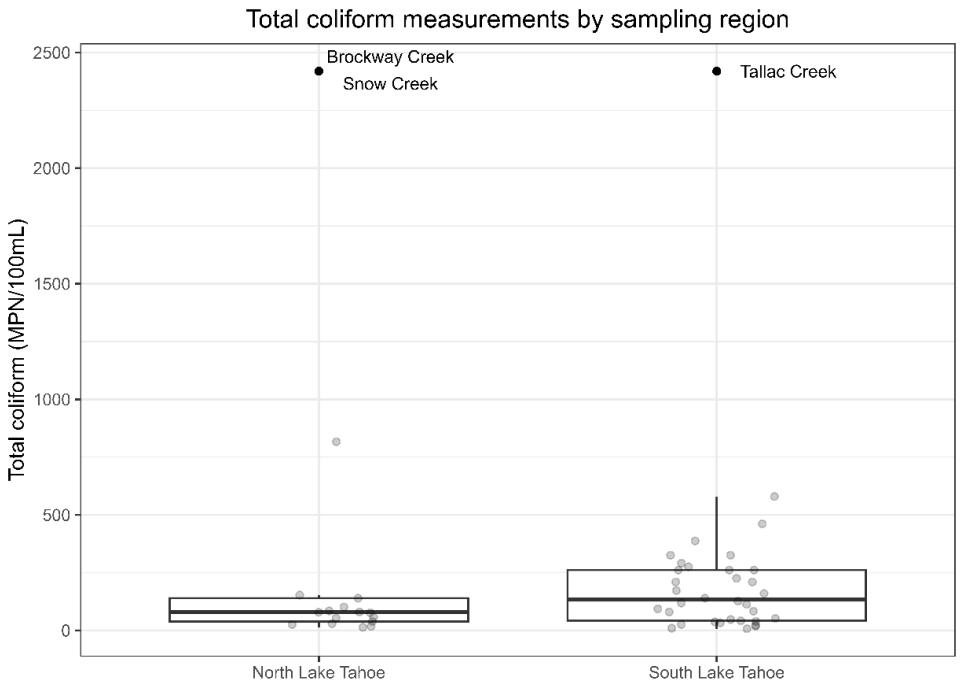

Figure 16: Total coliform

E. coli

E. coli is a bacteria found in the intestines of animals and humans. Elevated levels of *E. coli* in a water body can indicate fecal contamination.

E. coli was measured at 41 Snapshot Day sites and reported using the Most Probable Number (MPN) per 100mL. It was not measured in the Middle Truckee River region. The highest measurement was 365.4 MPN/100mL, recorded at Brockway Creek in North Lake Tahoe. The lowest *E. coli* measurement was 1 MPN/100mL, recorded at 14 sites across North and South Lake Tahoe. **Figure 17** displays the distribution of *E. coli* measurements for two sampling regions.

