16th Annual Snapshot Day Report

A Lake Tahoe Basin and Truckee Watershed Citizen Monitoring Event

(May 13 & 14, 2016)

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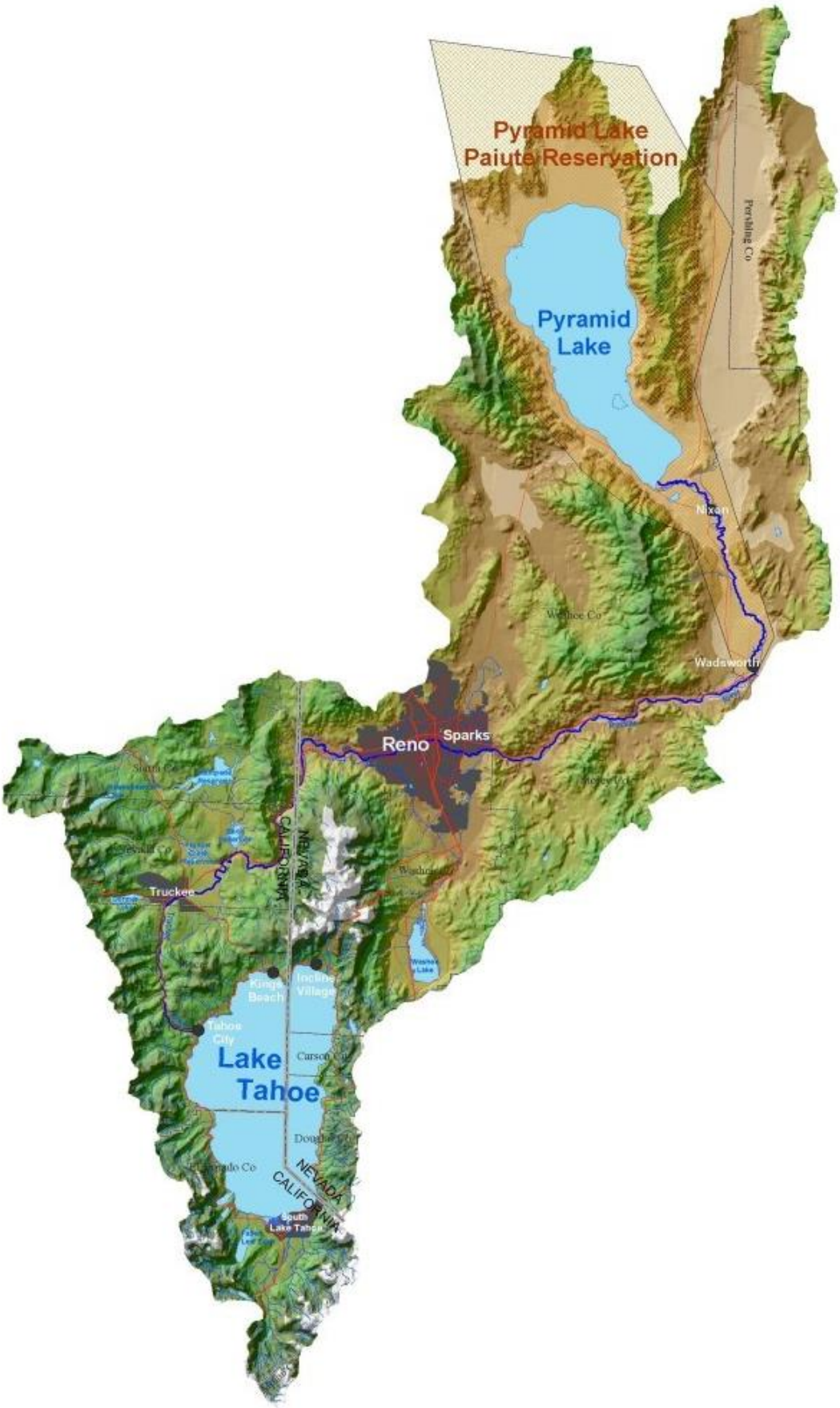
Table of Contents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Lake
Pershing Co
Nixon
Wadsworth
Reno
Sparks
Truckee
CALIFORNIA
NEVADA
Incline
Village
Kings
Beach
Tahoe
City
Lake
Tahoe
South
Lake Tahoe

Introduction

What is Snapshot Day?

Snapshot Day is a one-day, volunteer-based event designed to collect data on watershed health at a single point in time. Volunteers trained as team leaders lead volunteer teams to various pre-determined sites to collect water quality data. The 16th Annual Snapshot Day was held on May 13 and 14, 2016, at sites along the Truckee River Watershed from Reno to South Lake Tahoe. Snapshot Day is sustained by support from dedicated staff, funding from a few grants and donations, and by the commitment of hundreds of community members 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 adequately assess the status of all aquatic resources in the Truckee River Hydrologic Unit, which includes the Lake Tahoe Basin and the Truckee River Watershed. 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 (such as chemical spills, filling of wetlands, diversions, illicit discharges, destruction of stream environment zones, 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 Tahoe Regional Planning Agency for the Tahoe Basin and by State regulators within California and Nevada;
- Provide water quality data that may be used in status and trend analyses; and
- Provide some pre- and post-event data for evaluating the effectiveness of restoration activities.

Snapshot Day 2016

2016 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. 2016 Snapshot Day's data analyses demonstrate good water quality overall for the Tahoe-Truckee watershed, with very few water quality issues indicated. Water quality parameters such as fecal coliform and conductivity were somewhat elevated from previous years, but most samples collected met the standards set for the region.

In 2016, Snapshot Day celebrated its 16th 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 provide information on long-term trends and better assist agencies in watershed conditions analysis.

Volunteers and Locations

Snapshot Day 2016 was a collaborative effort between the North Shore Lake Tahoe, South Shore Lake Tahoe, Middle Truckee River near the town of Truckee and Lower Truckee River by Pyramid Lake.

Table 1: Volunteer and monitoring site location totals.

	Volunteers	Locations
North Shore Lake Tahoe	19	16
South Shore Lake Tahoe	119	32
Middle Truckee River	32	19
Lower Truckee River	220	14
Totals for 2016	**390**	**81**

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

Snapshot Day is a bi-state event and as such falls under two statewide citizen monitoring programs: the California State Regional Water Quality Control Board's (SWQCB) *Clean Water Team*, (http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml) and the Nevada Division of Environmental Protection, Bureau of Water Quality Planning, under *Project WET* outreach efforts (http://ndep.nv.gov/bwqp/wet01.htm). Through this bi-state collaborative, Snapshot Day is able to achieve a larger watershed approach to successful data collection.

In 2016, volunteers gathered data at a total of 81 locations throughout the Truckee River watershed from south of Lake Tahoe to its terminus at Pyramid Lake. A list of site names and codes can be found in **Appendix B**.

