PYRAMID LAKE PAIUTE TRIBE WATER QUALITY CONTROL PLAN

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CONTENTS

APPENDICES

FIGURES

TABLES

LIST OF ABBREVIATIONS AND ACRONYMNS

AWQC	Ambient Water Quality Criteria
CCC	Criterion Continuous Concentration (refers to Chronic Criteria)
CF	conversion factor
CFR	Code of Federal Regulations
CMC	Criterion Maximum Concentration (refers to Acute Criteria)
CWA	Clean Water Act
DIN	dissolved inorganic nitrogen
DO	dissolved oxygen
DON	dissolved organic nitrogen
DRP	dissolved reactive phosphorus
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GMAV	Genus Mean Acute Value
GMCV	Genus Mean Chronic Value
LCT	Lahontan Cutthroat Trout
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection (Carson City, NV office)
NTU	nephelometric turbidity unit
OP	orthophosphate-P
PAR	photosynthetically active radiation
PCB's	polychlorinated biphenyls
PL	Pyramid Lake
PLIR	Pyramid Lake Indian Reservation
PLPT	Pyramid Lake Paiute Tribe
PS	perennial streams
RMHQ	requirements to maintain existing higher quality
SAR	sodium absorption ratio
SWB	surface water bodies
TAN	Total Ammonia Nitrogen

TAS	treatment in a similar manner as states
TDS	total dissolved solids
TIDT	Tribal Interdisciplinary Team (PLPT)
TN	total nitrogen
TP	total phosphates
TR	Truckee River
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
WQCP	Water Quality Control Plan
WQS	Water Quality Standards

BACKGROUND

In 1983, the federal government established an American Indian policy to treat Tribal governments on a government-to-government basis, and to support the principle of self-determination and local decision making by tribes. The 1987 Amendments to the Clean Water Act (CWA) added Section 518. This section authorizes the U.S. Environmental Protection Agency (USEPA) to treat federally recognized Indian Tribes in a similar manner as states for certain provisions of the Act, including the water quality standards (WQS) program. WQS play a critical role in the nation's water quality improvement programs. By establishing the goals for a waterbody, WQS provide the regulatory and legal basis for point source and nonpoint source water quality-based control beyond those required by the technological requirements of the CWA (USEPA 1990).

The first step for the Pyramid Lake Paiute Tribe (PLPT) to establish WQS within Reservation borders was to qualify for treatment in a similar manner as states (TAS), or program authority for the WQS program. To do this, a tribe must meet the following: (1) it must be federally recognized by the U.S. Department of the Interior and meet the definitions found in Section 518 of the CWA; (2) it must have a governing body which carries out substantial duties and powers; (3) it must be able to demonstrate authority to manage and protect water resources within the borders of the Reservation; and (4) in the judgment of the Regional Administrator of the USEPA, there must be a reasonable expectation that it is capable of carrying out the functions of an effective WQS program. On the basis of the PLPT’s capabilities, and their history of involvement with local and regional water quality and quantity issues, USEPA granted program authority under Section 106 of the CWA to the PLPT to develop a WQS program in May of 1990.

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 WQS, which when implemented would help protect the beneficial uses of Pyramid Lake (PL) and that portion of the Truckee River (TR) within the Pyramid Lake Indian Reservation. The PLPT has a long history of actively pursuing the management and protection of its waterbodies. It was therefore concluded at the beginning of the WQS process that while the PLPT would use those standards established by the State of Nevada which it considered appropriate for protecting existing and desired beneficial uses of the TR, the scientific team would develop site-specific standards for PL and TR where needed. This was to be done primarily on the basis of new and existing, site-specific, scientific data and experimentation. The standards recommended for PL are, in fact, the first set of standards ever developed and applied to it; PL is not included in the State of Nevada WQS.

Since both PL and the TR are important regional and national waterbodies, and since the development of site-specific criteria were essential in these relatively unique systems, a diverse and comprehensive series of investigations were required. For PL, our approach included: evaluation of historical data, detailed limnological monitoring, field and laboratory research, 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 PL to anoxia, primary productivity and dissolved oxygen modeling, modeling of total dissolved solids concentration, nonpoint source management and assessment, and lake and watershed management. The results of these studies have been published in a series of technical reports and peer-reviewed scientific publications (see Literature Cited section in this report). The volumes entitled, *Pyramid Lake, Nevada, Water Quality Study 1989-1993, Volume I - Limnological Data* (Lebo et al. 1993a), *Volume II - Limnological Description* (Lebo et al. 1993b), *Volume III - Nutrient Budgets* (Lebo et al. 1993c), and *Volume IV - Modeling Studies* (Lebo et al. 1994a), have been widely distributed regionally and contain much of the information used to develop the PL standards. A variety of sources including, but not limited to, historic and current monitoring databases, new research/monitoring, existing State WQS for the TR, and numerous criteria published by the USEPA were used to develop the TR standards.

We believe this Water Quality Control Plan (WQCP) and standards recommended herein, are scientifically sound using the best data available at this time. Clearly, there are issues which still require further investigation such as, modeling of dissolved inorganic nitrogen dynamics in TR, ecological physiology of river periphyton, influence of augmented river flow on nutrient, dissolved oxygen and total dissolved solids levels, endocrine disruptor compound effects on aquatic life, and the management of local and regional nonpoint source pollution. The PLPT continues to have interest in addressing these and other related issues as part of its on-going commitment to water quality protection of its aquatic resources. The PLPT intends to further refine these standards as part of its triennial review and as new scientific data and methodologies becomes available. The PLPT will also continue its active role in regional dialogue on related water quality and water quantity issues. These standards are best viewed as one of many steps the PLPT has, and will, take in their mission of environmental stewardship.

The PLPT conducted public workshops on January 8, 2001, and April 3, 2007, in the Tribal Chambers located in Nixon, Nevada in accordance with 40 Code of Federal Regulations (CFR) Part 25. The PLPT also participated in several other local and regional meetings to present the WQCP. At the request of several stakeholders, the public comment period was extended another 90 days to July 18, 2007, to ensure all interested and affected members of the public were given opportunity to review and comment on the PLPT's WQCP. Public and agency comments were solicited and received, to which the PLPT responded with written comments.

On January 30, 2007 the PLPT received TAS program authority for CWA Section 303 WQS and CWA Section 401 Certification by the USEPA Region IX Administrator. The final version of the WQCP was reviewed by the Tribal Interdisciplinary Team and approved by the Pyramid Lake Tribal Council on September 19, 2008, with Pyramid Lake Paiute Tribal Council Resolution PL 66-08. The WQCP was then sent to the USEPA Region IX Regional Administrator on October 3, 2008, for final review and approval. On December 19, 2008, the PLPT received approval of the PLPT WQCP from the USEPA Region-IX Water Division Director.

Section 303(c) of the CWA requires all states and authorized tribes to conduct a comprehensive review of all WQS at least once every three years in a regulatory process known as a Triennial Review. This provides the public with the opportunity to contribute feedback on changes to existing criteria or adoption of new WQS if necessary. The PLPT worked with technical consultants from the Desert Research Institute and began its first Triennial Review in 2014 which included (1) historical water quality data analysis from all available sources; (2) a comprehensive review of existing technical research documents; (3) consultation with USEPA, Nevada Department of Environmental Protection, and neighboring upstream jurisdictions; (4) conducting a series Triennial Review workshops with TR Watershed stakeholders; and, (5) conducting a public hearing to gather public testimony at large.

The 2014–2015 Triennial Review resulted in changes to the PLPT's WQS including nutrients, fecal bacteria, and lake clarity. The dissolved reactive phosphorus criteria for the TR was reduced from 0.05 mg/L to 0.022 mg/L to equate the State's total phosphorus WQS of 0.05 mg/L upstream of the Reservation. The tribe also developed a new WQS for PL clarity based on light extinction coefficient of visible light measured as photosynthetically active radiation. Lastly, the Tribe modified the ammonia and fecal bacteria WQS for the TR and PL based on the current USEPA recommended water quality criteria. The final WQCP was approved by the Tribal Council on September 16, 2015. The revised plan and Triennial Review materials were submitted to USEPA and effective on December 23, 2015.

SECTION I

INTRODUCTION TO WATER QUALITY STANDARDS

The preservation (or reestablishment) of healthy aquatic ecosystems was made a priority in the United States when Congress passed the Federal Water Pollution Control Act in 1972; commonly referred to as the Clean Water Act (CWA). This national commitment to high water quality is evident in the basic objective(s) of the Water Quality Standards (WQS) program of the CWA. Indeed, the objective of the standards program is to restore and maintain the "chemical, physical, and biological integrity of the nation's waters" and, where attainable, to achieve a level of water quality which provides for the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water (USEPA 1988). These natural and human uses of different waterbodies are ideally protected through the development of WQS for a state's waterbodies designed to promote healthy self-sustaining ecosystems. In this section, we provide a brief description of WQS as defined in the CWA as an introduction to recommended WQS for the Pyramid Lake Paiute Tribe (PLPT) to be presented later in this document. Additional information is available through publications prepared by the U.S. Environmental Protection Agency (USEPA; USEPA 1983; 1988; 1990; 2014), which were primary sources of information for this section.

BACKGROUND

Congress enacted the CWA in response to public concern about the status of our nation's waters, and the WQS program is of central importance to the mission of the CWA. The WQS program of the CWA is authorized under section 303 of the CWA and is administered by the USEPA. This program requires that each state identify waterbodies within their borders and establish water characteristics that, if attained, will protect the integrity of those surface waters. These water quality characteristics or standards are then submitted to USEPA for approval based on how they meet the objective and regulations of the CWA. The role of USEPA in the process is to work with states to further develop WQS for the protection of a state's waters. On rare occasions, USEPA establishes WQS within a state's borders if the state fails to comply with the CWA.

Indian tribes may now also participate in a similar manner as "states" (TAS) in certain programs administered under the CWA. There were two important developments that occurred during the 1980s that led to this potential involvement by tribes in the WQS program (USEPA 1990): (1) USEPA's Indian Policy; and (2) Section 518 of the 1987 Amendments to the CWA. On January 24, 1983, the U.S. Federal Government established a policy to elevate Tribal governments and support the principle of self-determination and local decision making by Indian Tribes. USEPA (1984) subsequently adopted its own Indian Policy and Implementation Guidance. The policy adopted by USEPA was "to give special consideration to Tribal interests in making Agency policy and to ensure the close involvement of Tribal governments in making decisions and managing the environmental programs affecting Reservation lands." Amendments to the CWA in 1987 (section 518) expanded upon the new Federal Policy to authorize USEPA to treat federally recognized Tribes in a similar manner as states for certain provisions of the CWA.

The PLPT began the TAS process in 1989 in conjunction with USEPA for the purposes of the WQS program. The recommended WQS contained in this document are a culmination of that process which has proceeded in stages. In 1990, the PLPT received TAS (now referred to as Program Authorization) status by the USEPA under 40 Code of Federal Regulations (CFR) Parts 35 and 30 to receive funding to develop WQS for its Reservation. The PLPT has developed the regulatory components of its water quality management program through the passage of an ordinance defining how WQS will be implemented. The PLPT received USEPA TAS authority to establish WQS for the Reservation on January 30, 2007.

TERMINOLOGY

Water quality standards under the CWA are legal regulations that are necessary to protect certain uses of a waterbody. In this section, we define some of the common terms associated with WQS and the different components of a standard. A water quality standard has several elements that together define the desired water quality for a portion or an entire waterbody. Two of the basic elements of a standard are a set of beneficial designated uses for the waterbody and the water quality characteristics or criteria needed to restore or maintain those uses. The completed WQS document also contains an antidegradation policy. The definitions for these three elements of a WAS are provided in the following paragraphs. It is important to note that WQS established for a waterbody do not need to be achievable at the time the standards are set. One of the purposes of the WQS program is to establish goals for the desired water quality of our nation's waters. In addition, standards provide a basis for the development of water quality based-treatment controls and strategies, and for watershed management.

The first part of a WQS is the definition of the beneficial or designated uses, which establish the desired uses for a given portion or all of a specified waterbody. Each state (including participating Tribes) has the primary responsibility for determining the uses it considers appropriate for all bodies of water within its borders. At a minimum, WQS must provide for the protection and propagation of fish, shellfish and wildlife, and for recreation. This is the goal of "fishable/swimmable." Other uses may include public water supply, water supply for agricultural, industrial, commercial, navigation, aquatic life, protection of special habitat, etc. In the next section, beneficial designated uses for Pyramid Lake (PL) and the lower Truckee River (TR) are listed as part of the WQS recommendations for the Reservation. It is important to note that the USEPA does not recognize waste transport (e.g., discharge of treated sewage) as an appropriate beneficial designated use of a waterbody, although it is a common use of aquatic systems.

The USEPA differentiates a subset of the designated uses for a waterbody from the full set of desired uses and calls them existing uses. This distinction can have important regulatory ramifications. The definition of an existing use from a regulatory standpoint is all uses that have been attained since November 28, 1975, when USEPA promulgated the provisions of the CWA. The distinction between existing uses from the full set of designated uses becomes important if a State (or Tribe) wishes to eliminate a particular use from the WQS for a given waterbody. If a designated use has not been attained (and it is not likely that it ever will be), there is a procedure in the CWA through which it can be deleted. However, an existing use (attained since November 28, 1975) cannot be deleted regardless of the economic or political implications of that designated use. In the case of those waterbodies included as part of this document, no existing use is being considered for deletion.

The water quality characteristics necessary to protect the set of designated uses defined for a waterbody are called criteria, which are the second component of a water quality standard. Typically, it is assumed that if water quality is adequate to protect the most sensitive use then all other uses will be protected. The criteria describing the desired water quality characteristics for a waterbody may be expressed in either narrative or numeric form. Narrative criteria are concise declarations typically in the form of "free from" statements that express qualitative conditions. For example, a common narrative criterion included in WQS is that "waters shall be free from toxic substances in toxic amounts." The second form for water quality criteria is numeric standards that express actual concentrations of chemicals or other measurable parameters in a waterbody. An example of this second form of criteria pertinent to the Reservation is that water temperature in the TR during the spring cui-ui (*Chasmistes cujus*) spawning period shall be <14°C. USEPA believes that an effective program will contain both forms of criteria.

The development of a set of numeric criteria to protect a given set of designated uses for a specific waterbody or group of similar waterbodies can be done in several ways. Guidance for appropriate chemical concentrations that should not be exceeded to protect aquatic life and the human uses of a waterbody can be found in documents compiled by the USEPA under section 304(a) of the CWA. These documents include two important types of information: (1) scientific data on the effects of pollutants on human health, aquatic life, and recreation; and (2) quantitative concentrations or qualitative assessments of the pollutants in water which will generally ensure water quality adequate to support a particular water use. USEPA periodically issues a summary document containing the latest compilation of guidance on different chemical and physical characteristics of aquatic systems needed to protect designated uses. States and Tribes may utilize the numeric guidance provided by USEPA directly without any further justification, or they may develop site-specific criteria. A site-specific numeric criterion is one that is relevant to a given site (e.g., PL) reflecting local conditions such as the species present or unique water chemistry. In the development of WQS for the lower TR and PL, site-specific numeric criteria were developed for a number of water quality characteristics of primary concern applying USEPA guidance where appropriate.

The final component of a water quality standard is an antidegradation policy. USEPA sets a minimum requirement for a State's antidegradation policy, which must conserve, maintain, and protect the existing uses of a waterbody by maintaining high water quality. The idea of improving the water quality of our nation's waters bodies is at the core of the intent of the CWA, and the antidegradation policy requirement of WQS illustrates that intent. According to the

USEPA, at a minimum, antidegradation policy should contain the following components: (1) existing instream water uses and level of water quality necessary to protect existing uses shall be maintained and protected; (2) where quality of waters exceeds levels necessary to support the fishable/swimmable designation, that quality shall be maintained unless lowering of quality is necessary to accommodate important economic or social development in the area in which the waters are located; and (3) where high quality waters constitute an outstanding national resource, that water quality shall be maintained and protected (USEPA 1988).

As indicated above, an area where States (and Tribes) have some flexibility in developing an antidegradation policy is when current water quality exceeds the level necessary to protect the designated uses. In the case of high water quality, some degradation of water quality could occur without affecting the uses of the waterbody. One of the main objectives of an antidegradation policy is to define a process of how degradation of high water quality in systems exceeding the minimum needs for the protection of its uses should be handled. However, antidegradation makes any further loss of water quality of a portion or all of a waterbody an issue to be settled with public involvement.

