

# 23<sup>rd</sup> Annual Snapshot Day Report

## A Lake Tahoe Basin and Truckee Watershed Citizen Monitoring Event (May 20, 2023)



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# Table of Contents

## **Introduction**

What is Snapshot Day	5
What are the objectives of Snapshot Day	5

## **Snapshot Day 2023**

2023 Summary	6
Volunteers and locations	6
Lake Tahoe Tributaries, South Shore	7
Lake Tahoe Tributaries, North Shore	7
Truckee River Tributaries, Middle Truckee River	7
Methods of Data Collection	8
Water Quality Standards	9

## **Data Results**

Water Temperature	10
pH	11
Dissolved Oxygen	12
Turbidity	13
Streamflow	14-15
Conductivity	16
Fecal coliform	17
Nutrients	18-19
Visual observations	20

<b>Discussion</b>	21
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<b>References</b>	22
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## **Appendices**

Appendix A Resource Partners	24-25
Appendix B Sites Names and Site Codes	26-27
Appendix C Monitoring Equipment	28

## **Tables**

Table 1: Volunteer and monitoring site location numbers	6
Table 2: Examples of Lake Tahoe water quality standards	9
Table 3: Acceptable conductivity for different water types	16
Table 4: Number of monitored sites with in-stream flow	20

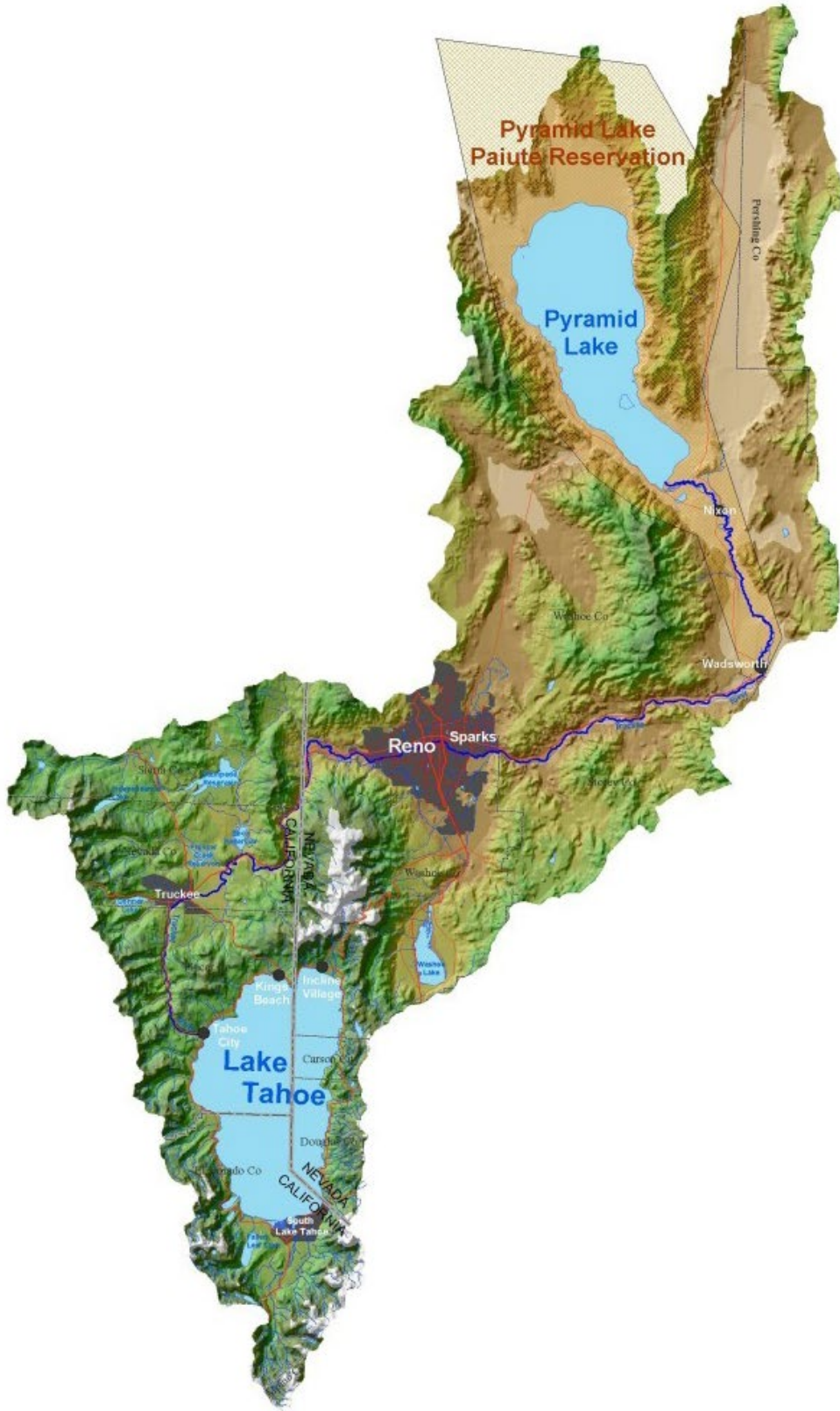
Table 5: Number of monitored sites for each sample color classification	20
Table 6: Number of monitored sites for each sample odor classification	20
Table 7: Number of monitored sites with the presence of the objects noted	20

**Figures**

Figure 1: Truckee River Watershed from South Lake Tahoe, CA to Pyramid Lake, NV	4
Figure 2: The maximum and minimum results recorded for water temperature	10
Figure 3: pH range that supports aquatic life	11
Figure 4: pH results outside optimal range for aquatic life	11
Figure 5: Dissolved oxygen concentrations below the 8 mg/L standard	12
Figure 6: Turbidity readings from Lake Tahoe sites that did not meet standard	13
Figure 7: Streamflow data from Upper Truckee River at South Lake Tahoe, California	14
Figure 8: Streamflow data from Truckee River at Town of Truckee, California	15
Figure 9: Highest and lowest conductivity values from Snapshot Day 2023	16
Figure 10: Fecal coliform bacteria counts above 20CFU/100 mL standard	17
Figure 11: Total Nitrogen average concentrations by region for 2023	18
Figure 12: Total Phosphorus average concentrations by region for 2023	19



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 indicating watershed health in the Tahoe Truckee region at a single point in time. Trained Volunteer Team Leaders bring groups of other volunteers to various pre-determined sites to collect water quality data. 2023 was the 23rd anniversary of Snapshot Day. Snapshot Day is sustained by support from dedicated staff, the funding of a few grants and donations, and by citizens who value 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 responsible for protecting 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 in the Tahoe-Truckee region, there is still insufficient information to assess the status of all aquatic resources in the Truckee River Hydrologic Unit, including 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 watershed management and pollution prevention information.

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 standards set by the TRPA 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 2023

## 2023 Event Summary

Snapshot Day provides an annual opportunity to highlight citizen science's contributions to maintaining the Tahoe-Truckee region's environmental health. 2023 Snapshot Day's data demonstrates good water quality overall for the Tahoe-Truckee watershed.