Lake Tahoe tributaries, South Shore

- Angora Creek
- Burke Creek
- Cascade Creek
- Eagle Falls Creek
- Edgewood Creek
- Fallen Leaf Lake
- Glen Alpine 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

- Barton Creek
- Burton Creek
- Carnelian Bay Creek
- First Creek

- General Creek
- Griff Creek
- Hatchery Creek
- Homewood Creek
- Lake Forest Creek
- Madden Creek
- Quail Lake Creek
- Secret Harbor Creek
- Snow Creek
- Tahoe City Urban Ditch
- Wood Creek

Truckee River tributaries, Middle Truckee River

- Alder Creek
- Bear Creek
- Cold Stream
- Donner Creek
- East Martis Creek
- Glenshire Creek
- Little Truckee River
- Martis Creek
- Prosser Creek
- Squaw Creek
- Trout Creek
- Union Valley Creek

Truckee River tributaries, Lower Truckee River

- Alum Creek
- Dry Creek
- Galena Creek
- North Truckee Drain
- Pyramid Lake
- Steamboat Creek
- Hunter Creek
- Thomas Creek
- White's Creek

Methods of Data Collection

All observations, photos, field measurements and samples were taken on May 13 and 14, 2016, between 9 am and noon; this maintains the 'Snapshot' aspect of the project. Citizen monitoring team leaders are provided training prior to Snapshot Day each year. Team leader trainings cover protocols for visual observations, photo documentation, water quality field measurements and collecting water samples to be sent to a laboratory for analysis. Each volunteer team leader is required to attend at least one session prior to the field day. Training for the team leaders is usually taught by the coordinator for that region, with assistance as needed from the cooperating resource and regulatory agencies.

It is important to remember that the measurements made on Snapshot Day were designed to represent a single point in time and do not necessarily represent average conditions. Monitoring results are compiled in **Appendix B**, which includes both the field measurements collected by volunteers and nutrient and bacteria analyses conducted by designated laboratories.

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

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 established "do not exceed" standards for nutrients and turbidity. Nevada, California and the Tahoe Regional Planning Agency have specific water quality standards, with indicators generally more stringent in certain watersheds and creeks, such as the Tahoe Basin, than elsewhere in the Truckee River Watershed. **Table 2** lists some of these standards for the Tahoe Basin. The selected standards shown in **Table 3** are from the Nevada Division of Environmental Protection for the Lower Truckee River Watershed.

Table 2: Examples of Lake Tahoe water quality standards

Parameter	Standard
Temperature	Shall not exceed 15°C, surface waters of Fallen Leaf Lake (CA)
pH	7.0 - 8.4 in Lake Tahoe (CA and NV)
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 (Tahoe Regional Planning Agency)
Secchi Depth	December-March average of not less than 33.4 meters for Lake Tahoe (TRPA), and a mean of 18.5 meters for Fallen Leaf Lake (Lahontan Region, CA)
Algae	Lahontan Regional Water Quality Control Board. waters shall not contain biostimulatory substances (nutrients) that cause algae to become a nuisance or to affect the water's beneficial uses (CA)
Total Nitrogen	Mean annual concentration in May is 0.087 mg/L but the maximum allowable is a mean of no more than 0.21 mg/L (Lahontan Region, CA)
Soluble inorganic Nitrogen	Mean of no more than 0.06 mg/L for most tributaries to Lake Tahoe, Nevada side of Lake Tahoe (NDEP)
Total Phosphorous	Annual average of no more than 0.05 mg/L for most tributaries, Nevada side of Lake Tahoe and no more than 0.008 mg/L for most tributaries, California side of Lake Tahoe; maximum allowable for California side is 0.018 mg/L (Lahontan Region, CA)
Soluble Reactive Phosphorous	Annual average of no more than 0.007 mg/L (combination of organic and inorganic) for Lake Tahoe, Nevada side (NDEP) and 0.009 mg/L for Lake Tahoe, California side (Lahontan Region, CA)

Fecal Coliform	Log mean of 20 CFU (30-day period) and maximum of 40 CFU (Lahontan Region, CA).

Table 3: Examples of Nevada state water quality standards for the Truckee River

Parameter	**Truckee River at Idlewild (LTR-IDL)**	**Truckee River at Wadsworth (LTR-WADS)**
Temperature	≤13ºC (month dependent)	≤14ºC (month dependent)
Dissolved Oxygen	≥5 mg/L (April-October) ≥ 6 mg/L (November-June)	≥5 mg/L (April-October) ≥ 6 mg/L (November-June)
pH	6.5-9.0	6.5-9.0
Chlorides	≤250 mg/L	≤250 mg/L
Total Phosphates	Annual average ≤ 0.10 mg/L	Annual average ≤ 0.05 mg/L
Ortho-phosphate	≤0.05 mg/L	N/A
Nitrate	≤2.0 mg/L	≤2.0 mg/L
Nitrite	≤0.04 mg/L	≤0.04 mg/L
Total Nitrogen	N/A	≤1.2 mg/L
Turbidity	≤10 NTU	≤10 NTU
Fecal coliform	≤1000 No./100ml	≤1000 No./100ml
E. coli	≤410 No./100ml single value or ≤126 No./100ml annual geometric mean	≤410 No./100ml single value or ≤126 No./100ml annual geometric mean

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

NDEP's Water Quality Standards Branch has created new web pages that educators and students may find useful. The Sortable Waterbody Standards Index page will help students easily locate a specific water body or stream section and identify its designated beneficial use. On the web page notice the new dropdown menu for NAC 445A Standards. Viewers click on the Sortable Waterbody Standards Index and can sort a column by clicking on the column header to easily search – for example, a particular water name or County.

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 provide better habitat for aquatic life in mountain streams and lakes since colder water contains more dissolved oxygen, essential 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 (e.g., trout) 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 percent of the population survives 60 days) for the species is 14.3°C.

In 2016, 80 sites were sampled for water temperature. The lowest recorded temperature from Snapshot Day 2016 was 4.6°C in the Middle Truckee River watershed at the Squaw Creek sampling location. The highest recorded temperature was 18.4°C in the Lower Truckee River Watershed at Pyramid Lake. **Figure 1** below represents the lowest and highest temperatures for each of the four regions sampled during the 2016 event. During the 2016 Snapshot Day, there were eight sample sites with temperatures above 15.6°C, the maximum optimal temperature for rainbow trout. 60 sample sites had temperatures below the minimum optimal temperature range for rainbow trout, 12.8°C.