SUBMISSION PROCESS

Participation by a Tribe in the WQS program of the CWA begins with an application to the Regional Administrator of the USEPA with jurisdiction over the State(s) in which the Tribe's Reservation is located. Section 518 of the CWA stipulates four criteria that a Tribe must meet to participate in the program or in USEPA terminology to receive Program Authorization (previously known as TAS) for the purposes of WQS. These are: (1) the Tribe must be Federally recognized; (2) the Tribe must have a governing body carrying out substantial duties and powers; (3) the Tribe must adequately demonstrate authority to manage and protect water resources within the borders of their Reservation; and (4) the Tribe is expected to be capable in the judgment of the Regional Administrator of carrying out an effective WQS program. When these conditions are met, the Tribe can receive authorization to participate in the WQS program of the CWA as a State.

The first step in the development of WQS is the identification of all waterbodies within a State's borders that will require standards. For the PLPT, there are two waterbodies on the Reservation that are of primary interest. These are PL and that portion of the lower TR within the exterior boundaries of the Pyramid Lake Indian Reservation (PLIR). In addition, all other surface waterbodies within the exterior boundaries of the PLIR, including but not limited to ephemeral, intermittent, or perennial streams, springs, and wetlands are also included in the surface waters of the Reservation requiring some definition of their water quality.

Following the identification of all waterbodies requiring standards, States (and Tribes) must designate the beneficial uses for each waterbody or different portions of the same waterbody. The States usually designate beneficial uses with a broad classification system to organize the different potential uses of waterbodies within their borders. Because there are only two main waterbodies on the Reservation, their specific designated uses on the PLIR are defined directly. It is also acknowledged that these two waterbodies are linked in terms of both hydrology and water quality (e.g., river loading, as altered by flow, is a source of water quality degradation for PL). Specific beneficial use designations for the Reservation are listed in the next chapter.

The third step in the WQS process is to define criteria (both chemical and otherwise) necessary to support the designated uses of a State's waterbodies. For Tribes beginning the standards process, there are three main approaches that can be used for establishing water quality criteria for their Reservations. These are: (1) negotiate with an adjoining State to apply the State's standards to Indian lands; (2) incorporate the standards of an adjoining State as the Tribe's own standards, with or without revision; or (3) independently develop and adopt standards for a Tribe's Reservation that may account for unique site-specific conditions and waterbody uses. We have utilized portions of both the second and third approaches (depending on the constituent) in the development of standards for PL and the lower TR. In particular, there are currently no standards for PL set by the State of Nevada requiring that water quality criteria for it be developed.

In the development of water quality criteria sufficient to protect designated uses, Tribes may either use recommended values or develop appropriate criteria for the specific waterbodies or portion thereof. The most direct source for developing criteria for a waterbody is to adopt criteria published by USEPA under section 304(a) of the CWA. Those recommended values may also be modified by a Tribe to reflect site-specific conditions. Tribes may also use other scientifically defensible methods to develop appropriate water quality criteria to protect waterbody uses.

The WQS process also requires States (and Tribes) to develop an antidegradation policy. An antidegradation policy, as previously discussed, is a key element in the CWA directing water quality policy toward improved and high water quality. The Tribe must develop methods to implement antidegradation to ensure the adopted WQS protect the designated uses by maintaining high water quality.

The development of WQS by a Tribe may also require that the Tribe adopt additional policies necessary for the application and implementation of the standards. For example, the PLPT has adopted a Water Quality Ordinance (Appendix C) asserting its authority over the surface waters of their Reservation for the purposes of water quality management and protection.

WQS for a State (or Tribe) are adopted through a process involving public participation in accordance with 40 CFR, Part 25. USEPA does not have a standardized procedure for the adoption of standards by States, but there is a Federal requirement that the process include public hearings and standards must be reviewed every three years (40 CFR, Part 131.20). Following public hearings for review of standards, a Tribe in this case, formally adopts the WQS. The legal authority for the Tribe then certifies that the Tribe followed the proper established procedures in adopting the standards package, and the entire package is submitted to the Regional Administrator for USEPA. USEPA will review the adopted standards and either approve them or work with the Tribe to eliminate deficiencies if they exist. The WQS then become effective within the jurisdictional boundaries of the Reservation at the point USEPA approves them.

Pursuant to 40 CFR 131.20, a State/Tribe is to hold public hearings at least once every three years for the purpose of reviewing its WQS and, as appropriate, modify them or adopt new standards.

SECTION II

PYRAMID LAKE PAIUTE TRIBE WATER QUALITY STANDARDS

INTRODUCTION

A WQS is a law or regulation which consists of the beneficial use(s) of a waterbody or segment therein, and the water quality criteria which are necessary to protect those uses. WQS also contain an antidegradation policy. In this section we present an antidegradation policy, beneficial uses, and narrative and numeric criteria for the PLIR. Both the narrative and numeric criteria apply to PL and the lower TR while only the narrative criteria apply to intermittent creeks that are tributaries to these waterbodies.

Criteria for PL apply to the entire surface (Table II.1), except in a designated mixing zone (see footnote in Table II.1 for definition of mixing zone). Two segments of the TR have also been assigned water quality criteria: southern Reservation boundary to Dead Ox Wash with a control point at Wadsworth (Table II.2), and Dead Ox Wash to PL with a control point at Nixon (Table II.3). For those constituents with criteria which apply to both PL and TR, but which are not included in the tables described above, numerical criteria are given in Table II.4. (The reader is referred to the accompanying footnotes in these tables for further explanation). Tables II.7 and II.8 present USEPA recommended criteria for toxic organic pollutant and toxic metal pollutants, respectively (mercury has been given site-specific criteria).

As discussed elsewhere in this document, standards for PL are based almost entirely on the results of extensive limnological research, and represent the first time standards have been recommended for this waterbody. The standards for the TR come from the current interagency database on river water quality, existing State of Nevada standards, and additional data collected during 1989–1994 as part of the University of California, Davis - PLPT study. Refer to Figure II.1 for a map of PL, the TR, and vicinity.

2015 Triennial Review

Beginning in 2014, the PLPT began reviewing its WQS to analyze the effectiveness of each water quality criteria and modified several numeric criteria. The PLPT and its consultants determined that changes were necessary for measurements of bacteria, lake clarity, and nutrients (phosphorus and ammonia). After the revised standards were drafted, the Program began an extensive public outreach process known as a Triennial Review, holding various workshops and meetings on the PLIR in Fernley, Reno, Sparks, and the town of Truckee, Nevada. After the Program received input from the stakeholders within the TR Watershed, the standards were finalized and submitted for the USEPA's review. The USEPA approved these revisions to the tribe's WQS for the lower TR and PL, contained within the Tribe's Water Quality Control Plan (WQCP) on December 23, 2015.

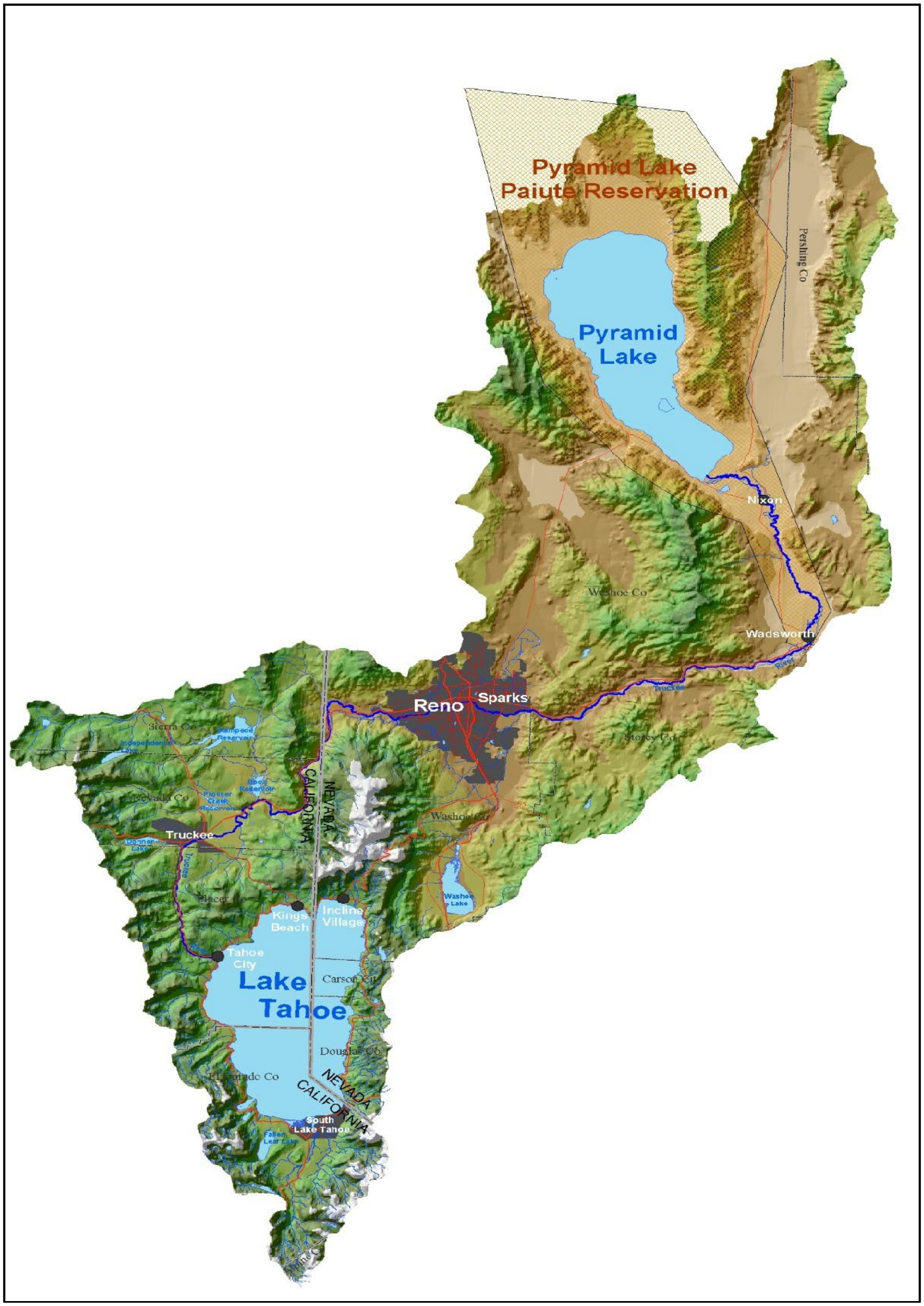

Figure II.1 Map of Pyramid Lake and the Truckee River Watershed. The Truckee River system begins at Lake Tahoe and ends at Pyramid Lake. Inflows to the Truckee River are regulated by several reservoirs. The Pyramid Lake Paiute Indian Reservation boundary is represented by the hatched polygon around Pyramid Lake and the terminal reach of the Truckee River.

ANTIDEGRADATION POLICY

Any surface waters of the PLPT that have a higher water quality than applicable beneficial use standard of water quality as of the date when those standards become effective must be maintained in their higher quality. No discharges of waste may be made that will result in lowering the net quality of these waters unless it has been demonstrated to the PLPT that the lower quality is justifiable because of economic or social considerations, or as may be allowed by meeting short-term modification requirements described later in this document in the Implementation chapter.

The antidegradation policy is implemented through the establishment of numeric water quality antidegradation standards, when available, on higher quality surface waters within the PLIR.

The PLPT has not established requirements to maintain existing higher quality (RMHQs) for the lower TR and PL as defined and implemented by the State of Nevada Division of Environmental Protection (NDEP). Rather, the PLPT has adopted numeric water quality antidegradation standards for certain parameters (e.g., color, chlorides, sodium, sulfate, and total dissolved solids [TDS]) for the higher quality waters within Tribal jurisdiction on the lower TR. Tribal antidegradation standards are consistent with State of Nevada RMHQ values provided by the February 2003 Nevada Administrative Code (NAC) 445A.189-190, for waters of the lower TR within the exterior boundaries of the PLIR.

Existing beneficial uses shall be protected and the level of water quality necessary to protect existing beneficial uses shall be maintained by an existing higher water quality, if one exists, or by applying appropriate beneficial use standards for the existing use. Existing uses are defined as those attained since November 28, 1975. Where existing water quality is better than the beneficial use standard levels necessary to support propagation of aquatic life, wildlife, and recreation in the water, that existing higher level of water quality shall be maintained and protected unless it is found, after full satisfaction of governmental and public participation requirements, that a lower level of water quality is justified to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation of water quality, the PLPT assures that the highest statutory and regulatory requirements shall be achieved for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control. Where better quality waters constitute a water of special ecological significance, the water quality antidegradation standard and beneficial uses of those waterbodies shall be maintained and protected to the fullest extent possible at all times.

Like beneficial use standards (See Implementation chapter, Review section, Item 31), antidegradation standards can be subject to modification if new scientific data and understanding of ecosystem processes or human health criteria for a given constituent becomes available. This does not preclude reevaluating or examining rationale or methods applied to existing data used to set antidegradation or beneficial use standards. Any modification of an antidegradation standard that may be viewed as a “relaxation” is acceptable if the justification and rationale supporting the standard adjustment is satisfactorily demonstrated to and accepted by the standards setting authority. USEPA approval of any standards change is required before the change becomes effective (40 CFR 131.21).

BENEFICIAL USES

An effective WQCP requires determination of the beneficial water uses which are either existing or are intended to be developed. Along with numerical/narrative criteria and an antidegradation policy, beneficial uses form the basis for the PLPT's WQS. Indeed, beneficial uses provide the framework from which the narrative and numeric criteria are built (i.e., the goal of the various criteria is to protect these uses). Section 303 of the CWA (as amended) defines WQS as both the uses of waters involved and the water quality criteria applied to protect those uses. It is believed that the list of beneficial uses accurately reflects the current and probable future uses that the PLPT currently envisions for PL**,** the TR**,** perennial streams (PS) to PL, and all other surface waterbodies (SWB) within the boundaries of the PLIR. Beneficial uses apply to surface water only and do not include groundwater. Reference to the TR applies to that portion of TR located within the PLIR.

Beneficial uses may be modified in the future consistent with Tribal or USEPA recommended water quality criteria guidance.

Definitions of Beneficial Uses

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 (TR/PL/PS).

COLD - Cold Freshwater Habitat. For the purpose of supporting cold water ecosystems including, but not limited to, preservation and enhancement of aquatic habitats, vegetation, fish and wildlife (including invertebrates). Based on the seasonal occurrence of cold-water tolerance species (TR/PL/PS).

EXAV - Extraordinary Aesthetic Value. For the purpose of preserving the unique aesthetic value of surface waters (TR/PL/PS/SWB).

FRSH - Freshwater Replenishment. For the purpose of increasing instream flows to maintain or improve surface water quality (e.g., reducing TDS) (TR/PL/PS).

GRND - Groundwater Recharge. For the purpose of recharge of groundwater for future extraction, maintenance of water quality, or other purposes (TR/PS).

INAL - Indigenous Aquatic Life. For the purpose of preserving aquatic plant and animal species and biodiversity in both freshwater and inland saline water habitats (TR/PL/PS/SWB).

IRRG - Irrigation. Beneficial uses of water for the purpose of irrigation including, but not limited to, farming, horticulture, range and range vegetation (TR/PS/SWB).

LSWT - Livestock Watering. For the purpose of watering range and farm livestock (TR/PS/SWB).

NATF - Maintenance and restoration of native fish species. For the purpose of promoting the reproduction and survival of native fish species (TR/PL/PS).

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 (TR/PL/PS/SWB).

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 (TR/PL/PS).

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 (TR/PL/PS/SWB).

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 (TR/PL/PS/SWB).

RIPH - Riparian Habitat. For the purpose of maintaining and enhancing the growth and survival of riparian vegetation (TR/PS/SWB).

SPFS - Sport fishing. For the purpose of collection of fish, or organisms related to sport fishing, intended for human consumption (TR/PL).

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 (*Oncorhynchus clarkii henshawi*; LCT) whether for rearing, stocking, and/or species recovery purposes. Includes fish rearing in TR for subsequent migration to PL (TR/PL/PS).

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 (TR/PL/PS/SWB).

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 (TR/PL/PS/SWB).

WQEN - Water Quality Enhancement. For the purpose of supporting enhancement or improvement of water quality in a downstream waterbody (TR/PS).

WSES - Water of Special Ecological Significance. For the purpose of preserving the unique ecological status of PL as one of the few large, deepwater, saline lakes in the world and to maintain the existing higher quality of the lower TR.

NARRATIVE STANDARDS OF WATER QUALITY

These narrative standards apply to PL, the lower TR, and tributaries or wetlands to these waterbodies. In addition, these narrative standards apply to all other surface waterbodies within the exterior boundaries of the PLIR including, but not limited to, ephemeral, intermittent, or perennial streams, springs, and wetlands.