In 2023, Snapshot Day reached its 23rd 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 2023 was a collaborative effort between the North Shore Lake Tahoe, South Shore Lake Tahoe, and the Middle Truckee River.

Volunteer and monitoring site locations are as follows:

*Table 1: Volunteer and monitoring site location numbers.*

	<b>Volunteers</b>	<b>Locations</b>
South Shore Lake Tahoe	113	36
North Shore Lake Tahoe	22	19
Middle Truckee River	28	21
<b>Totals for 2023</b>	<b>163</b>	<b>76</b>

This collaborative effort was sponsored 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 involved organizations, resource partners, and education partners.

In 2023, volunteers gathered data at a total of 76 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
- Cold Creek
- Edgewood Creek
- Glen Alpine Creek
- Heavenly Valley Creek
- McFaul Creek
- Meeks Creek
- North Zephyr Creek
- Tahoe Keys East Channel
- Tahoe Keys West Channel
- Tallac Creek
- Taylor Creek
- Upper Truckee River
- Trout Creek

### **Lake Tahoe Tributaries, North Shore**

- Barton Creek
- Brockway Creek
- Carnelian Bay Creek
- General Creek
- Griff Creek
- Hatchery Creek
- Incline Creek
- Lake Forest Creek
- Madden Creek
- McKinney Creek
- Quail Creek
- Rosewood Creek
- Secret Harbor Creek
- Snow Creek
- Tahoe City Urban Ditch
- Third Creek
- Tunnel Creek
- Ward Creek
- Watson Creek

### **Truckee River Tributaries, Middle Truckee River**

- Alder Creek
- Bear Creek
- Coldstream Canyon
- Deep Creek
- Donner Creek
- East Martis Creek
- Main Stem, Truckee River
- Little Truckee River
- Martis Creek
- Prosser Creek
- Squaw Creek
- Trout Creek
- Washeshu 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 and available upon request to the coordination committee. The data set includes the volunteer field measurements 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 apply to the region better. 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 team members in the field.

The volunteers use a variety of instruments and kits on Snapshot Day. 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 that are 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*

<b>Parameter</b>	<b>Standard</b>
Temperature	Shall not exceed 15°C, surface waters of Fallen Leaf Lake (C.A.)
pH	7.0 - 8.4 in Lake Tahoe (C.A. and N.V.)
Conductivity	Shall not exceed 95 µS/cm average in Lake Tahoe (C.A. and N.V.)
Dissolved Oxygen	Mean no less than 6.5 and a 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 bio-stimulatory substances (nutrients) that cause algae to become a nuisance or to affect the water's beneficial uses (C.A.)
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	The annual average is 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 a 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](http://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](http://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**.

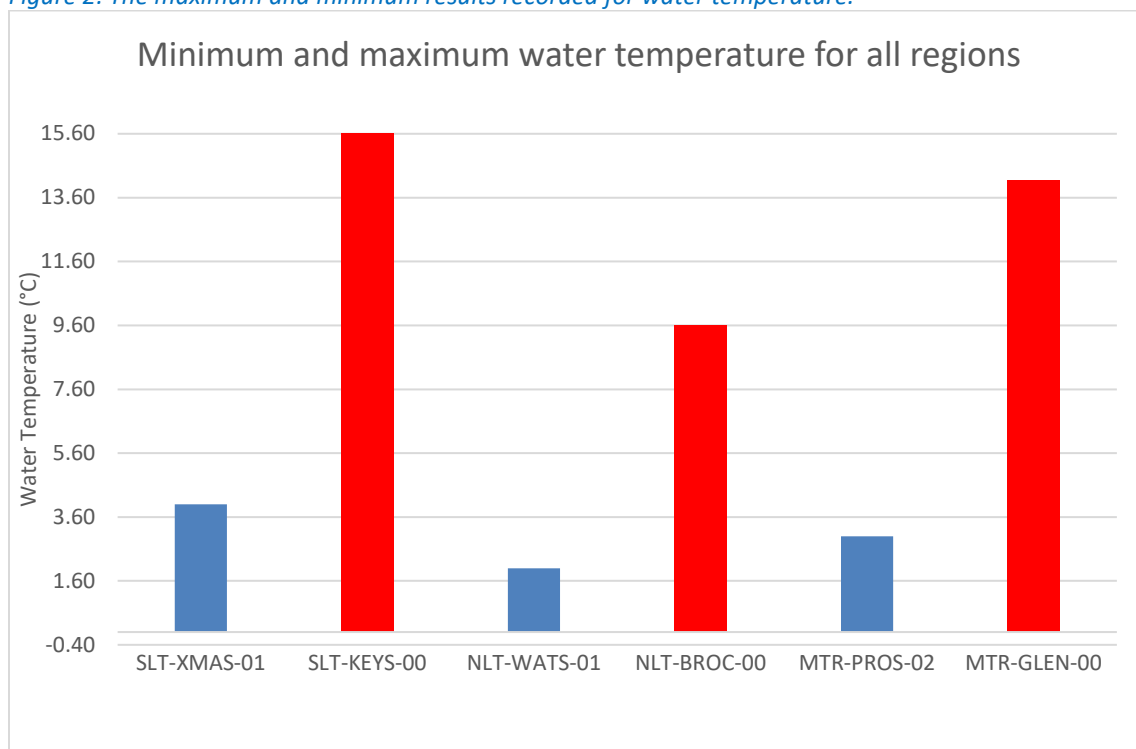
### Water temperature

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 as shade and thus prevents 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 2023, 75 sites were sampled for water temperature. The lowest recorded temperature from Snapshot Day 2023 was 2° C at the Watson Creek sampling location in North Lake Tahoe. The highest recorded temperature was 18.05° C recorded at the West Channel of the Tahoe Keys in South Lake Tahoe. Figure 2 below represents the lowest (blue) and highest (red) temperatures for the three regions sampled during the 2023 event. The high temperature noted above was collected from a tributary to Lake Tahoe and exceeded 15.6° C, the maximum optimal temperature for rainbow trout.

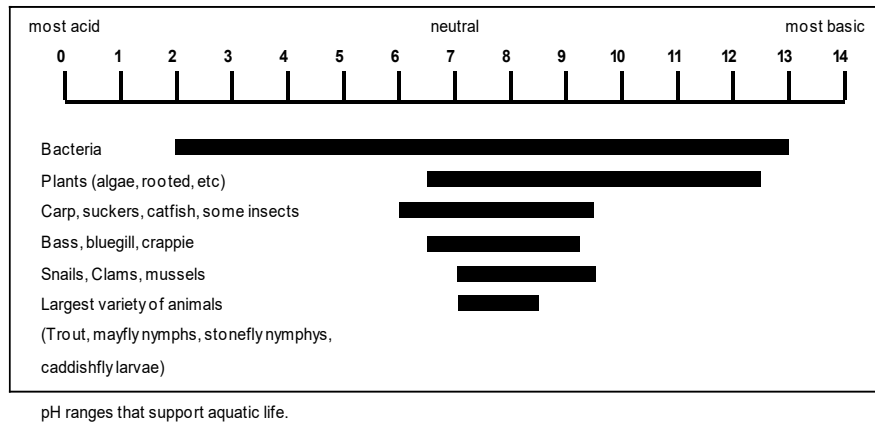
Figure 2: The maximum and minimum results recorded for water temperature.



