2019 Pyramid Lake Paiute Tribe Nonpoint Source Assessment Report

Pyramid Lake Paiute Tribe

Natural Resources Department

Water Quality Program

August 2019

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Section 1- Overview

Nonpoint source (NPS) pollution is generated from a combination of pollutants from a large area that are typically conveyed through storm water runoff, precipitation, atmospheric deposition, seepage or hydrologic modification. In contrast, point sources are defined in Section 502(14) of the Clean Water Act (CWA) as discernable, confined and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, and many others. NPS is defined as any other source of pollutants that does not meet the legal definition of a point source. The Pyramid Lake Paiute Tribe (PLPT, Tribe) recognizes the importance of identifying and addressing NPS issues on the Pyramid Lake Indian Reservation (PLIR, Reservation). The purpose and goal of this PLPT NPS Assessment Report is to identify current NPS issues on the Reservation, to provide a comprehensive technical summary of the condition of tribal water resources, and to update the issues on the Reservation that were addressed in the previous NPS Assessment Reports. The NPS Assessment Report will provide the foundation of the NPS Management Plan, which will guide the direction of the Tribe's CWA 319 NPS Program and propose on-the-ground projects to reduce NPS pollutants.

Tribal surface waters are heavily impacted by a variety of nonpoint sources both on and off the Reservation. For the lower Truckee River, most NPS pollutants originate from upstream sources including urban areas of Reno and Sparks and industrial development at the Tahoe Reno Industrial Center (TRIC). Typical NPS pollutants include:

- Excess nutrients and total dissolved solids from treated effluent at the Truckee Meadows Water Reclamation Facility
- Increased temperatures in stormwater runoff from impervious surfaces and development
- Erosion and favorable habitat for invasive species from historical hydromodifications of the lower Truckee River
- Oil, grease and toxic chemicals from urban runoff and energy production at the Tracy Power Plant
- Increased total dissolved solids from irrigation practices in Fernley and groundwater seepage
- Bacteria and nutrients from livestock, pet wastes and failing septic systems
- Mercury and other heavy metals from upstream legacy mining and mobilization from development of contaminated areas

While most NPS pollutants originate upstream of the Reservation, there are a number of NPS pollutants that occur within the Reservation boundary that impact the lower Truckee River, Pyramid Lake and Perennial streams including:

- Increased nutrients, total dissolved solids, bacteria, and sediment from agricultural return flows in Wadsworth and Nixon
- Erosion and hydromodification of streams due to riparian and rangeland grazing, as well as historical channelization by the Army Corps of Engineers
- Annual occurrences of wildfire destroyed ecological systems and exasperated local waterways with increased erosion, sediment loads and nutrient pollution

The objectives of the PLPT NPS Assessment Report include the review of the total distribution of Reservation waters, identify the primary waters of concern, determine the extent of NPS issues, and survey the current practices which may be useful for addressing NPS pollution issues. This report will

propose strategies for meeting each objective. First, the report will identify the particular PLIR NPS issues which may be tied to observable trends in water quality. Next, NPS pollution sources on the Reservation will be characterized by the extent and pattern of geographic distribution. After analyzing historical water quality data, this report will attempt to correlate water quality trends with NPS issues. The report finds that the NPS water quality parameters of concern include: dissolved oxygen, temperature, nutrients, and total dissolved solids.

Section 2- Introduction

The PLIR is located in a rural area approximately 35 miles northeast of Reno, Nevada. The Reservation contains 477,000 acres and is home to Pyramid Lake, a large desert terminal lake. The primary water source to the lake is the Truckee River, which drains from a large watershed extending southwesterly to the Sierra Nevada Mountains and includes Lake Tahoe. The PLIR is home to the members of the Tribe and are known as Kooyooe Tukadu, or the cui-ui eaters. The cui-ui, an endangered species of sucker fish endemic to Pyramid Lake, along with the threatened Lahontan cutthroat trout (LCT), have been a traditional food source for the Kooyooe Tukadu for thousands of years. The Truckee River and Pyramid Lake are not only important natural resources to the Tribe, but are integral to the Tribe's cultural and economic life.

In 1903, Derby Dam was constructed upstream of the Reservation to divert water from the Truckee River into the Carson Desert for agriculture. As a result, Pyramid Lake levels declined and drove the native LCT to extirpation and cui-ui to endangerment. Downstream, the decreases in flows and lake elevation resulted in incision and changes of channel morphology in the lower Truckee River. With the river disconnected from its floodplain, riparian habitat was encroached with upland plant species and susceptible to noxious plant infestation.

Even when impacts to tribal water resources was apparent, the Army Corps of Engineers (USACE) completed a series of flood mitigation projects throughout the lower Truckee River to decrease flooding in upstream Truckee Meadows. Projects included straightening and widening of the lower Truckee River channel to allow the river to drain flooded areas upstream. These projects resulted in an unnatural straight channel, with velocity of flows occurring at a much higher rate on the Reservation. The incision already occurring from Derby Dam resulted in increased erosion of banks and sedimentation to important spawning habitat. Although these impacts are still apparent today, the lower Truckee River is slowly recovering to a natural sinuous channel.

There are numerous upstream municipal and urban developments that rely on the Truckee River for their primary source of water. The largest municipalities, Reno and Sparks, have an estimated population of 248,853 and 100,888, respectively (US Census, 2011). Nearly all wastewaters from these cities are treated by the Truckee Meadows Water Reclamation Facility (TMWRF), which discharges treated effluent, elevated in levels of nutrients and total dissolved solids (TDS), to the Truckee River via Steamboat Creek which eventually flow down to Pyramid Lake. Downstream of Reno and Sparks is the Tahoe Reno Industrial Center (TRIC), known for being the largest industrial center in the world. The center is intended to be mixed-use, non-residential development, consisting of a wide range of industrial, office and businesses. The center is used by nearly 130 companies, including tech-giants Tesla, Google, Panasonic, Apple and Switch. The quick expansion of the center has been concerning due

to its self-proclaimed fast-track building permit process, and lack of environmental impact studies & publically available data concerning its use of heavy metals in manufacturing processes.

Land on the Reservation is primarily used for recreation, rangeland, agriculture, wildlife, mining, and municipal and industrial developments. Of the 477,000 acres of Reservation land, roughly 1,000 acres are used as irrigated crop land. These areas are situated on the lower Truckee River—between the towns of Wadsworth and Nixon. Approximately 303,360 acres of the land is designated as open grazing land for livestock and wildlife use. Aside from agricultural land use, there are three communities on the Reservation: Wadsworth, Nixon, and Sutcliffe. These communities consist of housing, commercial, and administrative developments, along with basic urban infrastructure. In 2010, the total population on the Reservation was 1,660 (U.S. Census Bureau, 2011). Lastly, there is currently one active mining operation, Paiute Pit, which is a gravel aggregate mine that located in Wadsworth and is leased to CEMEX, Inc.

The purpose of the NPS Assessment Report is to review the total distribution of the Reservation's waters, identify the primary waters of concern, determine the extent of NPS pollution issues, and survey the current practices which may be useful for addressing these issues. The projects implemented to reduce NPS pollution issues will be assessed, as well as any deficiencies that need improvement. This report provides a precursor to the NPS Management Plan, which describes how the Tribe will use the information gathered in this report for furthering these projects to reduce NPS pollution.

NPS pollution to the waters of the PLIR were first assessed and documented in the 1994 report, Pyramid Lake Paiute Tribe Indian Tribe Nonpoint Source Assessment and Management Plan. In this document, Marin E. Lebo, John E. Reuter, and Charles R. Goldman explain that NPS pollution comes from biotic and abiotic sources on the Reservation, with the Truckee River being the body of water most affected. Significant biotic sources in the report included atmospheric deposition of nutrients, overland and stream loading, and groundwater discharges containing nutrients, particularly in the Wadsworth and Dead Ox areas. Abiotic sources are considered most significant, including upstream inputs, croplands, and livestock grazing. Other NPSs in the report included urban stormwater runoff, mine discharges, domestic wastewater, and landfill wastes.

The updated 2014 report included up-to-date analytical data providing a more comprehensive supplement to the 1994 NPS assessment report. While the 1994 assessment report was a significant milestone in determining the unique character of the Pyramid Lake watershed, the report was just a snapshot of it at the time. The Greater Truckee River watershed is lined by many players and effluent inputs, and its character continues to be altered by hydromodification projects as it flows downstream. The dynamic character of the Truckee River demands constant monitoring and the need for updated scientific study. Since the publication of the 2014 Report, many changes occurred with upstream inputs and those changes demand evaluation through scientific study. Updating its practices based upon current scientific knowledge is an integral component of Tribal strategy to protecting the highest water quality for established uses.

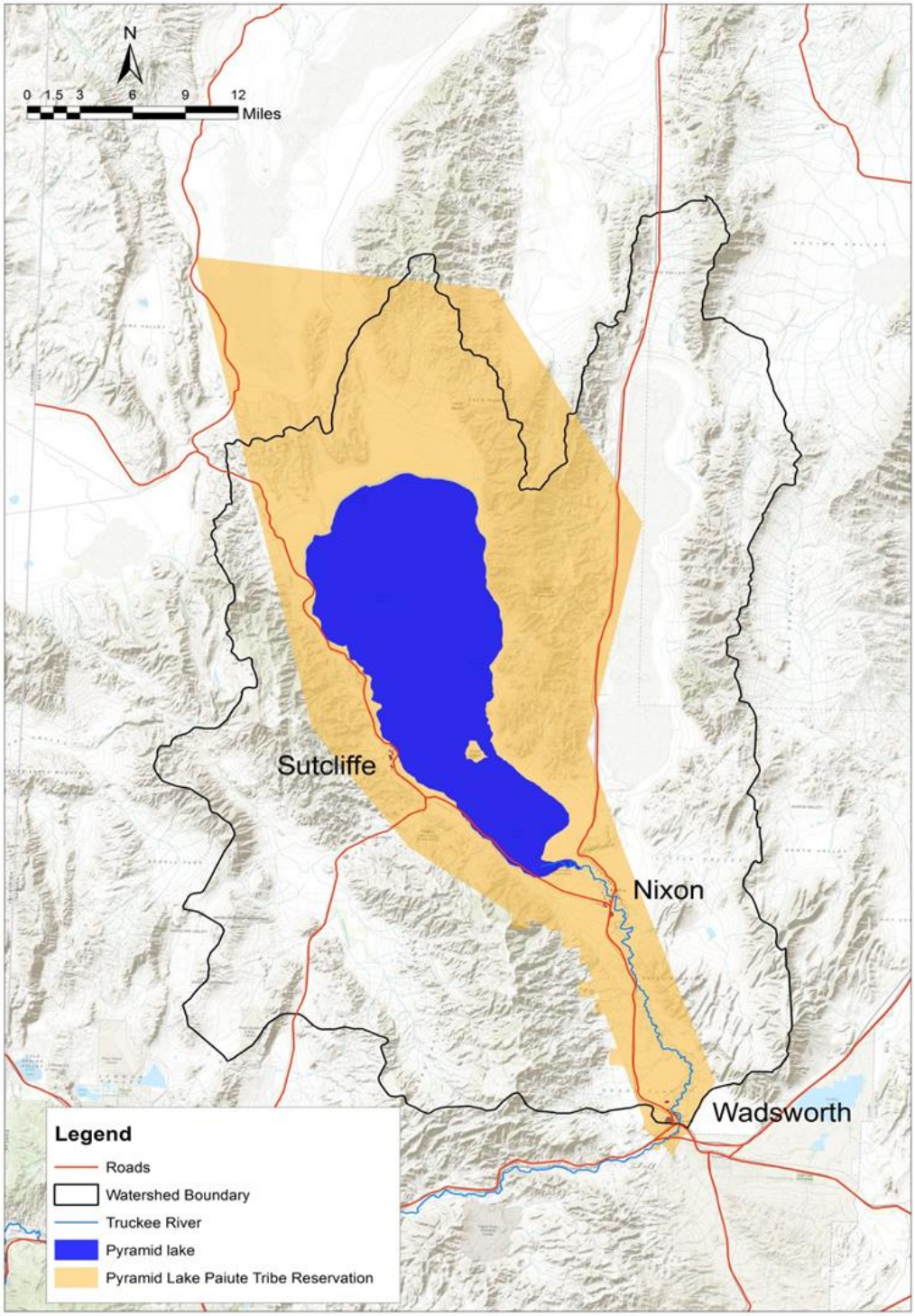


Figure 1: Pyramid-Winnemucca Lake Watershed (HUC 16050103) and the Pyramid Lake Indian Reservation area. (McKay & Baker, 2013)

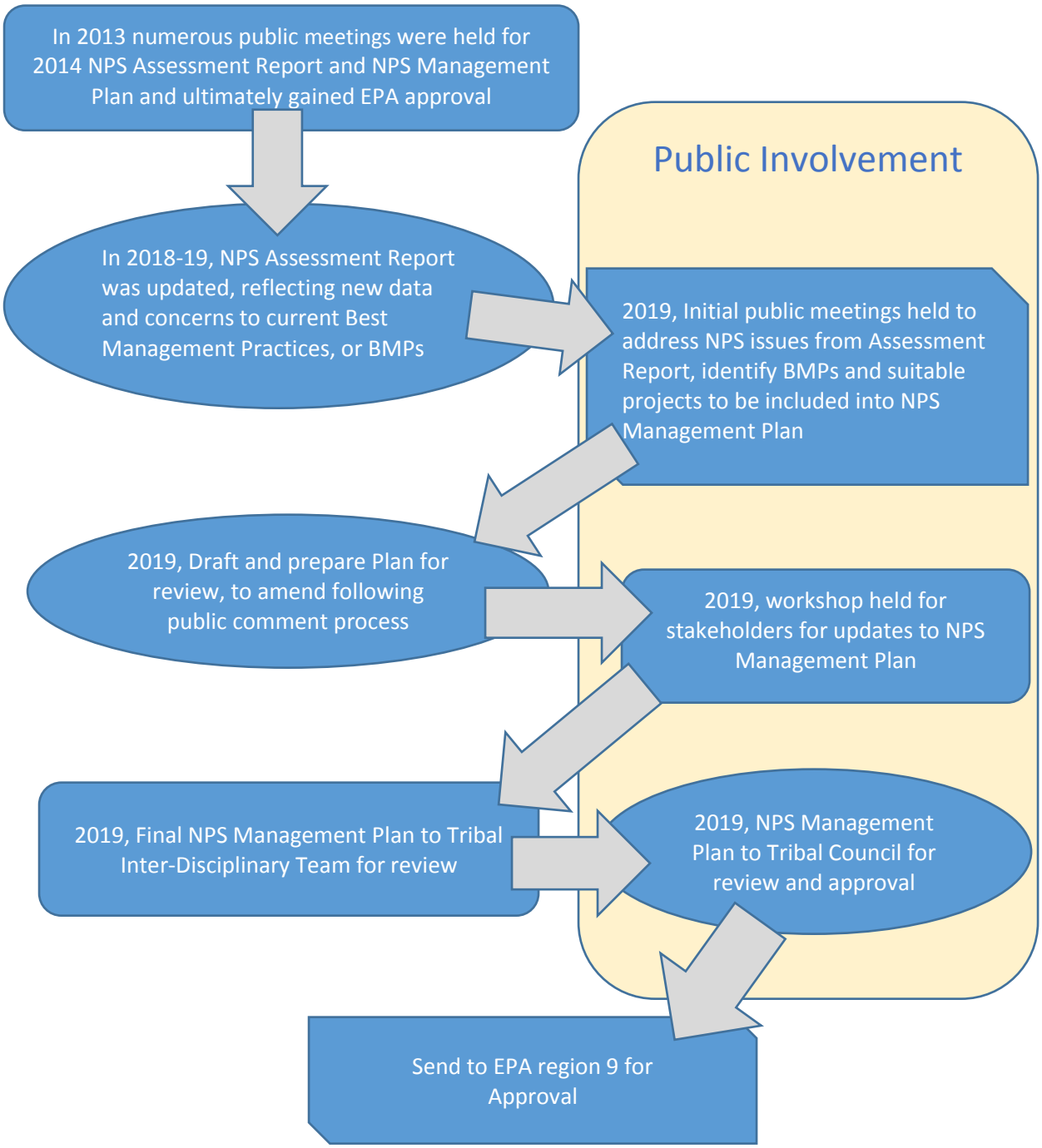
Public Comment Process

The input of Tribal members is valuable to successful planning for water quality improvement. To determine how the public should be engaged, goals were addressed in an open process that was developed on how Tribal members may provide feedback. Three public meetings were held regarding the NPS Assessment Report in 2014. At each of these critical milestones throughout the development of this document, core agency personnel and Tribal members were able to review and comment on the NPS Assessment Report and NPS Management Plan. Public involvement included listing known NPS issues, combined with a presentation of typical Best Management Practices (BMPs), which are utilized to address these impacts. Potential BMPs will be selected from the following agencies:

- United States Environmental Protection Agency (USEPA)
- United States Bureau of Indian Affairs (BIA)
- Nevada Department of Environmental Protection (NDEP)
- Nevada Department of Agriculture (NDA)
- Water Environment Research Foundation (WERF)
- American Public Works Association (APWA)
- The City of Reno

The BMPs that were identified by the above stakeholders were addressed during the public involvement process. Furthermore, professional input was sought on the BMPs that were of major concern. The results from this information were finalized in this report. The final draft is also made available for feedback from stakeholders and environmental professionals from the Tribe. The final document is to be presented at the Tribal Council meeting, which will then be forwarded to the EPA. Figure 2 demonstrates the process as described above.

2019 NPS Assessment Report & Management Plan Public Involvement Process



Section 3- Methodology

The NPS Assessment Report accounts for all the waters within the exterior boundaries of the Reservation and determined known NPS issues by reviewing historic records, studies, and other geographically referenced documents. Water quality samples collected include: Pyramid Lake data from 1994 to 2018, Truckee River data from 1999 to 2018, and perennial stream data from 2004 to 2018. It also considers information from key documents including the Pyramid Lake Ecological Study (Sigler & Kennedy, 1978) and the Pyramid Lake Paiute Tribe Nonpoint Source Assessment and Management Plan(s) of 1994 (Lebo, Reuter, & Goldman, 1994), and 2014 (Morgan 2014), which are previous publications of the NPS Assessment Reports. Other documents supporting this current report include: the Pyramid Lake Paiute Reservation Comprehensive Resource Management Plan (PLPT; NRCS-NV, 2005), Pyramid Lake Paiute Tribe Water Quality Control Plan (Pyramid Lake Paiute Tribe, 2008, since updated 2015), previous years' BAER plans and other supporting documents.

The NPS Assessment also considers historical stream, river, and lake data, collected by the Tribe and other agencies using EPA-approved PLPT Surface Water Quality Assurance Project Plan (QAPP) methods. Other historic and current water quality records that have been collected by the following:

- The State of Nevada
- The Cities of Reno and Sparks
- United States Geological Survey (USGS)
- United States Fish and Wildlife Service (USFWS)
- United States Bureau of Land Management (BLM)
- University of Nevada-Reno (UNR)
- University of California-Davis (UC Davis)
- Desert Research Institute (DRI).

Quality Assurance

Water quality data collected by the Tribe form the primary basis of this study. The data collected is used for assessing water quality conditions. It also helps determine if water quality standards are being met and provides a basis for evaluating watershed management strategies. This improves the overall understanding of processes that affect water quality conditions. All data collection activities conducted by the PLPT Water Quality Program are guided by USEPA-approved Quality Assurance Project Plans (QAPPs). These plans include:

- *Water Quality Monitoring of Surface Waters Within the PLIR, Nevada*
- *Bioassessment Monitoring in Surface Waters of the PLIR, Nevada*
- *Monitoring, Assessment, and Tracking of the PLIR Wetland Resources*

Historical water quality measurements that are analyzed in this report were collected using YSI EXO1, EX03, and 6 Series sondes. The multi-parameter devices were used to measure the following parameters: temperature, dissolved oxygen (DO), pH, specific conductivity, salinity, total dissolved solids (TDS), and turbidity. Grab samples were also collected and analyzed at the Pyramid Lake Fisheries Adeline Davis Research Laboratory in Sutcliffe, NV and Western Environmental Testing Laboratory

(WETLab) in Sparks, NV. Chemical analysis includes nitrate+nitrite (combined), total phosphorus, dissolved reactive phosphorus, ammonia-nitrogen, and total Kjeldahl Nitrogen. The following elements are part of these control measures:

- Analysis of method and field blanks
- Analysis of laboratory control samples
- Instrument calibration including initial calibration of equipment, calibration of blanks, and verification of calibration
- Analysis of matrix spikes
- Analysis of laboratory duplicates

Table 1: Pyramid Lake water quality standard curve evaluation criteria.

Interval	RPD%
<2 – DL	100%
2-3 – DL	80%
3-4 – DL	60%
4-5 – DL	40%
>5 – DL	20%

In addition to the criteria for the standard curve evaluation summarized in Table 1, the matrix spike recoveries should be 85-115% (95%-105% is desirable) and <50% of the lab duplicates should exceed variability limits (<20% is desirable).

After gathering background information and data, research of completed assessments will be made and compiled for review. The goal of this assessment activity is to describe general trends that can be observed in terms of monitored variables that relate to NPS pollution. The NPS Assessment Report only includes water quality parameters that are affected by NPS pollution. Rarely, exceptionally high values observed in the data were further investigated by reviewing original data entry and field forms and flagged, if necessary. Conclusions about the magnitude or significance of NPS issues will be summarized for stakeholder review.

Section 4 – Land Use Summary

The Pyramid Lake Paiute Reservation has a wide variety of landscape issues that have been compiled throughout the years. Particular attention will be given to the land uses as they relate to water quantity and quality, as well as nearby contributing watersheds. This review will provide the geographic, physical, and cultural context of NPS pollution issues, which will be reviewed in the following section.

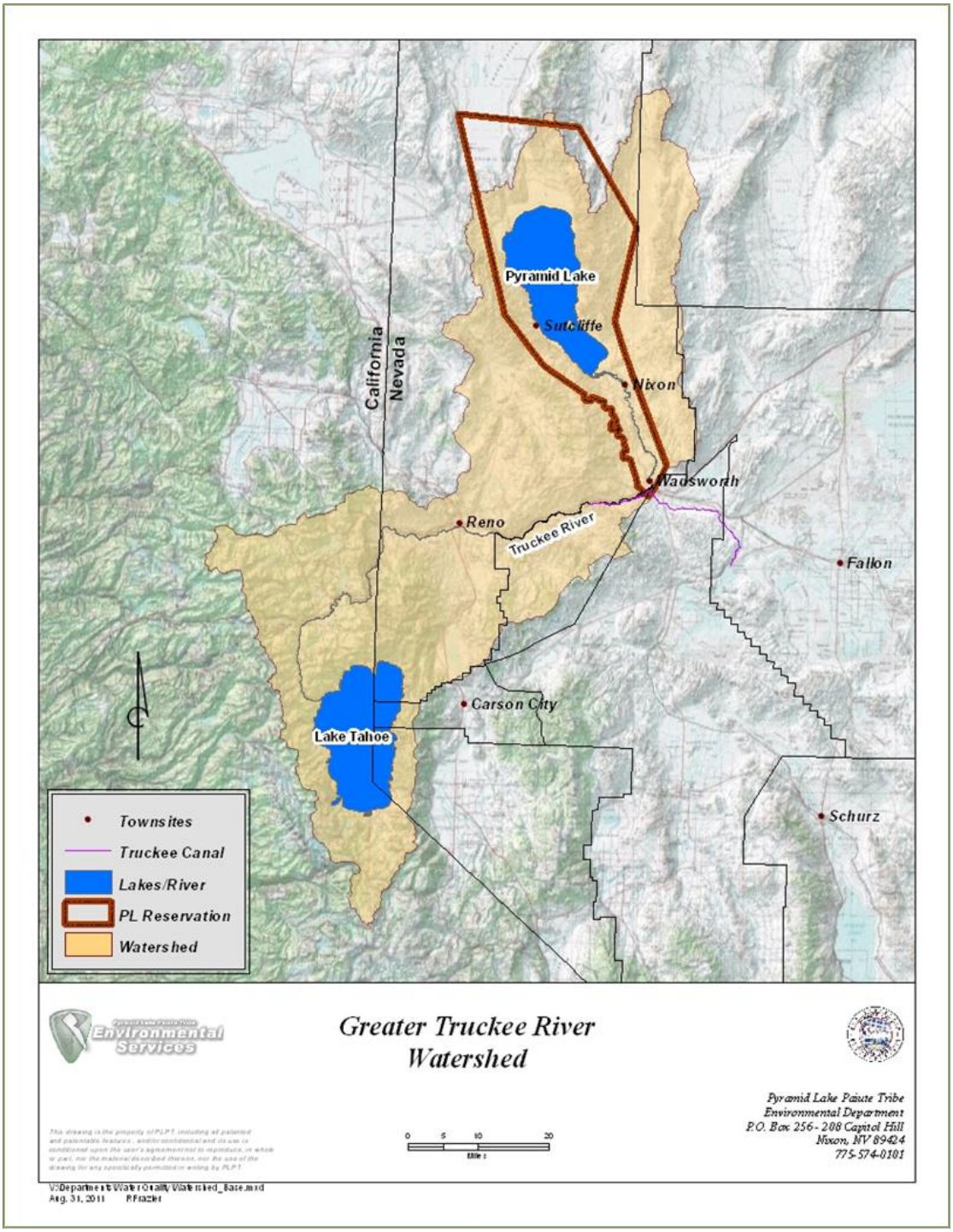


Figure 2: Greater Truckee River Watershed

Geographic Characteristics

The PLIR is in the basin and range province, which consists of alternating steeply faulted mountains and level valley floors. The Pah-Rah and Virginia Range bounds the Reservation on the west and a series of peaks ending in the Nightingale Mountains bound the Reservation on the east. Between these ranges are the Lake Range and Marble Bluff. These internal mountains separate Pyramid Lake from the dry lakebed of Winnemucca Lake. Elevations vary steeply from 3,800 feet above sea level at the lake to 8,182 feet at Tohakum Peak a short distance to the east (PLPT; NRCS-NV, 2005).

The PLIR has a climate that is semi-arid in character. Annual precipitation at the low elevations might reach 7 inches in a year, whereas the high mountains elevations can exceed 18 inches per year (PLPT/NRCS, 2005). Moisture levels also increase from south to north, as precipitation data between 1971 and 2000 indicates. Annual precipitation averages in Wadsworth amount to 6.01 inches, in Sutcliffe at 8.06 inches, and north of the Reservation in Gerlach at 8.36 inches. Throughout the year, winter snow typically does not exceed more than an inch at Wadsworth, while Sutcliffe has on average 6 days a year with over an inch of snow accumulation. Wetter seasons are more common in Sutcliffe, where in two out of 10 years there will be 10.43 inches or more precipitation, while Wadsworth's precipitation is 3 inches less for the same time period (USDA-NRCS, 2002).

Pyramid Lake receives water mostly from Sierra Nevada snowmelt via the Truckee River and through tributaries in the lake's basin. The Truckee River is the largest flowing waterbody within the Reservation. At the Nixon gage station, from the years 2013-2018, Truckee River flows ranged from a low daily mean of 27.1 cfs in 2015, an average daily rate of 614 cfs, and a peak flow of 10,200 cfs measured during peak runoff season (USGS, 2018). Streams located in the PLIR do not typically flow year round from the mountains to the lake or river. However, there are groundwater flows which are known to be hydrologically-connected to the lake. This groundwater also supplies water to the numerous riparian wetlands. Through this process, disconnected basins form isolated waters, which are utilized by wildlife and cattle.

The soils along the Truckee River’s floodplain and its stream terraces can be generally described as nearly level, somewhat poorly drained, and the particle texture is coarse to moderately fine. The south end of the Reservation is mostly composed of sedimentary lake bottom, which forms canyons in areas where the Truckee River flows through. Nearby upland soils are comprised of coarse-textured and sandy soils that are very deep and well-drained. The upland areas above have very shallow, well-drained fine particles over basalt and tuff. (USDA 1983, 1975) Alluvial soil deposits are a result of flowing waterbodies on the river and alluvial fans are formed through sedimentation build-up from nearby mountains.

The moderately unstable lower Truckee River channel remains incised, due to modified land use and steeply dropping lake levels. As a result, the Truckee River is constantly trying to achieve equilibrium in hydrodynamics. Erosion of the streambed also resulted from the Truckee River and Tributaries Project, implemented under the Flood Control Act of 1954 by the Army Corps of Engineers. This project straightened, de-snagged, cleared, removed riparian vegetation, and widened the channel throughout the basin. Although this reduced flooding in the Reno and Sparks region, it increased the velocity of water flowing through the PLIR and increased erosion rates.