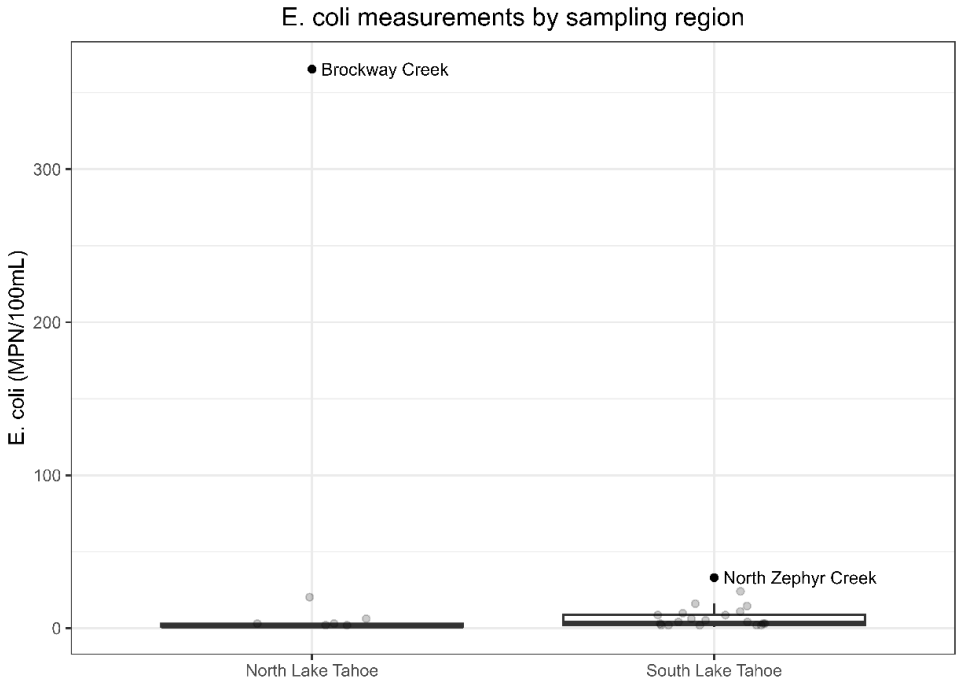

Figure 17: E. coli

Visual observations

In addition to taking in-field measurements and collecting samples for further analysis, volunteers also record visual observations at Snapshot Day sampling sites. Visual observations include evaluations of cloud cover, precipitation, wind, water clarity, sample color, sample odor, in-stream flow, and other indicators. These observations help provide context for the quantitative measures taken, offering possible causes of degraded and/or improved water quality (e.g., new inputs and discharges, restoration activities, etc.).

Across all three sampling regions, the visual observations showed continuity. **Figures 18-25** summarize visual observations by region.

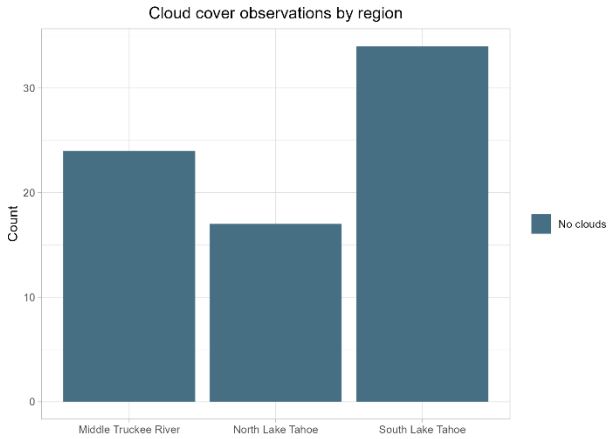

Figure 18: Cloud cover

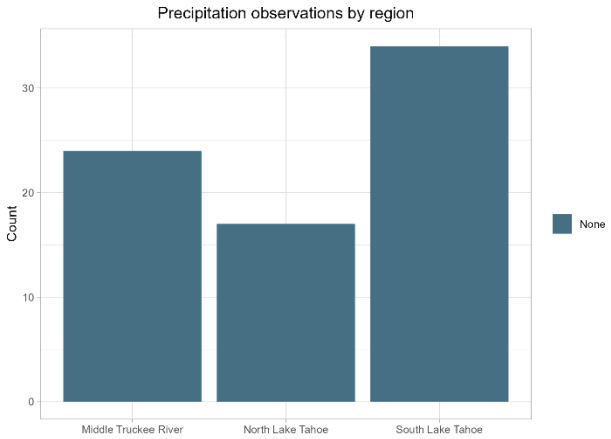

Figure 19: Precipitation

- **Cloud cover:** 100% of responding sites reported no cloud cover
- **Precipitation:** 100% of responding sites reported no precipitation