## pH

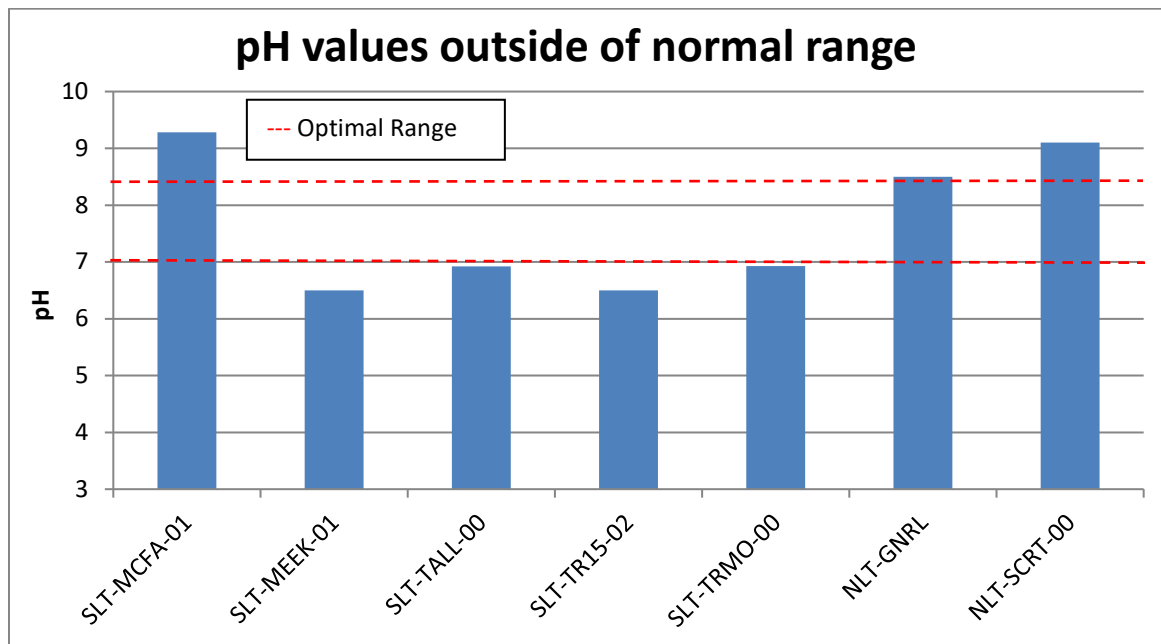
pH is a measurement of the degree to which water is "acidic" or "basic." pH is measured on a scale of 0 (very acidic) to 14 (very basic), with 7 in the middle as "neutral." Most aquatic life prefers a pH close to 7. **Figure 2** displays the pH ranges that support aquatic life.

*Figure 3: pH range that supports 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 8.4 range. This is commonly found in the tributaries to Lake Tahoe.

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



The lowest pH measurement for Snapshot Day 2023 was 6.5, taken at two locations in the South Lake Tahoe region, Meeks Creek upstream of Highway 89 and the Upper Truckee River at Airport sample locations. The highest pH measurement was 9.28 at McFaul Creek, also in the South Lake Tahoe region. Of the 75 sites that took pH readings, four sites had a pH below the optimal range, and three sample sites had a pH value above the optimal range.

## Dissolved Oxygen (D.O.)

Dissolved oxygen is a measure of the amount of gaseous oxygen (O<sub>2</sub>) dissolved in water. Dissolved oxygen is necessary to support aquatic life. When dissolved oxygen levels drop too low, stress occurs in aquatic life, especially fish.

Low dissolved oxygen concentrations are typically the result of the following:

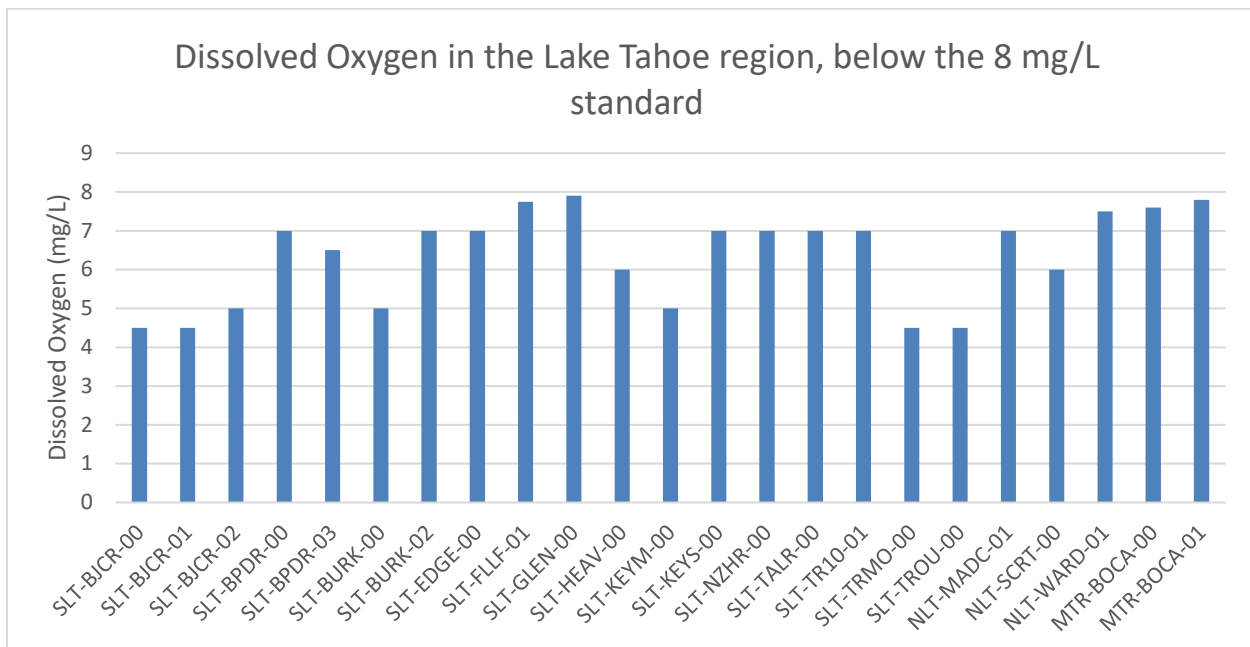
- Warming water: warmer water can dissolve and hold less oxygen than cooler water.
- Excess nutrients: too many nutrients in the water can fuel algae and bacteria growth, consuming oxygen upon decay.
- Slow or stagnant water: movement allows for oxygen and water to mix; slow or stagnant water thus has 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 for 2023 was 4.5 mg/L, recorded at four locations in South Lake Tahoe. The sites are Bijou Creek at Mouth and downstream of Fairway Dr., Upper Truckee River at Mouth, and the fourth result of 4.5 mg/L was taken at Trout Creek at Mouth.