Land Uses on the Reservation

Rangeland/Grazing
The majority of land on the Reservation is open range and grazed by livestock and various wildlife. Throughout the years, there have been three range assessments conducted on the Reservation: BIA Soils and Range Inventory (1980), USDA-SCS Pyramid Lake Range Inventory (1985), and the USDA- NRCS Pyramid Lake Range Inventory Report (2000-2004). Through these assessments, local cattlemen were able to help identify four major grazing areas that were managed based off current use and working partnerships. The estimated grazing area for the PLIR is 303,360 acres. This number does not incorporate the areas consisting of annual species.

Agriculture
Primary activities for the more recent 100 years have been farming alfalfa and raising livestock. There are currently a total of 935 acres of agricultural land in production on the Reservation. Agricultural lands are small and provide limited profit for farmers. There is an additional 530 acres of potentially irrigable land and another 395 acres of land that have been identified for clearing and leveling if there were sufficient water rights available.

Wildlife Habitat
Range and open lands are shared amongst 65 mammal species, including some of the following species: prong-horn antelope, mule deer, bighorn sheep, mountain lion, bobcat, and coyote. A significant population of American White Pelican nest and brood on Anaho Island located on Pyramid Lake, which is designated as a National Wildlife Refuge. The Greater Sage Grouse, a species under consideration for endangered listing by the USFWS, maintains viable populations in the mountains on the west and north sides of the Reservation (Nevada Department of Wildlife, 2012). The Tribe is working with its partners at the NV, and U.S. Departments of Wildlife to repopulate the surrounding hills of the PLIR with bighorn sheep following Tribal council approval of project.

Urban
Most developed areas include residences, Tribal administrative facilities, community facilities, and roads that connect the Reservation's communities. Tribal housing includes single-family houses, multifamily units, and mobile homes. A bicycle trail and telephone/fiber optic communication corridor has been established over an abandoned railroad easement and along roadways that traverse between the Reservation's communities. Paved and unpaved roads connect much of the Reservation; however, infrastructure is inadequate to address future development. The bulk of the PLPT's economy is recreational-related, including fishing, boating, and camping, (Carey, 2010).

Industrial/Mining
Various types of mining activities occur within the Reservation boundary. Some of these operations are currently in production. The Packard and Sano mine are located in the northern region of the Reservation that produced precious metals such as lead, silver, zinc, and gold. Another mining operation that is still in production is the gravel extraction facility known as Paiute Pit, which requires a lease agreement with the Tribe. Paiute Pit is operated by CEMEX, Inc. and located in Wadsworth along Hill Ranch Road.

Land Use Summary

A small study was conducted for this report to better characterize the distribution of land uses at the PLPT Reservation. Utilizing the collection of GIS information gathered over the years for specific projects such as the Comprehensive Resource Management Plan, wetland surveys, agricultural mapping, and firsthand knowledge, a new map was created that attempts for to describe how lands are used in general.

Land Use Group	*Size (acres)*	*Percentage of PLIR*
Range Land	248,623	54
Open Water	110,517	24
Open Space/Unclassified	49,038	11
Playa Region	40,399	9
Agriculture/Ranch	3,868	1
Tribal Resource	2,382	1
Riparian/Wildlife	1,401	<1
Residential	1,144	<1
Industrial/Mining	647	<1
Recreation/Park	285	<1
Institutional	103	<1
Commercial	19	<1
Mobile home/campground	16	<1
TOTAL	458,442	100

Table 2: Breakdown of the various land uses on the PLPT reservation

Identification of NPS Categories at Subcategory Level

It is important for the NPS Assessment Report to address the NPS pollution categories at sublevel to help prescribe mitigation and appropriate BMPs. On Table 3, NPS categories that were identified were of most concern throughout the PLIR. Acronyms and abbreviations used in Table 3 can be found in Appendix A. The subcategories under these nonpoint-sources identify the major areas of concerns and the types of potential pollutants that are associated with individual NPSs. More detailed discussions of the pollutant categories and subcategories are included in Sections 6 and 7.

NPS Source Category	NPS Code	Subcategory Units	Typical Pollutants
Urban/Residential	**UR**	Septic systems	microbiological pathogens, nutrients
		Urban/roadway stormwater	nutrients, pesticides, sediment, oil, Total Petroleum Hydrocarbons (TPH), surfactants, road salt, floating debris, microplastics
		Underground storage tanks	Fuel additives and bi-products: TPH, VOCs, MTBE
		Construction	sediment, TPH, pH, floating debris, TDS
Tourism/Recreation	**TO**	Special events	sediment, bacteria
		Recreation vehicles/camping	Microbiological pathogens, nutrients, surfactants, Dissolved Oxygen depletion
		Lake recreation	TPH, oil, floating debris, invasive species
		Boat servicing	TPH, oil, surfactants
Waste Disposal	**WD**	Illegal dumping	Oil, TPH, floating debris, microbiological pathogens
		Solid waste management	Oil, TPH, Floating debris, microbiological pathogens
		Spills/emergency response	Oil, TPH, Contaminants of Emerging Concern (CECs), surfactants, nutrients, toxics
Agriculture	**AG**	Field management	nutrients, pesticides, dissolved oxygen depletion
		Irrigation return flows	nutrients, pesticides, microbiological pathogens, dissolved oxygen depletion
		Irrigation maintenance	Sediment
Riparian Zone	**RZ**	Bank erosion	Sediment, nutrients, temperature
		Riparian encroachment	Sediment, nutrients, pesticides, temperature
		Riparian forestry	Sediment, temperature
		Bank ecosystem instability	Invasive species dissolved oxygen depletion
Livestock and Range	**LS**	Upland ecosystem instability	Invasive species, sediment
		Grazing management	Microbiological pathogens, nutrients, sediment, temperature, dissolved oxygen depletion
		Livestock waste	Microbiological pathogens, nutrients dissolved oxygen depletion
		Water supply scarcity	sediment, temperature
Resource Extraction	**RE**	Quarries	sediment, temperature, pH
		Mine drainage	Toxics, pH, TDS, metals
Natural Sources	**NA**	Atmospheric loading	sediment, nutrients, toxics
		Groundwater and soils	TDS, salt
		Geothermal activity	TDS, temperature, metals
		Blue-green algae	Cyanotoxins, dissolved oxygen depletion
		Wildfire	sediment, nutrients, dissolved oxygen depletion
		Climate change	sediment, temperature, DO
Off-Reservation	**OR**	Urban/roadway stormwater	nutrients, pesticides, sediment, oil, TPH, surfactants, road salt, floating debris, dissolved oxygen depletion
		Agricultural/Irrigation/Range	Microbiological pathogens, sediments, pesticides, nutrients, dissolved oxygen depletion
		Spills/emergency response	Oil, TPH, CECs, pH, surfactants, nutrients, toxics, dissolved oxygen depletion
		Groundwater contamination	TPH, TDS, pH, nutrients, toxics, dissolved oxygen depletion
		Induced flooding/low flows	Hydrographic manipulation, dissolved oxygen depletion
		Legacy and active mining	Metals, toxics, sediment, pH, nutrients

Table 3: Identification of NPS categories at subcategory level

Section 5 - Surface and Groundwater Quality

The Pyramid Lake Paiute Reservation falls primarily within the Pyramid Lake Watershed, which is USGS HUC-8 group number 16050103 (Pyramid-Winnemucca Lakes Watershed). A draft watershed-based plan was developed for this watershed in 2013, utilizing EPA CWA Section 319 funds administered by the Nevada Department of Environmental Protection (NDEP) and prepared by the Desert Research Institute (DRI) (McKay & Baker, 2013). However, the US EPA never approved the document and further revisions need to be made to meet US EPA requirements. Other watersheds that extend slightly within the tribal boundaries include the hydrologically-connected Truckee Watershed (16050102), and small parts of two isolated watersheds: Smoke Creek Desert Watershed (16040203) and Honey-Eagle Lakes Watershed (18080003). The Greater Truckee River/Pyramid Lake watershed includes Lake Tahoe and numerous reservoirs located in California and the Sierra Nevada mountain range.

Table 4: Statistics for Waterbodies on the Pyramid Lake Indian Reservation

Waterbody Type	Known amount		
	Named Bodies	Miles	Acres
Lake (Pyramid Lake)	1	*n/a*	110,517
River (Truckee River)	1	31	*n/a*
Perennial Stream	15	68	*n/a*
Wetland	6 *	*n/a*	20,003 *
Constructed Body	7	36.2	31.3 *
Ephemeral Stream	22	102.3	*n/a*
Geothermal Spring	3 *	*n/a*	*Note A*
Spring	14 *	*n/a*	*Note A*
Groundwater	-	*n/a*	*Note A*
Total	69 *	237.5	130,551.3 *

*known quantity shown; however, a revised inventory is necessary

Note A: No inventory data currently available

Table 4- Statistics for waterbodies on the PLIR

Surface Waters

As stated above, Pyramid Lake receives most of its water from the Sierra Nevada snowmelt via the Truckee River and tributaries. The Truckee River is the largest flowing waterbody within the Reservation. Since 1991, the Truckee River flow has a low daily average of 145 cfs. However, since 1958, the Truckee River at the USGS Gage station at Nixon Bridge had an average daily flow of 552 and maximum average daily flow of 5,230 cfs, which occurred during the flood of 1997. (USGS, 2018). Flows are diverted throughout the watershed for small hydroelectric and irrigation dams, including two large dams that have been built on the PLIR.

Marble Bluff, Numana and various other smaller dams have been built on the Reservation for various reasons. Marble Bluff Dam is located near the end of the Truckee River, approximately 3 miles upstream of Pyramid Lake. The facility was built in 1975 for the sole purpose of mitigating a head cut that was eroding the river bed, after lake elevation receded over 80 feet, due to previous diversions at Derby Dam. The facility also serves as a fish passage, helping the lake's fish migrate over the dam by using a fish lock system that serves as an elevator for the fish. Below the facility is the furthest downstream monitoring location, before the Truckee River flows into Pyramid Lake. Upstream of Marble Bluff Dam,

Numana Dam was constructed by the Bureau of Indian Affairs (BIA), which purpose was to promote the agricultural production. In addition, five low-head irrigation diversion dams have been built on the river within the Reservation.

Table 5: Major Waterbodies on the Pyramid Lake Indian Reservation					
Name of Waterbody	**Type of Waterbody**	**Monitored**	**# of WQ Sample Sites**	**Length or Area within Reservation**	**Entirely within PLIR**
Pyramid Lake	Lake	Yes	2	188 mi^2	Y
Truckee River	River	Yes	5	31 mi	N
Big Canyon Creek	Perennial Stream	Yes	1	2.0 mi	N
Big Mouth Canyon Creek	Perennial Stream	Yes	1	3.9 mi	N
Coal Canyon Creek	Perennial Stream	Yes	1	4.2 mi	N
Dove Creek	Perennial Stream	Yes	1	6.0 mi	Y
Hardscrabble Creek	Perennial Stream	Yes	2	8.7 mi	N
Jigger Bob Canyon Creek	Perennial Stream	Yes	1	8.6 mi	N
Mullen Creek	Perennial Stream	No	0	4.0 mi	N
Nugent Canyon Creek	Perennial Stream	Yes	1	5.6 mi	Y
Nugent Hole Canyon Creek	Perennial Stream	Yes	1	5.1 mi	Y
Poison Canyon Creek	Perennial Stream	Yes	1	2.0 mi	N
Rodero Creek	Perennial Stream	Yes	1	7.7 mi	N
Sharpes Canyon Creek	Perennial Stream	Yes	1	2.2 mi	N
Sheep Pass East Creek	Perennial Stream	No	0	2.3 mi	Y
Thunderbolt Canyon Creek	Perennial Stream	Yes	1	1.8 mi	Y
Tom Anderson Canyon Creek	Perennial Stream	Yes	1	3.9 mi	N

Table 5- Major waterbodies on the PLIR

Wetlands

The Reservation hosts a variety of both surface and groundwater-fed wetlands. PLIR's wetlands function as habitat for rich diversity of migratory birds throughout the year. These birds use wetlands for nesting and foraging during the growing seasons. Furthermore, wetlands act as a buffer to prevent erosion and damages to downstream areas during flood events. Secondly, wetlands are culturally-significant to the PLPT, providing cultural resources to the Tribe. For instance, coyote willow has been used for generations for basket weaving by the PLPT Tribal Members. Tule is used for making duck decoys for hunting. Third, wetlands have environmental benefits such as improved water quality because they filter harmful contaminates that are a result of upstream users. Numana Wetlands as a tool has shown great utility in fighting nutrient pollution since it was constructed. Lastly, wetlands are beneficial to human health, because they host a wide range of insects and amphibians that control mosquito population—a contributor to West Nile Virus (Mitsch & Gosselink, 2007).

It has been identified through previous wetland assessments that a number of wetlands within the PLPT Reservation are lower in biodiversity than others. Wetlands on the Reservation have suffered from a variety of impacts that have stressed local ecosystems. In effect, there have been losses to suitable habitat, declines in native vegetation, and an increase in invasive weeds. Furthermore, water diversions at Derby Dam have decreased lake levels leaving much of the lower Truckee River's banks incised. This

has resulted in a lowered water table, drying out many of the adjacent wetlands and allowing for the infiltration of invasive plant species. Lastly, cattle grazing that takes place throughout the Reservation and throughout former highly functioning wetlands has caused a decline in habitat quality.

Table 6: Major Wetlands on the Pyramid Lake Indian Reservation

Name of Waterbody	Type of Waterbody	Monitored	# of WQ Sample Sites	Length or Area within Reservation	Entirely within PLIR
Duck Lake Playa	Wetland	No	0	206 ac	Y
Mud Lake Slough	Wetland	No	0	Note A	Y
Numana Wetlands	Wetland	Yes	1	Note A	Y
Smoke Creek Desert Playa	Wetland	No	0	14,920 ac	N
Truckee Riparian Wetlands	Wetland	No	0	592 ac *	Y
Unnamed Playa Wetlands	Wetland	No	0	Note A	Y
Unnamed Seep Wetlands	Wetland	No	0	Note A	Y
Winnemucca Lake Playa	Wetland	No	0	4,285 ac	N
Duck Lake Playa	Wetland	No	0	206 ac	Y

*known quantity shown; however, a revised inventory is necessary Note A: No inventory data currently available

Table 6- Major wetlands of the PLIR

Groundwater

Groundwater saturates the ancient Pleistocene lake bed between Pyramid Lake and the greater Lahontan basin. The type of groundwater underlying the entire Reservation and surrounding areas is classified as the "Basin and Range Fill Aquifer" (U.S. Geological Survey, 2009). One area which has been extensively studied is the Fernley-Dodge Flat area on the south end of the Reservation. The natural occurring drainage from the Fernley basin moves towards the Truckee River and is a significant source of total dissolved solids (TDS) to the river (Epstein, Pohll, Bansah, & Makowski, 2007). In the northern region of the Reservation, groundwater flows west from the Warm Springs Basin through the Mullen Creek Pass.

The Tribe relies on groundwater for municipal uses in all its three communities, as well as individual ranchers and land assignees in isolated areas. For the town of Sutcliffe, the water supply has been improved in recent years with an arsenic treatment plant, due to high naturally-occurring levels of arsenic in the groundwater at Mullen Creek Pass. On a smaller scale, groundwater flowing in the riparian subsurface (hyporheic) zone is an important part of maintaining cooler stream water temperatures, as demonstrated in recent work on the Truckee River by USGS scientists. (Narranjo, Niswonger, Stone, Davis, & McKay, 2012) Intersection of smaller perched aquifers with mountain and hillside slopes creates numerous seeps and springs across the Reservation, and these available surface waters are important for wildlife and for tribal uses. Therefore, adequate recharge of groundwater supplies is critical for sustained yields at these seeps and springs.

Pollution Types

Numerous NPS pollutants are transported through runoff to the river, lake, streams and other waters on the PLIR.

Primary order pollutants include various species of nitrogen and phosphorous, pathogens, salts and other components of total dissolved solids (TDS); temperature due to increased solar exposure and/or

low flows; fine sediments and, when in suspension, turbidity; bioaccumulation of metals such as mercury and lead; Petroleum products, oil and grease; constituents of emerging concern (CECs), such as micropollutants and surfactants; as well as the solid waste issues of floating materials, dumping of toxic wastes, and inorganic debris.

Secondary NPS pollutants can be found as well at the PLIR, which complicate the problem by taking one pollutant and creating a new pollutant. These secondary pollutants are low dissolved oxygen (related to algal growth from nutrient loading, low flows and high solar exposure), invasive species (which alter the ecosystem, grow aggressively with available nutrients, and create new problems), and cyanotoxins (which relate to nutrient loading, flow rates, TDS levels, and weather dynamics). Both primary and secondary order pollutants are listed in categories, with examples listed in Table 7.

Order	NPS Type	Examples of Pollutant/Measure	Waterbodies Affected
Primary	Nutrients	Nitrogen, nitrate, nitrite, DIN, TN, phosphorous, phosphate, orthophosphorous, DRP, TP	All
	Pathogens	E. coli, fecal coliforms	All
	Total Dissolved Solids/TDS	Total Dissolved Solids, salts, conductivity, pH	Truckee River, Pyramid Lake, constructed bodies
	Temperature	Temperature, canopy cover	Truckee River, Perennial Streams
	Sediments	TSS, Turbidity, sediment deposition, erosion, pH	Truckee River, perennial streams, ephemeral streams, wetlands
	Metals	Elemental mercury, methyl mercury, lead, toxics	Truckee River, Pyramid Lake, Mullen Creek
	Petroleum	Oil, grease, TPH, surface sheen	Truckee River, Pyramid Lake
	Constituents of Emerging Concern/CECs	Foam, scum, toxics, measurement tools in development, microplastics	Truckee River, Pyramid Lake
	Wastes	Toxic spills, floating debris, pH, solid waste dumping	All
Secondary	Low DO	Algal blooms, aquatic invasive species, Dissolved oxygen (hourly)	Truckee River, Pyramid Lake, perennial streams
	Invasives	Purple loosestrife, tall white top, perennial pepperweed, hydrilla, Eurasian watermilfoil, tamarisk, quagga mussel	Truckee River, Pyramid Lake
	Cyanotoxins	Nodularin, microcystin, floating bloom, health reporting	Pyramid Lake

Table 7: Primary and secondary NPS types with a list of affected waterbodies affected

Wildfires

Following a fire, ash and other solids are carried to waterways through rain runoff, while gully and rill erosion occur in steep sloped drainages with moderate soil burn. Debris flows produced by runoff in areas of heavy precipitation lead to sediment deposition where stream gradient and capacity are decreased, leading to increased storm runoff. Increased sediment loads affect waterways with higher turbidity levels (and therefore lessened photic levels), lowered DO levels, and ultimately lead to decreased gill function in aquatic life. Normally, these effects will be magnified during the initial precipitation season and are expected to lessen over time due to natural vegetative recovery (Griggs,

2018). However, native plant life do not have the resiliency of noxious weeds, and need human constructive efforts to rebuild habitats in time to negate the competitive infiltration of noxious weeds.

Another concern about the contributions to NPS pollution is the physical effects of fire suppression. Bulldozers and other fire lines are cut into the earth, increasing erosion by loosening top layer soil and removing vegetation/soil cover. Furthermore, they increase the spread of invasive species, which are more resilient to fire and thus bounce back quicker, essentially outcompeting and crowding out stressed native plants. It is estimated that the return to natural hydrologic watershed conditions is probable within 3-5 years due to natural vegetative recovery, at low to moderate soil burn severity (Griggs, 2018). However, noxious weeds have a higher recovery rate native plants, so concerted efforts must be made to minimize these man made impacts.

Another concern of fire suppression efforts is the widespread use of fire retardant. Fire retardants such as Phos-chek contain water, fertilizers and other minor ingredients that contribute to NPS pollution. These retardants carry ammonium phosphate, a soluble compound which ionizes in water and contributes to nutrient pollution when these chemicals reach moving waters.

Wildfires and Climate Change

Climate change is the concept that current scientific knowledge attributes to the effects of increases in temperature, greater atmospheric carbon dioxide concentration, and changes in precipitation & drought have on ecosystems. While it is not fully understood, the idea on climate change is that it drives the effects of wildfires to greater intensity and frequency. Exacerbated by anthropogenic activities, higher temperatures and drier conditions serve as accelerators to wildfires since spring thawing events happen earlier in the year, leaving the summer months drier and more susceptible to wildfires.

Beneficial Uses of Waters

The beneficial uses of waters of the PLIR are primarily listed within the tribal water quality standards. The definitions of the uses, given below in Appendix A and Table 8, list how these uses interact with major waterbodies on the Reservation. Smaller waterbodies such as streams and wetlands do not have beneficial uses defined, and because it is incontrovertible that wetlands and ephemeral streams serve as drinking water supplies for livestock and wildlife in arid, high desert environments; PLPT water quality plan and its anti-degradation component exist to protect the highest established uses and ensure these smaller water bodies are protected. Table 8 below describes the general beneficial uses of all the waterbodies on the Reservation. Beneficial uses are described underneath Table 8, and also in greater detail in Appendix A.

Waterbody	Table 8: Beneficial Uses	
	Use in Numeric WQS	Other Use Named in WQS
Lake (Pyramid Lake)	INAL, WSES, PCCU, REC1, EXAV, WILD, SPFS, AQUA, SPWN, RARE	COLD, FRSH, NATF, WTLD
River (Truckee River)	INAL, IRRG, LSWT, PCCU, REC1, REC2, WSES, WILD, EXAV, FRSH	AQUA, COLD, GRND, NATF, RARE, RIPH, SPFS, SPWN, WTLD, WQEN
Perennial Stream	Not listed in Numeric WQS	AQUA, COLD, EXAV, FRSH, GRND, INAL, IRRG, LSWT, NATF, PCCU, RARE,REC1 REC2, RIPH, SPWN, WILD, WTLD, WQEN
Wetland	Not listed in Numeric WQS	EXAV, INAL, IRRG, LWST, PCCU, REC1, REC2, RIPH, WILD, WTLD
Constructed Body	Not listed in Numeric WQS	EXAV, INAL, IRRG, LWST, PCCU, REC1, REC2, RIPH, WILD, WTLD
Ephemeral Stream	Not listed in Numeric WQS	EXAV, INAL, IRRG, LWST, PCCU, REC1, REC2, RIPH, WILD, WTLD
Geothermal Spring	Not listed in Numeric WQS	EXAV, INAL, IRRG, LWST, PCCU, REC1, REC2, RIPH, WILD, WTLD
Spring	Not listed in Numeric WQS	EXAV, INAL, IRRG, LWST, PCCU, REC1, REC2, RIPH, WILD, WTLD
Groundwater	Not given Use in WQS	Not given Use in WQS

Acronym List

AQUA- Aquaculture. For the purpose of fish hatchery operations for either human consumption or biodiversity.

COLD- Cold Freshwater Habitat. For the purpose of supporting, preserving or enhancing cold water ecosystems/habitat

EXAV- Extraordinary Aesthetic Value. For the purpose of preserving the unique aesthetic value of surface waters.

FRSH- Freshwater Replenishment. For the purpose of increasing instream flows to maintain/improve surface water quality

GRND- Groundwater Recharge. For the purpose to recharge groundwater for extraction, WQ maintenance, etc.

INAL- Indigenous Aquatic Life. For the purpose of preserving biodiversity of aquatic plant and animal species of both freshwater and inland saline water habitats

IRRG- Irrigation. For the purpose of irrigation not limited to farming, horticulture, range and range vegetation

LSWT-Livestock Watering. For the purpose of watering range and farm livestock.

NATF- Native Fish Species. For the purpose of maintaining and restoration of the reproduction and survival of native fish species.

PCCU- Primary Contact Ceremonial Use. For the purpose of protecting quality of water specifically for ceremonial, cultural, holistic, religious and traditional purposes for tribal members. Includes immersion, vaporization & incidental or intentional ingestion

RARE- Rare, Threatened and Endangered Species. For the purpose of supporting habitats necessary for the survival and successful maintenance of plant or animal species established as rare, threatened or endangered.

REC1- Water Contact Recreation. For the purpose of recreational activities involving direct body contact with the water.

REC2- Non-contact Water Recreation. For the purpose of recreational activities involving proximity to water but not normally involving body contact.

RIPH- Riparian Habitat. For the purpose of maintaining and enhancing the growth and survival of riparian vegetation.

SPFS- Sport Fishing. For the purpose of the collection of fish/organisms related to sport fishing for human consumption

SPWN- Spawning, Development and Recruitment. For the purpose of supporting high quality aquatic habitat necessary for the reproduction and recruitment of fish and wildlife.

WILD- Wildlife and Wildlife Habitat. For the purpose of protection and propagation of all wildlife & supporting habitats

WTLD- Wetland Habitat. For the purpose of protection and propagation of wildlife, and plant & wildlife habitats

WQEN- Water Quality Enhancement. For the purpose of supporting enhancement or improvement of water quality in a downstream water body.

WSES- Water of Special Ecological Significance. For the purpose of preserving the unique ecological status of Pyramid Lake as one of the few large, deep water saline Lakes in the World and to maintain the existing higher quality of the TR.

Table 8- Beneficial uses of all waterbodies on the PLIR

Historical Water Quality Information

Water quality has been studied at Pyramid Lake frequently and with increasing detail, as the Pyramid Lake Paiute Tribe seeks to preserve the lake and its supporting ecosystems. This report will not try to reiterate all of the previous reports; however, it should be noted that such background information can be found in the documents Pyramid Lake Ecological Study (W.F. Sigler & Associates, 1978), Pyramid Lake, Nevada Water Quality Study 1989-1995 (Lebo, et. al. 1993-1995), and the Pyramid Lake Paiute Tribe NPS Assessment and Management Plan (Lebo, Reuter, & Goldman, 1994). Using more recent analyses including the Tribe's own data and statistics, the characteristics of the Truckee River, Pyramid Lake, and other waters will be presented. The focus of this work is admittedly stronger in terms of emphasis of Truckee River water quality. The Truckee River is the largest flowing stream on the Reservation and its health contributes to the larger Pyramid Lake ecosystem in important ways. It is also subject to nearly every NPS pollutant, including significant effects of off-Reservation/upstream sources.

Section 6- Water Quality Results

The following section describes general NPS pollutants that affect water quality on the Reservation and also analyzes the Truckee River's water quality data from 1999 to 2018. Acronyms and abbreviations used in this section are listed in Appendix A.

Related Studies, Inventories, and Documents

In 1989, the PLPT approached the University of California, Davis - Limnological Research Group (Dr. John E. Reuter and Dr. Charles R. Goldman) to help undertake the task of developing a reasonable and scientifically sound set of water quality standards, which when implemented would help protect the beneficial uses of Pyramid Lake and that portion of the Truckee River on Tribal land. This task included: evaluation of historical data, detailed limnological monitoring, field and laboratory experiments, limnological research, and modeling. Examples of topics investigated included, but were not limited to:

- measurement and evaluation of physical and chemical parameters,
- evaluation of nutrient and particulate matter,
- phytoplankton and zooplankton ecology,
- algal growth bioassays and nutrient limitation,
- measurement of surficial sediment composition,
- paleolimnology,
- measurement of primary productivity and algal biomass,
- internal and external loading of nutrients,
- development of nutrient budgets for carbon,
- nitrogen and phosphorus,
- estimates of sedimentation rates,
- evaluating susceptibility of Pyramid Lake to anoxia,
- primary productivity and dissolved oxygen modeling,
- modeling of total dissolved solids concentration,
- NPS management and assessment,
- Lake and watershed management.

The results of these studies have been published in a series of technical reports and peer review scientific publications. The volumes entitled, Pyramid Lake, Nevada, Water Quality Study 1989-1993:

Volume I - Limnological Data, Volume II - Limnological Description, Volume Ill - Nutrient Budgets, and *Volume IV - Modeling Studies*. These volumes contain much of the information used for developing the Pyramid Lake standards, sampling designs, and the first WQ Monitoring QA Project Plan.

All data collection activities conducted by the PLPT Water Quality Program are guided by approved QA Plans. These plans include:

> *-----Quality Assurance Project Plan for the Water Quality Monitoring of Surface Waters within the -Pyramid Lake Paiute Reservation, Nevada.*
>
> *-----Quality Assurance Project Plan for Bioassessment Monitoring in Surface Waters of the Pyramid Lake Paiute Reservation, Nevada: Pyramid Lake Paiute Tribe Bioassessment Procedure.*
>
> *-----Quality Assurance Project Plan for Monitoring, Assessment, and Tracking of the Pyramid Lake Paiute Reservation Wetland Resources.*

Nonpoint Causes or Sources of Concern (Categories and Subcategories)

Off- Reservation

Off-reservation sources of nonpoint source pollution are too numerous to count, as the Truckee River is lined by numerous inputs of discharge, notably the urban centers of Reno/Sparks and smaller towns upstream, the TMWRF and feeding tributaries that contribute NPS pollution as the river flows from Lake Tahoe to Pyramid Lake. Urban areas are major contributors to water pollution through stormwater runoff, which picks up many pollutants from impervious surfaces in cities and mobilizes them. Treated wastewater effluent, containing nutrients and TDS, is discharged at a rate of up to 40 MGD into the Truckee River by TMWRF. Hydrocarbon contamination makes up a good portion of stormwater runoff as the U.S Interstate-80 (I-80) highway runs parallel to a significant portion of the Truckee River. Back in the day, legacy mining activities caused significant levels of mercury contamination in the Washoe Lake area, with significant levels still being found in Steamboat Creek, a feeding tributary to the Truckee River. Combined with well-meaning but ill-conceived hydromodification, all these nonpoint sources of pollution add another layer of complexity for constructive solutions in dealing with regulation of the waterbody's character and function.