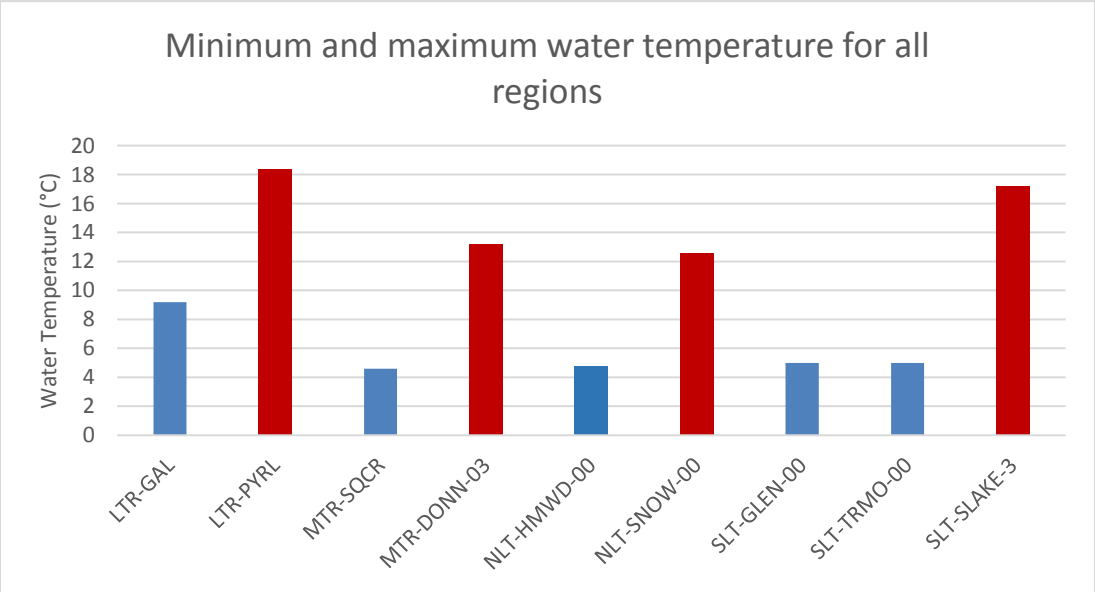
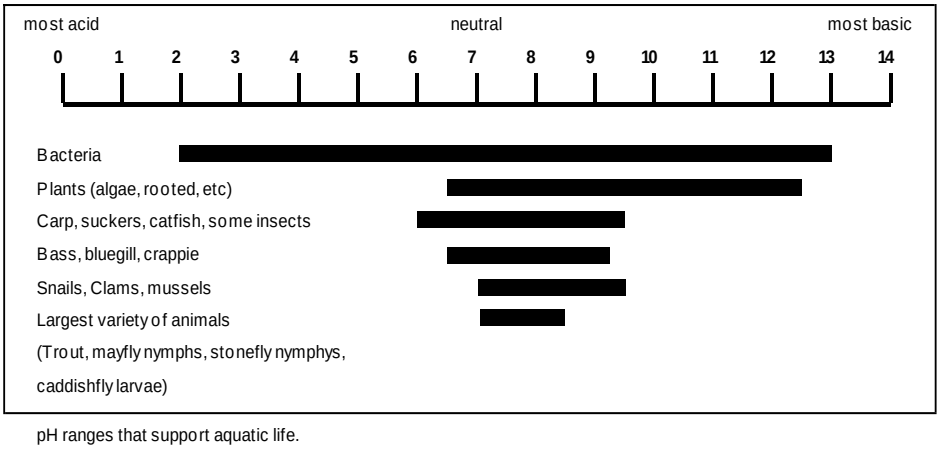


Figure 1: The high and low results recorded for water temperature.

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 prefer a pH close to 7. **Figure 2** displays the pH ranges that support aquatic life.



pH ranges that support aquatic life.

Figure 2: pH range that supports aquatic life.

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

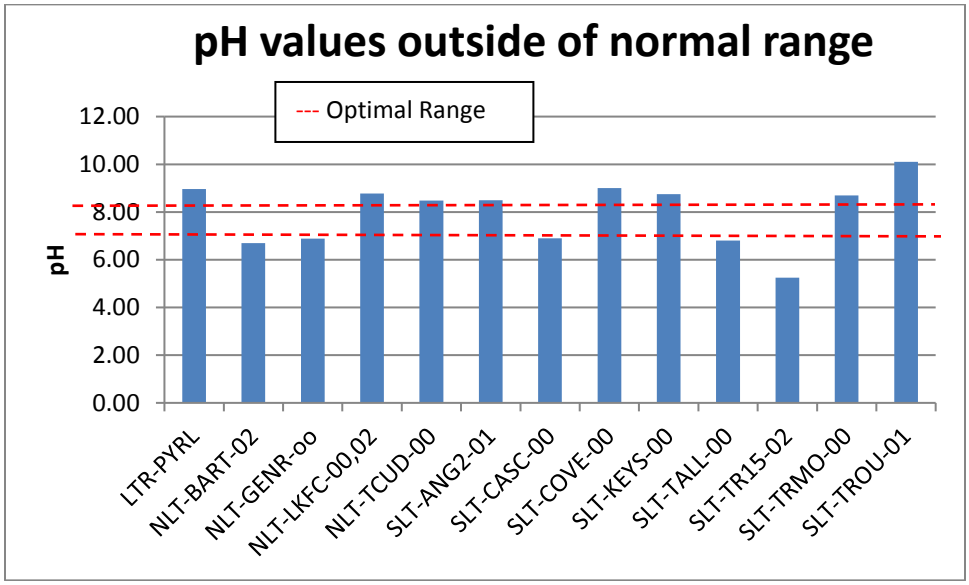


Figure 3: pH results outside optimal range for aquatic life.

The lowest and highest pH levels measured at Snapshot Day 2016 were both recorded in South Lake Tahoe. The lowest pH recorded was 5.25 found in the Upper Truckee River at the airport. The highest pH recorded was 10.1 at the Trout Creek confluence with Upper Truckee River. Of the 79 sites that

took pH readings, 13 sites had a pH below the optimal range and 9 sample sites had a pH value above the optimal range.

Dissolved Oxygen (DO)

Dissolved oxygen is a measure of the amount of gaseous oxygen (O2) dissolved in water. Dissolved oxygen is necessary to support aquatic life. Stress occurs in aquatic life, especially fish, when dissolved oxygen levels drop too low.

Low dissolved oxygen concentrations are typically the result of:

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

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

The lowest dissolved oxygen measured at Snapshot Day 2016 was 1.2 mg/L at Bear Creek along the Middle Truckee River. The highest recorded dissolved oxygen was 11.0 mg/L at Pyramid Lake. Dissolved oxygen was measured at 79 sites. 27 of the 33 Truckee River sites had a reading above 6.0 mg/L and three sites were below 5 mg/L. The only sample taken in Nevada below the 5 mg/L standard was at Steamboat Creek. 22 of the 48 sites in the Lake Tahoe Basin tested below the 8.0 mg/L standard and only two sites tested below 5 mg/L.