All three regions had dissolved oxygen sites below 8.0 mg/L, with 26 records in total. In 2023, 4 sites had dissolved oxygen results less than 5 mg/L, equal to the 2022 results for dissolved oxygen. The highest recorded dissolved oxygen content was 11.00 mg/L, collected at North Lake Tahoe at the Tahoe City Urban Ditch site and South Lake Tahoe at the Cascade Creek above Highway 89 site.

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



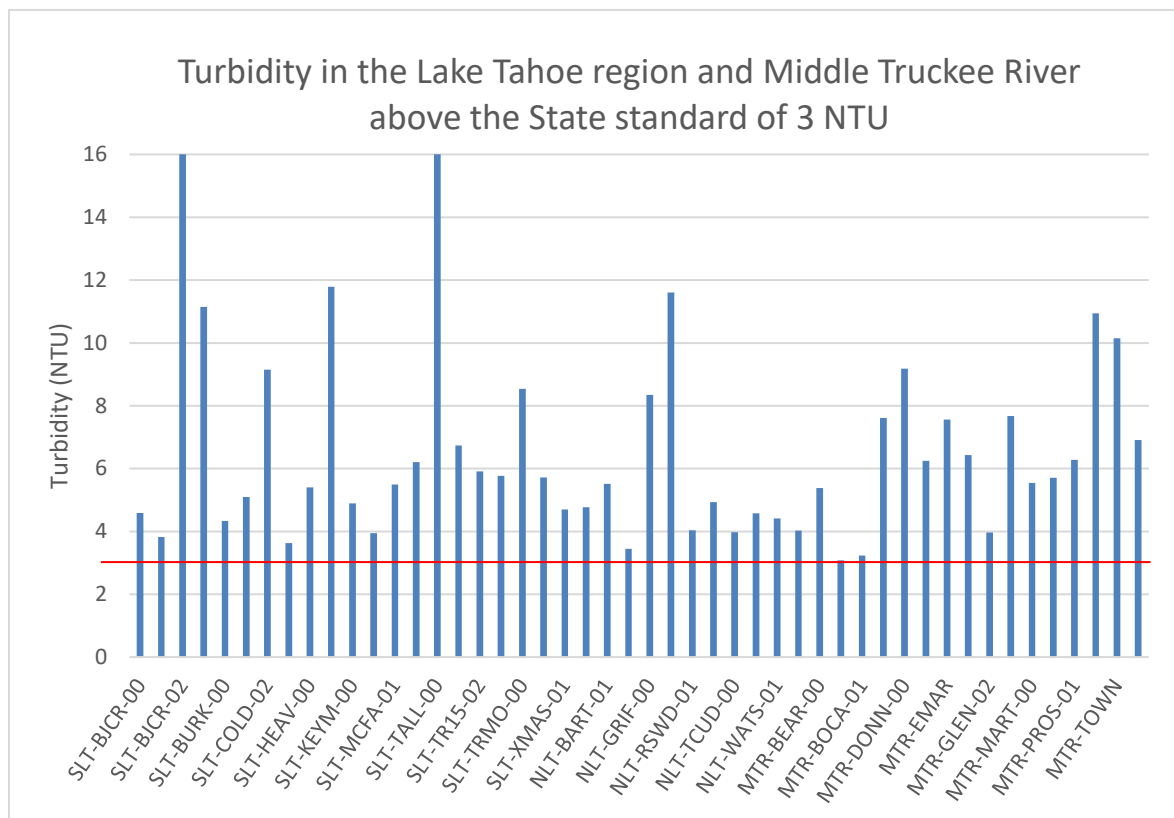
## Turbidity

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 Nevada is 10 NTU.

For the 2023 Snapshot Day event, 48 of the 75 sample sites had turbidity readings above the 3 NTU standard established by Tahoe Regional Planning Agency (TRPA). The highest turbidity reading for the 2023 Snapshot Day event was 26.55 NTU from Tallac Creek at Mouth in South Lake Tahoe. All three regions had turbidity values greater than 10.00 NTU during the 2023 Snapshot Day event; the creeks with values above 10 NTU were Bijou Creek, Heavenly Valley Creek, Tallac Creek, Incline Creek, Prosser Creek, and Truckee River through the Town of Truckee.

*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 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 sediment transfer can be of concern. Streamflow conditions can also impact fish habitat and other aquatic organisms and may affect the ability to spawn and/or reproduce.

The water year of 2023 (Oct. 2022-September 2023) was reported as the snowiest on record, with the National Oceanographic and Atmospheric Administration (NOAA) reporting the central and southern Sierra Nevada snow survey data from April 1, 2023 snowpack was the deepest in the past 90 years, greater than previous benchmark years of 1952, 1969, 1983 and 2017<sup>1</sup>.

The National Integrated Drought Information System (Drought.gov) has the following key points for the 2023 water year in California and Nevada.

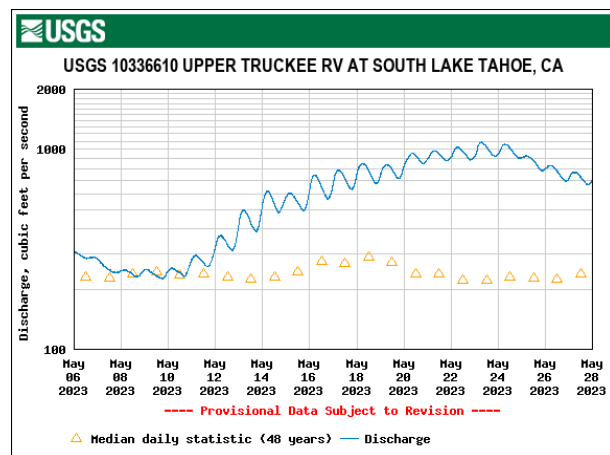
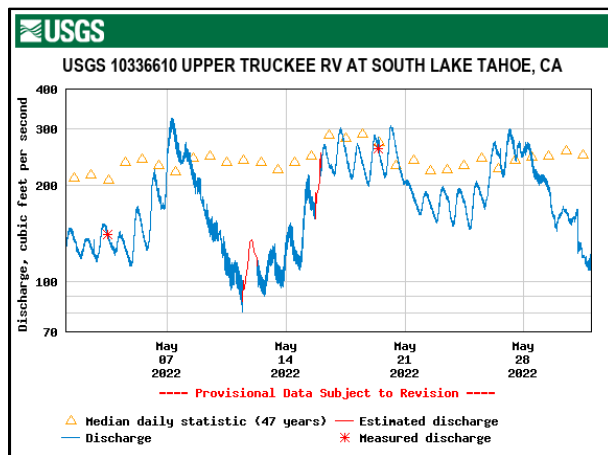
- According to the U.S. Drought Monitor, the [California-Nevada Drought Early Warning System](#) region began Water Year 2023 100% in drought and ended with less than 1% of the region in drought.
- Cool, wet conditions throughout the year led to a record snowpack in the Southern Sierra Nevada and the reemergence of Tulare Lake.