Deteriorated water quality issues from Upstream Sources include the following:

- Nutrients, pesticides, sediment, oil, surfactants, road salt, and floating debris from urban/roadway stormwater
- Pathogens, bacteria sediment pesticides, and nutrients from off-Reservation agricultural, irrigational, or range
- Oil, TPH, pH, nutrients, toxics and low dissolved oxygen as a result of spills
- Alteration of Hydrograph, resulting in induced flooding/low flows
- Metals, toxics, sediment, and pH issues from legacy and active mining
  Wastewater treatment from upstream urban areas

Hydromodification

Hydromodification throughout the watershed has had major effects on water quality throughout the Reservation since the construction of Derby Dam in 1902. When the dam began operation in 1905, all of the water within the Truckee River was diverted to Newlands Project in the Carson Desert. Between

1918 and 1970, the diversion resulted in Pyramid Lake levels decreasing 80 feet and the drying up of Winnemucca Lake, a basin east of Pyramid Lake. Various litigation and agreements over the century, including the Truckee River Operating Agreement (TROA), have mandated minimum stream flows in the lower Truckee River for the purpose of fish spawning and water quality objectives. However, the decades of significantly reduced flows had lasting impacts in the Truckee River corridor and water quality.

The diversion at Derby Dam has significant impacts on water quality. The diversion effectively decreased dilution capacity of pollutants in the Truckee River, resulting in increases in concentration of nutrients, total dissolved solids, and sediment entering from tributaries. Furthermore, the falling lake levels resulted in headcutting at the lower Truckee River's delta, which resulted in approximately 84,000,000 metric tons of sediment being transported down the river. Marble Bluff Dam was constructed in 1975 to prevent further incision in the river, while enabling fish to spawn in habitat upstream of the dam. The incised channel lowered the water table, which has dried out many of the important wetlands throughout the lower Truckee River and developed favorable habitat for the proliferation of noxious weeds.

Hydromodifications continued on the lower Truckee River when the Army Corps of Engineers (USACE) constructed a number of projects in the 1960s to reduce flooding in upstream areas. Such activities included straightening portions of the Truckee River between Truckee Meadows and Pyramid Lake, to drain water quicker from populated floodplains upstream. This resulted in an altered hydrograph, which decreased flooding upstream but increased flooding downstream. With the Truckee River channels already incised, the increased flows exacerbated erosion of banks during flood events.

Deteriorated water quality issues from hydromodificaton include the following:

- Hydrographic changes, resulting in induced flooding/low flows
- Lowered water table and riparian encroachment
- Favorable conditions for noxious weed establishment
- Decreased flows, resulting in less dilution of pollutants including nutrients and total dissolved solids
- Increased temperatures from widened river channel, resulting in lower dissolved oxygen concentrations
  Incised and easily erodible banks, resulting in sedimentation of downstream spawning habitat

Urban Residential: Roads, Highways and Bridges Runoff

There are number of paved areas within the Reservation including parking lots, tribal residential roads, highways, and bridges. Paved roads contribute NPS pollutants through stormwater runoff, which may contain accumulated road waste such as salts, dust, emissions, oil and rubber. The amount of these pollutants increases with the level of use on the roads. I-80 is a heavily used freeway that runs through the southern tip of the Reservation and crosses the Truckee River. There are also three state highways that traverse the Reservation, State Route (SR) 445 and SR 446, which run adjacent to Pyramid Lake and SR 447, which crosses the Truckee River in Nixon. The proximity of all of these vital roads to waterbodies results in increased probability of a potential hazardous spill.

Burning Man is an annual gathering in the Black Rock Desert of northwest Nevada, which typically last 10 days and with 85,000 attendees. I-80 and SR 447 are the primary routes for attendees, staff,

government personnel, and vendors to get to and from the event. Additionally, site preparations for the event take place up to 35 days in advance and site cleanup is conducted 35 days post-event. The event's organizers have recently proposed to increase attendance to 100,000 by 2022. The increased vehicle traffic and roadway presence increases the likelihood of adverse impacts to water quality. Degradation may result if runoff transports pollutants deposited on the roadways to nearby waterbodies.

NPS pollutant issues from Roads, Highways and Bridges category:

- Bacteria and nutrients from black water tanks of recreational vehicles
- Increased total dissolved solids from winter snow removal activities
- Increased water temperatures from stormwater runoff
- Increase in various pollutants including dust, emissions, oil and rubber
  Trash and debris dumped intentionally or accidentally by Burning Man participants

Recreation

Recreation is one of Pyramid Lake's main revenues and various activities have the potential to generate NPS pollutants. Pyramid Lake hosts a wide range of recreational activities such as camping, boating, fishing, and swimming. These recreational activities on the Reservation can have several potential impacts including nutrient loading and bacteria from recreational vehicles' black water storage tanks, petroleum products from leaking vehicles or boats, stormwater runoff from adjacent roads and parking lots, sediment from eroding unauthorized dirt roads and trails, and chemical residue from authorized fireworks discharge areas.

NPS pollutant issues from Recreation category include:

- Black water storage tank discharge (pathogens, bacteria, nutrients)
- Urban roadway stormwater (nutrients, pesticides, sediment, oil, TPH, surfactants, road salt, floating debris)
- Petroleum products from leaking boats and vehicles (TPH, VOCs, MTBE, fuel)
- Erosion from unauthorized dirt roads and trails (Sediment, nutrients, floating debris)
- Chemical residue from fireworks (metals, nutrients, VOCs)
  Possible introduction of AIS or noxious weeds

Waste Disposal

Despite recent Tribal efforts to reduce illegal dumping, there are still currently 14 documented sites considered illegal dumpsites. These dumpsites contain hazardous wastes with potential to pollute waters. NPS pollutants from these illegal dumpsites are more likely to impact water quality if the site is located in an area prone to flooding events. Typical pollutants found at dumpsites on the Reservation include motor oil, electronics, animal carcasses, paint, lead acid batteries, gypsum, and household cleaners such as bleach and ammonia. Microplastics are included with waste disposal because plastics can break down into microplastics if they are not recycled.

NPS pollutant issues from waste disposal runoff on the Reservation include:

- Illegal dumping—contaminates leaching through the soil into the water supply (Oil, TPH, floating debris, heavy metals)
- Solid waste management (Oil, TPH, floating debris)
- Spills/Emergency response (oil, TPH, CECs, pH, surfactants, nutrients, toxics, heavy metals)

Microplastics

Microplastics are a CEC due to the increase in micro-plastic pollution around the world, its ability to bio-accumulate and the lack of technical knowledge about toxicity of microplastics. Microplastics are plastics that are less than 5µm in diameter, and scientists are concerned that large 2-5 micron sized microplastics can act as a vector for pathogenic diseases, which are smaller and can fit on the surface of the larger microplastic particles. While microplastics have been added to cosmetics and other household products since the 1950s, public awareness is growing about its role in the overall food cycle. Microplastics have been found in human stool samples from around the world; furthermore, it is estimated that microplastics are found in 94% of US tap water, but authorities are unsure about the effects of microplastics in humans (Carrington, 2017).

Microplastics represent a threat to the aquatic wildlife and other organisms due to its inability to be removed from the food chain by any means: chemical, mechanical, or biological. The Tribe acknowledges the fact that plastics pollution are an inevitability of waste disposal and urban runoff, and recognizes that the ubiquity of plastic dependence by man serves as a constant source of non-point source pollution. Since the Pyramid Lake watershed is a terminal basin, it's feared that microplastics will never be removed.

NPS pollution issues from waste disposal of Microplastics in Tribal waters include:

- CECs (effects on aquatic life not understood)
- Wastes (floating debris, degraded solids)
- Pathogens (E. coli, fecal coliforms)

Agriculture Runoff

Tribal land assignments for irrigated agriculture are located throughout the Truckee River corridor between Wadsworth and Nixon. There are approximately 936 acres of irrigated land that are in production and are located on historic floodplains of the Truckee River. Much of these land assignments produce forage crops such as alfalfa. Farmers in these areas utilize the flood irrigation method, by diverting water from the Truckee River through a series of irrigation ditches and head gates. Some of the fields have excess water after irrigation, so the remaining runoff flows into return flow ditches or directly into the Truckee River. Irrigated agriculture is a significant source of surface water and groundwater NPS pollution on the Reservation. Typical NPS pollutants from agricultural runoff include sediment, nutrients, pesticides, salinity, pathogens and temperature.

Sediment is a common NPS pollutant when farm operations remove a significant amount of vegetation, exposing the soil surface to runoff and wind (Bianchi, 2002). Service roads surrounding the irrigated fields can also have the potential of rill and gully erosion. Sedimentation can also occur when the Truckee River migrates toward irrigated fields and sloughs the river's banks, especially during high flows. High levels of sediment adversely impacts water quality because it can increase temperature and decrease dissolve oxygen levels. Sediment also deposits in important spawning habitat in the lower Truckee River.

Farm operators typically utilize fertilizers or livestock waste to increase agricultural production (Bianchi, 2002). The two most significant nutrients affecting tribal waters are nitrogen (nitrate) and phosphorus. Excess nutrients from fields are NPS pollutants when they runoff into nearby waters and increase algal production. Work done by Desert Research Institute (DRI) in 2003 focused on irrigation activities at the

John Guerrero and Guerrero Ranches located in the Wadsworth area. The study found that over a two-year period, monitoring wells placed on these properties show higher levels of nitrogen and phosphorous.

Salts are accumulated when water is consumed by plants or lost to evaporation (Bianchi, 2002). When water is applied to the field, it is lost through evaporation or plant consumption, while the salts are left behind. More water than is needed is used to remove these excess salts through surface runoff or groundwater infiltration. Salts are detrimental to water quality, as increasing salinity will decrease dissolved oxygen solubility. In another DRI study, elevated TDS concentrations are seen between the stretches of Wadsworth and Nixon, especially in the Dead Ox Meadows area. A significant source of the TDS comes from the associated irrigated agriculture in the Fernley sub-basin.

Pathogens are microorganisms that can result in illness in humans or animals. Irrigated lands are a source of pathogens if the excess water is untreated and the water contains animal manure. The concentration of pathogens depends on the density of livestock within an area, as well as timing and frequency of grazing. Pathogens may become NPS pollutants when the daily rate of fecal decomposition exceeds buffers including vegetation, soil or solar decomposition.

NPS pollutant issues from agriculture runoff on the Reservation include:

- Field Management (nutrients, pesticides)
- Irrigation from return flows—contaminated runoff and direct deposition of manure to streams (nutrients, pesticides, bacteria)
- Irrigation maintenance (sediment)

Riparian Zone Degradation

Throughout the past century, there have been many adjustments to the Truckee River to control erosion. For the purposes of flood control in the Truckee Meadows, the Army Corps of Engineers straightened many of the meanders and channelized the Truckee River in the 1960s. The Corps also removed much of the riparian vegetation, which caused the banks to destabilize and erode habitats, while increasing sediment loads. The Corps also added the Tamarisk to the ecosystems, as a way to protect further erosion. The Tamarisk is a highly invasive plant, which formed monocultures on the Truckee River's remaining floodplains and outcompeted most native vegetation.

NPS pollutant issues from riparian zone degradation runoff on the Reservation include:

- Destruction of riparian vegetation from cattle grazing (sediment, temperature)
- Bank erosion (sediment, temperature)
- Spread of invasive weeds

Livestock and Range NPS

The Reservation contains approximately 303,360 acres of land that is designated for livestock and wildlife use which includes all lands outside of Pyramid Lake, residential communities, the Truckee River corridor and proposed lake range wildlife habitat region. Range allotments are designated solely to tribal members and the Pyramid Lake Cattlemen’s Association. In recent years, tribal rangelands have been stressed by prolonged drought, cheat grass, wildfires, and heavy use by feral horses and livestock.

Until the late 1990s, winter rangelands on the Reservation lacked proper fencing to protect riparian and other sensitive areas. The PLPT received funding from the USEPA in 1999 to install fencing along the

river to protect riparian vegetation and improve water quality. Even though these sensitive areas have been protected, lack of management and vandalism has resulted in sections of the fenced areas being left open for cattle to roam in undesignated units, such as the Truckee River corridor. Additionally, wildfires caused damage to portions of the boundary fencing of the Reservation, resulting in additional rangeland degradation.

Degradation of tribal rangelands has an impact to water quality on the Reservation's surface waters. Because these waters are located within designated grazing units, surface soil erosion and nutrient loading has been identified as a NPS. Lack of vegetative cover in areas of poor range condition are susceptible to erosion and runoff. Furthermore, livestock and feral horses tend to gather at sensitive riparian areas, damaging soils and vegetation through compaction and grazing of native species. Invasive plant species have been introduced through by grazing animals, outcompeting native species and increasing soil erosion (PLPT CRMP, 2005).

NPS pollutant issues from livestock and range runoff on the Reservation include:

- Upland ecosystem instability
- Grazing management- areas have secondary issues due to lack of boundary fencing
- Livestock waste—contaminated runoff and direct deposition of manure to streams (nutrients, pathogens like enterococci)
- Water supply scarcity—greater concentration of contaminants (sediment, nutrients, temperature)

Resource Extraction

There are numerous abandoned mines within the Reservation. The inactive Packard and Sano mines were underground operations located in the northern region of the Reservation, which produced small quantities of lead, silver, zinc, and gold. The Lakeview Mine, located on the east side of Pyramid Lake, produced gold, silver and copper. The Guanomi Mine, located in the southwest portion of the Reservation, produced molybdenum, gold and silver between the 1900s and 1920. In the early 2000s, the Tribe implemented a mine-reclamation project which included constructing a treatment wetland to prevent acid mine drainage to Pyramid Lake.

Other mining operations located outside of the Reservation may also affect tribal water resources. The Olinghouse mine is an open pit operation that extracted gold and silver by cyanide heap leaching. In the reclamation of this mine, a pond holding cyanide processing solution breached, which resulted in contaminated waters flowing down toward the Reservation. Other nearby mines, the Perry Canyon mines, are located west of the Reservation Boundary. However, drainage from these mines flow through Mullen Pass and discharges to Pyramid Lake, as well as recharges the Sutcliffe drinking water aquifer. The contaminated water from these mines are 320 times the acceptable level of arsenic.

The active and inactive mines described above have been identified as potential NPS. Abandoned mine drainage is a concern for acid mine drainage is the runoff of highly acidic water, with concentrated levels of heavy metals. Heavy metals are leached from rocks that come into contact with acid and the resulting waters are highly toxic and may contaminate tribal waters (EPA, 2018).

Paiute Pit is an active open-pit gravel mining operation managed by CEMEX, located in Wadsworth, NV. Paiute Pit is a NPS as it discharges excessive levels of nitrates and TDS into the water table, as well as thermal pollution by as much as 8-10 ^{o}C more than riparian water temperatures. Additionally, the lower-

than- ground- level operation of the pit lowered the water table and disrupted the aquifer supplying drinking water to the town of Wadsworth. This drying out event caused widespread cottonwood tree mortality around the Wadsworth riparian corridor.

NPS pollutant issues from resource extraction runoff on the Reservation include:

- Quarries (sediment, temperature, pH)
- Mine drainage (toxics, pH, TDS, metals)

Mercury

Before 1900, mercury was used during the milling of ores from the Comstock Lode throughout many areas of the Truckee River Watershed. Steam Boat Creek is a tributary severely impacted by mercury and other metals, which originates at Washoe Lake where mills used mercury for gold and silver extraction until the late 1800s.

During the initial environmental studies conducted at the proposed SouthEast Connector project site, the Regional Transportation Commission (RTC) identified the presence of methyl mercury in soils. This is concerning as biogeochemical conditions within wetlands provide an environment for the increase of production of methyl mercury, which can bio-accumulate in fish tissue. Since the project is required to mitigate for wetland area lost as a result of the roadway, the project is constructing additional wetland acreage within the area that is known to contain high levels of mercury laden soil. In addition, the disturbed project area due to construction raises likelihood of contaminated soil through stormwater runoff.

In the flood of 2017, the WQ Program received notification from RTC that the mercury-contaminated soils had breached as a result of the flood. The soil mound that had breach contained “Category 2” levels of mercury, which is the highest concentration of mercury on site. In the following days, the WQ Program met with RTC and Army Corps to develop a sampling plan to understand the extent of the breach. The results from the sampling not only showed a significant increase in mercury below the project site compared to the top, but it also revealed high concentrations of mercury coming from above the project site, likely originating from Washoe lake.

NPS pollution issues from mercury on the Reservation:

- Methylation of mercury
- Bioaccumulation in plants and animals

Natural Sources

Climate Change Potential Effects

Climate models and studies have shown that the southwest region of the United States will see an increasing temperature range in the future due to climate change. Cumulative temperature readings have been taken throughout the past century in the United States, which show a temperature increase of 0.56 ^{o}F. With an average increase of temperature within the Pyramid Lake Watershed, water temperatures will increase as well. Increasing water temperatures are associated with declining water quality and quantity, which include temperature pollution and decreased oxygen levels. This also gives bacteria and HABs an opportunity to thrive. Increased temperature has also be linked to increased wildfire frequency, with drought and severity of wildfire events seen as leading indicators of climate change.

Harmful Algal Blooms (HABs)

Toxic cyanobacterial blooms at Pyramid Lake have been documented increasingly over the past decade. Blue-green algae (also known as cyanobacteria) are found in water bodies throughout the world. Blue-green algae can grow rapidly under favorable conditions, often creating a bloom or surface scum. Some conditions that influence bloom formation are nutrient availability, light intensity, water temperature, species competition, wind patterns, water column mixing, and zooplankton predation. In some cases, blue-green algae produce toxins. Although environmental factors leading to toxin production are not well understood, toxins are more likely to reach harmful concentrations during bloom conditions. Only laboratory tests can confirm if a bloom is toxic or non-toxic.

Studies conducted on the watershed indicates the water is characterized by elevated phosphorous levels, while nitrogen are less, indicating the nitrogen was the limiting nutrient. However, annually during the summer, nutrient levels hit the eutrophication threshold and the lake experiences an Algal Bloom event. The WQD established protocol for such events, from public health advisories to beach closures for microcystin concentrations over 8.0 µg/L. HABs are included in this assessment report due to their dependence on Nitrogen and Phosphorous concentrations, both are considered NPS nutrient pollutants.

NPS pollutant issues from Harmful Algae Blooms on the Reservation include:

- Atmospheric loading (sediment, nutrients, toxics)
- Groundwater and soils (TDS, salt)
- Geothermal activity (TDS, temperature, and metals)
- Blue-green algae (cyanotoxins, DO)
- Climate change (sediment, temperature, DO)

Wildfires

Wildfires have always been destructive to the environment, destroying vegetation, animal and human habitats, displacing populations and requiring considerable human effort and resources for containment. In recent years, there has been annual occurrences of wildfires, such as the 2016 Tule Fire, as part of the five-fire event Virginia Complex fire; in 2017, the separate Truckee and Tokahum fires destroyed a combined 47,034 acres on the PLIR due to lightning; and, in 2018, the arson-caused Perry fire destroyed 18,081 acres in the Pah Rah mountain range. Because of the increasing frequency, severity and consequences of fire events, wildfire has to be considered as a nonpoint source of water pollution.

NPS pollutant issues from wildfires on the Reservation include:

- Atmospheric Loading (sediment, ash)
- Water table Loading (sediment, ash, TDS & nutrient pollution)
  Ecosystem Instability (habitat destruction, noxious weed infiltration, erosion)

Parameters

Pyramid Lake Parameters

A total of two sampling stations have been previously identified for on-going monitoring activities. Water quality monitoring for Pyramid Lake consists of monthly sampling at the deep index station (Way

Point 96 in the deep north basin); as well as quarterly sampling at the shallow index station (Way Point 93 in the shallower south basin). Quarterly synoptic samplings are conducted during winter mixing (February), the spring phytoplankton bloom (April-May), summer (August), and in the fall (November); the exact timing may vary from year to year. All lake sampling locations are accessible by boat and all sampling locations were previously recorded using global positioning system (GPS) equipment.

Field measurements at both stations include the following: water column profiles (using a SEACAT SBE19 plus) for: Temperature (^oC), pH, Specific Conductivity (SPC), Dissolved Oxygen (DO), photosynthetically active radiation (PAR), and chlorophyll-a. A Secchi Disk is used to determine water transparency and composite zooplankton samples (0-10 m, and 0-bottom) are collected. The SEACAT is sent in annually for calibration of all sensors within its framework, and new values are obtained for annual configuration adjustment upon its return. Samples are taken at certain depths and are verified through a Lowrance Marine Electronic Unit.

Water samples that are analyzed for nutrients are collected from discrete depths: Surface composite (0.5m + 2.5m + 5m), 10m, 20m, 30m, 45m, 60m, 75m, 90m, and 5m from the bottom. The nutrient analyses performed on samples include: NH_3, $N0_2$+$N0_3$, TKN, DRP, and TP.

Name of Waterbody	***Type of Water***	***Length or Area of Waterbody in Reservation***	***100% in PLIR***	***Beneficial Uses***	***Impairment Sources***
Pyramid Lake	*Lake*	*175 mi^2*	*Yes*	• *Aqua Culture* • *Cultural* • *Extraordinary Aesthetic Value* • *Freshwater Replenishment* • *IndigenousAquatic Life* • *Maintenance and restoration of native fish species* • *Rare, Threatened and Endangered Species* • *Water Contact Recreation* • *Non-contact water recreation* • *Sport fishing* • *Spawning, reproduction and development* • *Wildlife habitat* • *Water of special ecological significance*	*All Categories*

Table 9- Pyramid Lake Parameters and protected beneficial uses

Truckee River Parameters

Through degradation of channel morphology and loss of valuable native riparian vegetation, the lower Truckee River's water quality has been severely impacted. Shallow wide channels with a lack of shaded banks have resulted in increased water temperature and decreased dissolved oxygen that is necessary for aquatic life. In 2002, the EPA designated the lower Truckee River as an Impaired Waterbody with standard violations in total phosphorus, turbidity, and temperature.

A total of five monthly sampling stations along the Truckee River have been previously identified for ongoing monitoring activities: Marble Bluff (MB), Nixon Bridge (NB), Dead Ox (DO), Wadsworth Bridge (WB), and Pierson Dam (PD). All Truckee River sampling locations are accessible using a 4-wheel drive vehicle, and locations were previously recorded using global positioning system (GPS) equipment.

Field measurements taken at all sites (using YSI EXO 1 & 3 sonde instruments) include temperature, DO, pH, SPC, Total Dissolved Solids (TDS), salinity, and Turbidity.

Water samples are collected as grab samples at each site and analyzed for NH_3, $N0_2$+$N0_3$, DRP, and TP.

Name of Waterbody	***Type of Water***	***Length or Area of Waterbody in Reservation***	***100% in PLIR***	***Beneficial Uses***	***Impairment Sources***
Truckee River	*River*	*33 mi*	*No*	• *Aquaculture* • *Cultural* • *Cold freshwater habitat* • *Domestic supply* • *Extraordinary aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Rare, threatened and endangered species* • *Water contact recreation* • *Non-contact water recreation* • *Riparian habitat* • *Sport fishing* • *Spawning, reproduction and development* • *Wildlife habitat* • *Water quality enhancement* • *Water of special ecological significance*	*All Categories*

Table 10. Truckee River parameters and protected beneficial uses

Stream Parameters

A total of thirteen perennial stream sampling sites have been previously identified for on-going monitoring activities: Big Mouth Canyon Creek, Coal Canyon Creek, Tom Anderson Canyon Creek, Rodero Creek, Hardscrabble Creek, Jigger Bob Canyon Creek, Poison Canyon Creek, Thunderbolt Canyon Creek, Sharpes Canyon Creek, Big Canyon Creek, Dove Creek, Nugent Hole Canyon Creek, and Nugent Canyon Creek. Streams are sampled annually in conjunction with physical habitat surveys and bioassessment sampling events. This usually occurs in spring (April/May) depending on the annual snow pack and spring runoff rates. Field measurements are taken (YSI EXO 1 & 3 sondes) at all sites to measure ^{o}C, DO, pH, SPC, Total Dissolved Solids (TDS), salinity, and Turbidity. Water samples are collected at each site and analyzed for NH_3, $N0_3$+$N0_2$, Orthophosphate (DRP), and Total Phosphorus (TP).

Name of Waterbody	***Type of Water***	***Length or Area of Waterbody in Reservation***	***100% in PLIR***	***Data***	***Beneficial Uses***	***Impairment Sources (Subcategories)***
Big Canyon Creek	*Perennial Stream*	*2.0 mi*	*No*	*Yes*	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*
Big Mouth Canyon Creek	Perennial Stream	3.9 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*

Name of Waterbody	***Type of Water***	***Length or Area of Waterbody in Reservation***	***100% in PLIR***	***Data***	***Beneficial Uses***	***Impairment Sources (Subcategories)***
Coal Canyon Creek	Perennial Stream	4.2 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*
Dove Creek	Perennial Stream	6.0 mi	Yes	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• Upland ecosystem instability • Grazing management • Livestock waste • Water supply scarcity • Bank erosion • Riparian encroachment • Riparian forestry • Bank ecosystem instability • Atmospheric loading • Groundwater and soils • Geothermal activity • Blue-green algae • Wildfire • Climate change
Hardscrabble Creek	Perennial Stream	8.7 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*

Name of Waterbody	***Type of Water***	***Length or Area of Waterbody in Reservation***	***100% in PLIR***	***Data***	***Beneficial Uses***	***Impairment Sources (Subcategories)***
Jigger Bob Canyon Creek	Perennial Stream	8.6 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*
Mullen Creek	Perennial Stream	4.0 mi	No	No	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*
Nugent Canyon Creek	Perennial Stream	5.6 mi	Yes	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• Upland ecosystem instability • Grazing management • Livestock waste • Water supply scarcity • Bank erosion • Riparian encroachment • Riparian forestry • Bank ecosystem instability • Atmospheric loading • Groundwater and soils • Geothermal activity • Blue-green algae • Wildfire • Climate change

Name of Waterbody	***Type of Water***	***Length or Area of Waterbody in Reservation***	***100% in PLIR***	***Data***	***Beneficial Uses***	***Impairment Sources (Subcategories)***
Poison Canyon Creek	Perennial Stream	2.0 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*
Rodero Creek	Perennial Stream	7.7 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*
Sharpes Canyon Creek	Perennial Stream	2.2 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*

Name of Waterbody	***Type of Water***	***Length or Area of Waterbody in Reservation***	***100% in PLIR***	***Data***	***Beneficial Uses***	***Impairment Sources (Subcategories)***
Tom Anderson Canyon Creek	Perennial Stream	3.9 mi	No	Yes	• *Cultural* • *Cold freshwater habitat* • *Extraordinary Aesthetic Value* • *Freshwater replenishment* • *Groundwater recharge* • *Indigenous aquatic life* • *Irrigation* • *Livestock watering* • *Maintenance and restoration of native fish species* • *Wildlife habitat* • *Water quality enhancement*	• *Upland ecosystem instability* • *Grazing management* • *Livestock waste* • *Water supply scarcity* • *Bank Erosion* • *Riparian encroachment* • *Riparian forestry* • *Bank ecosystem instability* • *Atmospheric loading* • *Groundwater and soils* • *Geothermal activity* • *Blue-green algae* • *Wildfire* • *Climate Change* • *Agriculture/irrigation/range* • *Groundwater contamination*

Table 11. Stream parameters and protected beneficial uses

Data Presentation and Analysis

The Truckee River is the main waterbody flowing into Pyramid Lake and is the primary source of nonpoint source pollutants originating upstream. The PLPT Water Quality Program continues to conduct monthly sampling on the lower Truckee River and Pyramid Lake and annually on the Reservation's surrounding streams. There are five sites along the lower Truckee River, whose data are presented below as “Truckee River Monitoring (TRM)” site graphs, as well as four NPS discharge monitoring sites, whose data are presented below as “Nonpoint Source (NPS) Monitoring” site graphs. Note that NPS monitoring locations do not have site-specific numeric water quality criteria assigned to each location. Some graphs will have both TRM and NPS site data on the same graph and are titled “All Sites Monitoring”. This report will present recent data from 2015-2018 alongside with historical data dating back to 2002, for context and evaluating short and long term trends. Data is compared to the water quality standard(s) established by the Tribe, which is represented by a smooth red line in the graphs. Data points appearing as zero values are data points below the detectable limit and should not interpreted as a zero, or as the absence of an analyte. Additionally, data points that are unconnected or incontinuous are for reasons due to staffing, funding or sampling opportunity shortfalls.