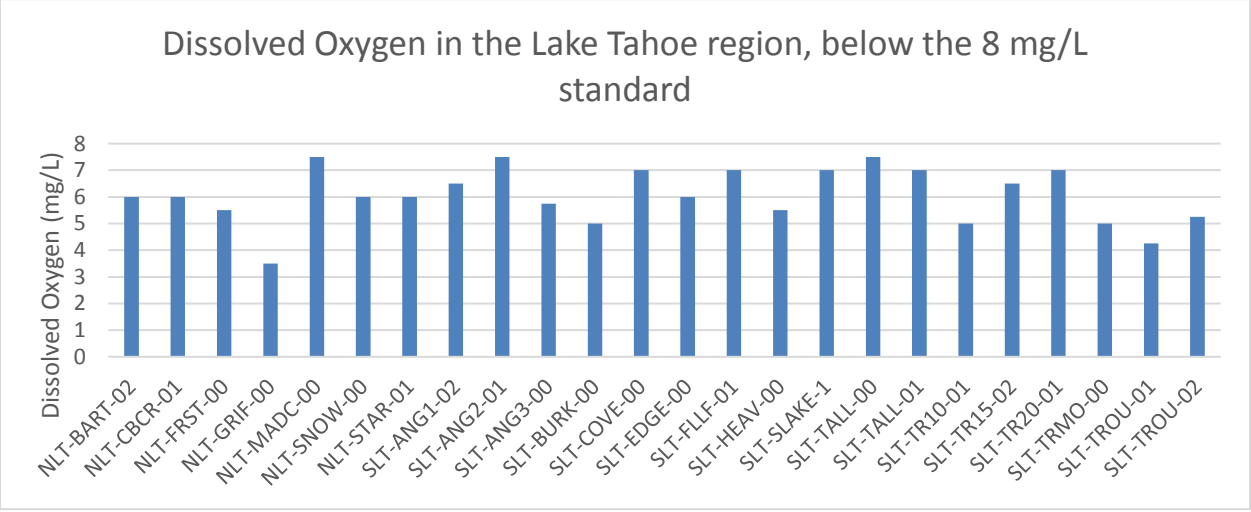


Figure 4: Dissolved oxygen concentrations from the Lake Tahoe Region that were below the 8 mg/L standard.

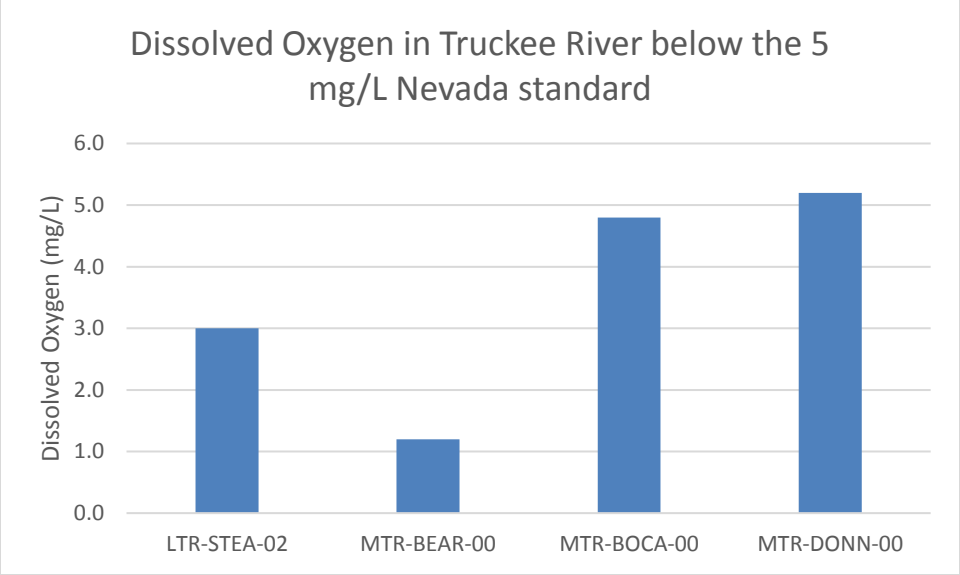


Figure 5: Dissolved oxygen concentrations from the Truckee River that were below the Nevada standard of 5 mg/L.

Turbidity

Turbidity is a measure of cloudiness or clarity of the water. Turbidity is measured in Nephelometric Turbidity Units (NTU); 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. 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. (Note, this standard differs significantly from the mid-lake average clarity for Lake Tahoe, 0.06 NTU.) The nearshore standard is rarely exceeded in Lake Tahoe. The standard for the Truckee River and many nearby streams in the State of Nevada is 10 NTU.

Most turbidity samples from Snapshot Day 2016 were indicative of good water quality. For the Truckee River, 33 samples were analyzed for turbidity and 11 sites had a reading above 10 NTU. The Lake Tahoe watershed was sampled at 44 locations; of these, 16 locations had results above the nearshore turbidity standard. The highest turbidity reading of the 2016 Snapshot Day event was 77.1 NTU from Timber Cove. In addition to high turbidity, this site also measured high for total dissolved solids. This could be due to how breezy it was on this day or other factors that could have disturbed the sediment.