Most of the Sierra Nevada region experienced > 150% of median snow water equivalent during the water year, with the sensor at Mt. Rose ski resort reporting 220% of median in May 2023<sup>2</sup>. The above-average snowpack dramatically affects the amount of runoff from tributary streams and the water levels in the multiple reservoirs that serve as the primary water source for the greater Reno/Sparks area.

The graphs below show streamflow 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. This data illustrates the 2023 flow levels compared to the dry year of 2022.

*Figure 7: Streamflow data from the Upper Truckee River above Lake Tahoe, California, during May 2022 and 2023, respectively.*

### Upper Truckee River:



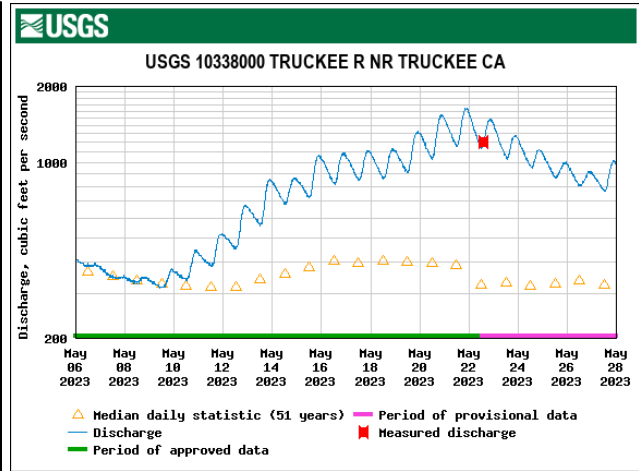
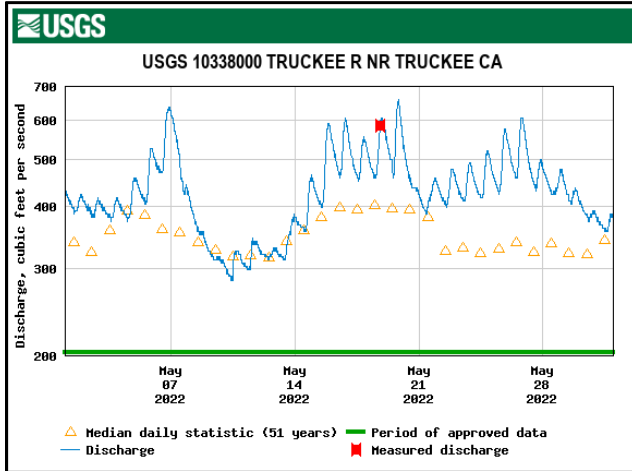
<sup>1</sup>National Centers for Environmental Information, National Oceanic and Atmospheric Administration, March 2023, National Climate Report, Western Region, Snowpack, <https://www.ncei.noaa.gov/access/monitoring/monthly-report/national/202303>

<sup>2</sup> <https://nwcc-apps.sc.egov.usda.gov/imap>



Figure 8: Streamflow data from the Middle Truckee River at the Town of Truckee, California, during May 2022 and 2023, 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. The geology through which the water flows mainly influences conductivity in rivers and streams.

Electrical conductivity is also sensitive to flows – at high flows, the charged particles that make conductivity are diluted, 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 deicers, and natural sources. Typically, urban areas or sites adjacent to high-traffic roads will show higher electrical conductivity readings.

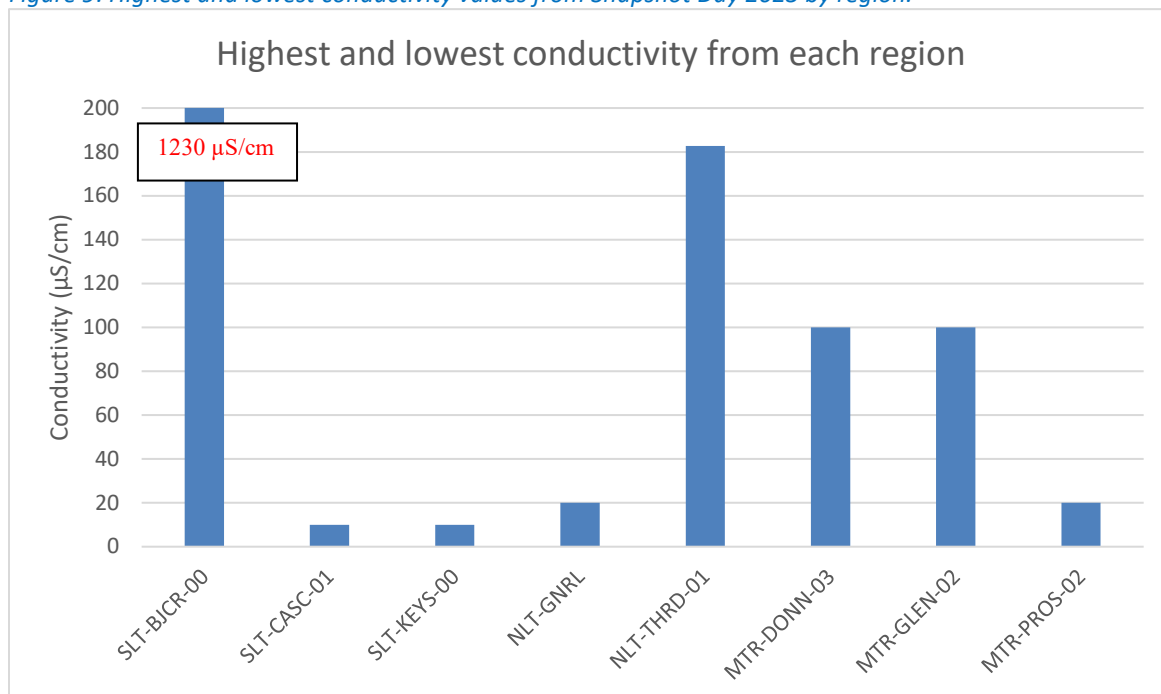
Abrupt changes in conductivity may indicate that new water sources or wastewater are being diverted into a stream or river. Acceptable ranges for water conductivity are dependent on the water type. **Table 4** displays acceptable conductivity ranges for several water types.

Conductivity was measured at 75 sample sites for Snapshot Day 2023. The lowest conductivity recorded was 10  $\mu\text{S}/\text{cm}$ , measured at Cascade Creek above Highway 89 and the Tahoe Keys West Channel in South Lake Tahoe. The highest conductivity recorded was 1230  $\mu\text{S}/\text{cm}$  at Bijou Creek at Mouth in South Lake Tahoe.