Bacteria, Coliform

Waters shall not contain concentrations of coliform bacteria attributable to human wastes.

Bioaccumulation

Toxic pollutants shall not be discharged as a result of human activities at levels that will bioaccumulate in aquatic resources to levels that are harmful to human health or aquatic life.

Biostimulatory Substances

Waters shall not contain biostimulatory substances in concentrations that cause aquatic growth to the extent that such growths promote nuisance conditions or adversely affect beneficial uses.

Chemical Constituents

Waters designated as IRRG or LSWT shall not contain concentrations of chemical constituents in amounts that adversely affect their beneficial uses for agricultural purposes.

Waters designated as WTLD shall not contain concentrations of chemical constituents in amounts that adversely affect their beneficial uses for propagation and/or development of sensitive wildlife species.

Waters shall not contain concentrations of chemical constituents in amounts that adversely affect water for any beneficial uses.

Color

Waters shall be free of coloration producing materials and/or substances that cause nuisance or adversely affects the water for beneficial uses. The natural color of fisheries or other inland surface water resources shall not be impaired.

Floating Materials

Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect the water for beneficial uses.

Oil and Grease

Waters shall not contain oils, greases, waxes or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect the water for beneficial uses.

Pesticides

Pesticide and adjuvant concentrations in water and aquatic sediments shall not reach or exceed levels that impair the health or reproductive success of human, animal, plant, or aquatic life.

Pesticides are defined under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Section 2(u) as "any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest."

Pesticides and associated adjuvants shall only be used in a manner consistent with the USEPA approved labeling. To use any registered pesticide in a manner that is inconsistent with the labeling is in violation of FIFRA Section 12 (G).

Pesticides are defined to include, herbicides, insecticides, fungicides, piscicides, rodenticides and other agronomic and agricultural poisons.

Radioactivity

Radionuclides shall not be present in concentrations which are deleterious to human, plant, animal, aquatic life or which result in the accumulation of radionuclides in the food web to the extent which presents a hazard to human, plant, animal, or aquatic life.

Sediment and Turbidity

The suspended sediment load and suspended sediment and turbidity concentrations shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or that adversely affects the water for beneficial uses.

Species Composition

Communities and populations of aquatic biota, including invertebrate, vertebrate and plant species, shall not be degraded as a result of point source or nonpoint source discharge. This applies to transient as well as cumulative conditions. Short-term variances from these objectives may be allowed for actions that are being taken to fulfill statutory requirements under tribal law or the federal Endangered Species Act.

Taste and Odor

Waters shall not contain taste or odor-producing substances discharged from activities in the watershed in concentrations that impart undesirable tastes or odors to fish or other edible products of aquatic origin, that cause nuisance or that adversely affect the water for beneficial uses. The natural taste and odor of fish used for human consumption shall not be impaired.

Temperature

The ambient receiving water temperature of all waters shall not be altered by point or nonpoint source inputs unless it can be demonstrated to the satisfaction of the Pyramid Lake Paiute Tribal Council and the Tribal Interdisciplinary Team (TIDT) that such an alteration in temperature does not adversely affect the water for beneficial uses.

Toxicity

All waters shall be maintained free of toxic substances which enter the waterbody from human activities in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life. The concentrations of toxic pollutants in the water column, sediments, or biota shall not adversely affect water for beneficial uses.

Furthermore, if it is determined that a compound of toxic affect is interfering with the beneficial uses of any waterbody on Tribal lands, but that this compound is not identified with a numeric criterion, the PLPT will consult with the USEPA and may, if appropriate, utilize the best science available to develop a numeric limit.

1) All effluents containing materials attributable to the activities of man shall be considered harmful unless acceptable bioassay tests have shown otherwise. In its discretion, the PLPT may require the party responsible for the discharge to perform bioassay tests on the effluent in question.

2) Compliance with this section of these standards will be determined using indicator organisms, population density, growth anomalies, bioassays, or other appropriate methods as specified by the PLPT.

3) At a minimum, the chronic effect on test organisms in the waterbody receiving the effluent in question shall not be more than that for waters of the same waterbody that are unaffected by the discharge of pollutant, or, when necessary, for other control water meeting the criteria described in the latest edition of *Standard Methods for the Examination of Water and Wastewater* (Baird et al. 2012).

4) Compliance with the above standards shall be evaluated with a 96-hour bioassay and/or a short-term method for estimating chronic toxicity using methods described in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (USEPA 2002) and *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (USEPA 1993), or any subsequent revisions approved by USEPA.

NUMERIC STANDARDS OF WATER QUALITY

The numeric standards of water quality for PL, the TR from the southern boundary of Tribal lands (Wadsworth) to Dead Ox, and the TR from Dead Ox to PL are provided in Tables II.1 through II.3. Additional water quality standards that apply to either PL or the TR are provided in Table II.4.

Table II.1 Numeric Standards of Water Quality: Pyramid Lake.†[a]

WATER QUALITY			
PARAMETER	**STANDARDS**	**BENEFICIAL USES [b]**	**Footnotes**
Dissolved Oxygen	**Single Value: ≥80%**	**Aquatic Life, WSES**	c
0-20 m	A-Avg.: ≥90%		
(percent saturation)			
hypolimnion (>20 m - >70 m)	Single Value: ≥6.0		d
(mg l^{-1})			
Temperature	**Single Value: ≤2**	**Aquatic Life, WSES**	e
(°C)			
Clarity (0-20 m)	**A-Avg.: ≤0.45**	**PCCU, REC1, EXAV, INAL**	f
(m^{-1})	A-Avg.: ≤0.25		r
Total Dissolved Solids	**A-Avg.: ≤5,900**	**Aquatic Life, WSES, WILD**	g, p
(mg l^{-1})			
Suspended Solids (0-20 m)	**Single Value: ≤20**	**Aquatic Life, WSES, EXAV,**	h
(mg l^{-1})	A-Avg.: ≤5	PCCU, REC1	
Turbidity (0-20 m)	**Single Value: ≤5**	**Aquatic Life, WSES, EXAV,**	h
(change in NTU)	A-Avg.: ≤2.5	PCCU, REC1	
pH	**Single Value: ≤9.7**	**Aquatic Life**	i
Fecal Bacteria			
E. coli	Geometric Mean ≤ 126	PCCU, REC-1	j
(#cfu/100 mL)	Single Value: ≤410		

WATER QUALITY			
PARAMETER	**STANDARDS**	**BENEFICIAL USES** [b]	**Footnotes**
Chlorophyll *a* (0-20 m)	**Depth Avg.: ≤ 0.055 (Apr-Oct)**	**COLD, WSES, EXAV, PCCU,**	k, m
(mg l^{-1})		REC1, SPFS, AQUA, SPWN, RARE	
Dissolved Reactive Phosphorus (DRP)	**Depth Avg.: ≤ 0.095 (0-20 m)**	**Aquatic Life, WSES**	l, m, q
DRP	Depth-Avg.: ≤ 0.115 (full water column)		l, p, q
(mg l^{-1})			
Total Phosphorus	**Depth Avg.: ≤0.120 (0-20 m)**	**Aquatic Life, WSES**	l, m, q
(mg l^{-1})	Depth-Avg.: ≤0.140 (full water column)		l, p, q
Ammonia (total)	**Depth Avg.: ≤ 0.015 (0-20 m)**	**Aquatic Life, WSES, EXAV**	m, q
(mg l^{-1})			
Dissolved Inorganic	**Depth Avg.: ≤0.045 (0-20 m)**	**Aquatic Life, WSES, EXAV**	m, n, q
Nitrogen	**Depth Avg.: ≤0.095 (mixed winter water column)**		o, q
(mg l^{-1})			
Total Nitrogen	**Depth Avg.: ≤ 0.90 (0-20 m)**	**Aquatic Life, WSES, EXAV**	m, q
(mg l^{-1})	Depth Avg.: ≤1.00 (full water column)		p, q

[†] All values apply to the full water column at the deep-water location (Station 96), unless noted otherwise.

[a] Water quality standards apply to the entire surface of PL except in a mixing zone where stream inflow enters PL. A mixing zone is defined as that portion of PL, influenced by tributary inflow, where TDS is less than 80% of that measured at mid-PL (Pyramid Lake Fisheries Station 96) using electrical conductivity as an indicator.

[b] Most restrictive beneficial uses(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.

[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-PL 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 PL that is directly influenced by the TR discharge provided the water quality criterion for temperature is being attained in TR. This applies only to situations where temperature increases as a result of point or nonpoint source inputs. Does not apply to natural cycles of PL 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] U.S. Fish and Wildlife Service 1992.

[h] NTU = nephelometric turbidity unit. 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] cfu = colony forming units. USEPA Recreational Water Quality Criteria guidance for *Escherichia coli (E. coli)* has been set forth in the 2012 updated *Federal Register* of November 29, 2012 (2012-28909) and the USEPA (2012) and associated documentation. Geometric Mean value will be evaluated on a quarterly basis, in addition to a single value for *E. coli*.

[k] Value not to exceed specified concentration on two consecutive monthly samples 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 monthly means during the period April-October. Samples taken from 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.

[q] See Section III for scientific justification.

[r] PLPT antidegradation value, based on analysis of historical PL photosynthetically active radiation and Secchi disk readings data.

s Ambient Water Quality Criteria for Chloride (USEPA 1988).

Table II.2 Numeric Standards of Water Quality: Truckee River: Southern Boundary of Tribal Lands (Wadsworth) to Dead Ox

WATER QUALITY			
PARAMETER	**STANDARDS**	**BENEFICIAL USES[a]**	**Footnotes**
Alkalinity (mg l^{-1} as $CaCO_3$)	Less than 25% change from natural conditions	**Aquatic Life, IRRG, LSWT**	b, f
Color	**Single Value: ≤10 above**	**Aquatic Life, PCCU, REC-1,**	b, c, d
(change in PCU)	natural conditions	REC-2	
Chlorides	**Single Value: ≤28**	**Aquatic Life, WSES**	d, e
(mg l^{-1})	A-Avg.: ≤20		
Fecal Bacteria			
E. coli	Annual Geometric Mean ≤126	PCCU, REC-1	f, l
(No. cfu/100 ml)	Single Value: ≤410		
Dissolved Oxygen - water	**Single Value:**	**Aquatic Life, WSES**	f
(mg l^{-1})	Nov-Jun: ≥6.0		
	Jul-Oct: ≥5.0		
pH	**Single Value: 6.5-9.0**	**Aquatic Life, PCCU, REC-1,**	f

WATER QUALITY			
PARAMETER	**STANDARDS**	**BENEFICIAL USES[a]**	**Footnotes**
(Units)	Change in pH: 0.5	REC-2, WILD	
Dissolved Reactive Phosphorus (mg l^{-1})	**A-Avg.: ≤0.022**	**Aquatic Life, PCCU, REC-1,** REC-2	e, g, k
Nitrogen Species (mg l^{-1})	**Total Nitrogen (TN) A-Avg.: ≤0.75** TN Single Value: ≤1.2 Nitrate Single Value: <2.0 Nitrite Single Value: <0.04 Total ammonia (see Table II.4)	**Aquatic Life, PCCU, REC-1,** REC-2, EXAV	k
Suspended Solids (mg l^{-1})	**A-Avg.: ≤25** Single Value: flow dependent 0-<1000 cfs: ≤50 >1000 cfs: ≤100	**Aquatic Life, WSES**	d
Sulfate (mg l^{-1})	**Single Value: ≤46** A-Avg.: ≤39	**Aquatic Life , WSES**	d
Sodium (SAR)	**Single Value: ≤2.0** A-Avg.: ≤1.5	**IRRG, WSES**	d
Temperature (°C)	**Nov-Mar: ≤13°C** Apr-Jun: ≤14°C Jul-Oct: Avg.: 21°C	**Aquatic Life**	h h i, k
Change in Temperature	**Single Value: ≤2°C**	**Aquatic Life**	f
Total Dissolved Solids (mg l^{-1})	**Single Value: ≤310** A-Avg.: ≤245	**FRSH, Aquatic Life, WSES**	d, j
Turbidity (NTU)	**Single Value: ≤10**	**Aquatic Life**	f

[a] Most restrictive beneficial uses(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 this section of river by historical database where it exists.

[c] PCU: Platinum Cobalt Units.

[d] SAR = sodium absorption ration. PLPT adopted antidegradation values required to maintain existing higher quality, consistent with RMHQ values for the State of Nevada – Division of Environmental Protection, for the Wadsworth Gage control point (see February 2003 NAC 445A.189).

[e] The term A-Avg. denotes the mean of monthly volume weighted averages, unless otherwise indicated.

f Consistent with WQS Beneficial Use values for the State of Nevada (February 2003 NAC 445A.189).

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

h To provide for propagation of cui-ui and early spawning LCT (Nov-Mar), and spring passage of LCT when flows are adequate to induce spawning runs (Apr-June). Expressed in terms of maximum daily temperature over a 24-hour period.

i Temperature desired for the protection of LCT juveniles and cui-ui larvae and juveniles. Value for Jul-Oct expressed in terms of average daily temperature over a 24-hr period.

j For protection of aquatic life in PL.

k See Section III for further details on scientific justification.

l. USEPA Recreational Water Quality Criteria guidance for *Escherichia coli (E. coli)* has been set forth in the 2012 updated Federal Register of November 29, 2012 (2012-28909), USEPA (2012), and associated documentation. Geometric Mean will be evaluated on a quarterly basis, in addition to a single value for *E. coli*.

Table II.3 Numeric Standards of Water Quality: Truckee River: Dead Ox to Pyramid Lake

WATER QUALITY			
PARAMETER	**STANDARDS**	**BENEFICAL USES**	**Footnotes**
Alkalinity (mg l^{-1} as $CaCO_3$)	Less than 25% change from natural conditions	**Aquatic Life, IRRG, LSWT**	b, f
Color (change in PCU)	**Single Value: ≤10 above** natural conditions	**Aquatic Life, PCCU, REC-1,** REC-2	b, c, d
Chlorides (mg l^{-1})	**Single Value: ≤130** A-Avg.: ≤105	**Aquatic Life, WSES**	d, e
Fecal Bacteria *E. coli* (cfu/100 ml)	Annual Geometric Mean ≤126 Single Value: ≤410	PCCU, REC-1	f, l
Dissolved Oxygen - water (mg l^{-1})	**Single Value:** Nov-Jun: ≥6.0 Jul-Oct: ≥5.0	**Aquatic Life, WSES**	f
pH (Units)	**Single Value: 6.5-9.0** Change in pH: 0.5	**Aquatic Life, PCCU, REC-1,** REC-2, WILD	f
Nitrogen Species (mg l^{-1})	**TN A-Avg.: ≤0.75** TN Single Value: ≤1.2 Nitrate Single Value: <2.0 Nitrite Single Value: <0.04 Total ammonia (see Table II.4)	**Aquatic Life, PCCU, REC-1,** REC-2, EXAV	k

WATER QUALITY			
PARAMETER	**STANDARDS**	**BENEFICAL USES**	**Footnotes**
Suspended Solids (mg l^{-1})	**A-Avg.: ≤25** Single Value: flow dependent 0-<1000 cfs: ≤50 >1000 cfs: ≤100	**Aquatic Life, WSES**	d
Sulfate (mg l^{-1})	**Single Value: ≤106** A-Avg.: ≤85	**Aquatic Life , WSES**	d
Sodium (SAR)	**Single Value: ≤2.9** A-Avg.: ≤2.4	**IRRG, WSES**	d
Temperature (ºC)	**Nov-Mar: ≤13°C** Apr-Jun: ≤14°C Jul-Oct: Avg.: 21°C	**Aquatic Life**	h
Total Dissolved Solids (mg l^{-1})	**A-Avg.: ≤415**	**FRSH, Aquatic Life, WSES**	d, j
Turbidity (NTU)	**Single Value: ≤10**	**Aquatic Life**	f

[a] Most restrictive beneficial uses(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 this section of river by historical database where it exists.

[c] PCU: Platinum Cobalt Units.

[d] PLPT adopted antidegradation values required to maintain existing higher quality, consistent with RMHQ values for the State of Nevada – Division of Environmental Protection, for the PL control point (see February 2003 NAC 445A.190).

[e] The term A-Avg. denotes the mean of monthly volume weighted averages, unless otherwise indicated.

f Consistent with WQS Beneficial Use values for the State of Nevada (February 2003 NAC 445A.190).

[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 daily temperature over a 24-hr period.

[j] For protection of aquatic life in PL.

[k] See Section III for further details on scientific justification.

l USEPA Recreational Water Quality Criteria guidance for *Escherichia coli (E. coli)* has been set forth in the 2012 updated Federal Register of November 29, 2012 (2012-28909), USEPA (2012), and associated documentation. Geometric Mean will be evaluated on a quarterly basis, in addition to a single value for *E. coli*.