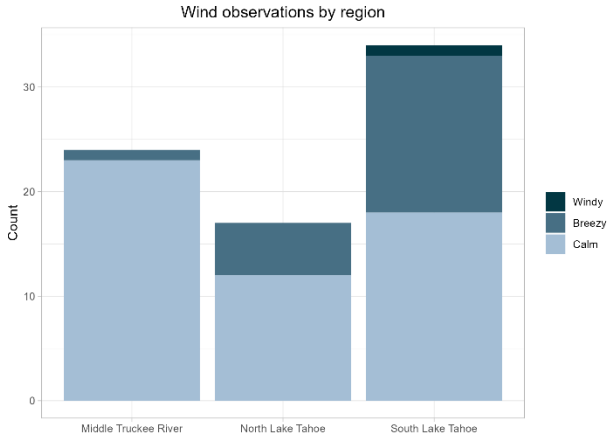

Figure 20: Wind

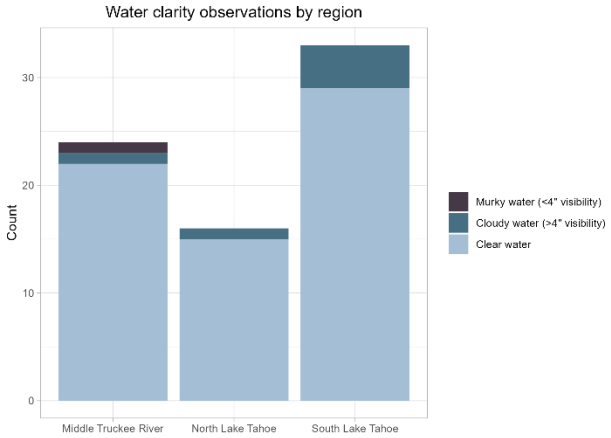

Figure 21: Water clarity

- **Wind:** 99% of responding sites reported calm or breezy conditions; 1% reported windy conditions
- **Water clarity:** 90% of sites reported clear water; 8% reported cloudy water (>4" visibility); 1% reported murky water (<4" visibility)

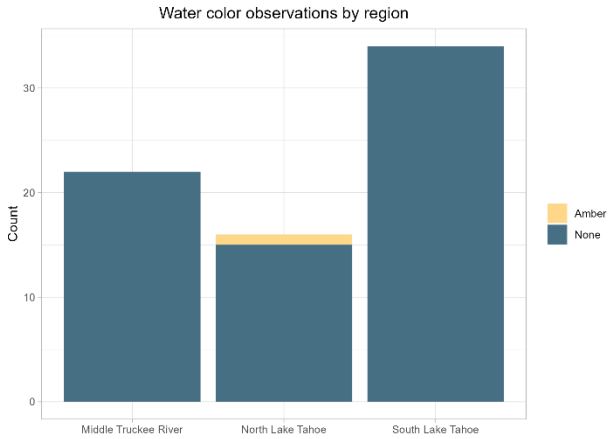

Figure 22: Sample color

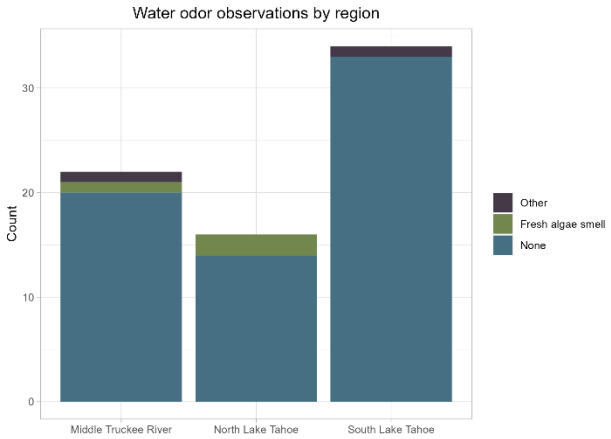

Figure 23: Sample odor

- **Sample color:** 99% of responding sites reported no sample color; 1% reported amber color
- **Sample odor:** 93% of responding sites reported no sample odor; 4% reported a fresh algae smell; 3% reported "other"