*Table 3: Acceptable conductivity for different water types.*

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

*Figure 9: Highest and lowest conductivity values from Snapshot Day 2023 by region.*



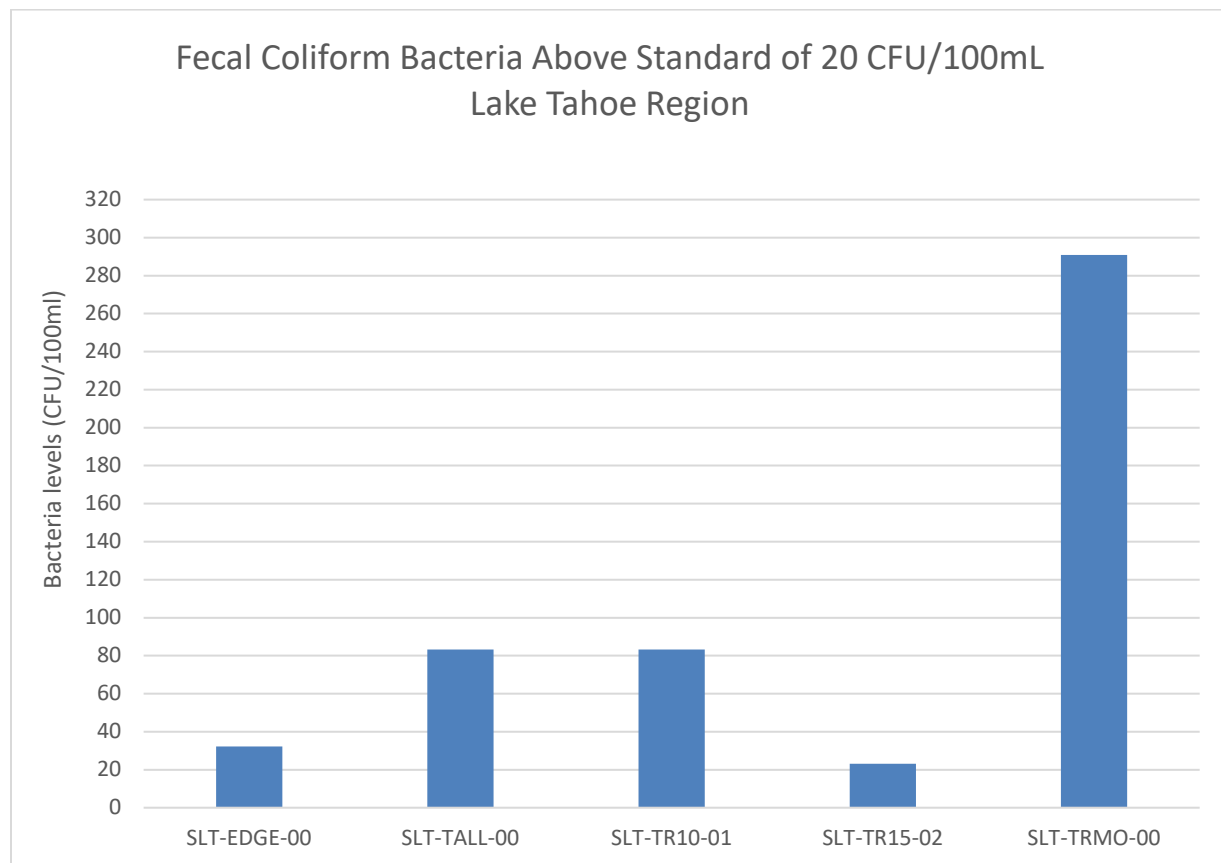
## Fecal Coliform Bacteria

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/100 mL). 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 54 locations on Snapshot Day 2023. Across all three regions, six samples had readings greater than 20 CFU/100 ml, and 12 samples recorded zero bacteria.

Figure 10: Fecal coliform bacteria counts above 20CFU/100 mL standard – Lake Tahoe Region.



## Nutrients

Sixty-one water samples collected at Snapshot Day 2023 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.

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 a byproduct of septic systems – it is a naturally occurring chemical left after decomposing human (and other animals) waste.

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

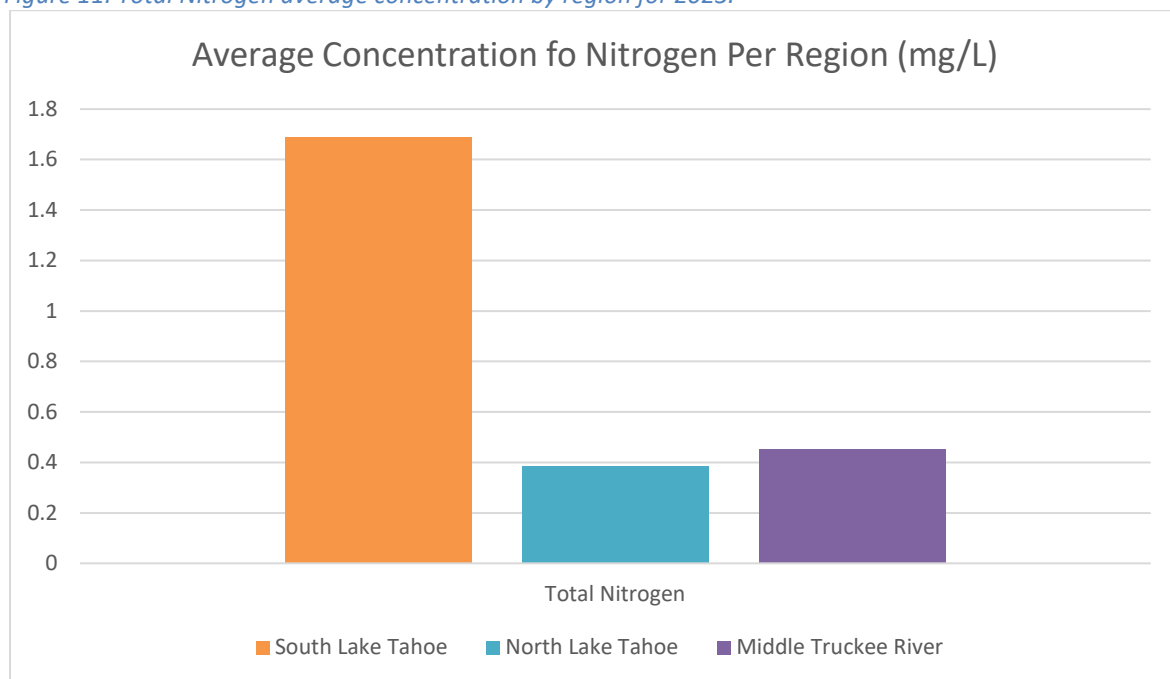
In 2023, the types of nutrients analyzed varied substantially amongst the participating entities. The variability of data collection makes an accurate comparison difficult throughout the watershed. The following information summarizes where the highest concentrations of nutrients were analyzed per region. Additionally, graphic representations of the average concentration of Total Phosphorus and Total Nitrogen are provided.