Table II.4 Additional Standards that Apply to Either Pyramid Lake or the Truckee River †

[Values expressed as µg/l]

Substance	**Aquatic Life [a]**	**IRRG**	**LSWT**
Aluminum	Refer to footnote [b]	5,000 [c]	5,000 [c]
Ammonia	Refer to footnote [d]	---	---
Boron	---	750 [e]	5,000 [e]
Chlorine	11/19 [e]		
Cobalt	---	50 [c]	5,000 [c]
Cyanide	5.2/22 [e]	---	---
Fluoride	---	1,000 [c]	2,000
Iron	1000 µg/L (CCC); -- µg/L(CMC)	5,000 [c]	---
Lead	see Table II.10	see Table II.10	
Manganese	---	200[c]	---
Molybdenum	19 [f]	10 [c]	---
Sulfide-H_2S	2 [e, g]	---	---
Nickel*	see Table II.10	see Table II.10	
Nitrite	40 [f]	---	---
Vanadium	---	100 [c]	100 [c]

† For each constituent, lowest concentration that applies to an appropriate beneficial use applies.

* Refer to Table II.10 for more information.

[a] The term Aquatic Life refers to the following beneficial uses, AQUA, COLD, INAL, RARE, SPFS and SPWN.

[b] For pH between 5 and 10.5; (USEPA 2013). Acute (CMC) and chronic (CCC) freshwater aluminum criteria values for a site shall be calculated using the 2018 Aluminum Criteria Calculator (Aluminum Criteria Calculator V.2.0.xlsx, or a calculator in R or other software package using the same 1985 Guidelines calculation approach and underlying model equations as in the Aluminum Criteria Calculator V.2.0.xlsx) as established in USEPA (2018). To apply the aluminum criteria for CWA purposes, criteria values based on ambient water chemistry conditions must protect the waterbody over the full range of variability, including during conditions when aluminum is most toxic.

[c] National Academy of Sciences – 1972.

[d] USEPA 2013 and associated documentation. Values are expressed as total ammonia nitrogen (TAN).

[e] USEPA (1986).

[f] Consistent with existing State of Nevada water quality standards for the Truckee River at Wadsworth Gage and PL control points. Contained in NAC 445A.189 and NAC 445A.190, respectively.

[g] For PL, this value does not apply during years when high freshwater discharge to Lake results in a condition of temporary meromixis. Applies to water above a depth of 10 m off the bottom in PL.

Measured pH and temperature at Wadsworth and Nixon will be used to calculate Criterion Maximum Concentration (CMC) and Criterion Continuous Concentration (CCC) values for those locations in the Truckee River. However, since the transition area in the vicinity of the Truckee River delta is ecologically important to both spawning cui-ui and LCT, and also to fry migrating downstream to PL, the potential for ammonia toxicity in this critical region will also be assessed by applying the higher PL pH (9.0-9.5) to the CMC and CCC values calculated from data collected at the Nixon monitoring site. This will not be done for samples taken at Wadsworth. Un-ionized ammonia is the more toxic form of ammonia. The proportion of potentially toxic ammonia increases as pH increases. A rise in pH as the Truckee River (pH 7.75-8.5) enters PL (pH 9.0-9.5) could result in a rapid increase in the fraction of potentially toxic ammonia in the water column. Should CMC and CCC values for total ammonia be exceeded, based on these calculations, direct monitoring will be conducted in PL in the vicinity of the Truckee River inflow to determine if standards are being exceeded. Exceedance of CMC or CCC values based on calculations using PL pH, will not be considered a violation by itself. Rather, it will provide the basis for sampling in PL's delta region to directly assess potential ammonia toxicity.

The CCC and CMC values also apply to PL. Note that USEPA guidance addresses the calculation of ammonia toxicity up to a pH of 9.0 for the CMC values. This will be taken as representative of PL despite the fact that pH in PL can reach 9.5. Additional calculations of ammonia toxicity up to pH 10.0 were provided by USEPA for the CCC values.

Ammonia Criteria Calculations

The PLPT criterion for ammonia is based directly on this guidance given below:

Acute Criterion Calculations (CMC)

The one-hour average concentration of total ammonia nitrogen (mg/L) is not to exceed, more than once every three years on the average, the CMC (acute criterion magnitude) calculated using the following equation:

$$CMC = MIN\left[\left(\frac{0.275}{1 + 10^{7.204 - pH}} + \frac{39.0}{1 + 10^{pH - 7.204}}\right), \left(0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - pH}} + \frac{1.6181}{1 + 10^{pH - 7.204}}\right) \times \left(23.12 \times 10^{0.036 \times (20-T)}\right)\right)\right]$$

The 2013 CMC equation (USEPA 2013) is predicated on the following:

1. The lowest Genus Mean Acute Value (GMAV) in this criterion update is for invertebrate species; thus the CMC is both pH and temperature dependent, and varies with temperature according to the invertebrate acute temperature relationship.

2. USEPA's recommended acute criterion magnitude is protective where salmonids in the genus *Oncorhynchus* are present, which becomes the most sensitive endpoint at lower temperatures. Vertebrate sensitivity to ammonia is independent of temperature, while invertebrate sensitivity to ammonia decreases as temperature decreases.

3. Where *Oncorhynchus* species are absent, USEPA retains all tested species in the order Salmoniformes as tested surrogate species representing untested freshwater fish resident in the United States from another order, but does not lower the criterion to protect them as commercially and recreationally important species. The lowest GMAV for a freshwater fish was calculated using mountain whitefish (*Prosopium williamsoni*).

4. As recommended by USEPA when a threatened and/or endangered fish is present, the tribe may consider conducting a future study to gather sufficient data to develop a site specific criterion magnitude. The dataset used to derive the 2013 ammonia criterion magnitudes included some threatened and endangered species, none of which were the most sensitive of the species tested.

See USEPA's 2013 Ambient Water Quality Criteria (AWQC) publication EPA-822-R-13-001 for full guidance on ammonia toxicity.

In summary, at pH 7 and 20°C the CMC is 17 mg Total Ammonia Nitrogen (TAN)/L, as primarily determined by the sensitivity of invertebrates (Figure II.2, Tables II.5a/b). As temperature decreases to 15.7°C and below, invertebrates no longer are the most sensitive taxa, and thus in this range the CMC is 24 mg TAN/L. Where recreationally and/or commercially important *Oncorhynchus* species are not present, the CMC is determined according to statement 3 above. Below 15.7°C, if *Oncorhynchus* species are not present the criterion continues to increase with decreasing temperature to 10.2°C and below, where the CMC is 38 mg TAN/L.

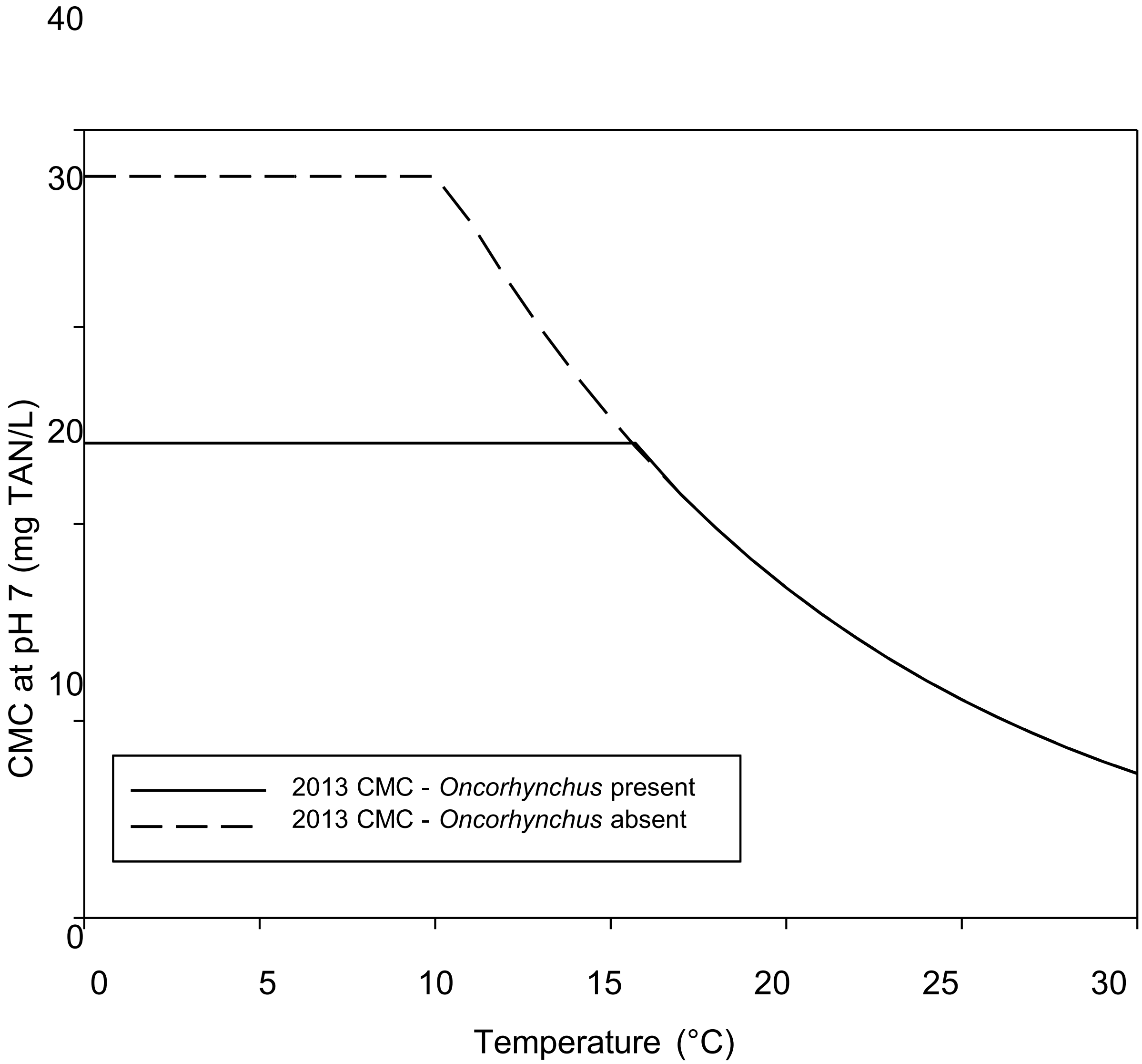

Figure II.2 2013 Acute criterion (CMC) magnitudes extrapolated across a temperature gradient at pH 7.

Table II.5a: Ammonia Toxicity for Acute Criterion Maximum Concentration- Oncorhynchus spp. Present (CMC; from USEPA [2013], pg. 44-45).

	Temperature (°C)																
pH	0-14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	33	33	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	31	31	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	30	30	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	28	28	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	26	26	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	24	24	23	21	20	18	**<u>17</u>**	15	14	13	12	11	10	9.4	8.6	8.0	7.3
7.1	22	22	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	20	20	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	18	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	15	15	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	13	13	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	11	11	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	9.6	9.6	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	3.0
7.8	8.1	8.1	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	6.8	6.8	6.6	6.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	5.6	5.6	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	4.6	4.6	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	3.8	3.8	3.7	3.5	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	3.1	3.1	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	2.6	2.6	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	2.1	2.1	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	1.8	1.8	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.59	0.54
8.7	1.5	1.5	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.2	1.2	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.0	1.0	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	0.88	0.88	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

Table II.5b: Ammonia Toxicity for Acute Criterion Maximum Concentration- Oncorhynchus spp. Absent (CMC; from USEPA [2013], pg. 44-45).

Temperature (°C)

pH	0-10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	51	48	44	41	37	34	32	29	27	25	23	21	19	18	16	15	14	13	12	11	9.9
6.6	49	46	42	39	36	33	30	28	26	24	22	20	18	17	16	14	13	12	11	10	9.5
6.7	46	44	40	37	34	31	29	27	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0
6.8	44	41	38	35	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.2	8.5
6.9	41	38	35	32	30	28	25	23	21	20	18	17	15	14	13	12	11	10	9.4	8.6	7.9
7.0	38	35	33	30	28	25	23	21	20	18	**17**	15	14	13	12	11	10	9.4	8.6	7.9	7.3
7.1	34	32	30	27	25	23	21	20	18	17	15	14	13	12	11	10	9.3	8.5	7.9	7.2	6.7
7.2	31	29	27	25	23	21	19	18	16	15	14	13	12	11	9.8	9.1	8.3	7.7	7.1	6.5	6.0
7.3	27	26	24	22	20	18	17	16	14	13	12	11	10	9.5	8.7	8.0	7.4	6.8	6.3	5.8	5.3
7.4	24	22	21	19	18	16	15	14	13	12	11	9.8	9.0	8.3	7.7	7.0	6.5	6.0	5.5	5.1	4.7
7.5	21	19	18	17	15	14	13	12	11	10	9.2	8.5	7.8	7.2	6.6	6.1	5.6	5.2	4.8	4.4	4.0
7.6	18	17	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5
7.7	15	14	13	12	11	10	9.3	8.6	7.9	7.3	6.7	6.2	5.7	5.2	4.8	4.4	4.1	3.8	3.5	3.2	2.9
7.8	13	12	11	10	9.3	8.5	7.9	7.2	6.7	6.1	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.2	2.9	2.7	2.5
7.9	11	9.9	9.1	8.4	7.7	7.1	6.6	3.0	5.6	5.1	4.7	4.3	4.0	3.7	3.4	3.1	2.9	2.6	2.4	2.2	2.1
8.0	8.8	8.2	7.6	7.0	6.4	5.9	5.4	5.0	4.6	4.2	3.9	3.6	3.3	3.0	2.8	2.6	2.4	2.2	2.0	1.9	1.7
8.1	7.2	6.8	6.3	5.8	5.3	4.9	4.5	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4
8.2	6.0	5.6	5.2	4.8	4.4	4.0	3.7	3.4	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2
8.3	4.9	4.6	4.3	3.9	3.6	3.3	3.1	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.96
8.4	4.1	3.8	3.5	3.2	3.0	2.7	2.5	2.3	2.1	2.0	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79
8.5	3.3	3.1	2.9	2.7	2.4	2.3	2.1	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1	0.98	0.90	0.83	0.77	0.71	0.65
8.6	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.58	0.54
8.7	2.3	2.2	2.0	1.8	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.45
8.8	1.9	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37
8.9	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.32
9.0	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.27

Chronic Criterion Calculations (CCC)

The thirty-day rolling average concentration of total ammonia nitrogen (mg/L) is not to exceed, more than once every three years on the average, the chronic criterion magnitude (CCC) calculated using the following equation.

$$CCC = \left(0.8876 \times \frac{0.0278}{1 + 10^{7.688 - pH}} + \frac{1.1994}{1 + 10^{pH - 7.688}}\right) \times \left(2.126 \times 10^{0.028 \times (20 - MAX(T,7))}\right)$$

In addition, the highest four-day average within the 30-day averaging period should not be more than 2.5 times the CCC (i.e., 2.5 x 1.9 mg TAN/L at pH 7 and 20°C or 4.8 mg TAN/L) more than once in three years on average.

The 2013 CCC equation is predicated on the following:

1. The lowest GMAV in this criteria update is for an invertebrate species; thus, the CCC is both pH and temperature dependent (based on the invertebrate chronic temperature relationship).

2. The most sensitive freshwater fish to chronic ammonia exposure are early life stages of *Lepomis* with a GMAV of 6.92 mg TAN/L. Note: LCT had a GMAV of 12.02, and a *Pteronarcys* stonefly had a GMAV of 73.74 mg TAN/L in this same study (USEPA 2013; for Ammonia, pg. 39).

3. All new chronic fish data added to this update of the freshwater Ambient Water Quality Criteria (AWQC) for ammonia are from early life-stage tests of the species (e.g., LCT - *Oncorhynchus clarkii henshawi*). Since the new chronic criterion magnitude lies far below all chronic values for tested species of fish, the early life stage of fish no longer warrants special consideration.

4. As recommended by USEPA when a threatened and/or endangered fish is present, the tribe may consider conducting a future study to gather sufficient data to develop a site specific criterion magnitude.

In summary, at pH 7 and 20°C the CCC of 1.9 mg TAN/L is determined by the sensitivity of invertebrates (Table II.6). As temperature decreases, invertebrate sensitivity to ammonia decreases until the CCC reaches a maximum of 4.4 mg TAN/L at pH 7 and temperature of 7°C and below.