Phosphorus Concentrations in Truckee River and Nonpoint Source Sites

Although past studies have observed that both the Truckee River and Pyramid Lake are nitrogen-limited systems, measuring phosphorus has been an important analyte sampled throughout the years. Any increase in phosphorus can promote excess levels of plant and algae growth, which can deplete oxygen levels needed by desirable plant and aquatic life.

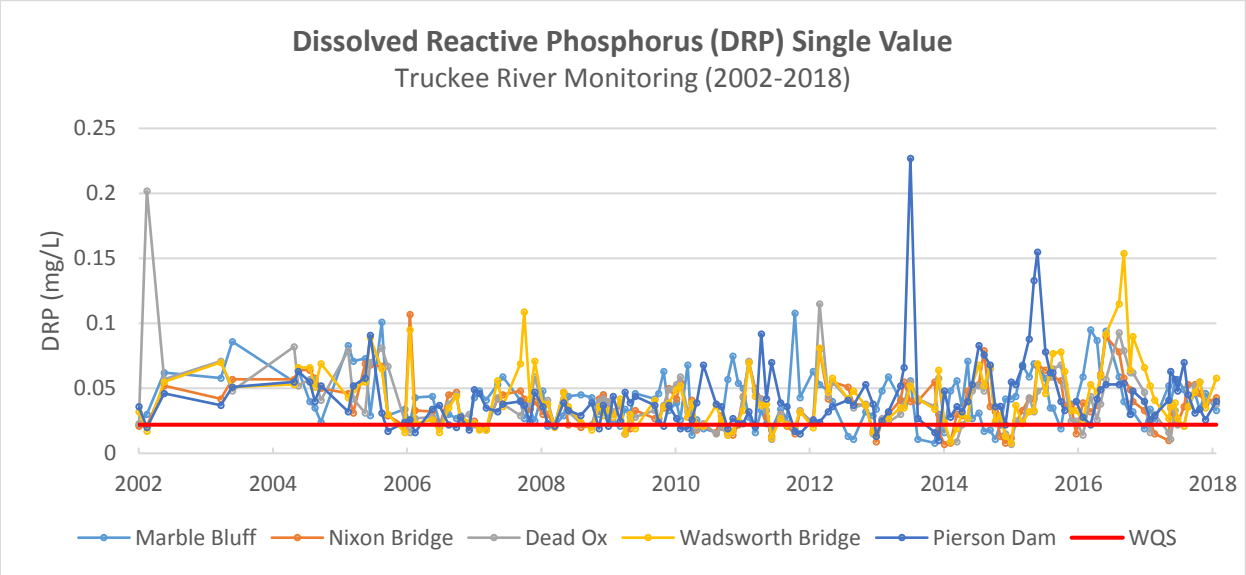
Annual *Nodularia spumigena* blooms represent a threat to public health, as they typically occur during the summer recreational season. Studies have shown that nitrogen is the limiting factor in algal growth and the concentration of phosphorous is secondary. The phosphorous water quality standards established by the Tribe are designed to protect against the accumulation of phosphorous in Pyramid Lake, as a protective measure against sustained or enhanced blue-green algal blooms (PLPT WQCP, 2015).

Nutrient inputs to lakes from drainage basins are typically the majority of nutrient budgets. In particular, wastewater discharge from the Reno/Sparks metropolitan area contributes excessive nutrient pollution in storm runoff. The runoff from agriculture land, septic systems, residential homes and industrial cleaning operations are all sources of phosphorus.

The PLPT has set phosphorus criteria for both Pyramid Lake and the lower Truckee River. Pyramid Lake has a seasonal water quality standard for dissolved reactive phosphorus (DRP) of 0.095 mg/L between depths of 0 and 20 meters, during the period April through October. DRP is also not to exceed 0.115 mg/L throughout the full water column throughout the entire year. There is also a seasonal total phosphorus (TP) standard of 0.120 mg/L in depths between 0 and 20 meters, during the period of April through October. TP is also not to exceed 0.140 mg/L throughout the full water column through the entire year.

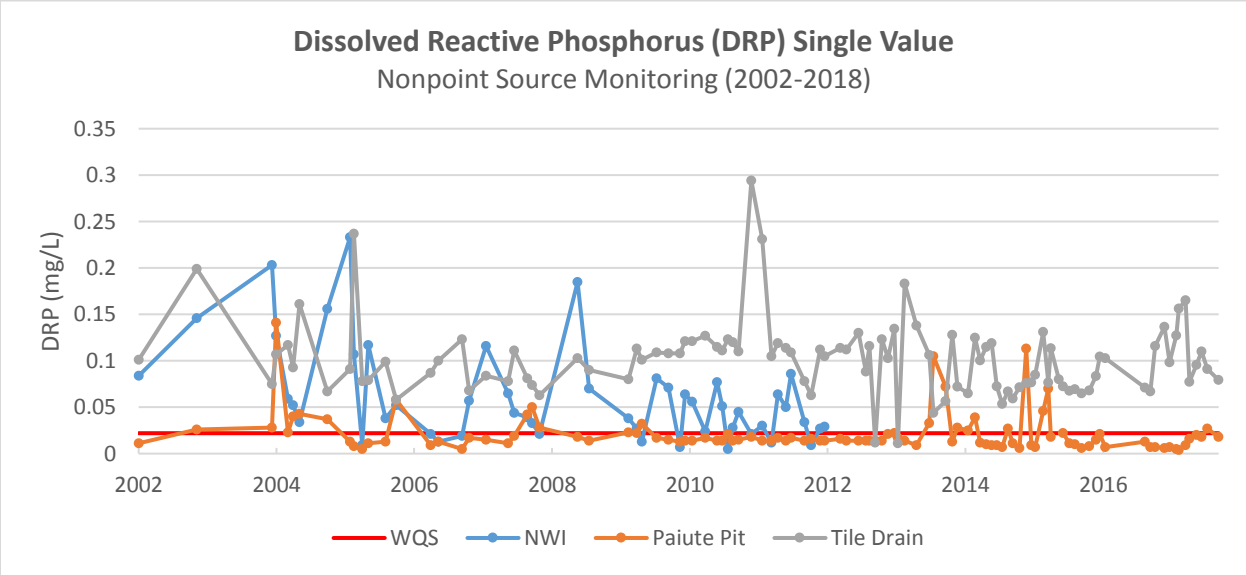
In 2015, the Water Quality Program completed its first triennial review of water quality standards. The Tribe worked closely with the tribal community, tribal departments, Tribal Council, Fisheries Board, the Nevada Division of Environmental Protection, and the EPA, to coordinate with the necessary

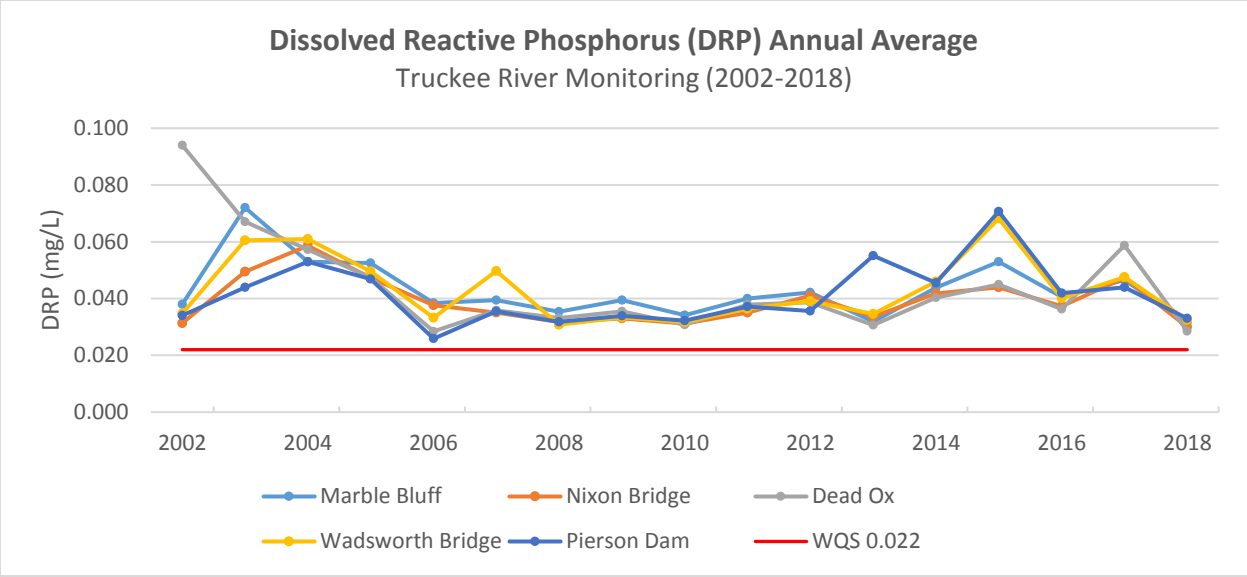
stakeholders throughout the process. During the Triennial Review, the Tribe revised its DRP standard from an annual-average of 0.05 mg/L to 0.022 mg/L, which is roughly the equivalent of the State of Nevada's TP water quality standard of 0.05 mg/L on the Truckee River above the Reservation's boundary. The Tribe decided to continue implementing a DRP standard, as opposed to a TP standard, for DRP is readily bioavailable to algal growth. DRP is not to exceed an annual average of 0.022 mg/L in a monthly volume weighted average.



Graph 1 (above): Truckee River Monitoring of DRP from 2002 to 2018, Single Value

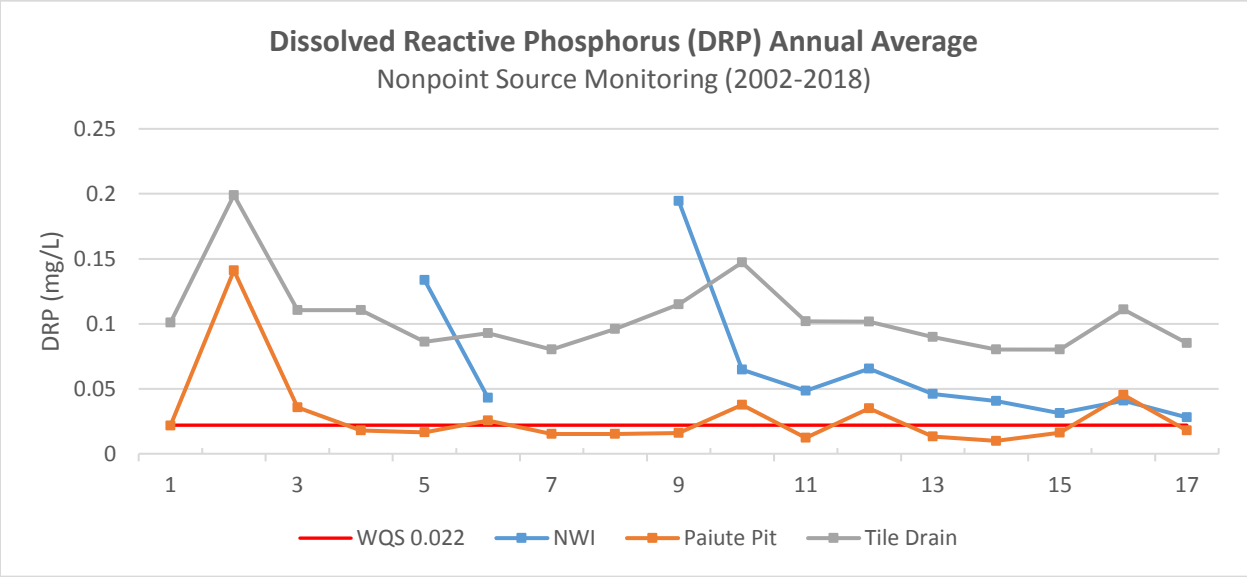
Graph 2 (below): Nonpoint Source Monitoring of DRP from 2002 to 2018, Single Value

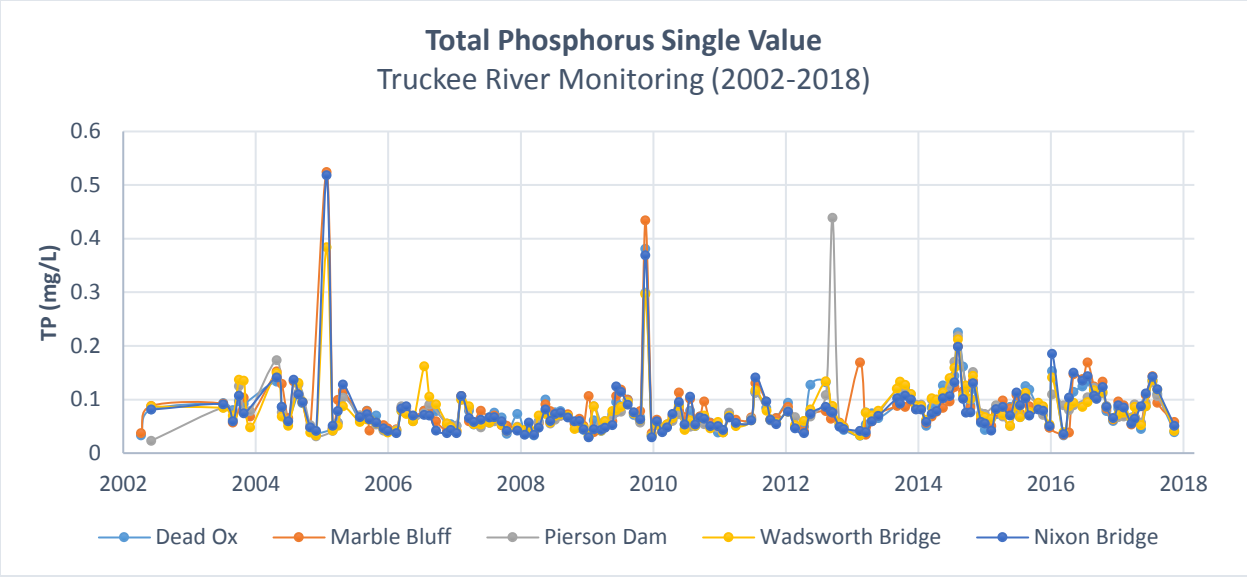




Graph 3 (above): Truckee River Monitoring of DRP from 2002 to 2018, Annual Average

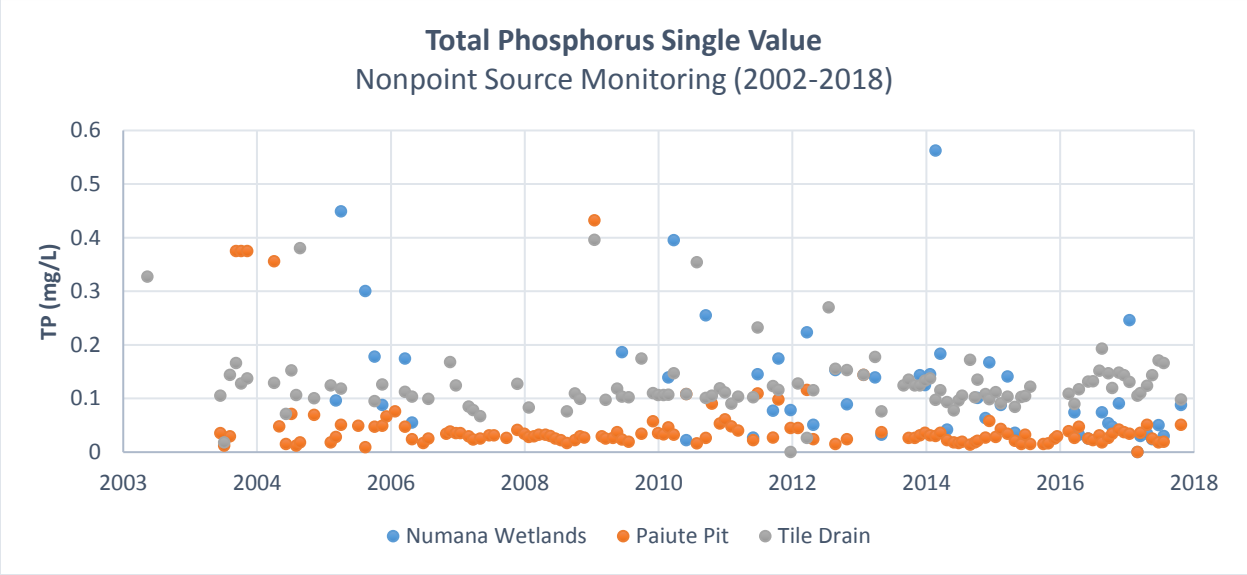
Graph 4 (below): Nonpoint Source Monitoring of DRP from 2002 to 2018, Annual Average





Graph 5 (above): Truckee River Monitoring of Total Phosphorous, from 2002 to 2018, Single Value

Graph 6 (below): Nonpoint Source Monitoring of Total Phosphorous, from 2003 to 2018, Single Value

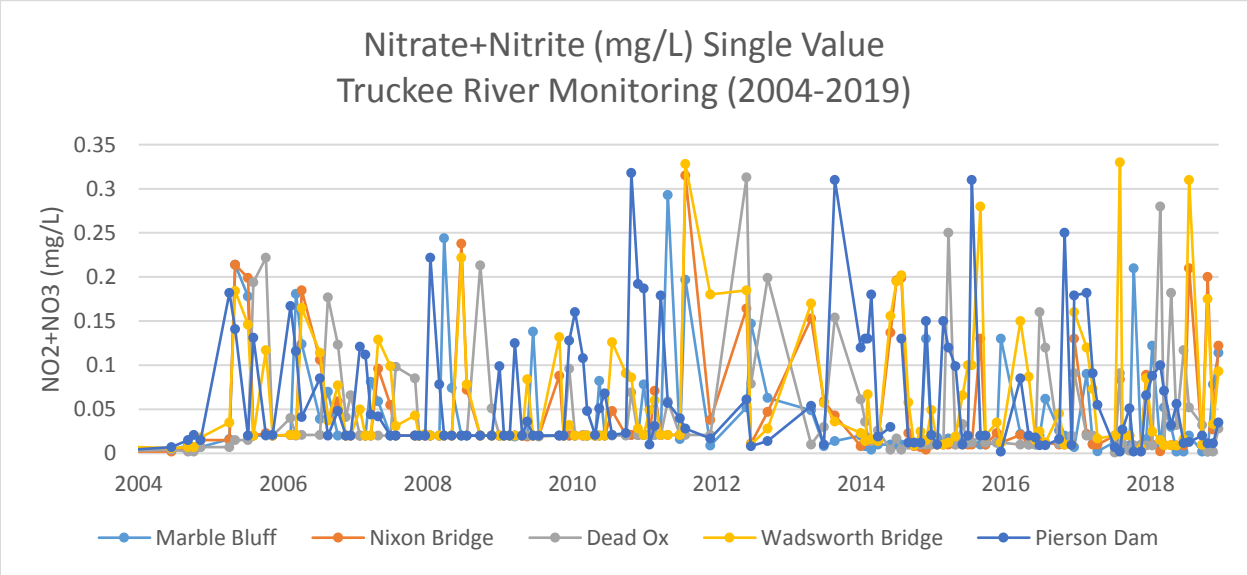


Nitrogen Concentrations of the Truckee River and Nonpoint Source Sites

Nitrogen is important in an aquatic ecosystem because it serves as a significant role in regulating factor in algal production. As stated above, both Pyramid Lake and the Truckee River are nitrogen-limited systems. With increases of available nitrogen to phosphorus, there are increases in algal productivity, resulting in decreases of dissolved oxygen.

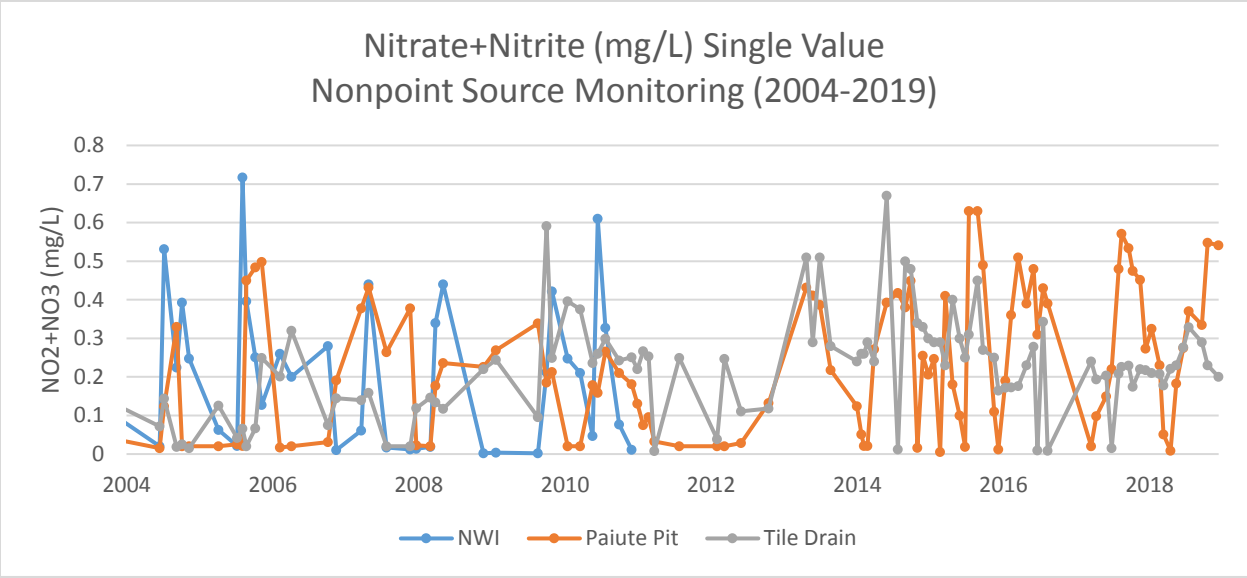
The Tribe depends on lake recreation and tourism for its economy. As a result, the Tribe established its nitrogen water quality standards to protect its coldwater sport fishery by maintaining food supply and adequately oxygenated waters. The water quality standard establishes a balance for the needs of lower level consumers that depend on algal growth for food (and serve as prey for fishes), and an overabundance of available nitrogen that leads to algal blooms, resulting in dissolved oxygen depletion in lower levels of the water column and subsequent fish kills (PLPT WQCP, 2015). Instead of Total Nitrogen, the PLPT set the standard for Dissolved Inorganic Nitrogen (DIN), which includes nitrates, nitrites and ammonium, because those compounds represent the bioavailable sources of nitrogen to algal and other species. Studies by Lebo et al. indicate that a strong empirical relationship exists between DIN input to surface waters and algal production (Lebo, 1994).

For the lower Truckee River, the PLPT has set various standards on nitrogen compounds. Total nitrogen has a set standard of 0.75 mg/L in an annual average and a single value of <1.2 mg/L. Nitrate also has a single-value standard of <2.0 mg/L and nitrite has a single-value of <0.04 mg/L. The PLPT has set different standards for Pyramid Lake.



Graph 7 (above): Truckee River Monitoring of Dissolved Inorganic Nitrogen- Nitrates, from 2004 to 2019, Single Value

Graph 8 (below): Nonpoint Source Monitoring of Dissolved Inorganic Nitrogen- Nitrates, from 2004 to 2019, Single Value

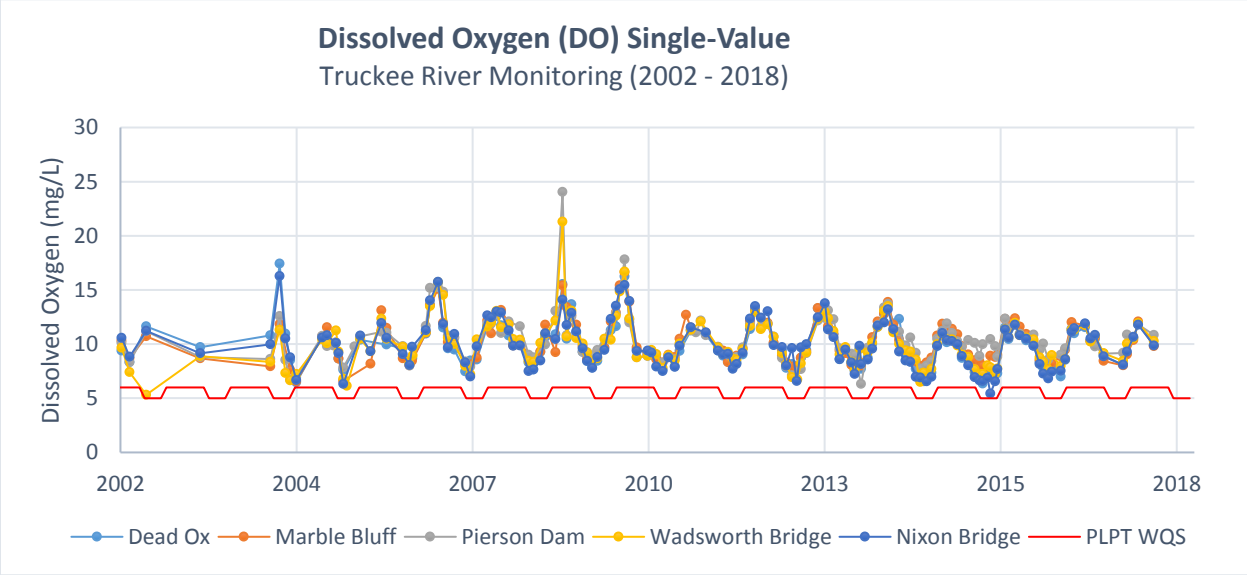


Dissolved Oxygen in the Truckee River and Nonpoint Source Sites

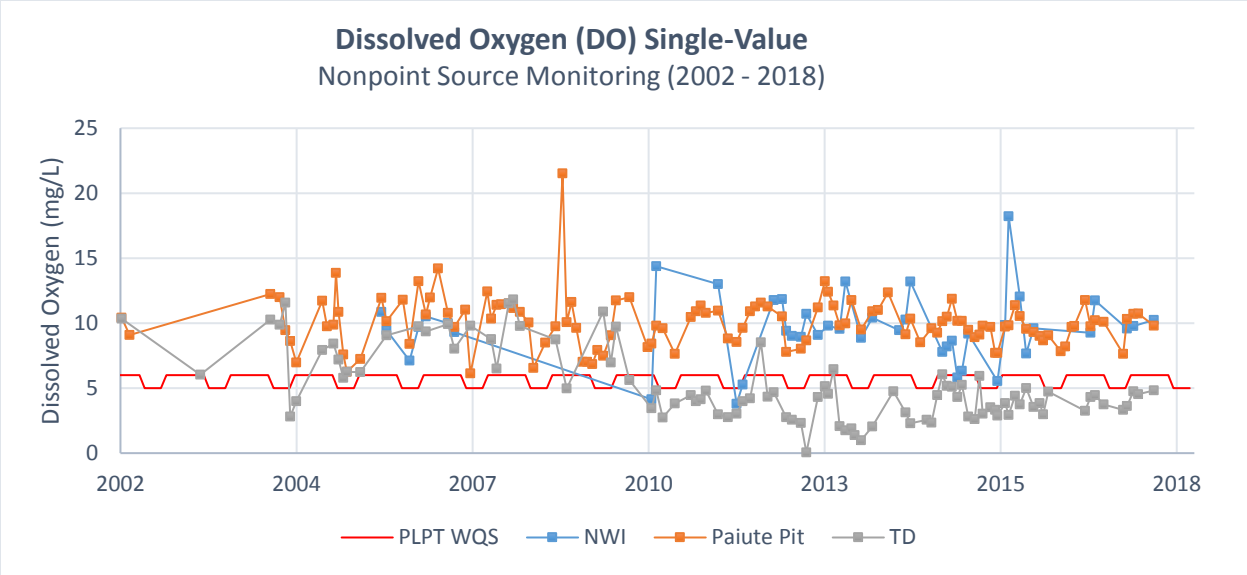
Dissolved Oxygen (DO) is an important parameter in monitoring water quality for its influence on aquatic organisms including fish, invertebrates, bacteria and plants. DO concentrations are constantly affected by diffusion, aeration, photosynthesis, respiration and decomposition (Fondriest). DO will also fluctuate with temperature, salinity and pressure changes. In the Truckee River, the life cycle patterns of the cui-ui and LCT are affected by factors such as low dissolved oxygen, temperature, and reduced stream flow.

In the 1980s, water quality monitoring on the Truckee River indicated that the river was impaired for DO. Excess benthic algae, which grows on solid surfaces such as substrate and submerged logs, was determined to be the primary reason for depleted DO levels. This algae thrives when there are excess bioavailable nutrients, as well as shallow water depth for increase photosynthesis.

The PLPT has identified two seasonal dissolved oxygen water quality standards for the lower Truckee River to protect beneficial uses including waters of ecological significance and aquatic life. The water quality standard for the lower Truckee River from November to June is ≥6.0 mg/L and ≥5.0 mg/L from July through October.