### **Nitrogen**

#### **Total Nitrogen (T.N.)**

Total Nitrogen was analyzed throughout all three regions for Snapshot Day 2023, with 67 results. The Lahontan region has a total nitrogen standard of annual mean concentration of 0.087 mg/L, but the maximum allowable monthly mean is no more than 0.21 mg/L. South Lake Tahoe had a maximum detection of 1.69 mg/L at the Burke Creek downstream of Highway 50 site. North Lake Tahoe had a maximum detection of 0.385 mg/L of Total Nitrogen at the Incline Creek site. The Middle Truckee River region had a maximum detection of Total Nitrogen at the Union Valley Creek site with a result of 0.454 mg/L.

*Figure 11: Total Nitrogen average concentration by region for 2023.*



**Ammonia (NH3)**

The highest ammonia (NH3) level was detected for 2023 at the Bear Creek site in the Middle Truckee River region, measuring 0.01 mg/L. All Lake Tahoe sites were not analyzed for ammonia.

**Nitrite (NO2)**

The highest nitrite (NO2) level was detected for 2023 at the Union Valley Creek site in the Middle Truckee River region, measuring 0.066 mg/L. All Lake Tahoe sites were analyzed at the laboratory minimum detection rate of < 0.020 mg/L.

**Nitrate (NO3)**

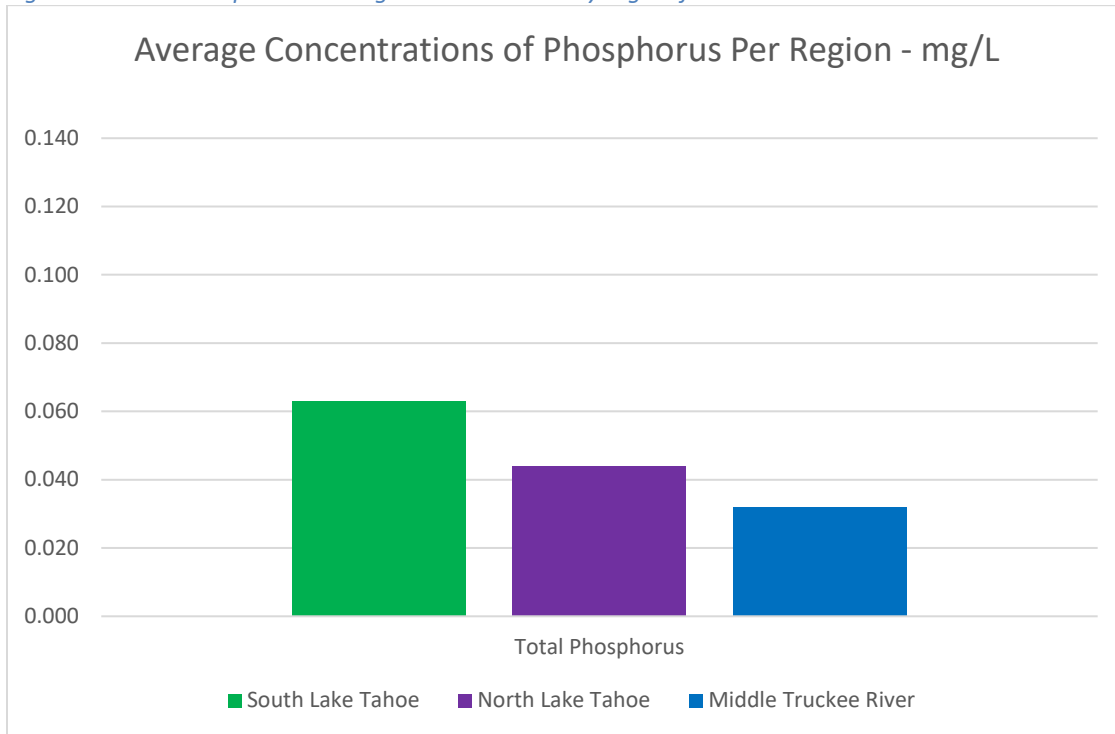
The maximum Nitrate (NO3) detection was 0.265 mg/L taken at the Bijou Park Drainage sample site in South Lake Tahoe. The maximum nitrate result in North Lake Tahoe was 0.089 mg/L taken at the Tahoe City Urban Ditch site. The Middle Truckee Region did not analyze samples for nitrate. For the 2023 sampling event, 46 samples were analyzed for nitrate throughout the watershed, with 28 results at the laboratory minimum detection rate of <0.020 mg/L.

**Phosphorus**

**Total Phosphorus (T.P.)**

For the 2023 Snapshot Day event, all three regions analyzed samples for Total Phosphorus. South Lake Tahoe had a maximum Total Phosphorus result of 0.324 mg/L from the Burke Creek downstream of Highway 50 site. The maximum Total Phosphorus result for North Lake Tahoe of 0.106 mg/L was taken from Incline Creek. Union Valley Creek had the highest total phosphorus result for the Middle Truckee River region, 0.055 mg/L.

Figure 12: Total Phosphorus average concentrations by region for 2023.



## 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 the identification of potential causes of degraded water quality (i.e., the presence of urban development)

Visual observations were recorded at 63 sites from Snapshot Day 2023. Visual observations included cloud cover, precipitation, wind, water clarity, in-stream flow, sample color, sample odor, and other items observed in the samples.

*Table 4: Number of monitored sites with In-Stream Flow*

### **In-Stream Flow**

<b>dry creekbed</b>	<b>isolated pools</b>	<b>trickle</b>	<b>slow/ smooth</b>	<b>moderate rippling</b>	<b>rapid/ turbulent</b>	<b>flooding</b>
0	0	0	5	19	34	10

*Table 5: Number of monitored sites for each sample color classification*

### **Sample Color**

<b>None</b>	<b>amber</b>	<b>yellow</b>	<b>green</b>	<b>brown</b>	<b>gray</b>	<b>other</b>
52	6	2	0	1	0	0

*Table 6: Number of monitored sites for each sample odor classification*

### **Sample odor**

<b>None</b>	<b>Fresh algae</b>	<b>Chlorine</b>	<b>Rotten eggs</b>	<b>Sewage</b>	<b>Other</b>
59	0	0	0	0	2

*Table 7: Number of monitored sites with the presence of the objects noted.*

### **Other presence**

<b>Algae or other water plants</b>	<b>Oily Sheen</b>	<b>Foam or suds</b>	<b>Litter or trash</b>	<b>Other</b>
15	1	12	6	4



## Discussion

Compared to many other watersheds in the nation, data collected within the Truckee River watershed indicates good overall water quality. Mountain streams and snowmelt conditions feed the Truckee River watershed, which contains heavily forested headwaters as well as urban concentrations (Reno/Sparks) located in the lower portion of the watershed. Concentrated urban development and high amounts of impervious surface areas exist within all watershed regions (upper, middle & lower). These land-use conditions can have a significant impact on water quality. They should continue to be monitored to assess the watershed's condition and ensure local water bodies meet regional and state standards.