Note: In the 1999 AWQC document, the temperature extrapolations for the CCC determination described above were conducted separately for adult fish, fish early life stages, and invertebrates. This was because fish Genus Mean Chronic Values (GMCVs) are not affected by temperature, and because the most sensitive fish species was an early life stage of *Lepomis*. As a consequence, even though the lowest GMCV at 20°C was for an invertebrate, as temperature decreases, invertebrates, but not fish, become less sensitive to ammonia, and below 14.6°C, fish genera become the most sensitive. However, the above scenario is not applicable now because at the new recommended CCC (1.9 mg TAN/L), invertebrate genera are the most sensitive across the entire temperature range.

In the chronic dataset for ammonia, the Federally-listed species are represented by three salmonid species in the genus *Oncorhynchus*, including sockeye salmon (*Oncorhynchus nerka*), rainbow trout (*Oncorhynchus mykiss*), and the subspecies LCT. The GMCV for *Oncorhynchus* of 12.02 mg TAN/L includes the three Species Mean Chronic Values ranging from 6.663 (rainbow trout) to 25.83 mg TAN/L (LCT). The CCC for ammonia of 1.9 mg TAN/L is expected to be protective of this genus as a whole.

Table II.6 Ammonia Toxicity for Chronic Criterion Maximum Concentration (CCC; from USEPA [2013], pg. 49).

pH	Temperature (°C) 0-7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
6.5	4.9	4.6	4.3	4.1	3.8	3.6	3.3	3.1	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.5	1.4	1.3	1.2	1.1
6.6	4.8	4.5	4.3	4.0	3.8	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1
6.7	4.8	4.5	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
6.8	4.6	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1
6.9	4.5	4.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0
7.0	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.2	2.0	**1.9**	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	0.99
7.1	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95
7.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90
7.3	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.97	0.91	0.85
7.4	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	0.96	0.90	0.85	0.79
7.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.83	0.78	0.73
7.6	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.4	1.3	1.2	1.1	1.1	0.98	0.92	0.86	0.81	0.76	0.71	0.67
7.7	2.6	2.4	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60
7.8	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53
7.9	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47
8.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.94	0.88	0.83	0.78	0.73	0.68	0.64	0.60	0.56	0.53	0.50	0.44	0.44	0.41
8.1	1.5	1.5	1.4	1.3	1.2	1.1	1.1	0.99	0.92	0.87	0.81	0.76	0.71	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35
8.2	1.3	1.2	1.2	1.1	1.0	0.96	0.90	0.84	0.79	0.74	0.70	0.65	0.61	0.57	0.54	0.50	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30
8.3	1.1	1.1	0.99	0.93	0.87	0.82	0.76	0.72	0.67	0.63	0.59	0.55	0.52	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26
8.4	0.95	0.89	0.84	0.79	0.74	0.69	0.65	0.61	0.57	0.53	0.50	0.47	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.26	0.25	0.23	0.22
8.5	0.80	0.75	0.71	0.67	0.62	0.58	0.55	0.51	0.48	0.45	0.42	0.40	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.18
8.6	0.68	0.64	0.60	0.56	0.53	0.49	0.46	0.43	0.41	0.38	0.36	0.33	0.31	0.29	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.16	0.15
8.7	0.57	0.54	0.51	0.47	0.44	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13
8.8	0.49	0.46	0.43	0.40	0.38	0.35	0.33	0.31	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.19	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11
8.9	0.42	0.39	0.37	0.34	0.32	0.30	0.28	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.09
9.0	0.36	0.34	0.32	0.30	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.08

Table II.7 Numeric Standards of Water Quality: Pyramid Lake Reservation Surface Waters: Toxic Organic Pollutants†

	FRESH WATER AQUATIC LIFE		HUMAN HEALTH CRITERIA[¥]
	Criterion Continuous Concentration (CCC) (µg/l)	Criterion Maximum Concentration (CMC) (µg/l)	Fish Consumption (units per liter)
Substance			
Acenaphthene	--	--	2700 µg
Acrolein	3	3	780 µg
Acrylontrile	--	--	0.66 µg
Aldrin[a]	--	3	0.00014 µg
alpha-Endosulfan[a,b]	0.056	0.22	--
Anthracene	--	--	110000 µg
Benzene	--	--	71 µg
Benzidine	--	--	0.00054 µg
Benzo (a) Anthracene	--	--	0.049 µg
Benzo (a) Pyrene	--	--	0.049 µg
Benzo (b) Fluoranthene	--	--	0.049 µg
Benzo (k) Fluoranthene	--	--	0.049 µg
beta-Endosulfan[a,b]	0.056	0.22	--
alpha - BHC	--	--	0.013 µg
beta - BHC	--	--	0.046 µg
gamma – BHC (Lindane)	--	0.95	0.063 µg
Bromoform	--	--	360 µg
Butylbenzyl Phthalate	--	--	5200 µg
Carbaryl	2.1	2.1	--
Carbon Tetrachloride	--	--	4.4 µg
Chlordane	0.0043	2.4	0.0022 µg
Chlorobenzene	--	--	21000 µg
2-Chloronaphthalene	--	--	4300 µg
Chlorodibromomethane	--	--	34 µg
Chloroethyl Ether (BIS-2)	--	--	1.4 µg
Chloroform	--	--	470 µg

	FRESH WATER AQUATIC LIFE		HUMAN HEALTH CRITERIA[¥]
	Criterion Continuous Concentration (CCC) (µg/l)	Criterion Maximum Concentration (CMC) (µg/l)	Fish Consumption (units per liter)
Chloroisopropyl Ether (BIS-2)	--	--	--
2-Chlorophenol	--	--	400 µg
Chlorpyrifos	0.041	0.083	--
Chrysene	--	--	0.049 µg
Cyanide[c]	5.2	22	--
4-4' - DDE	--	--	0.00059 µg
4-4' - DDD	--	--	0.00084 µg
4-4'- DDT[a]	0.001	1.1	0.00059 µg
Demeton	0.1	--	--
Diazinon	0.17	0.17	--
Di-n-butyl Phthalate	--	--	12000 µg
Dibenzo (a,h) Anthracene	--	--	0.049 µg
1,2 - Dichlorobenzene	--	--	17000 µg
1,3 - Dichlorobenzene	--	--	2600 µg
1,4 - Dichlorobenzene	--	--	2600 µg
3,3' - Dichlorobenzidine	--	--	0.077 µg
Dichlorobromomethane	--	--	46 µg
1,2 - Dichloroethane	--	--	99 µg
1,1 - Dichloroethylene	--	--	3.2 µg
2,4 - Dichlorophenol	--	--	790 µg
1,2 - Dichloropropane	--	--	39 µg
1,3 - Dichloropropene	--	--	1700 µg
Dieldrin	0.056[a]	0.24	0.00014 µg
Diethyl Phthalate	--	--	120000 µg
Dimethyl Phthalate	--	--	2900000 µg
2,4 - Dimethylphenol	--	--	2300 µg
2,4 - Dinitrotoluene	--	--	9.1 µg
2,4 - Dinitrophenol	--	--	14000 µg
Dioxin (2,3,7,8-TCDD)	--	--	0.000014 ng
1,2 - Diphenylhydrazine	--	--	0.54 µg

	FRESH WATER AQUATIC LIFE		HUMAN HEALTH CRITERIA[¥]
	Criterion Continuous Concentration (CCC) (µg/l)	**Criterion Maximum Concentration (CMC) (µg/l)**	**Fish Consumption (units per liter)**
alpha - Endosulfan	0.056	0.22	240 µg
beta - Endosulfan	0.056	0.22	240 µg
Endosulfan Sulfate	--	--	240 µg
Endrin	0.036[d]	0.086	0.81 µg
Endrin Aldehyde	--	--	0.81 µg
Ethylbenzene	--	--	29000 µg
Ethylhexyl Phthalate (BIS-2)	--	--	5.9 µg
Fluoranthene	--	--	370 µg
Fluorene	--	--	14000 µg
gamma-BHC (Lindane)	--	0.95	--
Guthion	0.01	--	--
Heptachlor[a]	0.0038	0.52	0.00021 µg
Heptachlor Epoxide[a,e]	0.0038	0.52	0.00011 µg
Hexachloroethane	--	--	8.9 µg
Hexachlorobenzene	--	--	0.00077 µg
Hexachlorobutadiene	--	--	50 µg
Hexachlorocyclopentadiene	--	--	17000 µg
Indeno (1,2,3-cd) Pyrene	--	--	0.049 µg
Isophrone	--	--	2600 µg
Malathion	0.1	--	--
Methoxychlor	0.03	--	--
Methyl Bromide	--	--	4000 µg
Methyl Chloride	--	--	**
Methylene Chloride	--	--	1600 µg
2 - Methyl - 4,6 - Dinitrophenol	--	--	765 µg
Mirex	0.001	--	--
Nitrobenzene	--	--	1900 µg
Nitrosodimethylamine N	--	--	8.1 µg
N- Nitrosodi-n-Propylamine	--	--	1.4 µg

	FRESH WATER AQUATIC LIFE		HUMAN HEALTH CRITERIA[¥]
Criterion Continuous Concentration (CCC) (µg/l)		Criterion Maximum Concentration (CMC) (µg/l)	Fish Consumption (units per liter)
Nitrosodiphenylamine N	--	--	16 µg
Nonylphenol	6.6	28	--
Parathion	0.013	0.065	--
PCB-1242	0.014	--	0.17 ng
PCB-1254	0.014	--	0.17 ng
PCB-1221	0.014	--	0.17 ng
PCB-1232	0.014	--	0.17 ng
PCB-1248	0.014	--	0.17 ng
PCB-1260	0.014	--	0.17 ng
PCB-1016	0.014	--	0.17 ng
Pentachlorophenol	15[f]	19[f]	8.2 µg
Phenol	--	--	--
Pyrene	--	--	11000 µg
Tetrachloroethane 1,1,2,2	--	--	11 µg
Tetrachloroethylene	--	--	8.85 µg
Toluene	--	--	200000 µg
1,2 - Trans-Dichloroethylene	--	--	140000 µg
Toxaphene	0.0002	0.73	0.00075 µg
Tributyltin (TBT)	0.072	0.46	--
1,1,1 - Trichloroethane	--	--	**
1,2,4, - Trichlorobenzene	--	--	940 µg
1,1,2 - Trichloroethane	--	--	42 µg
Trichloroethylene	--	--	81 µg
2,4,6 - Trichlorophenol	--	--	6.5 µg
Vinyl Chloride	--	--	525 µg

† Taken from *Federal Register* Vol. 63, No. 237, Thursday, December 10, 1998.

¥ It is assumed that only fish (no water) will be consumed from TR and PL.

** USEPA not promulgating human health criteria for this contaminant. Should be addressed in National Pollution Discharge Elimination System permit actions using narrative criteria for toxics.

a. These criteria are based on the 1980 criteria, which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. For example, the CMC derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

b. This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.

c. These recommended water quality criteria are expressed as µg free cyanide per liter.

d. The derivation of the CCC for this pollutant did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels.

e. This value was derived from data for heptachlor and there was insufficient data to determine relative toxicities of heptachlor and heptachlor epoxide.

f. Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH and values displayed in table correspond to a pH of 7.8. CCC = $e^{1.005(pH) - 5.134}$, CMC = $e^{1.005(pH) - 4.869}$

g. For open ocean waters where the depth is substantially greater than the euphotic zone, the pH may not be changed more than 0.2 units from the naturally occurring variation or any case outside the range of 6.5 to 8.5. For shallow, highly productive coastal and estuarine areas where naturally occurring pH variations approach the lethal limits of some species, changes in pH should be avoided but, in any case should not exceed the limits established for fresh water, *i.e.*, 6.5-9.0.

Table II.8 Numeric Standards of Water Quality: Pyramid Lake Reservation Surface Waters: Toxic Metal Pollutants†

	FRESH WATER AQUATIC LIFE		HUMAN HEALTH CRITERIA¥
	Criterion Continuous Concentration (CCC) (µg/l)	Criterion Maximum Concentration (CMC) (µg/l)	Fish Consumption (units per liter)
Antimony	---	---	4300 µg
Arsenic	150	340	--
Beryllium	--	---	a
Cadmium	exp {m_c [ln(hardness)]+b_c}x(CF) see Table II.10	exp {m_a [ln(hardness)]+b_a}x(CF) [b] see Table II.10	--
Chromium (VI)	11	16	a
Chromium (III)[e]	exp {m_c [ln(hardness)]+b_c}x(CF) [c] see Table II.10	exp {m_a [ln(hardness)]+b_a}x(CF) [c] see Table II. 10	a
Copper	exp {m_c [ln(hardness)]+b_c}x(CF) [c] Refer to tables II.9 & II.11	exp {m_a [ln(hardness)]+b_a}x(CF) [c] Refer to tables II.9 & II.11	--
Lead	exp {m_c [ln(hardness)]+b_c}x(CF) [c]	exp {m_a [ln(hardness)]+b_a}x(CF) [c]	a
Mercury	0.77[d]	1.4[d]	g
Nickel	exp {m_c [ln(hardness)]+b_c}x(CF) [c]	exp {m_a [ln(hardness)]+b_a}x(CF) [c]	4600 µg
Selenium	see Table II.12	see Table II.12	11,000 µg
Silver*	*see Table II.10	exp {m_a [ln(hardness)]+b_a}x(CF) [c] *see Table II.10	--

Thallium	--	--	6.3 µg
Zinc	exp {m_c [ln(hardness)]+b_c}x(CF) [c] see Table II.10 footnotes a,e	exp {m_a [ln(hardness)]+b_a}x(CF) [c] see Table II.10 footnotes a,e	--
	hardness expressed as mg·l^{-1} as CaC(		
	g = grams		
	mg = milligrams		
	µg =micrograms		
	Ng = nanograms		
	µg/l = micrograms per liter		

† Based on recommendations by the USEPA as published in the Federal Register Vol. 63, No 237, Thursday, December 10, 1998 – National Recommended Water Quality Criteria. Expressed in terms of dissolved metals unless noted.

¥ It is assumed that only fish (no water) will be consumed from TR and PL.[a] USEPA is not promulgating human health criteria for this contaminant. Should be addressed in National Pollution Discharge Elimination System permit actions using narrative criteria for toxics.

[b] Based on recommendations by the USEPA as published in the Federal Register Vol. 66, No 71, April 12, 2001 – Notice of Availability of 2001 Update: Aquatic Life Criterion Document for Cadmium.

c Values for coefficients m and b as well as for conversion factor (CF) above, are provided in Appendix A. CF expresses dissolved concentrations in terms of total recoverable concentrations. Taken directly from USEPA guidance contained in reference in footnote † above.

d Derived for data from inorganic Hg (II), but is applied here to total mercury. If a substantial portion of the mercury in the water column is methylmercury, this criterion will probably be under protective. This criterion does not account for uptake and bioaccumulation via the food chain.

[e] Express as total recoverable metal. Conversion factor of 0.922 can be used to express this in terms of dissolved metal.

[f] No value contained in Federal Register Vol. 63, No. 237, Thursday, December 1998 (page 68357) for CMC. Used value contained in Federal Register Vol. 57, No. 246, Tuesday, December 22, 1992.

[g] 0.271 ppm in 17.5 inch index-sized Lahontan cutthroat trout. Based on size vs. muscle mercury relationship. Consistent with an overall (average) angling diet at the 0.300 ppm National Criterion level. Unless noted otherwise, all fish mercury values in this document are presented in terms of wet weight concentrations, i.e. concentrations in fresh fish samples as taken by anglers.

See APPENDIX B for Pyramid Lake Mercury Criterion calculations and scientific justification.

Table II.9 Conversion Factors for Dissolved Metals Criteria

Metal	Freshwater CMC	Freshwater CCC	Saltwater CMC	Saltwater CCC
Arsenic	1.000	1.000	1.000	1.000
Cadmium	1.136672-[(*ln* hardness)(0.041838)]	1.101672-[(*ln* hardness)(0.041838)]	0.994	0.994
Chromium III	0.316	0.860	—	—
Chromium VI	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203-[(*ln* hardness)(0.145712)]	1.46203-[(*ln* hardness)(0.145712)]	0.951	0.951
Mercury	0.85	0.85	0.85	0.85
Nickel	0.998	0.997	0.990	0.990
Selenium	—	—	0.998	0.998
Silver	0.85	—	0.85	—
Zinc	0.978	0.986	0.946	0.946

1. Freshwater and saltwater aquatic life criteria apply as specified in paragraphs (d)(1) of this section.
2. Because of variations in chemical nomenclature systems, this listing of toxic pollutants does not duplicate the listing in Appendix A to 40 CFR Part 423 - 126 Priority Pollutants. The Chemical Abstracts Services (CAS) registry numbers provide a unique identification for each chemical.