Graph 9 (above): Truckee River Monitoring of Dissolved Oxygen, from 2002 to 2018, Single Value



Graph 10 (above): Nonpoint Source Monitoring of Dissolved Oxygen, from 2002 to 2018, Single Value

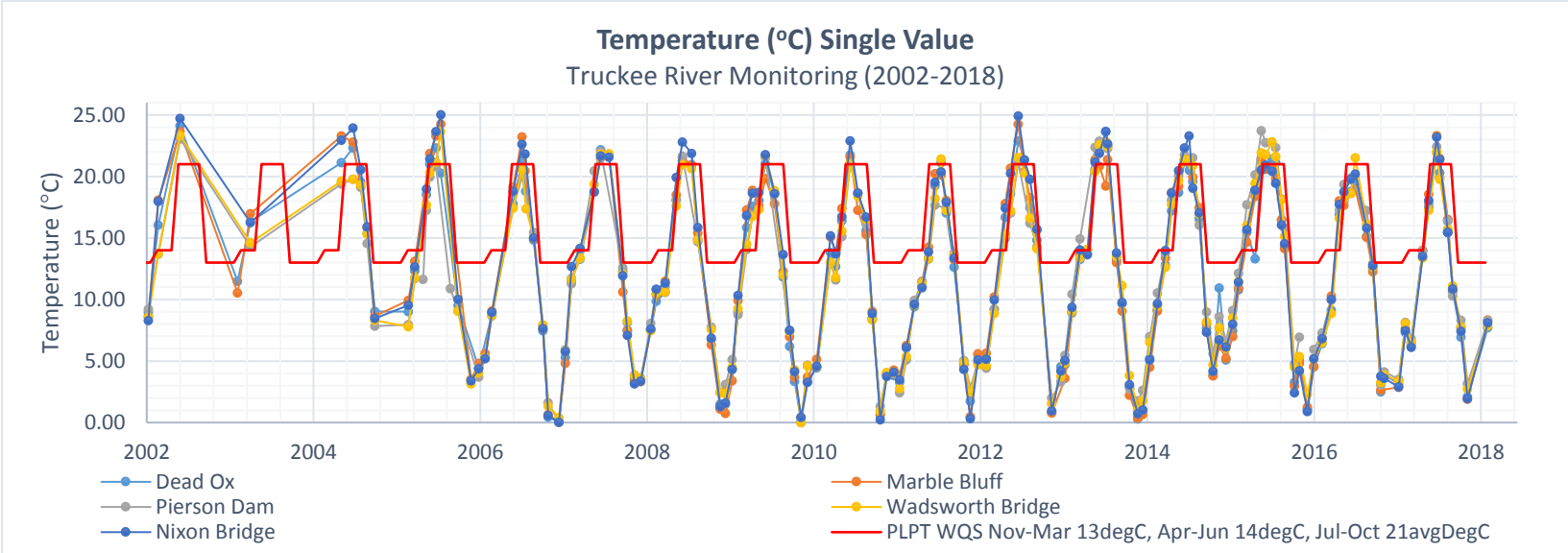
Temperatures in the Truckee River and Nonpoint Source Sites

Water temperature is important because it affects the suitability of aquatic habitats for fish. Fish have adapted to compete and reproduce within various ranges of water temperatures, resulting in reduced growth or death in a stressful temperature regime. Both the Lahontan cutthroat trout and the cui-ui are cold-water fish, which require cold waters to survive and successfully spawn. While the temperature of Pyramid Lake is not a constraint to the survival of either species due to ample cold waters in deeper portions of the lake throughout the year, the warming of the Truckee River waters during spawning season is a serious threat to a self-sustaining fishery. An inadequate temperature regime in the lower Truckee River during spring and summer months is so crucial that temperatures may interfere with successful natural spawning regardless of any other water quality factors (WQCP, 2015).

Extensive studies conducted by the Fish and Wildlife Service and others, temperature requirements were identified for the cui-ui and LCT spawning. Based on these studies, the Tribe's temperature standards for Pyramid Lake and the lower Truckee River were established for the protection and propagation of spawning by the LCT and cui-ui, and were partly based on the State of Nevada's WQS for temperature on the Truckee River, but with a lower summer season temperature range in protection of LCT juveniles (PLPT WQCP, 2015).

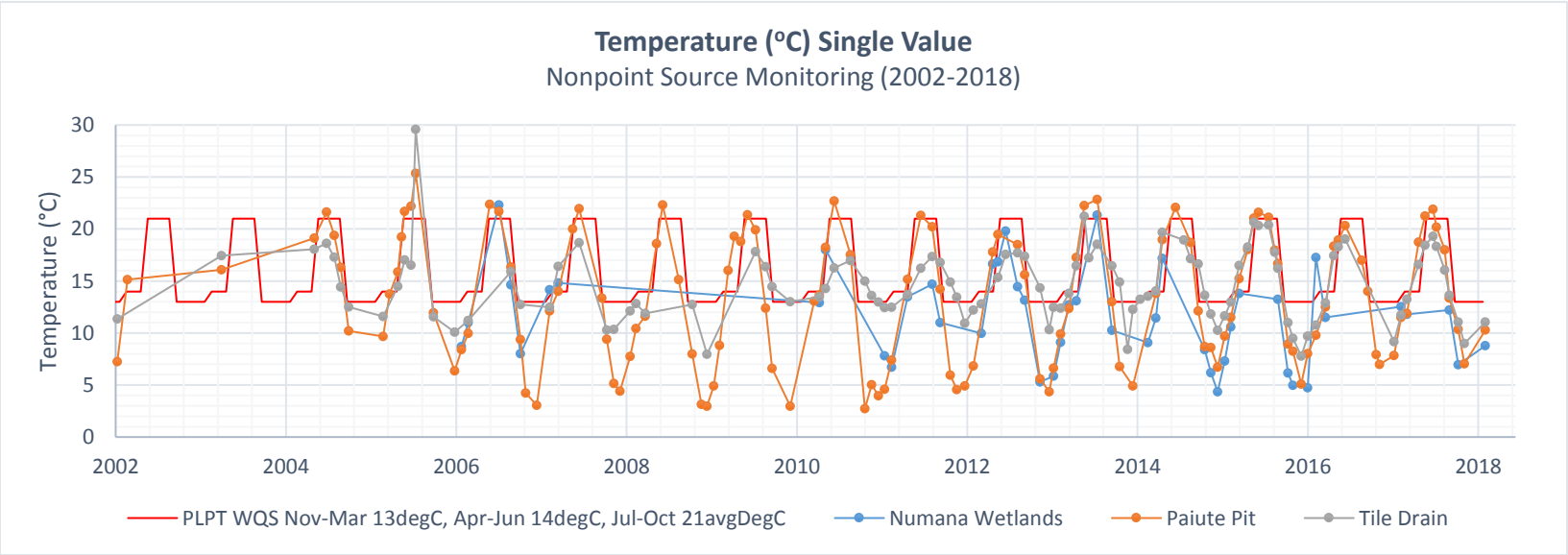
The PLPT temperature standard is <13°C November through March, and <14°C in April through June, and <21°C in July through October. This criterion was established to provide for propagation of cui-ui and LCT in the months when temperatures are ideal to induce spawning runs in April through June. The established criteria for the months July through October is provided for the protection of larvae and juveniles.

Interrelated to ecosystem health and nutrient loading is the production of algae, dissolved oxygen levels, and temperature. Data is not yet available to evaluate algae or 24-hour dissolved oxygen levels on the Reservation, but temperature data shows that water quality regularly exceeds temperature standards for aquatic species beneficial uses. Canopy cover and channel depth are issues that need improvement.

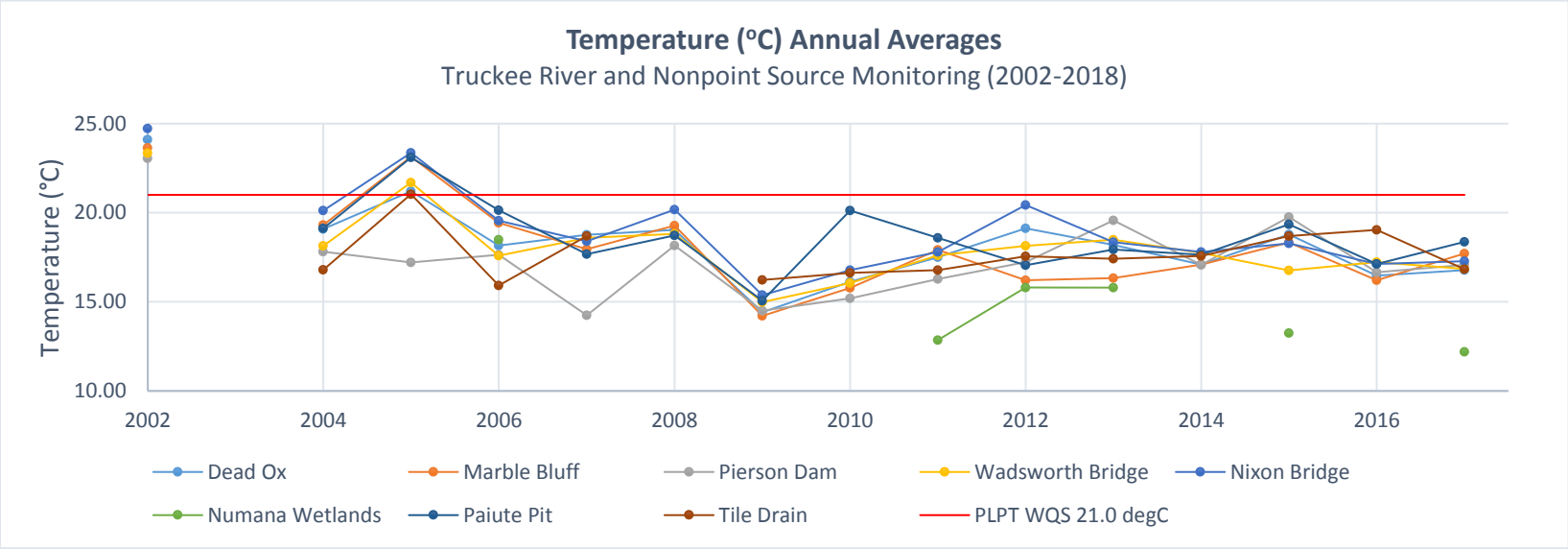


Graph 11 (above): Truckee River Monitoring of Temperature, from 2002 to 2018, Single Value

Graph 12 (above): Nonpoint Source Monitoring of Temperature, from 2002 to 2018, Single Value



Graph 13 (below): All Sites Monitoring of Temperature, from 2002 to 2018, Annual Averages

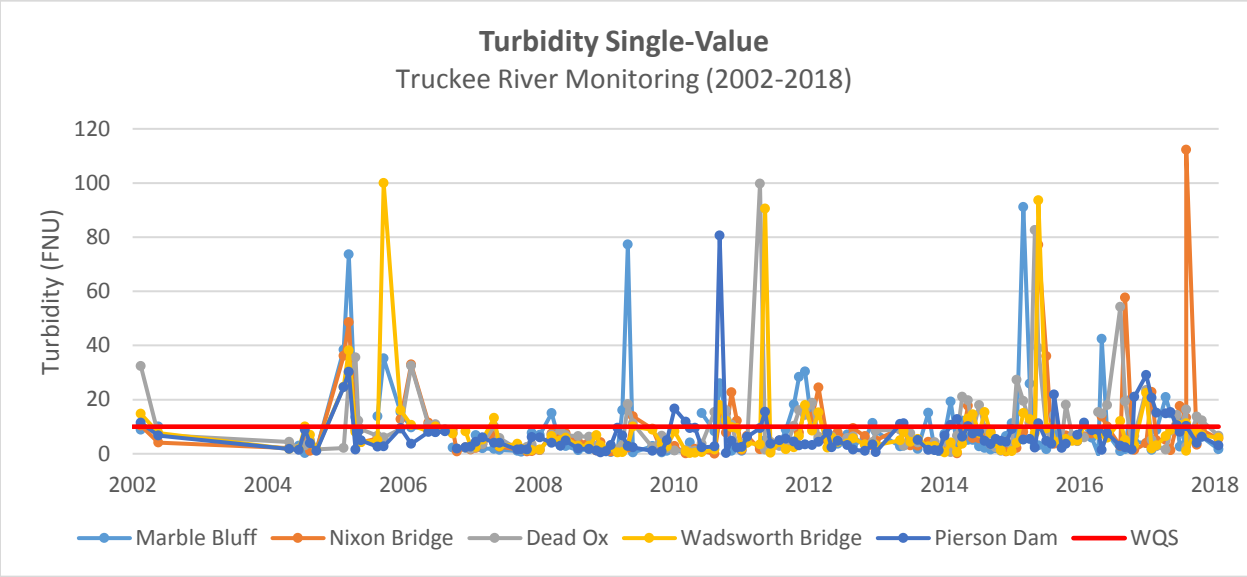


Turbidity of the Truckee River and Nonpoint Source Sites

Turbidity is an optical determination of water clarity estimated total suspended solids in a waterbody. Total suspended solids are particles that are larger than 2 microns, whereas anything smaller is considered a dissolved solid. Most suspended solids include inorganic materials, but may also be affected by bacteria and algae. Turbidity of water is derived from the amount of light that is scattered by particles in the water column. While turbidity and total suspended solids are related, turbidity is not a direct measurement of the suspended materials in water, but a measure of relative clarity.

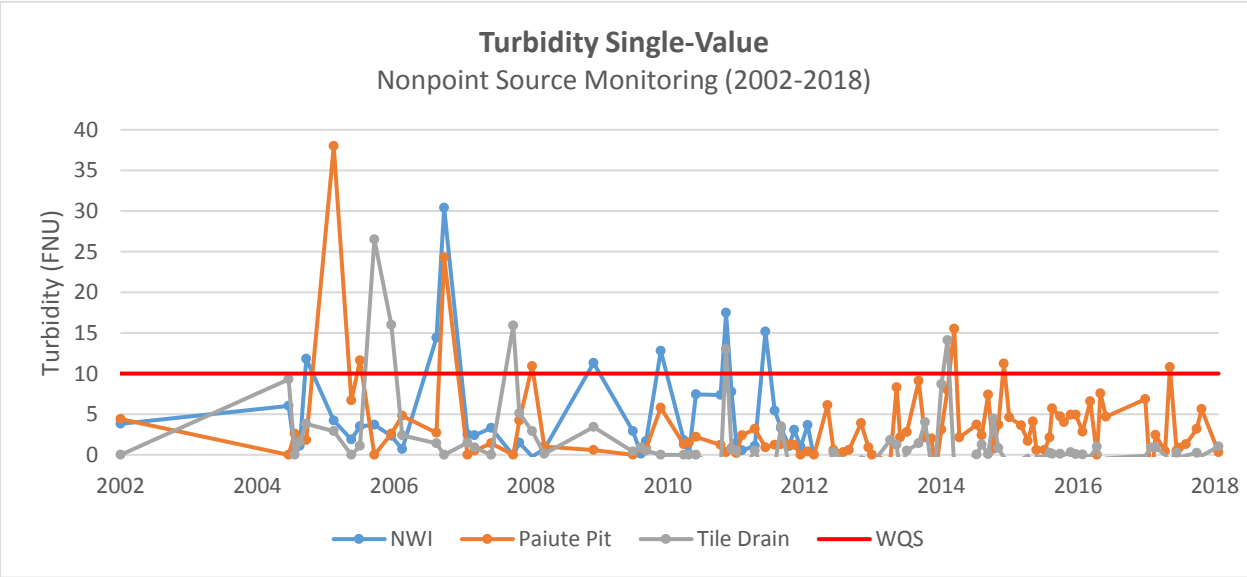
Within the surface waters of Pyramid Lake, the suspended sediment and turbidity concentrations should not be altered by nuisance which adversely affect beneficial uses. The Truckee River can contribute a significant amount of sediment loading to Pyramid Lake. Although the Truckee River typically has a relatively stable level of sediment suspension, there are high turbidity events during flooding and significant storm events which are exacerbated by wildfire and other erosive events.

The PLPT has established Turbidity standard criteria for the lower Truckee River. Turbidity is not to exceed more than 10 NTU (Nephelometric Turbidity Units) in a single reading.



Graph 14 (above): Truckee River Monitoring of Turbidity, from 2002 to 2018, Single Value

Graph 15 (below): Nonpoint Source Monitoring of Turbidity, from 2002 to 2018, Single Value

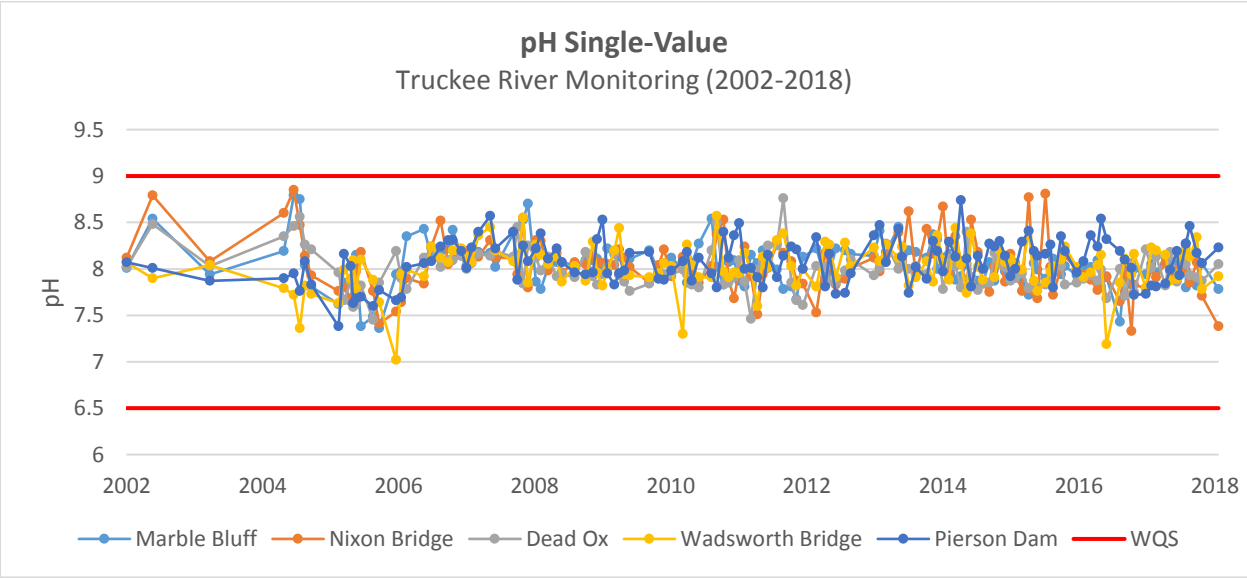


pH of the Truckee River and Nonpoint Source Sites

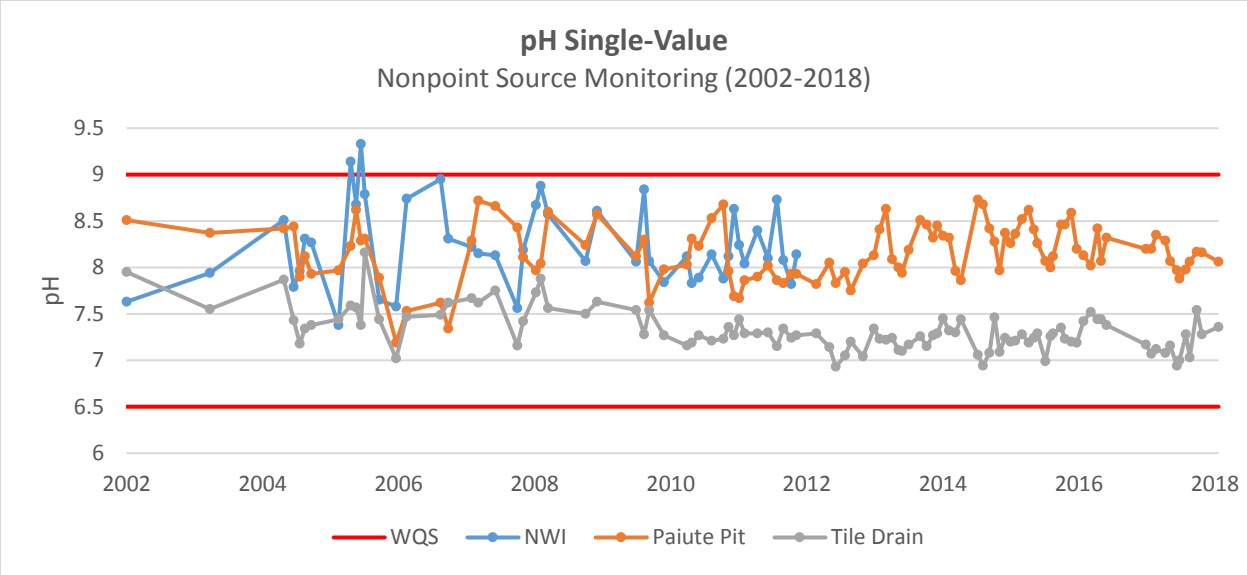
pH is a value based on a defined logarithmic scale and is a figure between 0 and 14, which determines how acidic or basic a body of water is. The lower the number, the more acidic the water is. The higher the number, the more basic. The numerical value of pH is determined by the molar concentration of hydrogen ions and by the negative logarithm of H^+ concentration.

pH is an important indicator of water quality because it affects most of the chemical and biological processes in a waterbody. The pH of water determines the solubility and bioavailability of chemical constituents such as phosphorus and nitrogen, as well as heavy metals (USGS). Both Pyramid Lake and the Truckee River are alkaline environments, where pH is higher. High pH for these waters may be a concern because un-ionized ammonia is more toxic than ionized ammonia as pH increases. This condition could develop where the Truckee River (pH 7.0-8.5) discharges to the Pyramid Lake delta (pH 9.0-9.5). The delta provides spawning habitat for cui-ui and LCT, as well as fry migrating to the lake. This is why Pyramid Lake pH is used to calculate the un-ionized ammonia component of total ammonia in Truckee River water samples. Other natural factors that may affect pH value include calcium carbonate, pine or fir forest (upper Truckee River Watershed), water table level, precipitation, seasons, photosynthesis, and respiration. Human induced causes include acid rain (from coal burning industries and automobile engines), point/NPS pollution, and mining.

The PLPT has set criteria for pH based off aquatic life, water contact recreation, non-contact water recreation, and extraordinary aesthetic value beneficial uses. Standards require that pH single- values are between 6.5 – 9.0 and change in pH is not to exceed 0.5. The pH standard is also consistent with beneficial use values for the State of Nevada.



Graph 16 (above): Truckee River Monitoring of pH, from 2002 to 2018, Single Value



Graph 17 (above): Nonpoint Source Monitoring of pH, from 2002 to 2018, Single Value

Total Dissolved Solids in the Truckee River and Nonpoint Source Sites

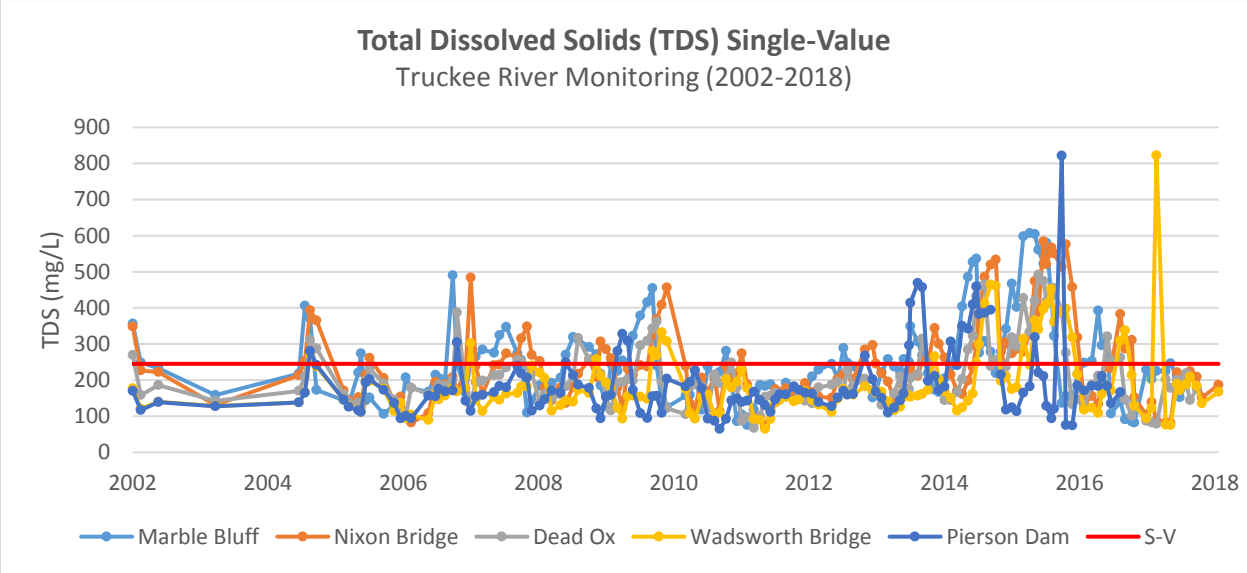
Total Dissolved Solids (TDS) is the sum of all ion particles that are smaller than 2 microns (In comparison, 2 microns is the equivalent size of bacteria). TDS includes all the disassociated electrolytes (salts) that make up salinity, as well as other compounds such as dissolved organic matter. Freshwater is considered is considered below 2,000 mg/L of TDS, but is usually much lower (Fondriest, 2017). Compare this to Pyramid Lake's water, which average TDS is between 4,843 mg/L to 5,893 mg/L. High concentrations of TDS is typical for terminal lakes because they accumulate TDS inputs from the entire watershed and remain in the waterbody when surface water evaporates. High freshwater inflow during wet years can sufficiently dilute salinity of surface waters and thereby lower TDS concentration in Pyramid Lake.

Depending on TDS's ionic properties, excessive TDS can produce toxic effects on fish and fish eggs. Salmonids exposed to higher than average levels of $CaSO_4$ at various life stages experienced reduced survival and reproduction rates. TDS is also important to aquatic life by keeping cell density balanced. In distilled or deionized water, water will flow into an organism's cells, causing them to swell. In water with very high TDS, cells will shrink. These changes can affect an organism's ability to move in the water column, causing it to float or sink beyond its normal range. TDS can also affect water taste and often indicates a high alkalinity or hardness (Fondriest, 2017).

The TDS of Pyramid Lake has increased considerably during the 20th century, due to decreasing lake elevation and the Truckee River's diversion at Derby Dam. This prompted a study in the early 1990s, to understand potential effects if lake volume continued to decrease and TDS increase. A TDS model was developed to predict single annual values of lake level and TDS concentration for Pyramid Lake based on changes in lake volume and TDS. From this study, a TDS water quality standard for Pyramid Lake was set at 5,900 mg/L, based on the toxicity of TDS to organisms presently in the lake. An increase in the TDS concentration of the lake may threaten native species by eliminating prey species for LCT and affecting the survival of larval cui-ui. Because Pyramid Lake's TDS levels are quickly approaching the water quality

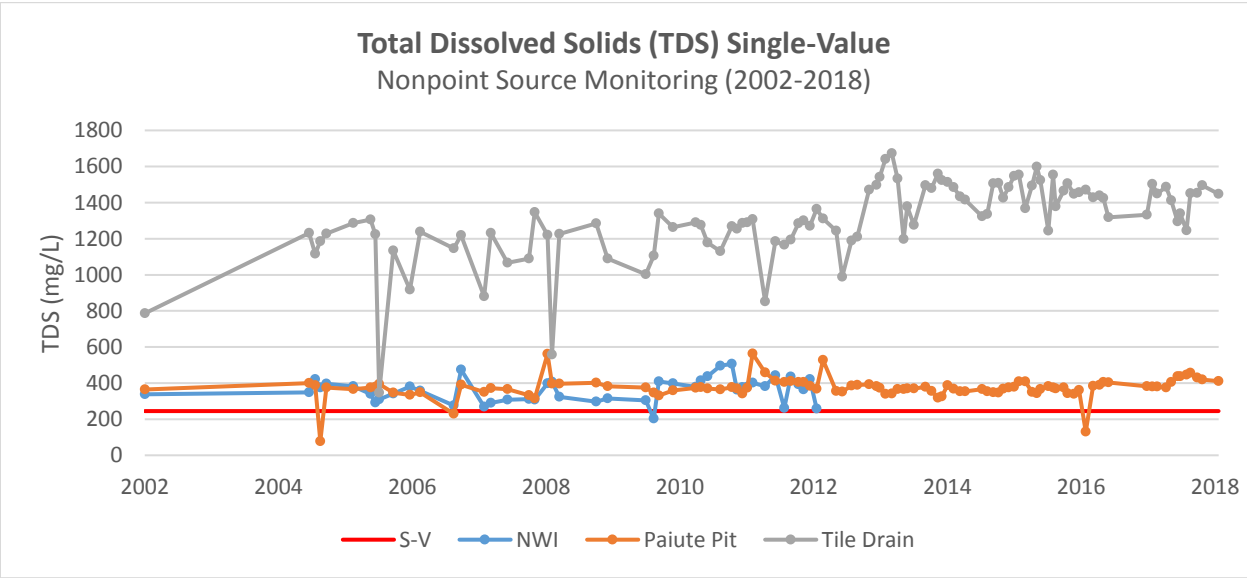
standard, it was recommended that water management in the Truckee River watershed should focus on providing as much water as possible to the lake (Lebo et. al, 1994).