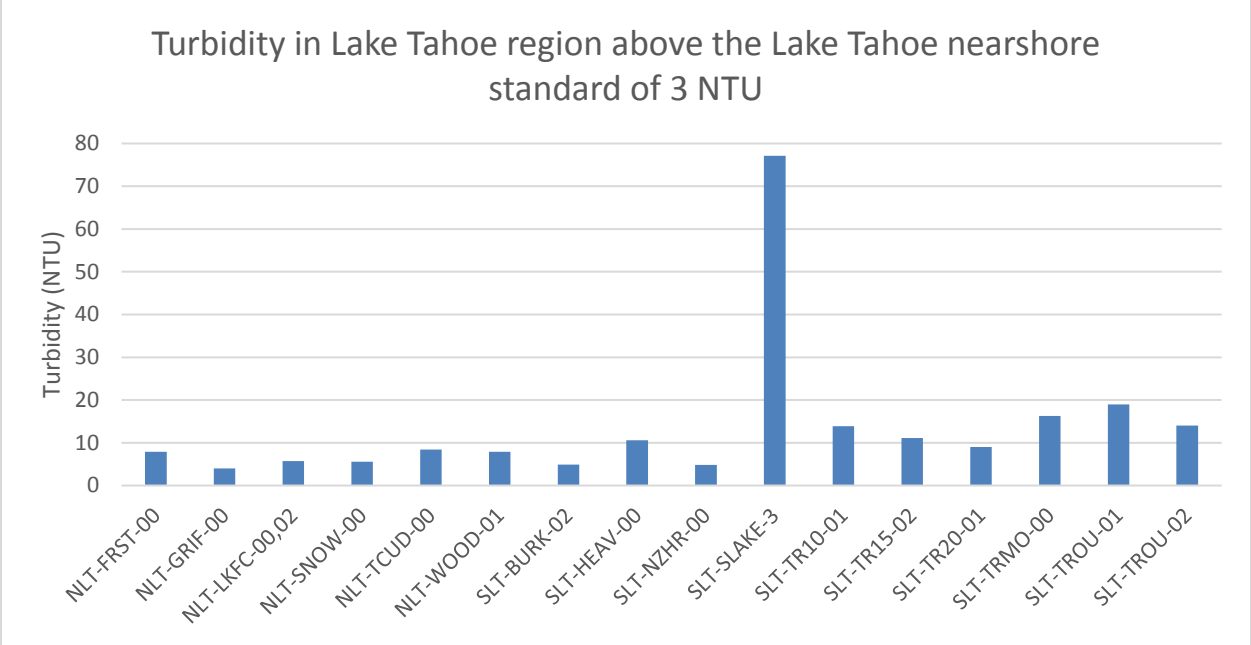


Figure 6: Turbidity readings from Lake Tahoe sites that did not meet the Lake Tahoe nearshore 1-3 NTU standard.

Stream Flow

Stream flow is the measure of the volume of water that is flowing, which varies with precipitation. Due to a winter with average snowpack, flows on all rivers and streams in Nevada and Eastern California were expected to be normal for spring 2016.

One of the major goals of Snapshot Day is to gain information on the vast numbers of streams and creeks that are not routinely measured for water quality or stream flow. 13 out of 64 streams in the Tahoe Basin are regularly measured. The Middle and Lower Truckee have even fewer streams that are monitored regularly. Volunteers provided observational data for stream flow at 66 sample sites.

Table 4: Number of monitored sites given the designated stream flow classification.

Dry creek bed	Isolated pools	Trickle	Slow to smooth	Moderate to rippling	Rapid to turbulent	Flooding
0	0	0	12	35	19	0

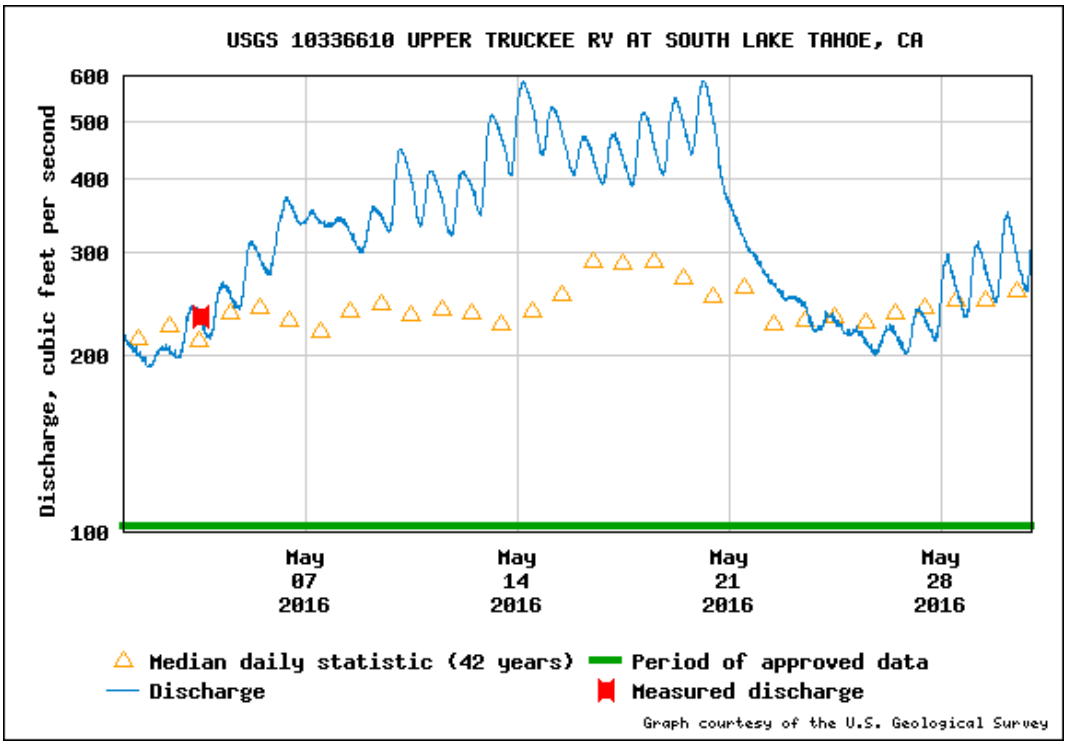


Figure 7: Stream flow data from the Upper Truckee River at South Lake Tahoe, California, during the month of May.

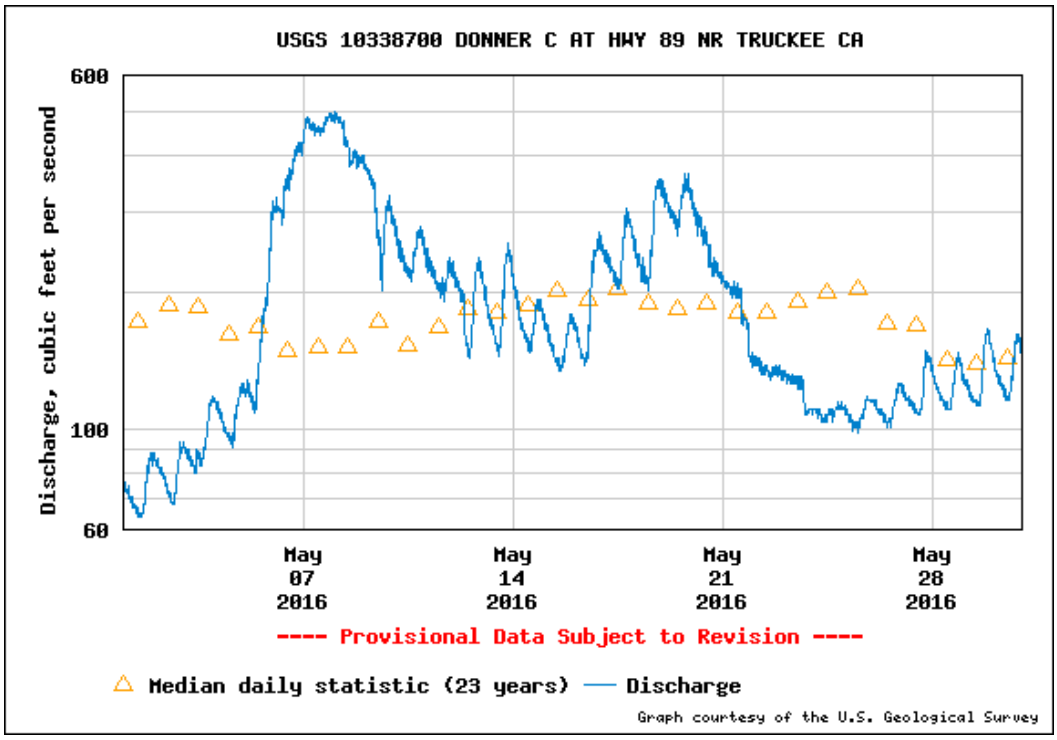


Figure 8: Stream flow data from Donner Creek at Highway 89 near Truckee, California, for the month of May.