Table II.10 Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent

Chemical	mA	bA	mC	bC	Freshwater Conversion Factors (CF)	
					CMC	CCC
Cadmium	0.9789	-3.866	0.7977	-3.909	1.136672-[(*ln* hardness)(0.041838)]	1.101672-[(*ln* hardness)(0.041838)]
Chromium III	0.8190	3.7256	0.8190	0.6848	0.316	0.860
Lead	1.273	-1.460	1.273	-4.705	1.46203-[(*ln* hardness)(0.145712)]	1.46203-[(*ln* hardness)(0.145712)]
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Silver	1.72	-6.59	—	—	0.85	—
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

Note: Hardness-dependent metals criteria (Table II.8) are calculated using the following equations:

CMC (dissolved) = exp{mA [*ln*(hardness)]+ bA} (CF)

CCC (dissolved) = exp{mC [*ln*(hardness)]+ bC} (CF)

Table II.11 Copper Aquatic Life Criteria for Fresh Waters

Metal	CAS No.	Criterion Maximum Concentration (CMC) [a] (µg/L)	Criterion Continuous Concentration (CCC) [b] (µg/L)
Copper	7440508	Acute (CMC) and chronic (CCC) freshwater copper criteria shall be developed using USEPA's 2007 *Aquatic Life Ambient Freshwater Quality Criteria—Copper* (EPA–822–R–07–001), which incorporates use of the copper biotic ligand model. Where sufficiently representative ambient data for dissolved organic carbon, calcium, magnesium, sodium, potassium, sulfate, chloride, or alkalinity are not available, the tribe shall use the 10th percentile values from publicly available peer-reviewed datasets such as the US Geological Survey National Waters Information System (NWIS) and USEPA's Storage and Retrieval Data Warehouse.	

[a] The CMC is the highest allowable one-hour average instream concentration of copper. The CMC is not to be exceeded more than once every three years.

[b] The CCC is the highest allowable four-day average instream concentration of copper. The CCC is not to be exceeded more than once every three years.

Table II.12 Selenium Aquatic Life Criteria for Fresh Waters

Criterion Element	Magnitude	Duration	Frequency
Fish Tissue[a] (Egg-Ovary)[b]	15.1 mg/kg dw	Instantaneous measurement[c]	Not to be exceeded
Fish Tissue[a] (Whole Body or Muscle)[d]	8.5 mg/kg dw or 11.3 mg/kg dw muscle (skinless, boneless filet)	Instantaneous measurement[c]	Not to be exceeded
Water Column[e] (Monthly Average Exposure)	1.5 µg/L in lentic aquatic systems 3.1 µg/L in lotic aquatic systems	30 days	Not more than once in three years on average
Water Column[e] (Intermittent Exposure)[f]	$WQC_{int} = \frac{WQC_{30\text{-}day} - C_{bkgrnd}(1 - f_{int})}{f_{int}}$	Number of days/month with an elevated concentration	Not more than once in three years on average

[a] Fish tissue elements are expressed as steady-state.

[b] Egg/ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.

[c] Fish tissue data provide point measurements that reflect integrative accumulation of selenium over time and space in fish population(s) at a given site.

[d] Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.

[e] Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data.

[f] Where $WQC_{30\text{-}day}$ is the water column monthly element, for either a lentic or lotic waters; C_{bkgrnd} is the average background selenium concentration, and f_{int} is the fraction of any 30-day period during which elevated selenium concentrations occur, with f_{int} assigned a value ≥0.033 (corresponding to 1 day).

IMPLEMENTATION

Acting under authority delegated by the Pyramid Lake Paiute Tribal Council, the TIDT shall implement the PLPT's WSQ, including the antidegradation policy, by establishing and maintaining controls on the discharge of pollutants into surface waters. The PLPT will also work in close cooperation with local, state, and federal agencies toward the goal of controlling regional discharges including nonpoint source pollution. Habitat restoration, especially along the lower TR, will be an important component of the implementation efforts. Particularly, the tribal natural resource departments represented on the TIDT shall do the following:

MONITORING AND ASSESSMENT

1. Monitor water quality to assess the effectiveness of pollution controls and to determine whether WQS are being attained. While emphasis will continue to be placed on chemical-based monitoring, additional biological indicators of water quality and ecosystem health may be developed.

2. Review adequacy of existing data base and obtain additional data when required. The PLPT will promote an active program to: better define the scientific understanding upon which the WQS are based; obtain information as to the impacts of point and nonpoint source discharges on receiving waters; and assist in implementation of water quality controls and habitat restoration projects.

3. The PLPT will continue to liaison with local, state, and federal monitoring and research activities. The PLPT will likewise liaison with relevant agencies and authorities on any such future regional monitoring and research activity which is consistent with PLPT WQCP goals and objectives.

PERMITTING

4. The PLPT has received TAS Program Authority for CWA 401 Certification, and will work with USEPA staff with the permitting approval process for point source discharges to receiving waters within the exterior boundaries of the PLIR, as appropriate. CWA 401 certification shall be exercised consistent with the PLPT WQCP and/ or Water Quality Ordinance (Appendix C) to ensure that federally licensed and permitted activities do not result in exceedances of WQS.

5. Assess the probable impact of discharges on receiving waters in light of designated uses and numeric and narrative standards. All permits issued or reissued shall be conditioned in such a manner as to authorize only activities that will not cause violations of tribal WQS. Permits may be subject to modification whenever the permitted activity appears to violate WQS. Factors such as frequency and magnitude of excursions along with seasonal, climatic, or process variations affecting an identified water quality violation will be considered in potential permit modification actions.

6. Work with USEPA to develop water quality-based effluent limitations and comments on technology-based discharge limitations, as appropriate, for inclusion in any federal permit issued to a discharger pursuant to Section 402 of the CWA (33 United States Code [USC] Section 1342).

7. Require that these water quality-based discharge limitations be included in any such permit as a condition for tribal certification pursuant to Section 402 of the CWA (33 USC Section 1342).

8. Coordinate with upstream jurisdictions to ensure that permits issued by these jurisdictions comply with, or support attainment of, the PLPT's WQS.

9. Advise prospective dischargers of discharge requirements and the need to update to current technology.

10. Develop and pursue inspection and enforcement programs to ensure that dischargers comply with requirements of the PLPT's WQS and any requirements promulgated thereunder, and in order to support the enforcement of federal permits by the USEPA.

11. A schedule to bring a source or nonpoint source into compliance with an existing or revised WQS may be established in a National Pollution Discharge Elimination System permit.

NONPOINT SOURCE CONTROLS

12. Encourage voluntary implementation of Tribal Nonpoint Sources Assessment and Management Plan (December 2014 with Pyramid Lake Paiute Tribal Council Resolution PL 76-14 and approved by USEPA Region IX on June 30, 2015 and amended on August 19, 2015 with Pyramid Lake Paiute Tribal Council Resolution PL 76-15) to control nonpoint sources of pollutants to achieve compliance with the PLPT's WQS.

13. Specific recommendations for best management practices in that plan include, but are not limited to; prioritizing nonpoint source control projects, submittal of implementation projects under Section 319 of the CWA (33 USC Section 1342), reduction of grazing pressures along the TR, restoration of TR riparian habitat, demonstration projects for water efficient irrigation. Best management practices established in permits, orders, rules or directives shall be reviewed and modified, as appropriate, to achieve compliance with water quality criteria.

14. Work with local, state and federal agencies, and private concerns to address and develop solutions to reduce adverse impacts of regional agricultural activities on the TR.

15. Work with local, state, and federal agencies, and private concerns, as appropriate, to coordinate nonpoint source control activities.

16. Investigate the benefits of "pollution trading" as a mechanism to decrease mass loading from regional nonpoint source and point source discharges.

WASTEWATER

17. Upgrade domestic wastewater treatment, as necessary, to protect and maintain beneficial uses and existing water quality.

EDUCATION

18. Encourage PLPT Environment, Pyramid Lake Fisheries, and Water Resource Department staff to obtain training in the areas of watershed management, water quality monitoring/protection, WQS, riparian restoration, and other appropriate topics.

19. Nonpoint source implementation will include an educational outreach to tribal members and landowners concerning how human activities affect quality of receiving waterbodies.

REGIONAL PLANNING

20. Participate with local, state, and federal agencies, and private concerns in regional water quality and riparian habitat restoration projects.

21. Participate with local, state, and federal agencies, and private concerns, in discussions on regional water supply planning.

22. Water quality on tribal lands could be affected by transportation accidents. The PLPT has completed an emergency response plan, with actions to be taken should such an accidental spill entering the TR. A memorandum of understanding between the PLPT and Washoe County will cover manpower and other regional resources needed to respond and take care of any accidental spills.

ENFORCEMENT

23. These WQS shall be enforced through all methods available to the PLPT including, but not limited to: issuance of permits by the USEPA; participation by the PLPT in the USEPA permitting process; including conditions in

leases of tribal lands, rights-of-way across tribal lands and other legal documents authorizing the use of tribal lands or interests in tribal lands; regulatory orders; court actions; review and approval of plans and specifications; evaluation of compliance with best management practices and all reasonable methods of prevention, control, and treatment of wastes prior to discharge; and coordination with tribal and non-tribal departments and regulatory agencies. Enforcement is further described in chapter 3 of the PLPT's Water Quality Ordinance (Appendix C).

SHORT-TERM MODIFICATIONS

24. The criteria established in these standards may be modified for a specific waterbody on a short-term basis in order to respond to emergencies, to accommodate essential activities, or to otherwise protect public health and welfare, even though such activities may result in a temporary reduction of water quality conditions below those criteria established by this regulation. If considered appropriate, and on the basis of adequate scientific documentation, TR WQS may be temporarily exceeded to accommodate increased flow in the TR. The time period for any authorized temporary reduction of water quality shall be designated by the TIDT to have a specific end date or by setting a period-ending trigger based on appropriate criteria associated with the condition or circumstance being responded to.

25. No degradation of water quality or aquatic habitat will be allowed if it causes long-term harm to the environment, human health, or cultural resources, or adversely impacts a threatened or endangered species.

26. Requests for short-term modifications shall be made to the Pyramid Lake Paiute Tribal Council. Such requests shall be made at least thirty days prior to the start of the activity impacting water quality, unless the modification is in response to an emergency requiring immediate action in which case notification shall be provided within twenty-four hours of the response decision.

SEASONAL VARIATIONS

27. It is recognized that natural conditions in both PL and the TR may, on occasion, be outside the limits established by the WQS. The PLPT's WQCP acknowledges that standards will not necessarily be considered violated when natural conditions cause criteria to be outside the established limits (these may be the result of natural physical, chemical and/or biological conditions). Exceedances of WQS will be considered on a case-by-case basis to determine, to the extent possible, the relative contribution of natural conditions and anthropogenic pollutant loading. Furthermore, it is also understood that the magnitude of water flow in the lower TR and water elevation in PL are inexorably linked to water quality and protection of beneficial uses. If, using a combination of evaluation tools, including but not limited to, water quality models, focused research, monitoring data, and scientific discretion, it is concluded that an overall benefit(s) to the PL or TR can be achieved by increased flow, the PLPT can make accommodations for a temporary condition in which existing water quality may be lowered (i.e., transient relaxation of antidegradation). Likewise, a similar approach may be applied for any specific water quality criteria.

28. It is recognized that natural seasonal variations of nitrogen can occur within PL following *Nodularia* blooms. In the case of the numerous beneficial uses for PL that focus on fisheries and aquatic ecology, it is recognized in principle, nitrogen loading to PL could be a net benefit by improving available food resources. The PLPT will not consider an increase in PL's nitrogen content as a violation of antidegradation policy if natural blooms of *Nodularia* are responsible for the increase. However, the PLPT will consider requests to increase nitrogen loading in light of the balance between improved trophic resources for fish and the potential for oxygen depletion. Requests will be considered on a case-by-case basis.

EXCEEDANCES

29. When numeric WQS are found to be exceeded, an investigation will be undertaken to determine the potential for fully protecting the beneficial uses. Initially, this investigation will consist of a trend analysis. Stressor identification analyses using bioassessment, stable isotope, and other information may also be used. Results from these analyses will be used to determine additional actions.

REVIEW

30. In accordance with section 303 (c) of the CWA (as amended), public hearings will be held at least once each three-year period for the purpose of reviewing applicable WQS and/or adopting new standards. Reviews may be held more frequently if necessary.

31. All numeric standards can be subject to modification if new scientific data and understanding of ecosystem processes or human health criteria for a given constituent becomes available. This does not preclude reevaluating or examining rationale or methods applied to existing data used to set antidegradation or beneficial use standards. Any modification of an antidegradation or beneficial use standards that may be viewed as a "relaxation" is acceptable if the justification and rationale supporting the standard adjustment is satisfactorily demonstrated to and accepted by the standards setting authority as meeting their approval conditions and process requirements. USEPA approval of any standards change is required before the change becomes effective (40 CFR 131.21).

FLOW

32. Water quality and habitat for aquatic biota within PLIR are tightly coupled to PL level and the timing and magnitude of flow in the TR. Generally, the aquatic biota benefit from higher lake levels and greater river flow. Although constrained by climate, water availability in the TR-PL basin is influenced and controlled by dams and diversion structures as well as human municipal, industrial, and agricultural usage. Conditions for aquatic biota within PLIR have suffered over the past century by upstream diversions and usage from the TR. Important steps to improve flow conditions in the lower TR have been taken such as the Truckee River Water Quality Settlement Agreement of 1996, the 2015 Truckee River Operating Agreement, and Operating Criteria and Procedures for the Newlands Reclamation Project, Nevada. The PLPT encourages upstream water conservation and minimizing diversions from Derby Dam in order to enhance water quality, riparian habitat, and aquatic biota in the lower TR and PL.

CLIMATE CHANGE

33. Climate change has the potential to impact the timing and magnitude of flows to PL as well as water temperature and evaporation rates. The PLPT has reviewed various hydrologic scenarios based on climate change projections that indicate a significant increase in variability and extreme events, both droughts and higher magnitude peak flows. With respect to water quality, "climate change" should not be considered as only a single stressor, but also as one that reinforces the role of other stressors. Thus, while a TDS concentration approaching 5,900 mg/L may be tolerable if it was the only stress, with climate change there is a greater likelihood of TDS, temperature, and reduced DO all interacting non-linearly to impact the aquatic ecosystem.

Based on the directive provided in the final paragraph of the PL TDS section to "…..initiate action to reduce the controllable TDS load in the basin where feasible," the PLPT will take steps to promote measures for reducing TDS loads throughout the TR Basin. Since climate change is likely to lead to drought periods when TDS concentrations will rise, these load reductions could help reduce adverse effects on the PL biota. The PLPT will continue to pursue improved understanding of how climate change may impact lake level and temperature, water quality, and the tolerance of biota to resulting conditions.

MONITORING

Physical, chemical and biological monitoring of PL and the TR is important in the implementation of these WQS. The data collected will be used to: (1) assess water quality conditions in both PL and the TR; (2) determine whether WQS are being achieved; (3) provide a basis for evaluating watershed management strategies; and (4) improve the overall understanding of processes that control water quality conditions in both waterbodies. The PLPT has conducted an extensive water quality and biological monitoring program on PL through efforts of the PL Fisheries. Water sampling will continue as defined below. The PLPT will actively engage in cooperative monitoring of the TR with other agencies and non-governmental entities. The PLPT will conduct monitoring activities on the TR as outlined below and discussed in further detail in the PLPT's Nonpoint Source Assessment and Management Plan (October 1994). All monitoring will be re-assessed as part of the triennial review of WQS.

PYRAMID LAKE

Water quality monitoring for PL consists of monthly sampling at the deep index station (WP96) as well as quarterly synoptic sampling at station WP93 in the shallower south basin, and annual sampling during the spring phytoplankton bloom of five stations along the north-south transect as suggested in Figure II.3. Quarterly synoptic samplings will be 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. At WP96, quarterly sampling will include: profiles of temperature (T), DO, pH, and electrical conductivity (as a surrogate for TDS); a profile of light intensity, and Secchi depth. Water samples will be collected from discrete depths for nutrient and chlorophyll analyses, respectively. Chlorophyll sampling will be conducted in the photic zone down to the depth of 1% light penetration, while nutrient sampling will be done at the bottom. Nutrient analyses will include ammonium, nitrate (+nitrite), total Kjeldahl-N, dissolved reactive-P and total-P. The established sampling methodologies, analytical techniques and quality assurance program established by Pyramid Lake Fisheries will continue to be used.