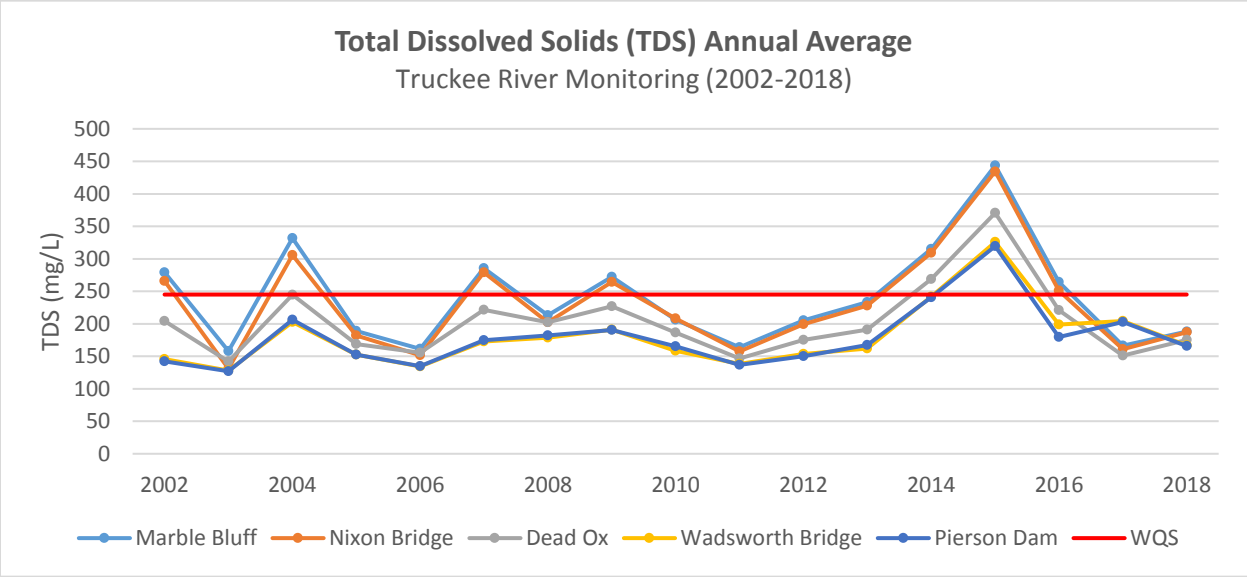
The Truckee River contains site-specific criteria for TDS at two locations within the Reservation. For the Wadsworth to Dead Ox reach, single vale TDS is not to exceed 310 mg/L and annual average is not to exceed 245 mg/L. For the Dead Ox to Pyramid Lake reach, annual average TDS is not to exceed 415 mg/L. The increase between the two control points is to account for groundwater inputs on the Fernley Bench, which contains high levels of TDS due to agricultural seepage.



Graph 18 (above): Truckee River Monitoring of TDS, from 2002 to 2018, Single Value

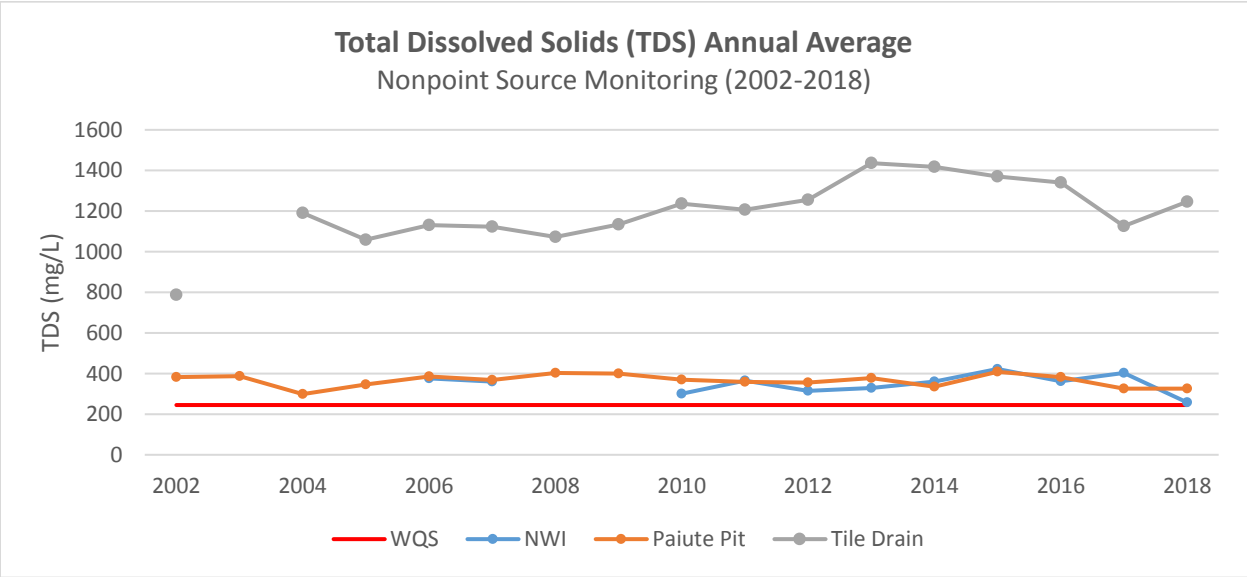
Graph 19 (below): Nonpoint Source Monitoring of TDS, from 2002 to 2018, Single Value





Graph 20 (above): Truckee River Monitoring of TDS, from 2002 to 2018, Annual Averages

Graph 21 (below): Nonpoint Source Monitoring of TDS, from 2002 to 2018, Annual Averages



Impairment Determination

The impairment determination for each monitoring location was completed by comparing historical data to the Tribe's established water quality standards. Data from each monitoring location evaluated based on site-specific criteria at the control points from Wadsworth to Dead Ox and Dead Ox to Pyramid Lake. The degree of impairment of the following waterbodies were based off exceedances of Pyramid Lake's water quality standards. This was completed by dividing the number of samples in exceedance by the total number of samples. If the monitoring sites had exceedance values of greater than 10 percent, the waterbody is considered "impaired." Samples that fell in between 0 and 10 percent exceedances were considered threatened. Some impairments are intermittent, or inconsistently impaired throughout the year due to factors such as flooding or drought. Other impairments are seasonally-impaired, or when the monitoring site is consistently impaired during a specific season, such as temperature in the summer.

Table 12: Truckee River Impairment Determination

Waterbody	Site	Parameter	Criteria exceeded	Status	Percent Exceedance	Degree of Impairment
Lower Truckee River	PD	DRP	Annual Average: ≤ 0.022 mg/L	Impaired	100%	High
		TDS	Single Value: ≤310	Threatened	9.6%	Low
			Annual Average: ≤ 245 mg/L		5.9%	
		Turbidity	Single Value: ≤10.0 NTU	Intermittent Impairment	18.9%	High
		DO	Nov-Jun Single Value: : ≥6.0 mg/L	N/A	0.0%	N/A
			Jul-Oct Single value: ≥5.0 mg/L		0.0%	
		Temperature	Nov-Mar Max Daily Temp (24 hrs): ≤ 13°C	Seasonally Impaired	0.0%	High
			Apr-Jun Max Daily Temp (24 hrs): ≤ 14°C		55.3%	
			Jul-Oct Average Daily Temp: ≤ 21°C		29.5%	
		pH	Single value: 6.5-9.0 pH	N/A	0.0%	N/A
		Inorganic Nitrogen	Based off CMC and CCC calculations			
	WB	DRP	Annual Average: ≤ 0.022 mg/L	Impaired	100%	High
		TDS	Single Value: ≤310	Threatened	10.5%	Low
			Annual Average: ≤ 245 mg/L		5.9%	
		Turbidity	Single Value: ≤10.0 NTU	Intermittent Impairment	22.2%	High
		DO	Nov-Jun Single Value: : ≥6.0 mg/L	N/A	0.0%	N/A
			Jul-Oct Single value: ≥5.0 mg/L		0.7%	

Waterbody	Site	Parameter	Criteria exceeded	Status	Percent Exceedance	Degree of Impairment
Lower Truckee River, cont'd	WB, cont'd	Temperature	Nov-Mar Max Daily Temp (24 hrs): ≤ 13°C	Seasonally Impaired	0.0%	High
			Apr-Jun Max Daily Temp (24 hrs): ≤ 14°C		55.3%	
			Jul-Oct Average Daily Temp: ≤ 21°C		33.3%	
		pH	Single value: 6.5-9.0 pH	N/A	0.0%	N/A
		Inorganic Nitrogen	Based off CMC and CCC calculations			
	DO	DRP	Annual Average: ≤ 0.022 mg/L	Impaired	100%	High
		TDS	Single Value: ≤310	Impaired	14.0%	
			Annual Average: ≤ 245 mg/L		11.8%	
		Turbidity	Single Value: ≤10.0 NTU	Intermittent Impairment	35.5%	
		DO	Nov-Jun Single Value: : ≥6.0 mg/L	N/A	0.0%	N/A
			Jul-Oct Single value: ≥5.0 mg/L		0.0%	
		Temperature	Nov-Mar Max Daily Temp (24 hrs): ≤ 13°C	Seasonally Impaired	0.0%	
			Apr-Jun Max Daily Temp (24 hrs): ≤ 14°C		52.6%	
			Jul-Oct Average Daily Temp: ≤ 21°C		33.3%	
		pH	Single value: 6.5-9.0 pH	N/A	0.0%	N/A
		Inorganic Nitrogen	Based off CMC and CCC calculations			
	NB	DRP	Annual Average: ≤ 0.022 mg/L	Impaired	100%	High
		TDS	Annual Average: ≤ 415 mg/L	Threatened	5.9%	
		Turbidity	Single Value: ≤10.0 NTU	Intermittent Impairment	23.9%	
		DO	Nov-Jun Single Value: : ≥6.0 mg/L	N/A	0.0%	N/A
			Jul-Oct Single value: ≥5.0 mg/L		0.0%	
		Temperature	Nov-Mar Max Daily Temp (24 hrs): ≤ 13°C	Seasonally Impaired	0.0%	
			Apr-Jun Max Daily Temp (24 hrs): ≤ 14°C		63.2%	
			Jul-Oct Average Daily Temp: ≤ 21°C		38.6%	
		pH	Single value: 6.5-9.0 pH	N/A	0.0%	N/A
		Inorganic Nitrogen	Based off CMC and CCC calculations			

Waterbody	Site	Parameter	Criteria exceeded	Status	Percent Exceedance	Degree of Impairment
Lower Truckee River (cont'd)	MB	DRP	Annual Average: ≤ 0.022 mg/L	Impaired	100%	High
		TDS	Annual Average: ≤ 415 mg/L	Threatened	5.9%	
		Turbidity	Single Value: ≤10.0 NTU	Intermittent Impairment	27.7%	
		DO	Nov-Jun Single Value: : ≥6.0 mg/L	N/A	0.0%	N/A
			Jul-Oct Single value: ≥5.0 mg/L		0.0%	
		Temperature	Nov-Mar Max Daily Temp (24 hrs): ≤ 13°C	Seasonally Impaired	0.0%	
			Apr-Jun Max Daily Temp (24 hrs): ≤ 14°C		67.6%	
			Jul-Oct Average Daily Temp: ≤ 21°C		28.6%	
		pH	Single value: 6.5-9.0 pH	N/A	0.0%	N/A
		Inorganic Nitrogen	Based off CMC and CCC calculations			

Table 13 (below): Pyramid Lake Impairment Determination

Waterbody	Site	Parameter	Criteria exceeded	Status	Percent Exceedance	Degree of Impairment
Pyramid Lake	Station 93	DRP	Depth Avg.:≤.095 mg/L (0-20m) Depth Avg.: ≤.115 mg/L (full water column)	Impaired	10.67	Low
		Chlorophyll-A	Depth Avg.:≤5 mg/L (0-20m) April-October	Non-Impaired	0	Low
		TDS	A-Avg.: ≤ 5,900 mg/L	Threatened	0.24	Low
		DIN	Depth Avg.: ≤.045 mg/L (0-20m)	Non-Impaired	0	Low
	Station 96	DRP	Depth Avg.:≤.095 mg/L (0-20m) Depth Avg.: ≤.115 mg/L (full water column)	Threatened	9.57	Low
		Chlorophyll-A	Depth Avg.:≤5 mg/L (0-20m) April-October	Impaired	19.7	Low
		TDS	A-Avg.: ≤ 5,900 mg/L	Threatened	0.77	Low
		DIN	Depth Avg.: ≤.045 mg/L (0-20m)	Non-Impaired	0	Low

Results Summary

Historical results from surface water quality monitoring indicate that the Reservation's waters do not consistently meet all water quality standards primarily due to historic land and resource management practices throughout the Truckee River Watershed. Similar to the Truckee River, the intermittent and perennial streams have faced similar water quality issues such as: temperature, nutrients, sediments, and habitat alterations including hydromodification and invasive species. Coupled with wildfire effects,

the waterways of the PLIR are impacted on many fronts which have varying degrees of effect on water quality. The threatened statuses of the PLIR are summarized in Table 14 below.

Table 14- Waterbodies & their physical habitat score, potential/existing impairments, the impairment sources

Name of Waterbody	Type of Water	Monitored	Length or Area in Reservation	100% in PLIR	Physical habitat assessment	Impairments, Existing	Impairments, Potential	Impairments, Sources
Truckee River	River	Yes	31 mi.	N	Marginal	Low DO, Temperature, Invasives, Sediments, TDS, Pathogens, Metals, Nutrients	CECs, Wastes, Petroleum, Cyanotoxins, pH	All categories
Pyramid Lake	Lake	Yes	175 sq. mi.	Y	Good	Cyanotoxins, TDS, Pathogens, Nutrients, Metals	Petroleum, pH, Wastes, CECs, Invasives, Low DO	All categories
Big Canyon Creek	Perennial Stream	Yes	2.0 mi	N	Marginal	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Big Mouth Canyon Creek	Perennial Stream	Yes	3.9 mi	N	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Coal Canyon Creek	Perennial Stream	Yes	4.2 mi	N	Marginal	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Dove Creek	Perennial Stream	Yes	6.0 mi	Y	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA
Hardscrabble Creek	Perennial Stream	Yes	8.7 mi	N	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Jigger Bob Canyon Creek	Perennial Stream	Yes	8.6 mi	N	Marginal	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Mullen Creek	Perennial Stream	No	4.0 Mi	N	*	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Nugent Canyon Creek	Perennial Stream	Yes	5.6 mi	Y	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA
Nugent Hole Canyon Creek	Perennial Stream	Yes	5.1 mi	Y	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA
Poison Canyon Creek	Perennial Stream	Yes	2.0 mi	N	Marginal	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Rodero Creek	Perennial Stream	Yes	7.7 mi	N	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Sharpes Canyon Creek	Perennial Stream	Yes	2.2 mi	N	Marginal	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR
Thunderbolt Canyon Creek	Perennial Stream	Yes	1.8 mi	Y	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA
Tom Anderson Canyon Creek	Perennial Stream	Yes	3.9 mi	N	Poor	Nutrients, Sediments, Pathogens, Temperature, Invasives	Low DO	LS, RZ, NA, OR

Section 7 – Discussion

As discussed in previous sections, NPS pollution originate from a variety of sources and is evident at all the monitoring locations. General NPS pollutants include septic systems, roadway and construction stormwater runoff, recreation, waste disposal, agriculture, habitat modification, livestock and grazing practices, mining, wildfires and off-Reservation sources. The following sections will describe the relationship between the water quality results from Section 6 and impacts on water quality by NPS category on the Reservation.

Long-term data analyses indicates an improvement in water quality for certain parameters at some monitoring sites. For example, both TP and DRP show a trend of improvement throughout the analyses interval. These trends of improvement indicate benefits from NPS abatement and mitigation activities, such as public outreach & education, and on-the-ground projects.

Ecosystem Health

Physical habitat assessments on tribal surface waters show that there has been significant habitat loss throughout the analysis interval. All of the streams assessed in the survey ranked a marginal or poor physical habitat score. As another way of measuring ecosystem health, riparian Proper Functioning Condition (PFC) assessments conducted by Water Quality Program Staff show that eastern PLIR boundary ecosystems like Big Canyon, Thunderbolt and Sharpes Canyon were rated “Functional- At Risk” in 2018, and Dove Canyon, Nugent Hole Canyon Creeks were rated in 2017 as “Non Functional.” Only one site, Nugent Canyon Creek, was in “functioning” condition in 2017-18. These areas have also been impacted by recent wildfires in the Truckee, Pah Rah, Lake and Virginia mountain ranges.

Phosphorus

The DRP water quality standard for all monitoring locations on the lower Truckee River is an annual-average of ≤0.022 mg/L. This criterion is more stringent than the former annual-average DRP water quality standard of ≤0.05 mg/L that was revised in the Tribe’s 2015 Triennial Review. Because of this strict criterion, the DRP water quality standard was exceeded at all the monitoring locations on the lower Truckee River in the 2002-2018 data analysis. When compared to the former 0.05 mg/L DRP water quality standard, only 17.6% of the DRP annual-average concentrations were in exceedance.

Along the lower Truckee River, the average DRP concentration for all samples was highest (0.044 mg/L) at the Dead Ox site. Other average DRP concentrations include Wadsworth Bridge (0.043 mg/L), Marble Bluff (0.043 mg/L), Pierson Dam (0.041 mg/L) and Nixon Bridge (0.039 mg/L). Despite impairment for DRP, there is a decreasing trend for all the monitoring locations over-time for the analysis interval. Below are some other annual-average summary statistics from 2002-2018:

	Pierson Dam	Wadsworth B.	Dead Ox	Nixon Bridge	Marble Bluff
Minimum	0.026 mg/L	0.031 mg/L	0.028 mg/L	0.030 mg/L	0.031 mg/L
Maximum	0.071 mg/L	0.068 mg/L	0.094 mg/L	0.059 mg/L	0.072 mg/L
Median	0.037 mg/L	0.039 mg/L	0.038 mg/L	0.039 mg/L	0.040 mg/L

Table 15: Annual-Average Summary statistics for Truckee River Monitoring, from 2002-18

Phosphorus levels exceed the DRP criteria even before the Truckee River flows enters the Reservation boundary due to anthropogenic sources upstream. Water quality monitoring upstream of the Reservation over the last decade indicates high phosphorus loads, associated largely with the Truckee

Meadows Water Reclamation Facility (TMWRF) and irrigation return flows. TMWRF is the only TMDL on the Truckee River, which allocates 214 pounds/day of total phosphorus. The TMDL is composed of a total phosphorus waste-load allocation of 134 pounds/day and load allocation of 80 pounds/day. The remaining upstream phosphorus inputs originate from a number of nonpoint sources, including irrigation return flows, use of fertilizers, erosion of banks, atmospheric deposition, urban stormwater runoff, and septic seepage.

Phosphorus levels at the remaining monitoring Truckee River locations located below Pierson Dam are varied, with some sites containing higher and lower phosphorus levels. The highest annual-average DRP concentrations was at Marble Bluff and may be the result of irrigation return flows throughout Nixon and adjacent rangelands. The Nixon Bridge site contained the lowest phosphorus levels, which may because the reach between Dead Ox and Nixon Bridge is stable, so very little erosion occurs.

For the NPS sites, Tile Drain in Wadsworth had the highest annual-average DRP level (0.105 mg/L). The Tile Drain site is located at a discharge located below a "tile drain," a drainage system that removes excess water from soil below its surface. The Numana Wetland site had the second-highest annual-average DRP level (0.067 mg/L), which is a constructed wetland located below Numana Fish Hatchery, which purpose is to treat hatchery effluent. Paiute Pit had the lowest annual-average DRP level (0.029 mg/L), which is an aggregate mine that pumps raw groundwater for excavation activities.

Nitrogen

Nitrate and nitrite (NO_2+NO_3) levels in the lower Truckee River vary year-to-year, but overall have remained consistent throughout the data analysis interval (2002-2018). For NO_2+NO_3 combined averages, there is a decreasing trend from upstream to downstream: Pierson Dam (0.062 mg/L), Wadsworth Bridge (0.055 mg/L), Dead Ox (0.042 mg/L), Nixon Bridge (0.040 mg/L), and Marble Bluff (0.037 mg/L), which may indicate that most nitrogen loading originates upstream of the Reservation boundary. Compared to the NO_2+NO_3 water quality standard for the lower Truckee River, none of the samples in the analysis interval exceeded the nitrate (Single-value < 2.0 mg/L) nor nitrite (Single-value < 0.04 mg/L) criteria, or 2.04 mg/L combined.

NO_2+NO_3 on the lower Truckee River likely originates from point-source and NPS upstream of the Reservation. Like phosphorus, the TMWRF facility's TMDL allocates 1000 pounds/day of total nitrogen, which is composed of 500 pounds/day wasteload allocation and load allocation of 500 pounds/day. These values were determined through the Dynamic Stream Simulation and Assessment Model (DSSAM), which found that if the existing flow regime persisted, further restriction on nitrogen loads would be needed to improve oxygen conditions in the Truckee River (NDEP, 1994). The remaining nitrogen comes from a variety of nonpoint sources, which includes stormwater runoff, fertilizers, irrigation return flows, erosion of natural deposits and septic tank seepage.

Like the Truckee River monitoring sites, none of the NPS sites exceeded single-value criteria for NO_2+NO_3 criteria. However, samples collected at NPS sites consistently contain higher NO_2+NO_3 concentrations than samples collected on the Truckee River. Paiute Pit contained the highest average NO_2+NO_3 levels at 0.265 mg/L over the analysis interval, followed by 0.218 mg/L at Tile Drain and 0.209 mg/L at Numana Wetland-In.

For NPS monitoring locations, nitrogen originates mostly from hatchery wastewater and irrigation seepage/return flows. Paiute Pit contained elevated levels of NO_2+NO_3 when compared to Truckee River samples, with significant increases in the 2014 – 2018 period. This could be attributed to the revised CEMEX lease agreement, which allowed the company to excavate and pump groundwater to 100 feet depth. Most of the groundwater originates from the Fernley Bench, which is composed of irrigation seepage from the agricultural operations located in the Carson Desert. The groundwater in this area may contain higher NO_2+NO_3 concentrations due to fertilizers containing nitrogen used in the Fernley area that infiltrates through the ground and then flows toward the Paiute Pit. Tile Drain also contained elevated NO_2+NO_3 levels also due to irrigation seepage from the fields on top of the tile drain system. Lastly, Numana Wetland-In contained high NO_2+NO_3 levels since the wetland treats hatchery wastewater from Numana Fish Hatchery.

Dissolved Oxygen

Overall, there has been a slight decrease in dissolved oxygen (DO) levels from upstream to downstream throughout the analysis interval. None of the Truckee River DO field measurements recorded between 2002 – 2018 exceeded the tribe's seasonal DO criteria, which includes DO must be ≥ 6.0 mg/L November – June, and ≥ 5.0 mg/L July – October. However, it's important to note that the analyses is based on spot-sampling field measurements, which may fail to detect episodic exceedances in the evening and early morning when DO is depleted. Future continuous water quality monitoring data should be used in future DO exceedance analyses.

The Dead Ox monitoring location had the lowest average DO concentrations during the analyses interval at 9.884 mg/L. The remaining average DO concentrations included Nixon Bridge (9.912 mg/L), Wadsworth Bridge (9.972 mg/L), and Pierson Dam (10.467 mg/L). Minimum single-value concentrations included Pierson Dam (6.320 mg/L), Wadsworth Bridge (5.320 mg/L), Dead Ox (6.33 mg/L), Nixon Bridge (5.440 mg/L), and Marble Bluff (6.540 mg/L).

For NPS monitoring locations, 67% of DO field measurements collected at Tile Drain exceeded water quality criteria, with an average DO concentration of 5.15 mg/L. However, this is mainly due to the monitoring site being located at the immediate discharge of the tile drain, which is sourced from groundwater. Other DO field measurements collected downstream at Tile Drain 1 and Tile Drain 2 show a rebound of DO levels. At Numana Wetland, 4.5% of the DO measurements exceeded criteria, with an average 9.91 mg/L. Lastly, the average DO concentration was 10.05 mg/L at Paiute Pit, with none of the samples exceeding criteria.

Nonpoint sources that may affect DO levels include over-enrichment of nutrients and high temperatures due to vegetated and incised banks.

Temperature

The lower Truckee River is impaired for temperature, especially during drought periods when there is low base flow. Temperature regularly exceeds water quality criteria during the April-October period, when flows are decreasing and air temperature increasing. Nixon Bridge contained the highest number of temperature exceedances, which 63% of samples exceeding criteria between April and June, as well as 38% between July and October. The average temperature for Nixon Bridge for all measurements throughout the analysis interval was 12.02 °C. The second highest temperature exceedances occurred

downstream of Nixon Bridge at Marble Bluff, with 67% exceeding criteria between April and June, and 28.6% between July and October. Other average temperatures include Wadsworth Bridge at 11.85 °C, Pierson Dam at 11.67 °C, and Dead Ox at 11.66 °C. None of the samples collected between November and March exceeded temperature criteria.

The majority of the temperature exceedances in the lower Truckee River are due to historic hydro-modifications, which resulted in a wide and un-vegetated stream channel that is exposed to direct sunlight. Other reasons for temperature impairment include upstream development that results in impervious surfaces that heat stormwater runoff before being discharged into the lower Truckee River. Temperatures in the river will be of increasing concern as upstream municipalities continue to expand and stormwater runoff increases.

Between November and March, Tile Drain contained the highest number temperature exceedances at 19.6%, followed by Numana Wetland-In at 9.5%. None of Paiute Pit's temperature measurements exceeded criteria in the analyses. Between April and June, Tile Drain again had the highest exceedances at 65.4%, followed by Paiute Pit at 54.3% and Numana Wetland-In at 26.7%. Lastly, in the months July through October, Numana Wetland-In contained the highest number of exceedances at 63.3%, whereas Paiute Pit and Tile Drain was 40.0% and 3.0%, respectively. Thermal pollution in nonpoint sources are the result of exposure to sunlight and groundwater discharge.

Turbidity

Turbidity criteria is frequently exceeded in the lower Truckee River and is intermittently impaired for turbidity during spring runoff and precipitation events. Turbidity in the lower Truckee River consists mostly of silt and organic material that originates from upstream runoff and ephemeral drainages in badlands located between the Wadsworth Bridge and Nixon Bridge monitoring locations. Turbidity exceedances were lowest where the Truckee River enters the Reservation and peaks in the Dead Ox region, until it begins to decline again before reaching Pyramid Lake.

Turbidity measurements at the Dead Ox have the highest number of exceedances, with 35.5% of all readings are greater than 10 NTU and average 10.7 NTU. The second highest number of exceedances occurred downstream at Nixon Bridge and Marble Bluff, with 23.9% (average 9.7 NTU) and 27.7% (average 9.8 NTU) of samples exceeding turbidity water quality standards. Other average turbidity measurements include Wadsworth Bridge at 8.8 NTU and Pierson Dam at 6.9 NTU.

Turbidity exceedances in the lower Truckee River are the result of erosion stemming from natural and anthropogenic factors. During spring runoff or precipitation events, particles surrounding the land are washed into the river resulting in higher turbidity measurements. High flows also results in higher flow velocities and volumes mixes and suspends material from the stream bed. The Dead Ox reach of the lower Truckee River contains soft sedimentary rocks and clay-rich soils, which is characterized by steep slopes, minimal vegetation, and high drainage density, resulting in higher exceedances in the Dead Ox reach during precipitation events. In recent years, the Reservation has also experienced a number of wildfires

Man-induced factors also contributes to high turbidity levels both on and off the Reservation. Upstream development has resulted increased stormwater runoff from impervious surfaces, as well as

construction sites. On the Reservation, over-grazing in uplands surrounding the Truckee River destabilizes soils by removal of native vegetation.

Turbidity in the NPS monitoring locations are much lower than measurements collected from the lower Truckee River. Numana Wetland-In contained the highest number of exceedances, with 16.7% of measurements over 10 NTU, followed by Tile Drain (6.5%) and Paiute Pit (6.4%). Turbidity exceedances in Numana Wetland-In and Tile Drain could be from excess algal growth, which is common to both constructed treatment wetlands. For Paiute Pit, water is pumped for the purposes of dewatering the gravel pit, which commonly requires moving the pumps for maintenance purposes.

pH

pH measurements collected on the lower Truckee River throughout the analyses shows that pH hasn't exceeded the Tribe's pH criteria. Overall, the pH of the lower river is consistently high and unchanging, due to the high alkalinity levels and ability to buffer pH.