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. 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 Tahoe Truckee 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 5** displays acceptable conductivity ranges for several water types. Conductivity was measured at 73 sample sites for Snapshot Day 2016. The lowest conductivity recorded was 0.014 µS/cm, measured at Tallac Creek above Highway 89. The highest conductivity recorded was 7,085 µS/cm at Pyramid Lake.

Table 5: 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

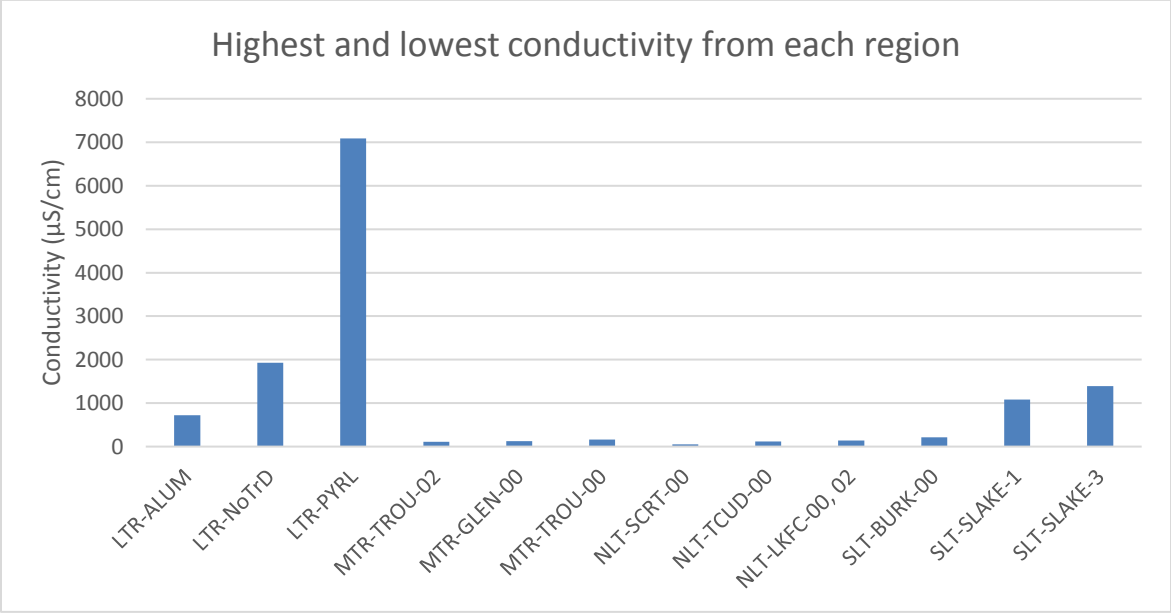


Figure 9: 12 highest and lowest conductivity values from Snapshot Day 2016 by region.

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.

Fecal coliform was measured at 39 locations at Snapshot Day 2016. Five of these samples had readings greater than 20 CFU/100ml. 37 samples had zero bacteria recorded or came in below the detection limit. Two sample locations from the Lower Truckee region had fecal coliform readings of greater than 350 CFU/100ml: North Truckee drain and Steamboat Creek at Rhodes Road.

Additionally, 45 locations were measured for *E. coli* bacteria. 10 of these locations had readings greater than 20 CFU/100ml. The highest *E. coli* reading was 327 CFU/100ml, taken at Steamboat Creek.

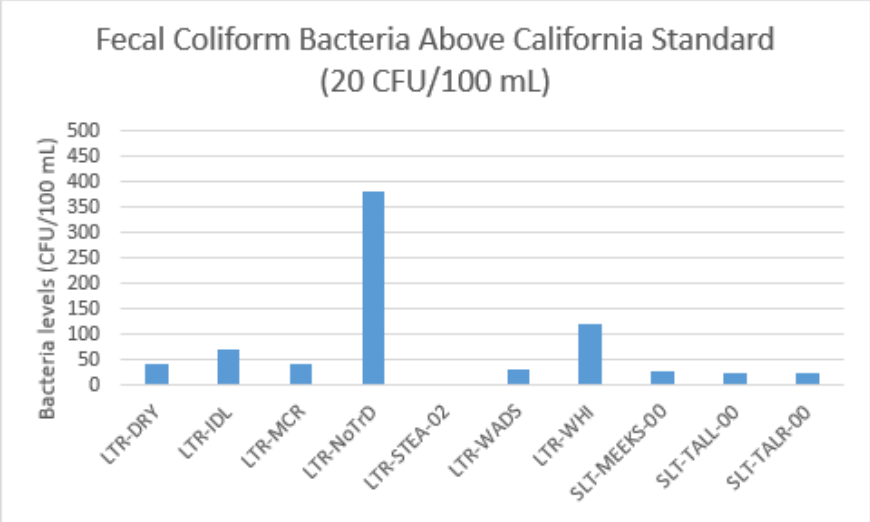


Figure 10: Fecal coliform bacteria counts above California standard

Nutrients

Sixty-five water samples collected at Snapshot Day 2016 were analyzed for nitrogen and phosphorus, which are of most concern for algal growth and water clarity. Along with excess algae growth, nutrient concentrations that are too high can lead to odors, discolored waters, loss of clarity and nighttime oxygen depletion.

The highest levels of total nitrogen were detected at the Lower Truckee River, North Truckee Drain and Timber Cove in South Lake Tahoe measuring 1.8 and 1.234 mg/L, respectively. The highest levels of total phosphorous were detected at Pyramid Lake and Timber Cove in South Lake Tahoe measuring 0.78 and 0.206 mg/L, respectively.