TRUCKEE RIVER

The PLPT is the responsible agency for the surface water quality monitoring on the TR within the boundaries of the Reservation. All sampling activities and protocols are outlined in the USEPA-approved Quality Assurance Project Plan for Water Quality Monitoring of Surface Waters Within the Pyramid Lake Indian Reservation, Nevada with USEPA Quality Assurance Office Document Control Number: WATR0878QV1.

The PLPT will initiate additional monitoring to document the aquatic biological and riparian habitat health on TR. The PLPT will continue to conduct annual surveys of benthic invertebrate species composition and biodiversity. Additionally, an annual survey of riparian cottonwood growth and general vegetation along TR's riparian corridor will be conducted to facilitate future management decisions regarding additional research and planning needs.

PRIORITY POLLUTANTS, METALS AND OTHER CONTAMINANTS

Water samples will be collected annually and analyzed for metals, priority pollutant organic compounds including endocrine disrupting compounds and other emerging contaminants of concern. Sample locations shall include PL and the TR (at Nixon). Analysis shall include parameters required for evaluating toxicity such as dissolved organic carbon and total hardness. At the same time, representative fish samples from these two waterbodies may also be analyzed for priority pollutants. Toxicity testing will be conducted as needed based on results from water quality monitoring. Furthermore, the PLPT may require toxicity testing in association with the issuance of new waste discharge permits.

The PLPT will approve all analytical methodologies used for monitoring samples in consultation with local, state and federal agencies. It is the intent of the PLPT to only accept methods which provide an appropriate limit of detection for water quality parameters.

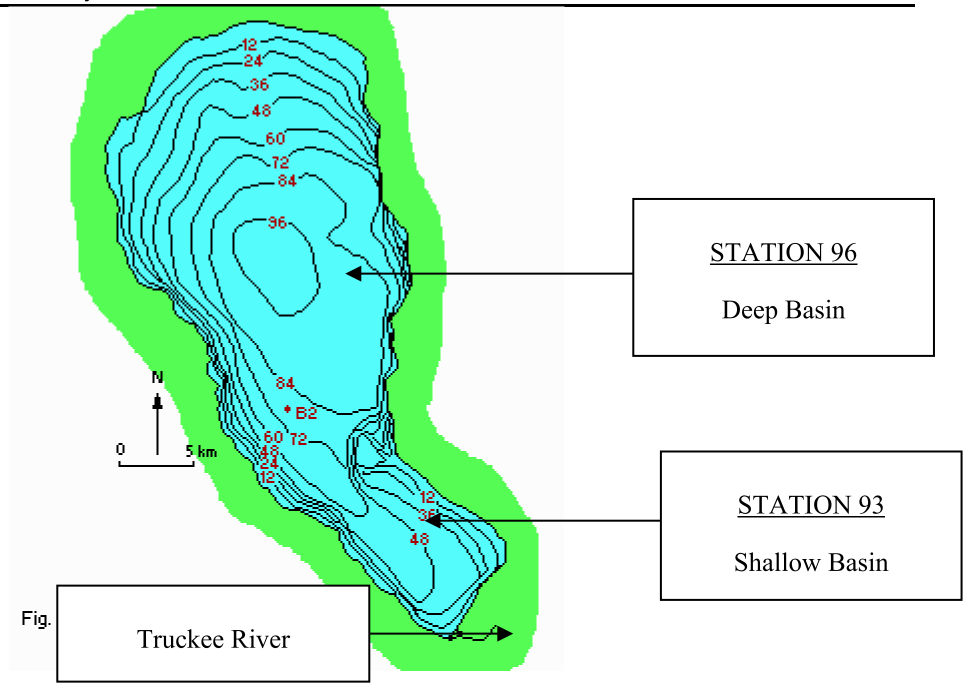

Figure II.3 Pyramid Lake monthly (Station 96) and synoptic (Station 93) sampling stations.

DEFINITION OF TERMS

AEROBIC: Life or life processes that require the presence of molecular oxygen.

ALGAE: Small aquatic plants which occur as single cells, colonies, or filaments.

ALKALINE: Waterbodies with pH higher than 7.

AMBIENT: Concentration of a nutrient or temperature in the bulk water mass.

ANAEROBIC: Processes that occur in the absence of molecular oxygen.

ANNUAL AVERAGE (A-AVG.): Annual mean of monthly, flow or volume weighted averages.

ANOXIA: A condition of no oxygen in the water; often occurs near the bottom of fertile stratified lakes in the summer and under ice in late winter.

ANTIDEGRADATION: Portion of water quality standards which sets minimum requirements to maintain and protect existing uses and water quality. Protects water quality if existing conditions are higher than standards to protect beneficial use(s).

AQUATIC SPECIES: Plant and animals which live at least part of their life cycle in water.

ARSENIC: Priority pollutant metal which is a carcinogen to humans and toxic to aquatic life. Certain waterbodies in the Reno, Nevada vicinity can have naturally elevated backgrounds because of regional geology.

BACKGROUND CONDITIONS: Biological, chemical and physical conditions of a waterbody, outside the area of influence of the point source, nonpoint source, or instream activity under consideration.

BENEFICIAL USE: Designated use of a waterbody. Examples include commercial, social, recreation, ecological, etc. Part of water quality standards.

BENTHOS: Macroscopic (seen without aid of a microscope) organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the substrate.

BEST MANAGEMENT PRACTICES: Physical, structural and/or managerial practices approved by a state or tribe that, when used singularly or in combination, prevent or reduce pollution.

BIOACCUMULATION: Process by which a compound is taken up by and accumulates in an aquatic organism, both from water and through food.

BIOASSAY: Experiments where the growth of organisms is used to evaluate what nutrient is limiting plant growth.

BIOCONCENTRATION FACTOR: Numeric value to describe bioaccumulation. Used in calculation toxicity risk assessment.

BIOLOGIC CRITERIA: Numerical values or narrative expressions that describe the biological integrity of biologic communities inhabiting waters of a given designated aquatic life use. Biological criteria serve as an index of aquatic community health.

BIOMASS: The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a waterbody at a given time. Often measured in terms of grams per square meter of surface.

BIOSTIMULATORY SUBSTANCE: In the context of bioassay experiments, an increase in phytoplankton biomass due to the addition of a limiting nutrient that is higher than any increase observed when no nutrients are added.

BIOTA: All plant and animal species occurring in a specified area.

BLOOM: When phytoplankton biomass becomes large in response to favorable growth conditions. For example, a peak in phytoplankton biomass is observed during the spring in many aquatic systems when there is an ample supply of nutrients and light.

CARCINOGEN: Any substance that produces or tends to produce cancer in humans.

CHLOROPHYLL: A green pigment in algae and other green plants that is essential for the conversion of sunlight, carbon dioxide, and water to sugar. Sugar is then converted to starch, proteins, fats, and other organic molecules.

CLEAN WATER ACT (CWA): Federal legislation passed in 1972 and amended in 1987 which was established to restore and maintain the chemical, physical and biological integrity of the nation's waters. Where attainable, the goal is to achieve a swimmable/ fishable use in surface waters.

COLORIMETRIC METHOD: A method where the intensity of color development is used to measure the concentration of a parameter of interest.

COMPOSITE SAMPLE: When water collected at several depths, locations or at various times during a sampling period are combined to yield a single, representative sample.

CONCENTRATION: Amount of a substance, such as nitrate, in a given volume of water. Common units of concentration are $\mu g \cdot L^{-1}$ or $mg \cdot L^{-1}$.

CONDUCTIVITY: Indirect measurement of the ionic content of water. Often serves as an easily measurable surrogate for total dissolved solids.

CONTROL POINT: Specific location in a waterbody where measurements are made to determine if water quality standards are being achieved.

CRITERIA: Description of water quality levels which will support a particular beneficial use. May be narrative or numeric. Numeric criteria can be site-specific or may be taken from water quality criteria published by the USEPA.

CRITERIA CONTINUOUS CONCENTRATION (CCC): The CCC is an estimate of the highest concentration of a material in surface water to which to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. The CCC is equal to the lowest of the Final Chronic Value, the Final Plant Value, and the Final Residue Value as defined and discussed in USEPA (1985). In addition, the highest four-day average within the 30-day period should not exceed 2.5 times the CCC. An acceptable exceedance frequency would be once every three years.

CRITERIA MAXIMUM CONCENTRATION (CMC): The CMC is an estimate of the highest concentration of a material in surface water to which to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The CMC is equal to one-half of the Final Acute Value as defined and discussed in the USEPA Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (1985). An averaging period of 1 hour has been established for the CMC. An acceptable exceedance frequency would be once every three years.

CUI-UI (*Chasmistes cujus*): Important species of fish in PL of cultural importance. Listed in 1967 as a federally endangered species. Utilizes the TR for spawning.

DEFICIENCY: When algal biomass lacks some of an essential nutrient compared with normal growth conditions.

DELTA: The accumulation of sediments at the mouth of a river.

DEPTH AVERAGE: Statistical approach to characterize the mean concentration of a water quality constituent in a portion or the entire water column.

DIMICTIC: Lake that mixes twice each year. Usually spring and fall.

DISSOLVED INORGANIC NITROGEN: Includes nitrate, nitrite and ammonium. Forms of nitrogen most readily used by algae for growth.

DRP: Abbreviation for dissolved reactive phosphorus.

ECOLOGICAL STUDY: The investigation of an ecosystem designed to identify the animals and plants present and how they interact.

ECOSYSTEM: A system of interrelated organisms and their physical-chemical environment. In this report, the ecosystem is defined to include the lake and its watershed.

EFFLUENT: Liquid wastes from sewage treatment, septic systems, or industrial sources that are released to a surface water.

ENDEMIC: Species that are only found in a specific location such as a group of lakes in one region.

EPILIMNION: Uppermost, warmest, well-mixed layer of a lake during summertime thermal stratification. The epilimnion extends from the surface to the thermocline.

EUTROPHIC: From Greek for "well-nourished," describes a lake of high photosynthetic activity and low transparency.

EUTROPHICATION: The process of physical, chemical, and biological changes associated with nutrient, organic matter, and silt enrichment and sedimentation of a lake or reservoir. If the process is accelerated by man-made influences, it is termed cultural eutrophication.

EXCEEDANCE: An instance at which a WQS is exceeded.

EXTERNAL NUTRIENT SOURCES: Nutrients entering the lake from the outside through river inflow, atmospheric deposition, eolian transport, etc.

EXISTING USE: All uses actually attained in a waterbody on or after November 28, 1975, whether or not they are explicitly stated in the WQS or presently existing.

FECAL COLIFORM: Portion of the coliform bacteria group which is present in the intestinal tracts and feces of warm-blooded animals.

FLOW WEIGHTED: Statistical approach used to calculate mean concentration of a water quality constituent based on the relative proportion of flow. Concentrations measured during periods of high flow have more weight in the calculation of a final average concentration.

FOOD WEB: Pattern of production and consumption of organic matter in an ecosystem. Green plants are an ultimate source of energy for all food chains.

GEOMETRIC MEAN: Either the nth root of a product of n factors, or the antilogarithm of the arithmetic mean of the logarithms of the individual sample values.

GROWTH POTENTIAL: The potential or ability of a phytoplankton population to increase total biomass if the factor controlling growth is removed. For example, the ability of phytoplankton to growth if nitrogen is added.

HARDNESS: Measure of the calcium and magnesium ions present in water. For many of the priority pollutant metals hardness acts to partially mitigate the toxic effect of these constituents.

HYDROLOGIC CYCLE: The circular flow or cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Runoff, surface water, groundwater, and water infiltrated in soils are all part of the hydrologic cycle.

HYPOLIMNION: Lower, cooler layer of a lake during summertime thermal stratification.

INDIGENOUS AQUATIC LIFE: Aquatic life which resides in a particular waterbody.

INTERNAL NUTRIENT SOURCES: Nutrients released within the lake as opposed to those entering the lake from the outside.

ISOTHERMAL: The same temperature throughout (e.g., the overturning of water in a lake can result in the mixing of different thermal layers so that eventually, the lake is the same temperature top to bottom).

LAHONTAN CUTTHROAT TROUT (*Oncorhynchus clarki henshawi*; LCT): Important cold-water sport fish. Downlisted in 1975 to a federally threatened species. Populations are maintained in PL by an active hatchery program managed by Pyramid Lake Fisheries with assistance from the USFWS.

LIMIT OF DETECTION: The minimum concentration of a nutrient that can be measured with the technique being used.

LIMNOLOGY: Scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes. Also termed freshwater ecology.

MEROMIXIS: Condition when lakes do not mix from top to bottom.

MESOTROPHIC: Describes a lake of intermediate photosynthetic production; See oligotrophic and eutrophic.

METALIMNION: Layer of rapid temperature and density change in a thermally stratified lake. Resistance to mixing is high in the region.

MONOMICTIC: Lakes that mix completely once during each year. Usually, during the winter.

MIXING ZONE: As used in PL, a mixing zone refers to that portion of PL, influenced by tributary inflow, where TDS is less than 80% of that measured at mid-lake (Station 96) using electrical conductivity as an indicator.

$mg \cdot L^{-1}$: An expression of concentration, milligrams per liter (equivalent to parts per million).

N: Abbreviation for nitrogen.

NARRATIVE STANDARDS: Can serve as the basis for limiting toxicity where a specific toxic pollutant can be identified as causing the toxicity when no numeric criterion in the standards is in place. The narrative standard can also be used to limit whole effluent toxicity where it is not known which chemical or chemicals are causing the toxicity.

NITROGEN DEMAND: The amount of nitrogen required by phytoplankton for growth.

NITROGEN FIXATION: Use of atmospheric nitrogen gas (N_2) by plants to fulfill nitrogen requirements for growth. Most plants use nitrate-N and ammonium-N for growth.

NH_4-N: Abbreviation for nitrogen in the form of ammonium.

NO_3-N: Abbreviation for nitrogen in the form of nitrate.

NODULARIA: Blue-green algae genus that fixes atmospheric nitrogen. Common in late summer to early fall in PL.

NONPOINT SOURCE: A source of pollution from diffuse sources rather than a distinct point of origin. One example is agricultural irrigation of croplands.

NUMERIC STANDARDS: Specific quantities for water quality constituents, which if achieved will protect the beneficial uses of a waterbody.

NUTRIENT: An element or chemical essential to life, including carbon, oxygen, nitrogen, phosphorus, and others.

NUTRIENT BUDGET: A comparison of all sources and losses of a nutrient to a waterbody.

NUTRIENT CYCLING: The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

NUTRIENT LOADING: Amount of a nutrient that enters a lake over a given period of time.

OLIGOTROPHIC: "Poorly nourished," from Greek. Describes a lake of low plant productivity and high transparency.

ORGANIC MATTER: Molecules manufactured by plants and animals and containing linked carbon atoms and elements such as hydrogen, oxygen, nitrogen, sulfur, and phosphorus.

OVERTURN: The mixing, top to bottom, of lake water caused by the formation of denser water at the surface due to cooling or warming and wind-derived energy. Can occur in fall, winter, and spring depending on the seasonal temperature range of the lake.

P: Abbreviation for phosphorus.

PERIPHYTON: Small plants that grow on the surface of rocks, sediment, or larger plants.

PERMIT: A legally binding document issued by a tribe, state, or federal permits agency to the owner or manager of a point source discharge. The permit document contains a schedule of compliance requiring the permit holder to achieve a specified standard or limitation by a specified date, which is usually the date that the permit becomes effective. Permit documents also specify monitoring and reporting requirements to be conducted by the applicant.

pH: A measure of the concentration of hydrogen ions of a substance, which ranges from very acid (pH = 1) to very alkaline (pH = 14). pH 7 is neutral and most lake waters range between 6 and 9. pH values less than 6 are considered acidic and most life forms cannot survive at pH of 4.0 or lower.

PHOTIC ZONE: The lighted region of a lake where photosynthesis takes place. Extends down to a depth where plant growth (based on the amount of light available) and respiration are balanced.

PHYTOPLANKTON: Microscopic algae and microbes that float freely in open water of lakes and oceans.

PLANKTON: Planktonic algae float freely in the open water. Filamentous algae form long threads and are often seen as mats on the surface in shallow areas of the lake.

PLATINUM COBALT UNITS: Defines level of color in water.

POLLUTION: Contamination, or other alteration of physical, chemical or biological properties, of any waters, including but not limited to change in temperature, taste, odor, turbidity or color of the water, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters as will or is likely to create a nuisance or impair any beneficial use of such waters.

POLLUTION TRADING: Novel approach taken to achieve an overall lower level of pollution loading to a waterbody. A discharger may be allowed to introduce pollutants into a waterbody if they act to abate other sources. For example, if agreed to by all parties, a wastewater plant may be allowed additional hookups if they can, through mitigation, reduce discharges from other point or nonpoint sources.