The data collected for Snapshot Day 2023 show that 12% of sites monitored have water quality objectives meeting regulatory requirements for Conductivity, Dissolved Oxygen, Fecal Coliform, pH, and turbidity. The spring runoff from the large winter greatly influenced turbidity values throughout the watershed, with 48 sites reporting turbidity values greater than 3 NTU, equaling 64% of the sites analyzed compared to 12% in 2022. The 2023 data set shows a decrease in the number of sample sites with elevated pH levels, with only 9% of sites sampled recording pH values above 8.4 compared to 12% in 2022. Dissolved oxygen depletion is similar, with 34% of samples below 8 mg/L compared to 30% in 2022. Dissolved oxygen levels below 8 mg/L are of concern for fish and other aquatic organisms.

All three regions held creeks that met the water quality standards for all analyzed parameters. In South Lake Tahoe, Trout Creek had two locations. North Lake Tahoe had three unique creeks: Tunnel Creek, Carnelian Bay Creek, and Quail Creek. The Middle Truckee River region had two locations on Trout Creek.

As previous data sets from the past 22 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, 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, contact the following agencies and organizations:

- *North Lake Tahoe:* Sarah Vidra (775) 832-1284; Incline Village GID Waste Not
- *South Lake Tahoe:* Kelci Brown, (530) 541-5388, League to Save Lake Tahoe
- *Middle Truckee River (Tahoe City to Nevada State Line):* Michele Prestowitz, (530) 550-8760, x4; Truckee River Watershed Council

## 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](http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml)

EPA's Draft Volunteer Stream Monitoring: A Methods Manual, U.S. Environmental Protection Agency

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Standard Methods for Water and Wastewater Collection, 21<sup>st</sup> 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](http://www.nrcs.us.gov)

# Appendices

## Appendix A – Resource Partners

### 2023 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

- Eben Swain (Truckee River Watershed Council)
- Kelci Brown (League to Save Lake Tahoe)
- Sarah Vidra (Incline Village General Improvement District)

### Organizations hosting Snapshot Day 2023

- 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

Snapshot Day site and site code are listed below.

South Lake Tahoe	
Angora Creek at View Circle	SLT-ANG1-01
Angora Creek upstream of Lake Tahoe Boulevard	SLT-ANG1-02
Bijou Creek at Mouth	SLT-BJCR-00
Bijou Creek downstream of Fairway Dr	SLT-BJCR-01
Bijou Creek upstream of Pioneer	SLT-BJCR-02
Bijou Park Drainage at Mouth	SLT-BPDR-00
Bijou Park Drainage upstream of Verdon Lane	SLT-BPDR-03
Burke Creek at Mouth	SLT-BURK-00
Burke Creek downstream of Highway 50	SLT-BURK-02
Cascade Creek at Mouth	SLT-CASC-00
Cascade Creek above Highway 89	SLT-CASC-01
Cold Creek above Pioneer Trail	SLT-COLD-02
Edgewood Creek at Mouth	SLT-EDGE-00
Fallen Leaf Lake near Dam	SLT-FLLF-01
Glen Alpine Creek at Fallen Leaf Lake	SLT-GLEN-00
Heavenly Valley Creek at Trout Creek Confluence	SLT-HEAV-00
Heavenly Valley Creek upstream of Pioneer Trail	SLT-HEAV-01
Tahoe Keys East Channel	SLT-KEYM-00
Tahoe Keys West Channel	SLT-KEYS-00
McFaul Creek at Mouth	SLT-MCFA-00
McFaul Creek downstream of Highway 50	SLT-MCFA-01
Meeks Creek at Mouth	SLT-MEEK-00
Meeks Creek upstream of Highway 89	SLT-MEEK-01
North Zephyr Creek at Mouth	SLT-NZHR-00
Tallac Creek at Mouth	SLT-TALL-00
Taylor Creek at Mouth	SLT-TALR-00
Upper Truckee River upstream of Lake Tahoe Boulevard	SLT-TR10-01
Upper Truckee River at Airport	SLT-TR15-02
Upper Truckee River downstream of Elks Club Drive	SLT-TR20-01
Upper Truckee River at Mouth	SLT-TRMO-00
Trout Creek at Mouth	SLT-TROU-00
Trout Creek at Grinding Stone	SLT-TROU-02
Upper Truckee River at Christmas Valley	SLT-XMAS-01
Lake Tahoe at Regan Beach	TAH-SLAKE-04
Lake Tahoe at Nevada Beach	TAH-SLAKE-05

Lake Tahoe at Roundhill Pines	TAH-SLAKE-07
North Lake Tahoe	
Barton Creek above Star Harbor	NLT-BART-01
Brockway Creek at mouth	NLT-BROC-00
Carnelian Bay Creek at highway	NLT-CBCR-01
Carnelian Canyon at highway	NLT-CRCN-03
General Creek at mouth	NLT-GNRL
Griff Creek at mouth	NLT-GRIF-00
Incline Creek at mouth	NLT-INCL-00
Lakeforest Creek at mouth	NLT-LKFC-00
Madden Creek at highway	NLT-MADC-01
Quail Creek at mouth	NLT-QULC-00
Rosewood Creek above confluence w/Third Creek	NLT-RSWD-01
Secret Creek at mouth	NLT-SCRT-00
Snow Creek at mouth	NLT-SNOW-00
Tahoe City Urban Ditch between Safeway & Jakes	NLT-TCUD-00
Third Creek above Lakeshore Dr.	NLT-THRD-01
Tunnel Creek at mouth	NLT-TUNN-00
Ward Creek above Highway	NLT-WARD-01
Watson Creek at mouth	NLT-WATS-01
Middle Truckee River	
Alder Creek	MTR-ALDR
Bear Creek - west of confluence w Truckee	MTR-BEAR-00
LTR below Boca dam	MTR-BOCA-00
LTR @ Boyington	MTR-BOCA-01
Coldstream Canyon	MTR-COLD-00
Donner @ confluence	MTR-DONN-00
Donner Creek @ 89	MTR-DONN-01
Downstream of dam	MTR-DONN-03
East Martis @ Bridge	MTR-EMAR
Union Valley Creek	MTR-GLEN-00
Upstream of Glenshire Pond	MTR-GLEN-02
I80 @ Floriston	MTR-I-80C
Martis Creek at Mouth	MTR-MART-00
ACOE boundary @ Lahontan	MTR-MART-01
Prosser Creek below dam	MTR-PROS-01
Prosser below 89	MTR-PROS-02



Truckee River in Town	MTR-TOWN
Mainstem below Tahoe dam	MTR-TR01
Trout Creek @ Mouth	MTR-TROU-00
Tahoe Donner Clubhouse	MTR-TROU-02
Washesu - west of confluence w/ Truckee	MTR-WASH-00

## 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  $\mu$ S/cm resolution or Oakton Conductivity Low+ meters 1  $\mu$ S/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 the Truckee River Watershed Council, the League to Save Lake Tahoe, and the Tahoe Water Suppliers Association.

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 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.