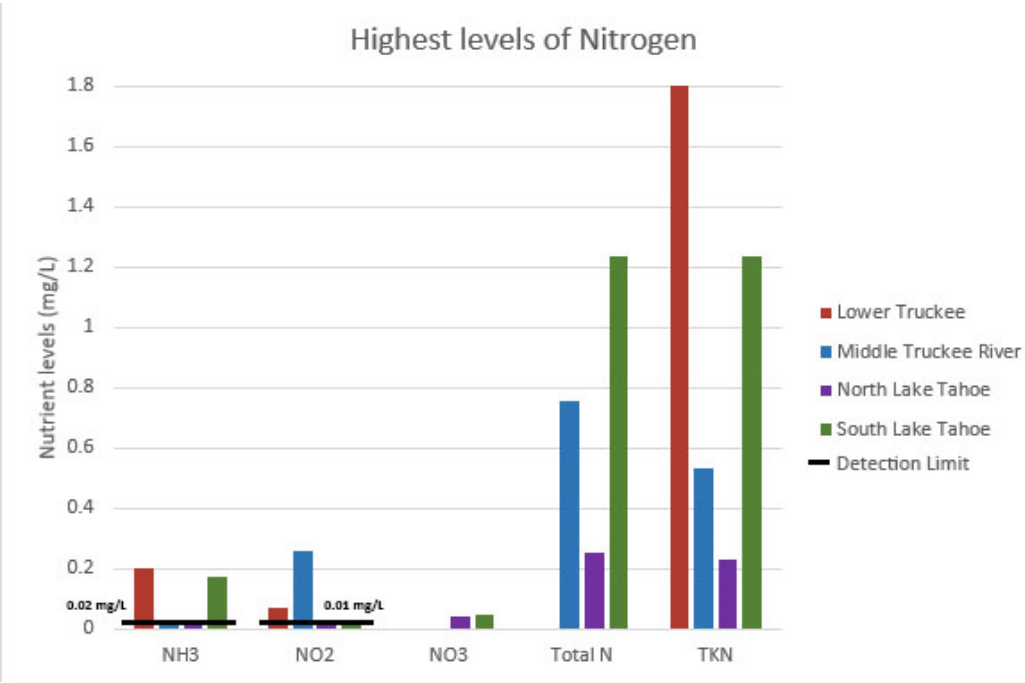


Figure 11: Highest levels of nitrogen recorded in each region.

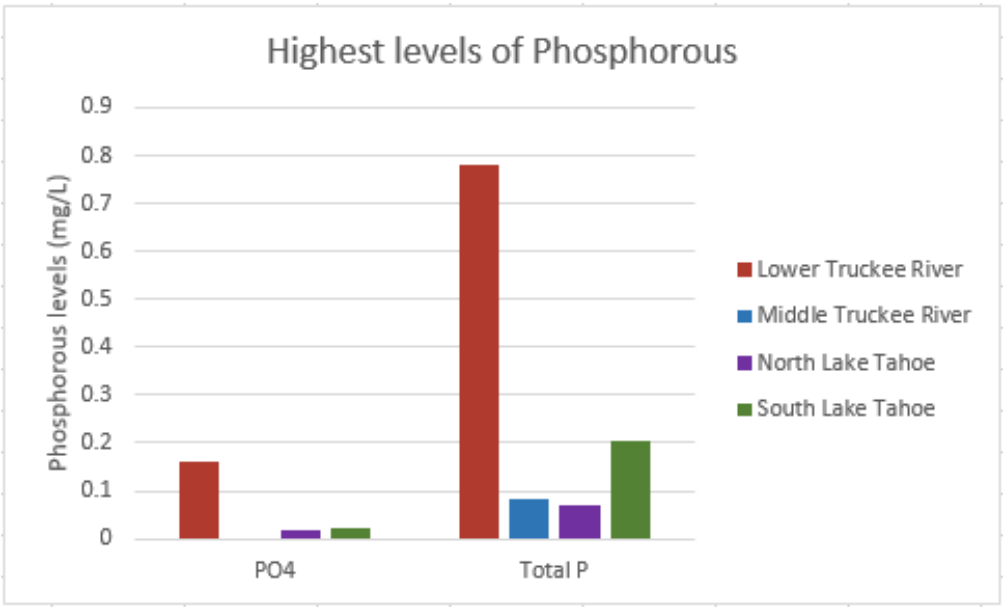


Figure 12: Highest levels of phosphorous recorded in each region.

Observations

Observations were recorded at 66 of the 82 sample sites from Snapshot Day 2016. Observations included cloud cover, precipitation, wind, water clarity, in-stream flow, sample color, sample odor and other items observed in the samples.

Table 6: Number of monitored sites reporting on odor.

None	Fresh algae	Chlorine	Rotten eggs	Sewage	Other
59	0	0	0	0	3

Table 7: Number of monitored sites reporting on other objects present.

Algae or other water plants	Oily Sheen	Foam or suds	Litter or trash	Other
28	0	7	3	10

Discussion

The data collected for Snapshot Day 2016 is indicative of good overall water quality with very few outlying constituents. As discussed in previous sections, most of the samples collected met the standards for the region. Parameters of concern in 2016 were fecal coliform bacteria and conductivity when compared to levels found the previous year. While fecal coliform bacteria were elevated in both years, it showed an overall reduction at most sites from 2015 to 2016. The site that had the most fecal coliform bacteria this year did not have a concerning amount of fecal coliform bacteria last year, and will be investigated further.

It is important to note that areas with concerning levels of the parameters that are tested for will often be around developed communities. For example, the highest turbidity levels will often be near roads and highways where there can be stormwater pollution that contributes fine sediment loads. High levels of nutrients can come from areas where fertilizer is being used for gardening or areas commonly used for dog walking. Dog feces, lawns that attract geese, and horse stables that do not properly dispose of waste can contribute to elevated levels of fecal coliform.

As previous data sets from the past 16 years are compiled and data storage is improved, this program can show long-term trends and better assist government agencies. The events have been funded primarily through local and state agencies and private organizations. The extensive event coordination is partner-driven and participation on 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.

Snapshot Day is a great way for community members and visitors to get involved in conservation efforts within the Tahoe-Truckee Watershed. Immediate actions that can be taken are picking up pet waste, choosing low-impact transportation and adopting native landscaping. 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:* Savannah Rudroff (530) 541-5388; League to Save Lake Tahoe
- *Middle Truckee River (Tahoe City to Nevada State Line)*: Eben Swain, (530) 550-8760, x7; Truckee River Watershed Council
- *Lower Truckee River (Nevada Stateline to Pyramid Lake)*: Mary Kay Wagner, (775) 687-9454; Nevada Division of Environmental Protection

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Appendices

Appendix A – Resource Partners

2016 Snapshot Day sponsors

- California State Water Resources Control Board
- Incline Village General Improvement District, Public Works
- Lahontan Regional Water Quality Control Board
- Lake Tahoe Community College
- League to Save Lake Tahoe
- Martis Fund
- 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
- U.S. Geological Survey

Citizen Monitoring Working Group Snapshot Day Planning Committee

- Eben Swain, Truckee River Watershed Council
- Mary Kay Wagner, Nevada Division of Environmental Protection
- Savannah Rudroff, League to Save Lake Tahoe
- Sarah Vidra, Incline Village General Improvement District
- Joe Hill, Incline Village General Improvement District
- Madonna Dunbar, Tahoe Water Suppliers Association

Organizations hosting Snapshot Day 2016

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

Laboratory analyses (nutrients and bacteria)

- South Lake Tahoe Public Utility District
- Nevada State Health Laboratory
- Lahontan Regional Water Quality Control Board Laboratory
- U.S. Geological Survey
- Incline Village General Improvement District
- High Sierra Water Lab