For the NPS monitoring locations, Numana Wetland-In was the only site to exceed pH criteria, with 4.3% of pH measurements in exceedance. The violations may be the result of photosynthesis by algae and plants in the wetland. As these organisms use hydrogen to photosynthesize, hydrogen is used resulting in increasing pH levels.

Although exceedances in pH criteria is extremely rare, changes in pH will be of increasing concern as nearby cities continue to grow and produce carbon dioxide. Carbon dioxide is the most common cause of acidity in water through acid rain.

Ammonia-Nitrogen

Ammonia takes two forms: Ammonia (NH_3), which is unionized, is toxic to aquatic life. Ammonium (NH_4^+), is ionized and is slightly less toxic. Because Pyramid Lake is an alkaline terminal lake whose water leaves solely through evaporation, its alkaline waters could result in deprotonated ammonium and turn into ammonia. The tribal ammonia criteria are dependent on pH and temperature, so the standards vary slightly according to season. Since the pH is relatively constant over time, temperature is a crucial variable. Considering the presence of salmonid species, the Criterion Continuous Concentration (CMC) of ammonia at 8 pH and 22 ^{o}C is 3.3 mg/L during the summer and 5.6 mg/L during the winter (0-10 ^{o}C). Hypothetically, CMC values of pH levels one standard deviation above the mean at that temperature range are 2.3 mg/L and 3.8 mg/L, respectively. The increase of pH by two tenths of a point allows for less of temperature variability in determining ammonia toxicity. Aquatic systems are not robust in allowing for the slightest in temperature changes in basic waters, which is important as the desert terminus is more basic than the Truckee River.

The Chronic Criterion Calculation (CCC) for ammonia at 8 pH and 22 ^{o}C is 0.68 mg/L during the summer, and at 8 pH and 0-10 ^{o}C is 1.8 mg/L in the winter. Ammonia tests conducted by the PLPT found the water of the lower Truckee River to contain 0.023 mg/L of ammonia/ammonium on average, with the highest concentrations sampled at Numana Wetlands. The single largest values collected there were 0.348 and 0.29 mg/L, which doesn't exceed the CCC criterion.

PLF sampling data shows that both stations 93 and 96 sample consistently below the detectable limits (<0.005 mg/L) of analysis at any depth and samples are consistently around 0.010 mg/L.

Total Dissolved Solids

Data was compared to three Total Dissolved Solids (TDS) water quality standards: (1) single-value not to exceed 310 mg/L between Pierson Dam and Dead Ox; (2) annual-average not to exceed 245 mg/L between Pierson Dam and Dead Ox; and (3) annual average not to exceed 415 mg/L between Dead Ox and Pyramid Lake. Total Dissolved Solids (TDS) measurements show that TDS concentrations have increased slightly over time. However, most exceedances observed over the analysis occurred in 2014 and 2013, when baseflows were extremely low due to severe drought. In 2014, minimum baseflows occurred in September, at 32 cfs. Similarly, minimum baseflows in 2015 were 23 cfs. This resulted in the TDS concentrations being higher during the end of the analysis interval, which skews each monitoring location's trendline to an upward trend from 2002 – 2018. Furthermore, there is an increasing TDS trend as the Truckee River flows toward Pyramid Lake.

First, the 310 mg/L single-value criteria was exceeded most at the Dead Ox location, with a 14% exceedance rate over 150 field measurements. Other single-value results include Wadsworth Bridge at 10.5% exceedance rate over 152 samples and Pierson Dam at 9.6% over 13 samples. The Dead Ox location was highest because the high TDS concentrations that are transported through groundwater that originates in the Fernley Bench.

The second TDS criteria, annual-average not to exceed 245 mg/L between Pierson Dam and Dead Ox, was exceeded in all three monitoring locations in 2015. The highest annual-average occurred Dead Ox, with a TDS annual-average of 371 mg/L. Wadsworth Bridge had the second-highest annual-average in 2015, at 326 mg/L. Pierson Dam had the lowest TDS exceedance at 320 mg/L.

Finally, the TDS annual-average concentration between Dead Ox and Pyramid Lake is not to exceed 415 mg/L, but both Marble Bluff (444 mg/L) and Nixon Bridge (434 mg/L) exceeded this criterion in 2015.

Although NPS monitoring locations do not have TDS site-specific criteria, TDS concentrations were much higher than field measurements collected on the lower Truckee River during the same time. The highest TDS concentrations occurred at Tile Drain, with an average TDS of 1,196 mg/L over the 17-year period. Paiute Pit and Numana Wetland-In were much lower than Tile Drain at 365 mg/L and 350 mg/L, respectively.

Much of the TDS originating upstream of the Reservation originates from anthropogenic sources. A major contributor to TDS is the TMWRF facility, whose TMDL allots its 30-day average TDS discharge to 360 mg/L at all times of the year. The facility sometimes violates this limit during the winter months of year when a relatively high proportion of the water supply is being obtained from groundwater sources. In drought years, the facility still needs to discharge its treated effluent while there are low baseflows, resulting in much higher TDS levels in the lower river. The remaining anthropogenic-related TDS upstream can also come from sources such as runoff, agriculture and erosion.

There are also anthropogenic sources of TDS loading on the Reservation. The biggest TDS contributor is groundwater inflow in the Dead Ox region. In 2001, the Desert Research Institute conducted a study to evaluate the groundwater transport of TDS on the Fernley Bench. The study found that there is a hydrologic divide on the western edge of Fernley, which causes groundwater in irrigated areas to either flow toward the Carson Sink or back toward the Truckee River. The water quality of this groundwater includes high TDS due to irrigation seepage. The study also found that decreases in irrigation recharge and Truckee Canal seepage would lead to the most significant reductions in TDS loading to the Truckee

River. Lastly, the remaining TDS sources on the Reservation originate from agricultural return flows, groundwater pumping and discharge at Paiute pit, and bank erosion.

Mercury and Methylmercury

Mercury and methylmercury represent a serious threat to aquatic life. The current WQS adopted by the Tribe is 1.4 µ/L for the Criterion Maximum Concentration (CMC) and 0.77 µ/L for the Criterion Continuous Concentration (CCC). A study conducted by Slutton and Ayers from 2001- 2003 found that fish muscle samples were well over the adopted criteria. The study also found that cui-ui and LCT over 18 inches in length exceeded the EPA mercury guidelines of 0.30 ppm muscle tissue. Also, of those fish measuring over 21 inches in length, 67% of those had over 0.50 ppm levels (Sutton, 2002). The report found that mercury levels probably are the result of mining sources and have lessened over time, despite being 3 times the pre-contact levels. Also, in 2013 Tile Drain soil samples were studied for their mercury content, and it was found at some areas to be up to 0.38 mg/kg. Unfortunately, there is not much available up-to-date data and studies will need to be conducted regularly.

E. Coli

There was no sampling events or analytical tests that were conducted for E. coli levels since the previous publication of the NPS Assessment report. The Tribe recognizes the importance of maintaining water quality standards in preserving recreational uses of its waters and future E. coli testing will be of high priority in upcoming years.

Discussion Summary

Total Phosphorus, dissolved oxygen, temperature, and turbidity exceeded the water quality standards more than any of the other parameters analyzed. Other violated parameters included TDS, nitrogen, and pH. In the follow-up work with the Pyramid Lake NPS Management Plan, the PLPT will focus on identifying future NPS projects to mitigate these pollutants. The NPS Management Plan will also identify ways to implement projects that gather more water quality data and assess which streams should have regular sample events, as well as decide which WQS should have more vigilance applied in terms of increased screening emphasis. E. coli, organic compounds and metals composition are three aspects of water quality that were not measured since the previous publication of the NPS Assessment Report. The strategies for including them into regular sampling and testing events will be outlined in the NPS Management report.

Description of Ranking Criteria

A ranking system was originally developed by the authors of the 1994 NPS Assessment Report, which formed the basis for an updated evaluation of NPS pollution concerns. The system describes the degree to which a waterbody is affected and the types of water quality problems. Included in the analysis is the likelihood that those problems can be improved with some action. While the ranking system from the 1994 NPS Assessment Report is a sophisticated measuring tool for nonpoint sources on the Reservation, the updated ranking system expands upon additional NPS concerns. The new table also adds perennial streams to the affected waterbodies of the Truckee River and Pyramid Lake.

In the development of the updated table, waterbodies are broken down into individual sample sites and are ranked according to whether individual NPS pollutant types are present. If the NPS type is present, a

“1” is designated to the individual sample site. If the problem is absent at the individual sample site, a “0” is assigned. Each NPS problem description is then added up according to total sites that the NPS problem exists and a total number is calculated.

The impairment scale used for the table(s) below is according to major, moderate, and potential impairment. Major (points 10-14) impairment encompasses the most serious NPS problems to the tribal surface waters. These types of NPS issues should be a priority for mitigation through management actions. Moderate (points 5-9) is of lower priority and is used to describe NPS problems that exists and should be addressed in the future. Lastly, potential (points 0-4) level NPS problems pose risks, but should be a lesser priority than moderate and major impairment rankings.

	Waterbodies																				
	Truckee River Site ID					Pyramid Lake Site ID		Perennial Streams Site ID												Total	Impairment Ranking
Problem Description	PD	WB	DO	NB	MB	Sta. 96	Sta. 93	BGC	BMC	COC	HSC	JBC	NUC	POC	ROC	SHC	TAC	TBC	DOC		
Off-Reservation Sources	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1				**15**	Major
Anthropogenic Hydro-Modification/Channelization	1	1	1	1	1	1	1	1			1									**9**	Moderate
Invasive Weed Species	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**19**	Major
Aquatic Invasive Species	1	1	1	1	1	1	1				1						1			**9**	Moderate
Fernley Bench Groundwater			1	1	1	1	1													**5**	Low
Irrigation Return-Flows	1	1	1	1	1	1	1	1			1									**9**	Moderate
Feral Horse/Upland Grazing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**19**	Major
Unpaved Roads/OHVs	1	1	1	1	1	1	1	1	1		1	1	1	1			1	1	1	**16**	Major
Riparian Grazing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**19**	Major
Recreation (PL, Burning Man)	1	1	1	1	1	1	1													**7**	Low
Atmospheric Loading	1	1	1	1	1	1	1													**7**	Low
Bank Instability/Erosion	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**19**	Major
Channel Incision	1	1	1	1	1	1	1	1		1	1			1	1		1	1	1	**15**	Major
Beaver Activity	1	1	1	1	1															**5**	Low
Domestic Wastewater	1	1	1	1	1	1	1													**7**	Low
Current/Legacy Mining	1	1	1	1	1	1	1										1			**8**	Moderate
Urban Stormwater Runoff	1	1	1	1	1	1	1				1				1		1			**10**	Moderate
Construction Stormwater	1	1	1	1	1	1	1				1									**8**	Moderate
Hatchery Operations			1	1	1	1	1													**5**	Low
Leaking Septic Systems	1	1	1	1	1	1	1													**7**	Low
Underground Storage Tanks			1	1	1	1	1													**5**	Low
Wildfires	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**19**	Major
# of NPS:	19	19	22	22	22	21	21	10	7	7	13	7	6	8	8	6	10	7	7		

Key
Major: 13 – 19
Moderate: 8 – 13
Low: 1 – 7

Table 16: Ranking of NonPoint Sources of Pollutants

Section 8 – Section of Best Management Practices

The purpose of this section is to identify how we will choose BMPs to address NPS issues identified in this report. The BMPs will be selected utilizing results from the data analysis, prioritizing sites that are contributing to NPS pollution, with the least amount of resources. Other factors that were taken into consideration include BMPs that are appropriate for the Reservation's unique environment, success and lessons learned from previous demonstration projects, potential for community buy-in, and technical and monetary support. In selecting following BMPs, it was also important to consider participation in local and regional working groups. Cooperation between the Tribe, developers, and governmental agencies is crucial in implementing future NPS-reducing projects.

This section will discuss core participants for planning and implementation. Information includes identifying the agency(ies), organization(s), or partner(s) responsible for BMP selection and how the entity's mission is appropriate for NPS projects. This section will all discuss the level of participation for each entity and specific programs that will be contacted for BMP selection. Types of participation include technical assistance, education, demonstration projects and financial assistance.

The WQ Program protects the Reservation's surface waters through data collection, restoration, and public outreach. The WQ Program's mission statement provides the scope and direction of the program:

> "The Water Quality Program's mission is to maintain the biological, chemical and physical integrity of surface waters and riparian areas within the Pyramid Lake Indian Reservation and improve water quality conditions for the benefit of the threatened and endangered wildlife in Pyramid Lake and the lower Truckee River."

Core Participants

The Pyramid Lake Paiute Tribe has worked with numerous agencies since the WQ Program was first established. This includes cooperation between other Tribes, federal governmental agencies, state agencies, local government and nongovernmental agencies for water quality planning in the Truckee River Watershed.

Participant	Role
Pyramid Lake Paiute Tribe Natural Resources Department/Water Quality Program	The PLPT Natural Resources Department provides oversight the tribe's WQ and NPS programs. The WQ Program provides oversight and administration for the Tribe's CWA Performance Partnership Grant, which includes CWA 319 (Base and Competitive), CWA 106, and CWA 104(b)(c). The WQ Program serves as the lead contact to the EPA Project Officer and is responsible for submitting annual grant applications. The Water Quality Program will work with other programs within the Natural Resources Department including Noxious Weeds, Brownsfields, Rangeland, Aquatic Invasive Species, Water Resources and Irrigation in identification and implementation of NPS BMPs.
Pyramid Lake Paiute Tribal Council	The PLPT Tribal Council plays a crucial role in reviewing and approving regulatory policy for natural resources on the Reservation. All projects and grant funding must be reviewed and approved by Tribal Council prior to implementation.

Tribal Interdisciplinary Team	The Tribal Interdisciplinary Team (IDT) is a monthly tribal workgroup that is composed appointees including the Tribal Chairman, Vice-Chairman, Pyramid Lake Fisheries, Tribal Historic Preservation Officer, Natural Resources Director and Water Quality Manager. The group identifies potential impacts to cultural and natural resources and is the first level approval needed before a project is reviewed by Tribal Council. All NPS-reducing projects will be reviewed by the IDT.
Pyramid Lake Fisheries	The Pyramid Lake Fisheries operates to maintain the fishery facilities throughout the lower Truckee River and Pyramid Lake on the Reservation. The goal of the Pyramid Lake fisheries is to enhance cui-ui and Lahontan cutthroat trout populations, while balancing natural resource management, which reflects social, cultural, economic, and other natural resource values of the Tribe. Pyramid Lake Fisheries provides in-kind match to CWA programs through monthly and quarterly sampling of Pyramid Lake. Pyramid Lake Fisheries and the WQ Program will continue to collaborate to identify BMPs that improve water quality and aquatic habitat.
Pyramid Lake Housing Department	The PLPT Housing Department provides Tribal members with quality services, housing opportunities, and community development. The WQ Program will work with Housing to identify low impact development and construction BMPs for future projects.
Pyramid Lake Water Resources Department	The Water Resources Department is responsible for negotiating water rights settlements, oversee upstream water diversions and irrigation on the Reservation. The WQ Program will coordinate with Water Resources to identify agricultural-related BMPs and water schedules/flow.
Pyramid Lake Grants Department	The PLPT Grants Department oversees contracts for grant-funded tribal programs, including all grants that are administered through the WQ Program. The Grants Department will assist in identify funding sources and review all grants before submission to funding agencies.
U.S. Department of the Interior, Bureau of Indian Affairs	The Bureau of Indian Affairs (BIA) provides Public Law 93-638 (638 Contracts) funding for various environmental programs, including the Tribe's Noxious Weeds, Aquatic Invasive Species, Rangeland, Bighorn Sheep, Burn Area Emergency Response (BAER) and other programs. The BIA's mission is to "promote economic opportunity, and to carry out the responsibility to protect and improve the trust assets of American Indians, Indian tribes, and Alaska Natives."
US Environmental Protection Agency, Region 9	The EPA provides technical assistance and regulatory oversight, along with grant funding for NPS projects. Region 9 oversees the CWA 106, CWA 104, and CWA 104(b)(c) Grants. The EPA is responsible for the review and approval NPS Assessment and Management Reports, which provides the scope and direction of the NPS Program.
U.S. Fish and Wildlife Service	The PLPT has worked with the U.S. Fish and Wildlife Service for oversight of various NPS projects. The USFWS can provide technical assistance and grant funding for restoration and NPS-reducing projects. Approval prior to implementation of certain projects will be required to determine impacts to threatened and endangered species.

U.S. Army Corps of Engineers	The U.S. Army Corps of Engineers (USACE) provides oversight of the CWA 404 Program, which regulates discharge or dredged or fill materials into Waters of the U.S. (WOTUS). USACE's approval is required for future NPS projects working in WOTUS, including lower Truckee River, perennial streams and wetlands. USACE also provides funding to start, continue and complete studies and construction projects to improve the environment.
Nevada Department of Environmental Protection	The Nevada Department of Environmental Protection's (NDEP) mission to preserve and enhance the environment of the state in order to protect public health, sustain healthy ecosystems, and contribute to a vibrant economy. NDEP may provide funding for NPS projects and plays a key role in administering water quality standards upstream of the Reservation, TMDL Program, NPS Program, discharge permits, Construction General Permits, and conducts statewide water quality monitoring.
Truckee River Flood Management Authority	The Truckee River Flood Project is an agency that is devoted to protecting upstream areas from the impact of the Truckee River flooding upstream of the Reservation. Furthermore, the agency believes in restoring the river's habitat while improving recreational value. The entity may serve as a funding source and partner in funding restoration projects that increase flood storage.
Nevada Resource Conservation Service	The Nevada Resource Conservation Service (NRCS) is a subdivision of the U.S. Department of Agriculture. The NRCS works with landowners through conservation and provides assistance that benefits various types of natural resources. The NRCS can help with the selection of BMPs by providing technical assistance, funding opportunities, and consultation.
The Nature Conservancy	The Nature Conservancy is a nonprofit organization that is dedicated to protect the lower Truckee River. The organization has already restored miles of the lower Truckee River upstream of the Reservation and is currently working in the headwaters of the Truckee River Watershed. The Nature Conservancy can provide technical assistance, funding and collaboration opportunities. The WQ Program will continue working with TNC to identify and achieve common goals.
One Truckee River	One Truckee River (OTR) is a collaboration of public and private partners working together to sustain the Truckee River's natural ecology, cultural resources and wildlife, and connects residents and visitors to unparalleled opportunities for recreation and regeneration. OTR is developing a Watershed Based Plan, which will identify water quality improvement projects upstream of the Reservation. The WQ Program will continue working with OTR to identify and achieve common goals.

Public Participation

The PLPT will engage the Tribal community and governmental entities by involving them throughout the process of selecting BMPs. The PLPT will identify specific messages that will be generated for the community and projects. Community members include students, ranchers, farmers, neighbors, families, upstream users, and other stakeholders. The WQ Program often utilizes volunteers from the community implement NPS projects.

Translating science to a message is an important step to increase participation. The WQ Program will get the community involved with water quality sampling events, public workshops, cleanups, and other education activities that will help the community understand NPS problems. With community involvement and awareness of NPS issues, success of BMPs long after implementation is more likely. The following items are ways of obtaining stakeholder involvement to successful BMP identification and implementation:

- Message: Identify stakeholders necessary in planning and implementation of BMPs and craft a message.
- Format: Determine how the stakeholders will be addressed.
- Distribution: Plan public meetings, workshops, and other public outreach activities.
- Evaluation: Evaluate success of message.
- Benefits: Show the targeted stakeholders the benefits of BMPs. Demonstrating that there will be economic, health, home, and cultural benefits.
- Barriers: Consider any barriers before preparing a message in selecting BMPs.

Existing BMPs on the Pyramid Lake Reservation

The table below describes BMPs that have already been implemented, or are currently being implemented to address NPS pollution:

NPS Category	NPS Pollutants	BMP	Partner(s)	Funding
Agriculture	Nutrients, Sediment	Laser-leveling of farmlands	NRCS, USDA, PLPT Irrigation Program	NRCS, USDA
	Nutrients, Sediment	Tile Drain Constructed Wetland	USEPA, USACE, NRCS, Washoe County, PL Fisheries, Land Assignees, Otis Bay Ecological	NRCS, USEPA, Washoe County
Livestock & Range	Nutrients, Sediment, Bacteria	Dead Ox and Black Mountain Stock Water Project	WELSCO Drilling, USEPA, PL Fisheries, PL Cattleman's Association	WELSCO Drilling, USEPA
	Nutrients, Sediment Bacteria	Livestock exclusion fencing in riparian areas	USEPA, PL Cattleman's Association, PL Fisheries, NRCS	NRCS, USEPA

Livestock & Range, cont'd	Nutrients, Sediment, Bacteria, Temperature	Proper Functioning Condition (PFC) assessments and implementation	UNR, BLM, NRCS, BIA	USEPA, BIA
	Sediment, Nutrients, Bacteria, Temperature	Feral horse round-ups/reductions	BIA, BLM, PL Cattleman's Association	BIA
	Sediment	Road-drainage improvements	BIA, NDOT, PL Roads Department, FEMA	BIA, NDOT, FEMA
	Nutrients, Sediment, Bacteria, Temperature	Temporary rangeland closures/range rests following wildfires	BLM, BIA, PL Cattleman's Association, BAER	BIA
Riparian Zone	Nutrients, Bacteria	Numana Constructed Wetland	USFWS, PL Fisheries, USEPA	USEPA, PL Fisheries
	Sediment, Temperature	Post-Flood Streambank Stabilization	FEMA, PLPT	FEMA, PLPT
	Sediment, Temperature, Low Dissolved Oxygen, Nutrients, Noxious Weeds	Numana Permaculture Project	USEPA, PL Fisheries, USACE	USEPA
	Sediment, Temperature, Invasive Species, Nutrients	Various re-vegetation projects	Noxious Weed Program, Patagonia, PL High School, BLM, TNC	Noxious Weed Program, Patagonia, PL High School, BLM, TNC
	Terrestrial Invasive Species	Noxious weed removal	BIA, Washoe County, PL Noxious Weed Program, USFWS, NRCS	BIA, USFWS, NRCS
Waste Disposal	Trash/Debris	Burning Man post-event highway cleanup	Burning Man Project, Pyramid Lake Maintenance, PUD	Burning Man Project
	Trash/Debris	Pyramid Lake and Truckee River cleanup events	Boys Scouts, PL High School, Nutchez Elementary, various Departments	Boys Scouts, PL High School, Nutchez Elementary, various Departments
Urban & Residential	Toxic: Asbestos, Lead, Mold, Heavy Metals, Petroleum	Brownsfields assessment and redevelopment	USEPA, PL Housing	USEPA

Urban & Residential, cont'd	Sediment, Petroleum	Various construction stormwater BMPs	PL Housing, PL Fisheries, NDOT, USEPA	Project Operator
	Nutrients, Bacteria	Wastewater treatment ponds in Wadsworth and Nixon	PLPT, IHS, PL PUD	IHS
Tourism & Recreation	Aquatic Invasive Species	Construction of Aquatic Invasive Species-check station	BIA, PL Fisheries, AIS Program, USFWS	USFWS, BIA
	Nutrients, Bacteria	Construction of public restrooms around Pyramid Lake beaches	NV, PLPT	NV Special License Plates Funds
	Nutrients, Bacteria, Petroleum	Pyramid Lake shoreline buffer	PLPT	PLPT
Mining	Sediment, Temperature	Paiute Pit Reclamation	PLPT, CEMEX	CEMEX
	Heavy Metals, Acid Mine Drainage	Guonomi Mine Reclamation		
Natural Sources	Mercury	Mercury sampling and abatement for in-stream projects in Truckee River	USEPA, BoR	USEPA, BoR
	Nutrients, Temperature, Sediment	Re-seeding post-wildfire areas	BIA, BLM, BAER, THPO	BIA

Table 17: Existing BMPs on the Reservation

The following items are ways that the PLPT may approach selecting BMPs:

- Hold public meetings regarding the prioritization list, key pollutants, and select BMPs that address Categories and Sub-Categories of NPS pollution.
- Involve various entities that have experience in identifying project-specific BMPs and can provide technical assistance for implementation.
- Develop a detailed list of BMPs and use partners to narrow down the list of applicable BMPs by estimated effectiveness.
- Develop close relationships with key landowners and land managers to educate and involve them in BMP implementation.
- Identify BMPs that benefit all groups and that have the potential for collaboration between key partners.
- Once implemented, share progress and success BMPs to stakeholders through presentations and promote future NPS pollution reduction projects.

Section 9 - Nonpoint Source Control Programs

Available Programs for Controlling NPS Pollution

The Tribe has utilized a variety of funding sources over the years to in NPS planning and abatement activities. Diversifying NPS funding sources enables broad coverage for a multitude of activities and

methodologies in the management and treatment of NPS pollution issues. To date, the Tribe has conducted project work with funding provided by the USEPA, NRCS, BIA, USFWS, FEMA, Washoe County, Truckee River Fund, and Pyramid Lake License Plate funds. Future funding opportunities will be pursued through the following funding entities, as well as a number of other potential resources:

Federal

US Environmental Protection Agency—USEPA

The USEPA provides funding through various sections of the CWA. Most NPS implementation projects are funded under the CWA NPS Competitive and Wetland Program Development Grants. Incremental funds are designated for development and implementation of watershed-based plans and Total Maximum Daily Loads (TMDLs) to restore surface waters. Base funds are used to provide staffing and support activities identified in the NPS Management Plan. The Tribe may use this funding to support a variety of projects including technical assistance, financial assistance, education, training, technology transfer, demonstration projects and monitoring.

Natural Resource Conservation Service—NRCS

Conservation Innovation Grants (CIG) are intended to inspire innovation in resource conservation to improve water quality, soil health and wildlife habitat. NRCS funding can be used for projects that target NPS pollution issues for single or multi-year, but does not exceed three years. The CIG granting process is a nation-wide competitive funding source benefiting varying NPS projects.

U.S. Department of Interior, Bureau of Indian Affairs—BIA

The BIA provides a political relationship between tribes and the Federal Government. The BIA Division of Natural Resources provides oversight of programs such as irrigation, agriculture, invasive species, rangelands, minerals, fisheries, water resource development, and integrated resource management planning. The BIA can be useful for the NPS program to provide funding opportunities for the collection and analysis of baseline data. Furthermore, the agency can be used to match funds of NPS control programs.

Burn Area Emergency Response – BAER

The BAER Program addresses stabilization and rehabilitation of lands affected by wildfires, including severe vegetation and soil erosion, water quality and flash flooding. The program provides funds in the immediate aftermath of a wildfire, which aims to prevent degradation to cultural resources, minimize threats to life or property, and to repair physical improvements necessary to prevent degradation of land or resources. The agency also provides “restoration” funds, which is appropriated for long-term solutions such as bank stabilization, revegetation/reseeding, noxious weed treatments, and others.

Indian Health Services—IHS

The Indian Health Service provides health care and disease prevention services. The IHS can provide technical expertise to ensure high-quality public and environmental health services. IHS also provides technical support on regulations regarding drinking water, sewage treatment, and solids waste disposal.

U.S. Fish and Wildlife Service—FWS

The U.S. Fish and Wildlife Service strives to establish partnerships with Tribes to leverage protection on ecological systems. The USFWS administers a variety of natural resource grants to Tribes, including the Tribal Wildlife Grant, provides funding to projects such as stream restoration and stabilization. USFWS

can provide technical and financial assistance to projects that benefit wildlife and their habitats. Projects include conservation, management, research, surveys, monitoring, conservation easements, and public outreach.

U.S. Department of Agriculture—USDA
The U.S. Department of Agriculture provides essential programs for economies in rural areas. The Rural Development Grant Assistance program was created to provide either direct or guaranteed loans, grants, and technical assistance. The USDA Rural Development Program provides grants for water and sewer systems, housing, health clinics, emergency service facilities, electric and telephone service.

U.S. Geological Survey—USGS
The USGS grant program solicits proposals to inventory geoscientific collections, create metadata for individual samples, enhance digital infrastructure and rescue data. USGS collects flow discharge and water quality measurements on the lower Truckee River and can provide technical assistance in monitoring after implementation of NPS projects.

National Oceanic and Atmospheric Association—NOAA
The National Oceanic and Atmospheric Association protects, restores, and promotes stewardship aquatic habitat to preserve fisheries for future generations. The NOAA provides grants and cooperative agreements to entities like Tribes to support research and conservation initiatives.

State

Nevada Division of Environmental Protection—NDEP
The Nevada Division of Environmental Protection (NDEP) provides state regulatory and voluntary programs to control and mitigate the impacts of NPS pollution through public awareness, coordination with agencies and land owners, and BMPs. The NDEP can provide funding through the CWA NPS Competitive funding. State Revolving Fund for the purchase water rights to the Truckee River to improve water quality.

Nevada Division of Conservation Districts—NDCD
The Nevada Division of Conservation Districts (NDCD) mitigates NPS issues by implementing programs that build community awareness and technical assistance to rural and urban landowners. Planning includes prevention of soil erosion, protection and restoration of riparian areas and wetlands, and implementation of BMPs.