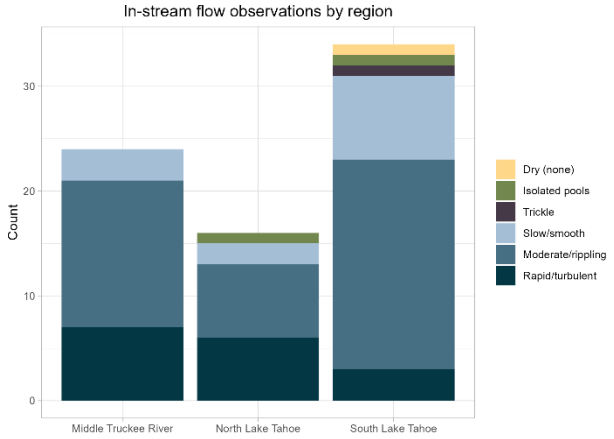

Figure 24: In-stream flow

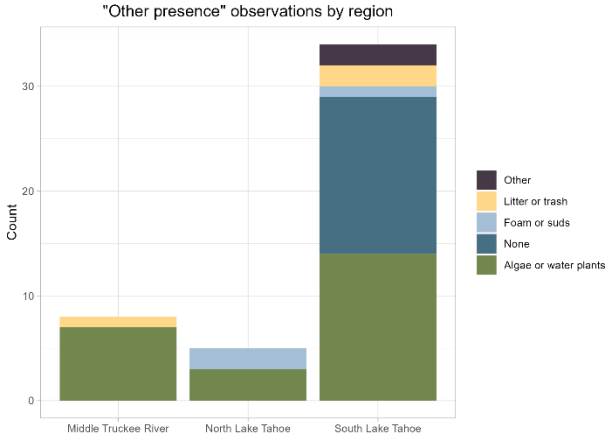

Figure 25: "Other presence"

- **In-stream flow:** 55% of responding sites reported moderate/rippling in-stream flow conditions; 22% reported rapid/turbulent conditions, 18% reported slow/smooth conditions; 5% reported one of isolated pools, trickling, or dry conditions
- **"Other presence":** 57% of sites reported no other concerns at their site; 32% reported algae or water plants; 4% reported litter or trash; 4% reported foam or suds

Discussion

The Truckee River Watershed is an area with diverse land uses, from heavily forested areas in the upper region near Lake Tahoe to dense urban areas in the lower region near Reno and Sparks. Urban development throughout the watershed has created impervious surfaces including roads, parking lots, and other structures, all of which can negatively impact water quality. However, compared to many other watersheds in the nation, data collected within the Truckee River Watershed typically indicates good overall water quality. As outlined in the results above, the data collected at Snapshot Day 2024 is no exception.

Because Snapshot Day captures a moment in time, rather than monthly or annual averages, the data may be particularly sensitive to snowmelt conditions determined by snow levels during the winter prior. One indicator that shows the impact of snowpack on spring runoff is turbidity: In 2023, following the snowiest year on record in the Sierra Nevada, 64% of sites measured for turbidity reported values above 3 NTU, the Lake Tahoe Basin standard. In 2024—a more typical snow year—that percentage dropped to 19% of sites.

As Snapshot Day data collected over the past 24 years is 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, make 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 in the Truckee River Watershed, contact the following agencies and organizations:

- **North Lake Tahoe:** Sarah Vidra, Incline Village General Improvement District; (775)-832-1284
- **South Lake Tahoe:** Courtney Thomson, League to Save Lake Tahoe; (530)-541-5388 ext. 212
- **Middle Truckee River (Tahoe City to Nevada State Line):** Michele Prestowitz, Truckee River Watershed Council; (530)-550-8760 ext. 4

References

American Public Health Association, American Water Works Association, & Water Environment Federation. (2007). *Standard methods for the examination of water and wastewater* (21st ed.). Retrieved from https://www.standardmethods.org/doi/book/10.2105/SMWW.2882

California Regional Water Quality Control Board, Lahontan Region. (1993). *Water quality control plan for the Lahontan region*. Retrieved from https://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/

California State Water Resources Control Board. (2001, September). *The California Streamside Biosurvey: An introduction to using aquatic invertebrates as water quality indicators*. Retrieved from https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/351.pdf

California State Water Resources Control Board. (n.d.). *Clean Water Team*. Retrieved from http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml

Dickerson, B. R., & Vinyard, G. L. (1999). Effects of high chronic temperatures and diel temperature cycles on the survival and growth of Lahontan cutthroat trout. *Transactions of the American Fisheries Society*, *128*(3), 516–521. https://doi.org/10.1577/1548-8659(1999)128<0516:eohcta>2.0.co;2