Equipment and contact

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

Education partners

- Excel Christian School
- Galena High School
- High Desert Montessori
- Lake Tahoe Boys and Girls Club
- Lake Tahoe Community College
- Mountain View Montessori
- Natchez Elementary School
- North Star Online School
- Spanish Springs High School
- Sparks Middle School
- TRiO Upward Bound
- Washoe Innovation High School

Resource Partners

- Nevada Division of Environmental Protection
- U.S. Geological Survey
- WET Laboratory
- City of Sparks Public Works
- City of Reno Public Works
- Incline Village General Improvement District
- The Nature Conservancy
- Nevada Department of Transportation
- Pyramid Lake Environmental Staff
- Stantec
- Desert Research Institute
- Truckee Meadows Water Authority
- Keep Truckee Meadows Beautiful

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- Nevada Division of State Lands, for funding nutrient analysis
- Nevada State Health Lab, for Lower Truckee River laboratory analyses
- Paul Honeywell, U.S. Geological Survey, Truckee, CA office, for coordinating bacterial analyses
- Rebecca Sawyer Williams, IVGID, for turbidity analyses
- Scott Valentine, Lake Tahoe Community College, for hosting the South Lake Tahoe event
- Soroptimist International of the Tahoe Sierra, for funding the event
- Waterman's Landing, for hosting the North Lake Tahoe event
- **And all the volunteers that make Snapshot Day possible!**

Appendix B – Site Names and Codes

South Lake Tahoe	
SLT-ANG1-01	Angora Creek at View Circle
SLT-ANG1-02	Angora Creek above Lake Tahoe Blvd
SLT-ANG2-01	Angora Creek at Washoe Meadows
SLT-ANG3-00	Angora Creek at Truckee Confluence
SLT-BURK-00	Burke Creek at mouth
SLT-BURK-02	Burke Creek below Hwy 50
SLT-CASC-00	Cascade Creek at mouth
SLT-CASC-01	Cascade Creek above Hwy 89
SLT-COVE-00	Cove East
SLT-EAGL-00	Eagle Falls Creek at mouth
SLT-EAGL-01	Eagle Falls above Hwy 89
SLT-EDGE-00	Edgewood Creek at mouth
SLT-FLLF-01	Fallen Leaf Lake
SLT-HEAV-00	Heavenly Creek at Confluence with Trout Creek
SLT-KEYS-00	Tahoe Keys West Channel
SLT-MEEKS-00	Meeks Creek at mouth
SLT-MEEKS-01	Meeks Creek at meadow
SLT-NZHR-00	North Zephyr Creek at mouth
SLT-SLAKE-1	Ski Run Marina
SLT-SLAKE-3	Timber Cove
SLT-SZHR-00	South Zephyr Creek at mouth
SLT-TALL-00	Tallac Creek at mouth
SLT-TALL-01	Tallac Creek above Hwy 89
SLT-TALR-00	Taylor Creek at mouth
SLT-TALR-01	Taylor Creek at bridge
SLT-TR10-01	Upper Truckee River below Lake Tahoe Blvd
SLT-TR15-02	Upper Truckee River at airport
SLT-TR20-01	Upper Truckee River at Elks Club bridge
SLT-TRMO-00	Upper Truckee River at mouth
SLT-TROU-01	Trout Creek at confluence with UTR
SLT-TROU-02	Trout Creek at Grinding Stone
SLT-TROU-03	Trout Creek at Blackbart Bridge
North Lake Tahoe	
NLT-BART-02	Barton Creek above Hwy 28
NLT-BRTN-01	Burton Creek at Star Harbor
NLT-CBCR-01	Carnelian Bay Creek above Hwy 28
NLT-FRST-00	First Creek at mouth
NLT-GENR-00	General Creek at mouth
NLT-GRIF-00	Griff Creek at mouth

NLT-HMWD-00	Homewood Creek at mouth
NLT-LKFC-00,02	Lake Forest Creek at mouth
NLT-MADC-00	Madden Creek at mouth
NLT-QULC-00	Quail Lake Creek at mouth
NLT-SCRT-00	Secret Harbor Creek at mouth
NLT-SNOW-00	Snow Creek at mouth
NLT-STAR-01	Hatchery Creek at Star Harbor
NLT-TCUD-00	Tahoe City Urban Ditch at lake
NLT-WOOD-01	Wood Creek at Lakeshore
Middle Truckee River	
MTR-ALDR-00	Alder Creek
MTR-BEAR-00	Bear Creek
MTR-BOCA-00	Little Truckee River below Boca Dam
MTR-BOCA-01	Little Truckee River at Boyington Mill
MTR-COLD-00	Cold Stream Canyon Basin
MTR-DONN-00	Donner Creek at mouth
MTR-DONN-01	Donner Creek at Highway 89 crossing
MTR-DONN-03	Donner Creek at Lake outflow
MTR-EMAR	East Martis
MTR-GLEN-00	Glenshire/Union Valley Basin
MTR-GLEN-2	Glenshire above pond
MTR-MART-00	Martis Creek at mouth
MTR-MART-01	Martis Creek at COE boundary
MTR-PROS-01	Prosser Creek below dam
MTR-PROS-02	Prosser at Highway 89
MTR-SQCR	Squaw Creek
MTR-TOWN	Truckee Town Corridor
MTR-TR01	Truckee River near Tahoe City
MTR-TROU-00	Trout Creek at mouth
MTR-TROU-02	Trout Creek in Tahoe Donner
Lower Truckee River	
LTR-ALUM	Alum Creek
LTR-DRY	Dry Creek
LTR-GAL	Galena Creek
LTR-HUN	Hunter Creek
LTR-IDL	Truckee River at Idlewild Park
LTR-MCR	Truckee River at McCarran Ranch
LTR-NIXB	Truckee River above Nixon Bridge
LTR-NoTrD	North Truckee Drain
LTR-PYRL	Pyramid Lake
LTR-ROC	Truckee River at Rock Park

LTR-STEA-02	Steamboat Creek
LTR-THOM	Thomas Creek
LTR-WADS	Truckee River at Wadsworth
LTR-WHI	White's Creek (Old Virginia Rd)

Appendix C – Monitoring Equipment

Most volunteer 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 the Truckee River Watershed Council, the Tahoe Regional Planning Agency and the League to Save Lake Tahoe.

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

Bacteria samples were 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. Geological Survey field office in Truckee. Bacteria samples collected from the Lower Truckee River were transported to the Nevada State Health Laboratory. The need for multiple labs for such a large area is to ensure sample analysis within the allotted 8-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 were delivered to South Tahoe Public Utility District in South Lake Tahoe within the allotted hold time. Lower Truckee River nutrient samples were taken to the Nevada State Health Lab for analysis. Middle Truckee River samples were processed in-house by the Truckee River Watershed Council.