Nevada Department of Wildlife—NDOW
The Nevada Department of Wildlife (NDOW) manages wetlands on Wildlife Management Areas, monitors fish and wildlife habitat, and implement projects that prevent NPS pollution that impact aquatic ecosystems. Funding is available to Tribes and other entities for restoration projects that prevent erosion and storm water drainage.

Regional

Patagonia
Patagonia is a clothing company that is committed to protecting and enhancing environmental resources. Patagonia's outlet based in Reno provides small environmental grants to local projects such as dam removal, re-vegetation projects, climate change mitigation, protecting threatened/endangered species, and supporting sustainable agriculture.

Table 18: Agricultural BMPs and Funding by Nonpoint source Category				
NPS Category	Nonpoint source	NRCS Conservation Practice Standards		Potential Funding
Urban Residential	Septic Systems	313	Waste Storage Facility	IHS, BIA
	Urban/Roadway storm water	570	Stormwater Runoff Control	CWA 319, CWA 106
	Construction	410	Grade Stabilization Structure	CWA 319
Tourism/Recreation	Special Events	654	Road/Trail/Landing Closure and Treatment	NRCS
	Recreation vehicles/camping	561	Heavy Use Area Protection	BIA
	Lake recreation	566	Recreation Land Grading and Shaping	BIA
	Boat servicing		Invasive Species Inspection	USFWS, BIA
Waste Disposal	Illegal Dumping	634	Waste Transfer	IHS, BIA
	Solid waste management	317	Composting Facility	IHS, BIA
	Spills/emergency response	455	Land Reclamation, Toxic Discharge Control	BIA, NRCS
Agriculture	Field management	464	Irrigation Land Leveling	CWA 319
	Irrigation return flows	554	Drainage Water Management	CWA 319, CWA 106, USDA
	Irrigation maintenance	428	Irrigation Ditch Lining	USDA,
Riparian Zone	Bank erosion	327	Conservation Cover	Tribal EPA, NRCS, USFWS
	Riparian encroachment	382	Fence	CWA 319, EQIP
	Riparian forestry	512	Forage and Biomass Planting	CWA 319
	Bank ecosystem instability	315	Herbaceous Weed Control	BIA, NRCS
Livestock and Range	Upland ecosystem instability	645	Upland Wildlife Habitat Management	NRCS, BIA
	Grazing management	645	Upland Wildlife Habitat Management	NRCS, BIA
	Livestock waste	591	Amendments for Treatment of Agricultural Waste	CWA 319, CWA 106, USDA,BIA
	Water supply scarcity	574	Spring Development	EQIP
Resource Extraction	Quarries	544	Land Reclamation, Abandoned Mined Land	BIA, CEMEX
	Mine drainage	455	Land Reclamation, Toxic Discharge Control	BIA
Natural Sources	Atmospheric Loading	N/A	N/A	
	Groundwater and soils	353	Monitoring Well	
	Geothermal activity	N/A	N/A	
	Blue-green algae		Nutrient Sampling	CWA 319, CWA 106
	Wildfire	394	Firebreak	
	Climate change	N/A	Public Awareness	NOAA
Off-Reservation	Urban/Roadway storm water	570	Stormwater Runoff Control	CWA 319, CWA 106
	Agricultural/Irrigation/Range	554	Drainage Water Management	
	Spills/emergency response	455	Land Reclamation, Toxic Discharge Control	
	Groundwater contamination	355	Wellwater Testing	CWA 319, CWA 106
	Legacy and active mining	638	Water and Sediment Control	

Existing Tribal NPS Programs

PLPT Water Quality Program

The WQ Program is responsible for coordinating with tribal and non-tribal partners to address NPS issues. The WQ Program oversees all of the Tribe's CWA grants including 106 (Water Quality Monitoring), 104(b)(c) (Wetland Program Development), and 319 Base and Competitive (Nonpoint Source). The Program also applies for/manages other grants supporting NPS projects including funding from USFWS, BIA, NRCS, and others. The program implements a variety of NPS activities including public outreach, restoration projects, monitoring, and regulation of tribal waterbodies, which addresses all the NPS Categories described in this report.

401 Certification Program

The WQ Program administers the Tribe's 401 Certification Program, which certifies projects requiring a federal permit that may result in a discharge to tribal waters that have established water quality standards. 401 Certification allows the Tribe to waive, deny, approve, or approve with conditions to require certain BMPs are implemented to reduce NPS pollution. Typical certification of federal permits include CWA 404 and National Pollutant Discharge Elimination System (NPDES) permits. NPS Categories addressed through the 401 Certification Program include Urban/Residential and Mining.

Pyramid Lake Fisheries

The Pyramid Lake Fisheries maintains the fishery facilities at Pyramid Lake and the lower Truckee River for the purpose of enhancing cui-ui and Lahontan cutthroat trout populations, while creating a balance within water quality management actions, which reflects the social, cultural economic, and natural resources of the Tribe. The WQ Program works collaboratively with Pyramid Lake Fisheries to protect, conserve, and restore aquatic resources, fish habitats, and water quality. Pyramid Lake Fisheries also conducts water quality monitoring on Pyramid Lake, which serves as in-kind match to the Tribe's CWA grants. Pyramid Lake Fisheries is a partner to address the Riparian Zone NPS Category.

PLPT Tribal Response/Brownsfield Program

The Tribal Response Program (also known as the Brownfields Program) is an enforcement program whose primary purpose is to provide the Tribe with enforcement authorities to ensure that hazardous sites (including brownfield sites) are assessed and cleaned-up in accordance with all applicable laws and regulations (see CERCLA Section 128(a)(2)(B)). The Tribal Response Program addresses NPS pollution by cleanup of hazardous sites such as underground storage tanks, illegal dumps, oil pits, and others. The program is a partner to addressing the Urban and Residential NPS Category.

PLPT Noxious Weed Program

The Noxious Weed Program is committed to eradicating and reducing noxious weed species in riparian and surrounding areas. Invasive weeds species including salt cedar, tall white top, and Russian olive proliferate and displace native species that help reduce NPS pollution. In addition to reduction and removal of noxious weeds, the program also implements public outreach activities to inform the public of impacts to natural resources. The Noxious Weed Program is a partner in addressing Livestock and Range, Riparian Zone, and Natural Source NPS Categories.

PLPT Rangeland Program

The Rangeland Program, funded by the BIA, conducts rangeland surveys throughout the Reservation to develop management strategies and determine animal unit month (AUM) estimations, or forage inventories. Many of Reservation's streams are within the rangeland units, which are effected by

overgrazing and other water quality impacts. The Rangeland Program is a partner in addressing the Livestock and Range, as well as the Riparian Zone NPS Category.

PLPT Aquatic Invasive Species Program

The Tribe's AIS Program was established in 2019, which aims to prevent and mitigate the spread of AIS throughout tribal waters. The program is designed to monitor, prevent, and control invasive species in an effort to maintain a healthy ecosystem. The program has also constructed an AIS inspection and decontamination station, which prevents boats and other vessels from transporting AIS from other waterbodies. AIS can drastically alter a water quality through changes in runoff dynamics, nutrients, and other attributes that influence water quality. The AIS Program is a partner in addressing the Tourism and Recreation NPS Category.

Burn Area Emergency Response

Since 2016, the Reservation has been affected by a number of wildfires including the Tule, Tohakum II, Truckee, and Perry Fires. Large wildfires prompt the Burn Area Emergency Response (BAER) Team, which consists of a multidisciplinary team to study post-fire effects and prescribe stabilization measures for short and long-term restoration. After the assessment, BAER funding is allocated to the Tribe to implement these measures, much of which address NPS pollution such as noxious weed abatement, stream stabilization, monitoring, reseeding and others. The BAER program funding will help address the Riparian Zone, Livestock/Range, and Natural Source NPS Categories.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers is responsible for implementing the CWA Section 404 Program, which regulates discharge or dredged or fill materials into WOTUS. Activities in WOTUS include water resource projects including dams/levees, infrastructure, and mining projects. The WQ Program works closely with the USACE in the review of 401 Certification, as well as projects occurring upstream of the Reservation requiring a 404 Permit. The USACE is a partner is addressing the Riparian Zone, Agriculture, Livestock and Range, Mining, Natural Sources, and Urban and Residential NPS Categories.

Nevada Department of Transportation

There are several state highways throughout the Reservation that managed by the Nevada Department of Transportation (NDOT) including State Route (SR) 445, 446 and 447. Whenever maintenance work is needed that affects Waters of the United States (WOTUS), NDOT works closely with the WQ Program and the Army Corps of Engineers to acquire tribal 401 Certification. NDOT is a partner in addressing the Urban and Residential NPS Category.

Nevada Department of Environmental Protection

The Nevada Department of Environmental Protection's (NDEP) Bureau of Water Pollution Control (BWPC) division protects the waters of the State from discharge of pollutants. The BWPC regulates all discharges through issuing permits and enforcing the State's water pollution control laws and regulations. BWPC publishes discharge permits to the public, which the WQ Program has 30-days to comment. BWPC is a partner in addressing the Upstream Sources NPS Category.

Section 10 - Conclusions

The goal of this report is to provide a technical summary of the condition of tribal water resources and provide a foundation to identify projects that will address NPS Categories/Sub-Categories in the NPS Management Plan. There are a number of NPS Categories to be addressed, including: Urban/Residential,

Tourism/Recreation, Waste Disposal, Agriculture, Riparian Zone, Livestock and Range, Mining, and Natural and Off-Reservation Sources. These issues will be addressed through identifying BMPs with stakeholders to successfully reduce NPS pollution in tribal surface waters. Pyramid Lake, which receives all of its water from the combination of flows from the Truckee River, perennial streams, and groundwater, is effected by all upstream nonpoint sources. This is why it's imperative that the Tribe continues working with upstream stakeholders to ensure that discharges are mitigated through BMP and low-impact development measures implementation.

The Truckee River continues to be affected by current and historic hydro-modifications completed by the USACE and other governmental entities, which has resulted in an altered hydrograph and negatively impacting water quality. Many of the parameters analyzed in this report exceed water quality criteria before the Truckee River enters the Reservation. The channelization of the Truckee River has increased flood magnitude, causing the banks to be susceptible to erosion and incision. The diversion at Derby Dam in the early 1900s resulted in most of the Truckee River's water being diverted to the Carson Desert and caused lake levels to drop and incision in the lower Truckee River. Furthermore, the exponential growth in Reno/Sparks has increased stormwater runoff and ever-growing amount of wastewater discharge. These changes to the lower Truckee River contributes to thermal pollution, nutrients, total dissolved solids, and sediment impairments.

Land uses within the Reservation also contribute to NPS pollution to the lower Truckee River. In Wadsworth, the river runs through urban areas and agricultural areas that contribute stormwater runoff and agricultural return flows. CEMEX's Paiute Pit discharges groundwater that's pumped from the mine to the river and is high in total dissolved solids, nitrates, and temperature. With most of the Reservation being open-grazing, the river is also impacted by overgrazing, contributing nutrients, sediment, bacteria, and other pollutants. Groundwater flows in the Dead Ox region adds significant total dissolved solids concentrations to the river, as irrigation seepage in Fernley migrates toward Pyramid Lake. Decreased riparian vegetation in upland areas and loss of remote water sources adversely affect wildlife and create drier conditions that are more prone to wildfires. Reducing NPS pollution in the lower Truckee River is crucial for protecting water quality in Pyramid Lake.

The perennial and ephemeral streams throughout the Reservation share common nonpoint sources and water quality issues. Wildfires in recent years have affected all the Reservation's mountain ranges including the Pah-Rah, Virginia, Black Mountain and Lake Ranges. Wildfires have a number of effects to waterbodies including (1) initial flush of ash with normal precipitation, (2) gully and rill erosion on steep slopes, (3) debris flows initiated by high intensity precipitation with sediment deposition where stream gradients flatten, and (4) increases in average stormwater runoff. These impacts will affect water quality, with increases in sedimentation, temperature, and nutrient loading.

The following descriptions demonstrate how the Tribe will address each NPS Category in the NPS Management Plan:

Livestock and Range -- The WQ Program will address NPS pollution stemming from livestock and range by working with the Cattlemen's Association to implement BMPs that increase upland/lowland ecosystem stability by reducing overgrazing. Additionally the Tribe will be vigilant monitoring areas where boundary fencing may be damaged or destroyed, to prevent wayward herds contributing pollutants to the water table. The WQ Program will also work with Federal entities such as the NRCS and

BLM to obtain funding for burn area restoration, livestock exclusion fencing, stock water and other projects.

Agriculture -- The WQ Program will address the Agriculture NPS Category through working in collaboration with the Reservation's ranchers. Typical projects include construction of treatment wetlands for tile drain and other agricultural discharges, livestock exclusion fencing, identifying smart watering practices, and conducting public outreach.

Riparian Zone -- The WQ Program will address the Riparian Zone NPS Category by working with governmental entities to identify areas in need of restoration. A geomorphology study will first be completed to understand dimension, pattern and profile of the altered stream system to emulate a natural river.

Constituents of Emerging Concern -- The WQ Program will work with its partners in researching other CECs not currently studied, such as microplastics and pharmaceutical compounds like hormones, narcotics and others to which standards are not yet adopted by the Tribe. Currently, the Tribe is working with researchers in determining the amount of trace pharmaceuticals in surface waters.

Recreation -- The WQ Program will reduce NPS pollution stemming from tourism and recreation by conducting public outreach and implementing new ordinances protecting water quality. The WQ Program will also conduct regular microbiological testing to preserve the Water Contact Recreation and Primary Contact Ceremony Use beneficial uses.

Off-Reservation Sources -- The WQ Program will continue working with upstream partners and will continue to be active in all Truckee River Watershed planning activities, such as municipal, county, state and private construction projects that may affect the water quality of the TR watershed.

Urban/Residential -- The WQ Program will reduce NPS pollution from the Reservation's urban developments by continuing its 401 Certification Program.

Waste Disposal -- The WQ Program will reduce NPS pollution stemming from waste disposal by working with partners in cleaning up illegal dumpsites, promoting public awareness of the hazards of illegal dumping, revising the response plan for emergency spills, and continuing & expanding the program for common recyclables.

Resource Extraction -- The WQ Program will address NPS pollution from the resource extraction category by reviewing any remaining reclamation issues that contribute metals, nutrients, toxics, and/or sediment to the Reservation's waters. Furthermore, the Tribal policies will be reviewed to assess whether standards regarding resource extraction are adequate. The WQD will also explore analytical methods for the identification and quantification of metals content in reservation waters.

Natural Sources -- The WQ Program will continue its efforts in adaptive management to mitigate natural sources of NPS pollution such as climate change, atmospheric loading, wildfire events, and other natural sources. The WQP program will continue cyanobacteria monitoring during the summer recreation season and will work with other Natural Resources Department programs to ensure that post-fire BAER management plans are followed to ensure that native vegetative climates are restored to pre-fire status.

Finally, the PLPT will continue working with the US EPA to implement and refine its NPS Assessment Report and NPS Management Plan. With the information gathered in this report, the NPS Management plan will address NPS issues and continue to protect the Tribe's water quality.

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Appendix A

Acronyms and Abbreviations List

AAT	Annual Average Temperature
ACOE	Army Corps of Engineers
AIS	Aquatic Invasive Species
BAER	Burned Area Emergency Response plan
BAR	Burned Area Rehabilitation
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMPs	Best Management Practices (sediment- and pollutant-control methods)
CECs	Constituents of Environmental Concern (pharmaceuticals, etc.)
cfs	Cubic Feet per Second
Corps	U.S. Army Corps of Engineers
CRMP	Comprehensive Resource Management Plan
DO	Dissolved Oxygen
DRI	Desert Research Institute
DRP	Dissolved Reactive Phosphate, i.e. orthophosphate
EPA	U.S Environmental Protection Agency
MGD	Millions of Gallons per Day
MTBE	Methyl Tertiary-Butyl Ether
NDEP	Nevada Department of Environmental Protection
NPS	Nonpoint source Pollution
NRCS	Natural Resources Conservation Service
OCAP	Newlands Project Operating Criteria and Procedures
OHV	Off-Highway Vehicle
PCPP	Person Care Products and Pharmaceuticals
PFC	Proper Functioning Condition
PLEDP	Pyramid Lake Economic Development Plan
PLF	Pyramid Lake Fisheries

PLIR	Pyramid Lake Indian Reservation
PLPT	Pyramid Lake Paiute Tribe
PLPT WQP	Pyramid Lake Paiute Tribe Water Quality Program
SPC	Specific Conductivity
TCID	Truckee-Carson Irrigation District
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TMWRF	Truckee Meadows Water Reclamation Facility
TN	Total Nitrogen
TP	Total Phosphorous
TPH	Total Petroleum Hydrocarbons
TRIC	Tahoe Reno Industrial Center
TRM	Truckee River Monitoring
TROA	Truckee River Operating Agreement
TRPA	Tahoe Regional Planning Agency
UCD	University of California - Davis
UNR	University of Nevada - Reno
UR	Urban
USFWS	U.S. Fish and Wildlife Service
USACE	U.S. Army Corps of Engineers
USBR	U.S. Department of Interior, Bureau of Reclamation
USEPA	U.S Environmental Protection Agency
VOCs	Volatile Organic Compounds
WQAR	Water Quality Assessment Report
WQCP	Water Quality Control Plan
WQS	Water Quality Standards
WRP	Wetland Reserve Program
1994 Plan	PLPT Nonpoint Source Assessment and Management Plan, 1994
2014 Plan	PLPT Nonpoint Source Assessment and Management Plan, 2014

Appendix B

Use	Beneficial Use Title and Description
AQUA	**Aquaculture.** For the purpose of aquaculture of fish hatchery operations including, but not limited to, propagation, cultivation, maintenance and harvesting of biota used either for human consumption or biodiversity.
COLD	**Cold Freshwater Habitat.** For the purpose of supporting cold water ecosystems including, but not limited to, Reservation and enhancement of aquatic habitats, vegetation, fish and wildlife (including invertebrates). Based on the seasonal occurrence of cold-water tolerance species.
EXAV	**Extraordinary Aesthetic Value.** For the purpose of preserving the unique aesthetic value of surface waters.
FRSH	**Freshwater Replenishment.** For the purpose of increasing instream flows to maintain or improve surface water quality (e.g. reducing TDS)
GRND	**Groundwater Recharge.** For the purpose of recharge of groundwater for future extraction, maintenance of water quality, or other purposes.
INAL	**Indigenous Aquatic Life**. For the purpose of preserving aquatic plant and animal species and biodiversity in both freshwater and inland saline water habitats.
IRRG	**Irrigation**. Beneficial uses of water for the purpose of irrigation including, but not limited to, farming, horticulture, range and range vegetation.
LSWT	**Livestock Watering.** For the purpose of watering range and farm livestock.
NATF	Maintenance and restoration of native fish species. For the purpose of promoting the reproduction and survival of native fish species.
PCCU	**Primary Contact Ceremonial Use.** For the purpose of protecting quality of water specifically for ceremonial, cultural, holistic, religious and traditional purposes for members of the PLPT. These include, but are not limited to, immersion, vaporization, or intentional, accidental ingestion.
RARE	**Rare, Threatened and Endangered Species.** For the purpose of supporting habitat necessary for the survival and successful maintenance of plant or animal species established as rare, threatened or endangered.
REC1	**Water Contact Recreation.** For the purpose of recreational activities involving body contact with water. These include, but are not limited to, swimming, wading, water skiing, skin and scuba diving, wind surfing, jet skiing, fishing, bathing.
REC2	**Non-contact Water Recreation**. For the purpose of recreational activities involving proximity to water but not normally involving body contact. These include, but are not limited to, picnicking, sunbathing, hiking, beach combing, camping, boating, hunting, sightseeing, and aesthetic enjoyment in conjunction with the above activities.
RIPH	**Riparian Habitat.** For the purpose of maintaining and enhancing the growth and survival of riparian vegetation.
SPFS	**Sport fishing.** For the purpose of collection of fish, or organisms related to sport fishing, intended for human consumption.
SPWN	**Spawning, Development, and Recruitment.** For the purpose of supporting high quality aquatic habitat necessary for reproduction and recruitment of fish and wildlife. This includes all life stages of Cui-ui (egg incubation, development, recruitment, and larvae, juvenile, adult migrations) from March through July, all life stages of tahoe suckers (Catostomus tahoensis), and Lahontan Cutthroat Trout whether for rearing, stocking, and/or species recovery purposes. Includes fish rearing in Truckee River for subsequent migration to Pyramid Lake.
WILD	**Wildlife and Wildlife Habitat.** For the purpose of protection and propagation of wildlife (including fish, birds and other water dependent biota), and supporting wildlife habitat.
WTLD	**Wetland Habitat.** For the purpose of protection and propagation of wildlife (including amphibians, fish, birds and other water dependent species), and the protection of plant and wildlife habitat.
WQEN	**Water Quality Enhancement.** For the purpose of supporting enhancement or improvement of water quality in a downstream waterbody.
WSES	**Water of Special Ecological Significance.** For the purpose of preserving the unique ecological status of Pyramid Lake as one of the few large, deepwater, saline Lakes in the world and to maintain the existing higher quality of the Lower Truckee River.

Appendix B

Numeric Standards of Water Quality- Pyramid Lake

PARAMETER	WQS	BENEFICIAL USES	Foot-Notes
Dissolved Oxygen 0-20 meters (% sat) Hypolimnion (>20m - ≤70m) (mg/l)	Single Value: ≥ 80%; Avg: ≥ 90%; Single Value:≥ 6.0	Aquatic Life, WSES	C D
Temperature (°C)	Single Value: ≤2	Aquatic Life, WSES	E
Clarity (0-20m)	Avg: ≤ 0.45	PCCU, REC1, EXAV, INAL	F
Total Dissolved Solids (mg/l)	Avg: ≤ 5,900	Aquatic Life, WSES, WILD	G,P
Suspended Solids (0-20m) (mg/l)	Single Value: ≤ 20; Avg: ≤ 5	Aquatic Life, WSES, EXAV, PCCU, REC1	
Turbidity (0-20m) (NTU)	Single Value: ≤ 5; Avg: ≤ 2.5	Aquatic Life, WSES, EXAV, PCCU, REC1	H H
pH	Single Value: ≤ 9.7	Aquatic Life	I
Fecal Bacteria (E Coli)	Mean: ≤126 per 100 ml; Single Value: ≤410 CFU	PCCU, REC-1	J
Chlorophyll a (0-20m) (µg/l)	Depth Avg:≤5 (Apr-Oct)	COLD,WSES, EXAV,PCCU,REC1, SPFS	K,M
Dissolved Reactive Phosphorus (µg/l)	Depth Avg:≤95 (0-20m); ≤120 (full water column)	Aquatic Life, WSES	L,M,Q
Total Phosphorus (µg/l)	Depth Avg: ≤120 (0-20m); ≤140 (full water column)	Aquatic Life, WSES	L,M,Q P
Ammonia (µg N/l)	Depth Avg:≤15 (0-20m)	Aquatic Life, WSES	M,Q
Dissolved Inorganic Nitrogen (µg N/l)	Depth Avg: ≤45 Depth Avg: ≤900	Aquatic Life, WSES Aquatic Life, WSES	M,N,O Q
Total Nitrogen (µg N/l)	Depth Avg: ≤900 (0-20m); ≤1000 (full water column)	Aquatic Life, WSES, EXAV	M,Q,P

Key to Pyramid Lake Footnotes

A: All Values Apply to the full water column at the deep-water location (Station 96) unless noted otherwise.
B: Water quality standards apply to the entire surface of Pyramid Lake except in a mixing zone where stream flow enters the Lake. A mixing zone is defined as that portion of the Lake, influenced by tributary inflow, where total dissolved solids (TDS) is less than 80% of that measured at mid-Lake (Station 96) using electrical conductivity as an indicator.

C: The term "A. Avg", or Annual Average, denotes the mean of monthly volume weighted averages.

D: Measured at a control point at a depth of 70 m at the mid-Lake index station. Dissolved oxygen concentration should not be lower than this value during two consecutive one week periods. If a concentration less than this value is measured, resampling for this parameter must be conducted within 10 days.

E: Maximum allowable increase in water temperature (degrees Celsius) at any depth outside the boundary of a mixing zone. Does not apply to that portion of Pyramid Lake that is directly influenced by the Truckee River discharge provided the water quality criterion for temperature is being attained in the River. Applies only to situations where temperature increases as a result of point or Nonpoint source inputs. Does not apply to natural cycles of Lake heating and cooling.

F: Light extinction coefficient (m^{-1}). By definition, the 0.45 m^{-1} value is the negative of the actual calculated value, i.e., a value of -0.50 is greater than a value of -0.45 and would exceed the criterion.

G: Value comes from Cui-ui Recovery Plan (U.S. Fish and Wildlife Service 1992).

H: Does not apply to suspended Solids of autochthonous algal origin or precipitated carbonates during natural whiting events.

I: Represents approximately a 0.25 unit increase relative to maximum natural conditions.

J: USEPA guidance recommends 235 CFU's (Colony forming units) as the sample single maximum for designated beach areas.

K: Value not to exceed specified concentration on two consecutive monthly sampling during the period April-October; however, does not include times when *Nodularia spumigena* contributes greater than or equal to 5 percent of the phytoplankton biomass.

L: Corrected for arsenic

M: Mean of months means during the period April-October. Samples taken from the photic zone waters (0-20 m), based on a vertical profile of at least two discrete depths.

N: Summation of nitrate (plus nitrite) and ammonia (all forms)

O: Concentration at winter overturn (during complete mixing) at Station 96

P: Mean of monthly means for the entire year. Samples taken in a vertical profile from surface to bottom at Station 96.

Appendix B

Numeric Standards of Water Quality—Truckee River

Parameter	WQS	Beneficial Uses	Footnotes
Alkalinity (mg/L)	< 25% change from Natural conditions	Aquatic Life, IRRG, LSWT	B, F
Color (change in PCU)	Single Value ≤10 above Natural conditions	Aquatic Life, PCCU,REC1 REC2	B, C, D
Chloride (mg/L)	Single Value ≤28, Avg:≤20	Aquatic Life, WSES	D, E
Fecal Bacteria/E. Coli (#/100mL)	Annual Geo Mean ≤126 Single Value ≤410	PCCU, REC1	F
Dissolved Oxygen (mg/L)	Single Value: Nov-Jun: ≥ 6.0 Jul-Oct: ≥ 5.0	Aquatic Life, WSES	F
pH	Single Value: 6.5-9.0	Aquatic Life, PCCU,REC1, REC2, WILD	F
Dissolved Reactive Phosphorous (mg P/L)	Avg: ≤ 0.05	Aquatic Life, PCCU,REC1, REC2	E, G, K
Nitrogen Species (mg N/L)	TN Avg: ≤0.75 TN SV: ≤ 1.2 NO_3 SV: ≤2.0	Aquatic Life, PCCU, REC1 REC2, EXAV	K
Suspended Solids (mg/L)	Avg: ≤25; SV Flow Depend-ent: ≤1000cfs: ≤50 >1000cfs: ≤100	Aquatic Life, WSES	D
Sulfate (mg/L)	SV: ≤46; Avg: ≤39	Aquatic Life, WSES	D
Sodium (SAR)	SV: ≤ 2.0, Avg: ≤ 1.5	IRRG, WSES	D
Temperature (°C)	Nov-Mar: ≤ 13 Apr-June: ≤ 14 Jul-Oct: ≤ 21	Aquatic Life	H
Total Dissolved Solids (mg/L)	SV: ≤ 310; Avg: ≤ 245	FRSH, Aquatic Life, WES	D, J
Turbidity (NTU)	SV: ≤10	Aquatic Life	F

Key to Truckee River Footnotes

A: Most restrictive beneficial use(s). It is assumed that all other beneficial uses will be protected if standards are attained. The term Aquatic Life refers to the following beneficial uses: COLD, SPFS, AQUA, SPWN, RARE, and INAL.

B: Natural conditions defined for these sections of river by historical data where it exists.

C: PCU refers to Platinum Cobalt Units

D: PLPT adopted anti-degradation values required to maintain existing higher water quality, consistent with RMHQ values for the State of Nevada – Division of Environmental Protection, for Wadsworth Gage control point, and Pyramid Lake control point, respectively.

E: The term Avg. denotes the mean of monthly volume weighted averages, unless otherwise noted.

F: Consistent with WQS Beneficial Use values for the State of Nevada.

G: Phosphorus criteria apply to dissolved-P only and not total-P.

H: To provide for propagation of Cui-ui and early spawning Lahontan cutthroat trout (Nov-Mar), and spring passage of Lahontan cutthroat trout when flows are adequate to induce spawning runs (Apr-June). Expressed in terms of maximum daily temperature.

I: Temperature desired for the protection of Lahontan cutthroat trout juveniles and Cui-ui larvae and juveniles. Value for Jul-Oct expressed in terms of average dialing temperature over a 24-hr period.

K: For protection of aquatic life in Pyramid Lake