National Integrated Drought Information System (NIDIS). (2024, October 17). *Drought status update: California-Nevada*. Retrieved from https://www.drought.gov/drought-status-updates/drought-status-update-california-nevada-2024-10-17

Nevada Division of Environmental Protection. (1995). *Nevada Administrative Code (NAC), Chapter 445A*. Retrieved from https://www.leg.state.nv.us/NAC/NAC-445A.html

U.S. Department of Agriculture (USDA). (2024). *National Water and Climate Center (NWCC)*. Retrieved from https://nwcc-apps.sc.egov.usda.gov/

U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). *Water supply*. Retrieved from https://www.nrcs.usda.gov/programs-initiatives/sswsf-snow-survey-and-water-supply-forecasting-program/water-supply

U.S. Environmental Protection Agency. (2000, December). *Ambient water quality criteria recommendations: Rivers and streams in nutrient ecoregion II*. Retrieved from https://www.epa.gov/sites/default/files/documents/rivers2.pdf

U.S. Environmental Protection Agency. (n.d.). *Ambient water monitoring and assessment: Resources and tools*. Retrieved from https://www.epa.gov/awma

U.S. Environmental Protection Agency. (n.d.). *Draft volunteer stream monitoring: A methods manual*. Retrieved from https://www.epa.gov/sites/default/files/2015-04/documents/volunteer_stream_monitoring_a_methods_manual.pdf

U.S. Geological Survey (USGS). (2024). *Monitoring locations 10336610 and 10338000*. Retrieved from https://waterdata.usgs.gov

Appendices

Appendix A: Resource partners

2024 Snapshot Day Sponsors

- California State Water Resource Control Board
- Lahontan Regional Water Quality Control Board
- League to Save Lake Tahoe
- Pyramid Lake Paiute Tribe
- South Tahoe Public Utility District
- Tahoe Environmental Research Center
- 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

- Michele Prestowitz (Truckee River Watershed Council)
- Kelci Brown, Courtney Thomson (League to Save Lake Tahoe)
- Sarah Vidra (Incline Village General Improvement District)

Organizations Hosting Snapshot Day 2024

- 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

Laboratory Analyses (Nutrients and Bacteria)

- South Tahoe Public Utility District
- Lahontan Regional Water Quality Control Board Laboratory
- United States Geologic Survey
- 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
- Tahoe Environmental Research Center
- Truckee River Watershed Council, Michele Prestowitz
- United States Geological Survey, Paul Honeywell

Special thanks to

- Kelly Huck, Lahontan, for bacteria and turbidity analysis
- Paul Honeywell, U.S. Geologic Survey, Truckee, CA office, for coordinating bacterial analysis
- Anne Liston, Tahoe Environmental Research Center, for hosting equipment calibration
- Dan Arce, South Tahoe Public Utility District, for nutrient analyses
- And all the volunteers that make Snapshot Day possible!

Appendix B: Site names and codes

Region	Site code	Site name
Middle Truckee River	MTR-ALDR	Alder Creek
	MTR-BEAR-00	Bear Creek near mouth
	MTR-BOCA-00	Little Truckee below Boca Dam
	MTR-BOCA-01	Little Truckee at Boyington Mill
	MTR-COLD-00	Cold Creek
	MTR-DONN-00	Donner Creek near mouth
	MTR-DONN-01	Donner Creek at Highway 89
	MTR-DONN-03	Donner Creek below dam
	MTR-EMAR	East Martis Creek
	MTR-GLEN-00	Union Creek below Glenshire
	MTR-GLEN-02	Union Creek at Glenshire Pond
	MTR-I80C	Truckee River in I-80 corridor
	MTR-MART-00	Martis near mouth
	MTR-MART-01	Martis at USACE boundary
	MTR-POLE-00	Pole Creek
	MTR-PROS-01	Prosser Creek below dam
	MTR-PROS-02	Prosser Creek at Highway 89
	MTR-SAGE-00	Sagehen Creek
	MTR-SUMM-02	Summit Creek at TDLT
	MTR-TOWN	Truckee River in town corridor
	MTR-TR01	Truckee River near Tahoe City
	MTR-TROU-00	Trout Creek near mouth
	MTR-TROU-02	Trout Creek in Tahoe Donner

	MTR-WASH-00	WaSheShu Creek
North Lake Tahoe	NLT-BART-01	Barton Creek @ Star Harbor
	NLT-BROC-00	Brockway Creek @ mouth
	NLT-GNRL-00	General Creek @ mouth
	NLT-GRIF-00	Griff Creek@ mouth
	NLT-HMWD-01	Homewood Creek @ highway
	NLT-INCL-00	Incline Creek @ mouth
	NLT-LKFC-00	Lake Forest Creek @ mouth
	NLT-MKNY-01	McKinney Creek @ highway
	NLT-QULC-00	Quail Creek @ mouth
	NLT-RSWD-01	Rosewood Creek above Third Creek
	NLT-SCRT-00	Secret Harbor Creek @ mouth
	NLT-SNOW-00	Snow Creek @ mouth
	NLT-TCUD-00	Tahoe City Urban Ditch @ mouth
	NLT-THRD-00	Third Creek @ mouth
	NLT-THRD-01	Third Creek @ Rosewood Creek
	NLT-WARD-01	Ward Creek @ highway
	NLT-WATS-01	Watson Creek above highway
South Lake Tahoe	SLT-ANG1-02	Angora Creek upstream of Lake Tahoe Boulevard
	SLT-ANG2-01	Angora Creek at Washoe Meadows State Park
	SLT-ANG3-00	Angora Creek at Upper Truckee River confluence
	SLT-BJCR-00	Bijou Creek at mouth
	SLT-BPDR-00	Bijou Park Drainage at mouth
	SLT-BURK-00	Burke Creek at mouth
	SLT-EAGL-00	Eagle Creek at mouth
	SLT-EAGL-01	Eagle Creek upstream of Highway 89
	SLT-EDGE-00	Edgewood Creek at mouth
	SLT-EDGE-01	Edgewood Creek upstream of Highway 50
	SLT-FLLF-01	Fallen Leaf Lake near dam
	SLT-GLEN-00	Glen Alpine Creek at Fallen Leaf Lake
	SLT-HEAV-00	Heavenly Valley Creek at Trout Creek confluence
	SLT-HEAV-01	Heavenly Valley Creek downstream of Pioneer Trail
	SLT-KEYM-00	Tahoe Keys East Channel
	SLT-KEYS-00	Tahoe Keys West Channel
	SLT-MCFA-00	McFaul Creek at mouth
	SLT-MEEK-00	Meeks Creek at mouth
	SLT-MEEK-01	Meeks Creek upstream of Highway 89
	SLT-NZHR-00	North Zephyr Creek at mouth
	SLT-SZHR-00	South Zephyr Creek at mouth

	SLT-TALL-00	Tallac Creek at mouth
	SLT-TALL-01	Tallac Creek upstream of Highway 89
	SLT-TALL-02	Tallac Creek upstream of Spring Creek Road
	SLT-TALR-00	Taylor Creek at mouth
	SLT-TALR-02	Taylor Creek upstream of Highway 89
	SLT-TR10-01	Upper Truckee River upstream of Lake Tahoe Boulevard
	SLT-TR15-02	Upper Truckee River at airport
	SLT-TR20-01	Upper Truckee River at Elks Club Drive
	SLT-TRMO-00	Upper Truckee River at mouth - Venice location
	SLT-TROU-00	Trout Creek at mouth
	SLT-TROU-01	Trout Creek at Bellevue Avenue
	SLT-TROU-02	Trout Creek at Grinding Stone
	TAH-SLAKE-03	Lake Tahoe at Timber Cove

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)

Bacteria, nutrient, and turbidity samples are collected in sterile sample bottles. 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 and turbidity samples are 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 use of multiple labs ensures sample analysis within the allotted 24-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 the 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.