PRIMARY PRODUCTIVITY: The rate at which algae and macrophytes fix or convert light, water, and carbon dioxide to sugar in plant cells. Commonly measured as milligrams of carbon per square meter per hour.

PRIORITY POLLUTANT METALS: Metals associated with human and aquatic life toxicity. Include such compounds as arsenic, chromium, copper, mercury, zinc, etc. Numeric criteria for these metals come from USEPA.

PRIORITY POLLUTANT ORGANICS: Organic compounds associated with human and aquatic life toxicity. Includes such compounds as pesticides, trichloroethylene, benzene, phenol, polychlorinated biphenyls (PCB's), etc. Numeric criteria for these metals come from USEPA.

PYRAMID LAKE FISHERIES: An organization formed by the PLPT in 1974; responsible for managing fishery operations, the PL water quality program, fish recovery efforts, and improving fish habitat within the boundaries of the Pyramid Lake Indian Reservation.

RADIONUCLIDES: Radioactive substance.

RESERVATION: Defined as the legal boundary of tribal property. Protection of water quality and aquatic life in the waterbodies, or portions of waterbodies, contained on the Reservation is the responsibility of the PLPT.

RIPARIAN: Refers to plant and animal communities which occur along river and stream channels. Important for bank stability and provide shade which helps reduce water temperature.

RISK LEVEL: For carcinogenic compounds probability that exposure will result in cancer during a lifetime. The USEPA recommends a range of 10^{-5} to 10^{-7} be used to establish water quality criteria. For example, with a risk level of 10^{-6} an individual would have a 1 in 1,000,000 chance of developing cancer if exposed to the concentration expressed in the standard.

SEDIMENT: Bottom material in a lake that has been deposited after the formation of a lake basin. It originates from remains of aquatic organisms, chemical precipitation of dissolved minerals, and erosion of surrounding lands.

SITE-SPECIFIC: Refers to a particular waterbody. Typically applied to situations where criteria have been developed for a specific waterbody.

SPATIAL VARIABILITY: Variations in parameters around the lake (e.g. across and along the lake).

STANDING CROP: Another term for biomass.

STRATIFICATION: Layering of water caused by differences in water density. Thermal stratification is typical of most deep lakes during summer. Chemical stratification can also occur.

SURFACE WATERS OF THE PLPT: All waterbodies within the boundaries of the Reservation.

TERMINAL LAKE: A lake with no outlet to facilitate flushing (e.g., PL). All materials which enter PL basin either stay in solution or settle to the bottom sediments.

THREATENED OR ENDANGERED SPECIES: Plant and animal species protected under the federal Endangered Species Act.

TERTIARY TREATMENT: Level of effluent treatment at municipal waste facilities where nitrogen, phosphorus, or both are removed before wastewater is discharged into surface waters.

THERMAL STRATIFICATION: Lake stratification caused by temperature-created differences in water density.

THERMOCLINE: A horizontal plane across a lake at the depth of the most rapid vertical change in temperature and density in a stratified lake. See metalimnion.

TOXICITY: Refers to acute or chronic toxicity.

TOXIC POLLUTANT: Pollutants, or combinations of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the USEPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological and/or reproductive malfunctions, or physical deformations, in such organisms or their offspring.

TRIBE: Pyramid Lake Paiute Tribe

TRIBAL COUNCIL: Elected governing body of the Pyramid Lake Paiute Tribe.

TRIBAL INTERDISCIPLINARY TEAM (TIDT): Tribal Interdisciplinary Team composed of the Tribal Chairman, Tribal Vice-Chairman; and Directors, Managers and Specialists within the Environmental, Pyramid Lake Fisheries, and Water Resource Departments of the PLPT, whose mission is to work with the Tribal Council to manage air, land, and water related activities within the boundaries of the Pyramid Lake Paiute Indian Reservation.

TRIBAL NATURAL RESOURCE DEPARTMENTS: The Environmental, Pyramid Lake Fisheries, or the Water Resource Departments of the PLPT.

TROPHIC STATE: The degree of eutrophication of a lake. Transparency, chlorophyll-a levels, phosphorus concentrations, amount of macrophytes, and quantity of dissolved oxygen in the hypolimnion can be used to assess state (e.g. oligotrophic).

$\mu g \cdot L^{-1}$: Micrograms per liter; one thousand times less than $mg \cdot L^{-1}$.

WATER COLUMN: Water in the lake between the interface with the atmosphere at the surface and the interface with the sediment layer at the bottom. Idea derives from vertical series of measurements (oxygen, temperature, phosphorus) used to characterize lake water.

WATER QUALITY STANDARD (WQS): A water quality standard is a regulation or law which consists of the beneficial use, water quality criteria which are necessary to protect the use(s), and an antidegradation policy. A water quality standard establishes water quality goals for a specific waterbody and is the basis for establishing water quality based treatment control and strategies beyond the technology based levels of treatment required in the CWA (Sections 301 (b) and 306).

WATERSHED: A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

ZOOPLANKTON: Microscopic animals which float freely in lake water, graze on detritus particles, bacteria, and algae, and may be consumed by fish.

Note - Many of these definitions are derived from Moore and Thornton (1988) and USEPA (2022a; 2022b).

SECTION III

SCIENTIFIC JUSTIFICATION FOR SITE-SPECIFIC WATER QUALITY CRITERIA

TEMPERATURE

Water temperature is an important factor affecting the suitability of lakes and rivers as habitat for fish. Typically, fish species are adapted to successfully compete and reproduce within a range of water temperatures, with either reduced growth or death resulting from a stressful temperature regime. A stressful temperature regime can also affect fish in physiological and/or behavioral ways that limit a waterbody's ability to function as a beneficial environment for that fish. For PL, LCT and cui-ui are both coldwater species requiring that water temperature remain below a threshold value for the fish to survive and successfully spawn. The temperature of PL is not a constraint to the survival of either species due to ample cold waters in the deeper portions of PL throughout the year (Lebo et al. 1992a,b). The summer thermocline in PL typically establishes itself in the vicinity of 20-30 m in depth. Water temperatures below that depth are always adequate for fish survival. This was an important consideration in setting the dissolved oxygen (≥6.0 mg/L) control point in PL at 70 m. If oxygen above 70 m is sufficient for survival, this gives fish the zone between 20-30 m and 70 m as a refuge against higher surface temperatures.

However, warming of TR waters during the spawning season for both species and the juvenile stage for LCT (Dickerson and Vineyard 1999) can be a serious threat to the restoration of a naturally self-sustaining fishery for those two species. It also is an important factor in the listing of the cui-ui as endangered and LCT as threatened at the current time (USFWS 1992). An inadequate temperature regime in the lower TR during spring and summer is sufficient by itself to interfere with the successful natural spawning of LCT and cui-ui regardless of other water quality factors (USFWS 1993).

The temperature requirements for the PL fishery for spawning of LCT and cui-ui in the TR and rearing of juvenile LCT through the summer have been defined through previous studies of the system. Through extensive work by the USFWS and others, the temperature requirements for the spawning of cui-ui and LCT have been well-defined. Indeed, present water management strategies (in years with adequate flow) are directed toward maintaining water temperatures in the lower river below 13°C during November-March and 14°C during April-June to allow for the spawning of cui-ui and LCT. Monitoring of the PL spawning run indicates that adult LCT begin to enter the TR as early as November and may remain in TR as late as June. The recent identification of larval and juvenile LCT in the TR downstream of Derby Dam confirms that LCT are successfully reproducing in this reach. Dunham (1999) identified a weekly maximum temperature of 12.8°C for the protection of LCT during spawning, egg incubation, and fry emergence.

There are two direct studies which address the issue of juvenile LCT and summer water temperature in the lower TR. These must be taken as the best scientific information currently available. The first is by Vigg and Koch (1980) who reported that a constant water temperature of between 21.8°C and 23.0°C (mean of 22.3-22.6°C depending on strain of fish) is lethal to juvenile LCT. That study is based on a temperature toxicity study conducted at the Desert Research Institute during the late 1970s where 63-70 mm juvenile LCT, assayed in TR water, were exposed to increasing temperatures over a period of several weeks. The authors reported sub-lethal effects (e.g., stress symptoms, feeding inhibition, and loss of equilibrium) occurred at temperatures approximately 1° C lower than lethal temperatures.

A more recent study done at the University of Nevada-Reno (Dickerson and Vineyard 1999) concluded that while "there was no significant mortality observed at treatment temperatures of 24°C and below," chronic stress experiments suggest that the upper limit for growth and survival in LCT (juveniles) is between 22°C and 23°C when food availability is high." These authors provide further data to indicate LCT may be tolerant to temperatures above the chronic stress values provided the remaining temperatures during a diel period (24 hours) are lower. They state that fish tolerances to higher temperatures are not increased, but rather fish will remain inactive and resume activity once temperatures decline. Even though these fluctuating temperature experiments hold out the possibility that LCT can tolerate temperatures greater than the 22-23°C values reported in this study, provided they are part of a normal daily fluctuation which brings temperatures down during the less warm periods of the day, Dickerson and Vineyard (1999) point out that their conclusions are based on the assumption that sufficient food is present in the natural environment. They state that the food ration used during the experiment was very high relative to field conditions, and the amount of food available to fish in the wild should be considered in future temperature tolerance studies.

The recommended temperature standards for the TR are designed to protect the propagation of the PL fishery by providing an adequate temperature regime for spawning and juvenile rearing. Identical to the State of Nevada, the temperature standards for river waters during November through March and April through June are ≤13°C and ≤14°C, respectively. The standard set by the State of Nevada during July through October of each year is ≤25°C, although NDEP recognizes lower water temperatures (less than 21°C) are needed to support juvenile LCT in the TR (Footnote "d" in the State of Nevada water quality standards for the TR (NDEP 2022). This condition was also recognized by the USFWS in their 1993 Biological Opinion (File No. 1-5-93-F-30) to the USEPA. The PLPT recommends that temperature standard for the portion of the TR on the Reservation during July through October be set at ≤21°C implemented as a daily average. In the TR, daily fluctuations in water temperature can be as large as 5°C over a 24-hour period (P. Wagner, former Pyramid Lake Fisheries Director pers. comm.). The implementation of a summer water temperature standard for TR as a daily average takes into account that sufficient food is present for the fish, and they have access to cold water refugium during part of the diel period.

TOTAL DISSOLVED SOLIDS

The TDS concentration in aquatic systems is an important factor determining species composition and biodiversity. In systems where TDS concentrations are low, freshwater species will dominate the biological assemblage while saline species will be found when TDS is high. At moderate levels of TDS, such as in PL, species which are both tolerant and intolerant of high TDS concentrations occur. This mixture of biological organisms makes slightly saline lakes like PL both unique and susceptible to changes in the TDS concentration. An increase in the TDS concentration above natural levels may be toxic to some of the more sensitive organisms present, leading to a change in biological diversity. Thus, an increase in the TDS concentration in PL may alter the ecological community by eliminating salt intolerant species.

Pyramid Lake TDS

The TDS WQS proposed for PL of 5,900 mg·L^{-1} is based on concerns for biotoxicity. The beneficial uses for PL include a sport fishery, protection of threatened and endangered species, preservation of indigenous aquatic life, and preservation of unique ecological communities. An increase in the TDS concentration of PL may threaten all of these uses by eliminating prey species for LCT and cui-ui and affecting the survival of cui-ui larvae. The recommended TDS standard for PL is designed to protect the integrity of the biological assemblage in PL by protecting the most sensitive species from toxic levels of TDS.

The impact of increasing TDS concentration in PL was evaluated by a series of toxicity analyses conducted by Lockheed Ocean Sciences Laboratory (1982) and Galat and Robinson (1983). Those analyses evaluated the effects of a range of TDS concentrations on the algal, zooplankton, benthic invertebrates, and fish species found in PL. TDS concentrations tested ranged from nearly freshwater in some cases up to 4.5 times existing TDS in PL at the time of testing (5,839 mg·L^{-1}). Results of the studies indicated that an increase in TDS concentration in PL above the present value at that time would likely affect the survival of several organisms in PL including cui-ui. In the research, the survival of cui-ui larvae entering PL after spawning of adults in the TR showed a large decrease between values of 5,839 and 8,500 mg·L^{-1} indicating that a further increase in the TDS concentration of PL above 5,839 mg·L^{-1} could affect the recovery of the cui-ui population. The study found that 90% of cui-ui larvae perished above the concentration of 5,839 mg·L^{-1}. These toxicity studies were conducted at ambient PL water temperature that ranged from 15°C to 19°C; thus the possible effects of temperature on TDS biotoxicity were not evaluated. Small increases in TDS also adversely affected the survival of two zooplankton species, two cyprinid species (Lahontan redside shiner (*Richardsonius egregius*) and speckled dace (*Rhinichthys osculus*), and two species of benthic invertebrates. Since the zooplankton and benthic invertebrate populations in PL are a major food source for the cui-ui and other fish species in PL, even a small increase in the TDS concentration of PL could cause shifts in the biological assemblage in PL, changing the ecological community. Walker Lake, Nevada, a terminal lake that has higher salinity than PL, provides an example of stresses placed on invertebrates and fish from progressively elevated salinity (Dickerson and Vineyard 1999, Herbst et al. 2013), with reduced survival or extirpation having occurred for some species.

The recommended TDS standard for PL of <5,900 $mg \cdot L^{-1}$ is intended to protect the aquatic life of the system by maintaining its biological integrity and is consistent with the cui-ui recovery plan developed by the U.S. Fish and Wildlife Service (USFWS 1992). At that level, the biological integrity of PL is expected to be maintained by promoting the recovery of the cui-ui population to a self-sustaining level and preserving the diversity of the zooplankton and benthic invertebrate populations. While TDS expressed as an annual average did not exceed the tribe's standard of 5,900 $mg \cdot L^{-1}$ during the 2010 decade, it came within 7.1 $mg \cdot L^{-1}$ or 0.12% during 2016, when the annual average was 5,892.7 $mg \cdot L^{-1}$. Furthermore, 59% of the measurements collected during 2016 exceeded the standard.

PL is a terminal lake with no outlet, although water can flow to the currently dry adjacent Lake Winnemucca if PL levels were to rise above a threshold level. TDS concentrations in PL vary with water elevation, but will generally tend to increase through time due to evaporation. Climate models are predicting warmer conditions in the coming years, which may present an additional stressor that compounds the effect of increasing TDS on fish larvae and other aquatic organisms. Also, changes in DO concentrations may lead to additional habitat constriction. With TDS concentration in PL having approached the proposed standard value, water management in the TR watershed should focus on providing as much high quality water (e.g., low TDS) as possible to PL. It is recommended that the PLPT work with other stakeholders to evaluate upstream sources of TDS and initiate action to reduce the controllable TDS load in the basin where feasible. At the time of the next Triennial Review the tribe should assess progress towards quantifying sources and reduction in TDS load. An evaluation of interactive effects on aquatic life stages from changes in TDS and water temperature will be needed to refine estimates of TDS impacts on the biota.

Truckee River TDS

The recommended TDS standards for the TR are identical with those adopted by the State of Nevada under the category of RMHQ, consistent with the PLPT's proposed antidegradation policy.

NITROGEN

Nitrogen concentration in aquatic ecosystems is an important factor affecting algal production. Although it is generally assumed that algal production in lakes is controlled by the availability of phosphorus, research in arid and mountainous regions of the western United States has shown that nitrogen can be of equal or greater importance is some systems (e.g., Thornton and Rast 1989; Elser et al. 1990). This pattern of nitrogen control in the arid west has been shown by Reuter et al. (1991) to include lakes in northern Nevada, especially PL. The extensive eutrophication study conducted at PL during 1989-1992, which served as a basis for developing these WQS, provided overwhelming evidence for nitrogen control of algal growth in PL (e.g., Reuter et al. 1993; Lebo et al. 1994b). The nitrogen fractions available to algae were consistently low, indicating a strong potential for nitrogen limitation of algal growth. This general conclusion of nitrogen limitation was supported by nitrogen deficiency of algal cells, stimulation of algal growth by nitrogen addition, and the presence of algal species in PL which are able to utilize atmospheric N_2 gas to support growth. Annual productivity in PL was also directly related to the supply of dissolved inorganic nitrogen (DIN) to the surface waters of PL during the six years when adequate data was available (Figure III.1).

Pyramid Lake DIN

The DIN (or nitrate plus nitrite, and ammonium) standard recommended for PL is designed to both promote and protect the fishery. One of the primary beneficial uses for PL is as a coldwater sport fishery upon which the PLPT depends for part of its economic base. A coldwater fishery in a lake environment has two basic requirements: an adequate food supply to promote growth and a well-oxygenated habitat. The DIN standard for PL is designed to meet both needs. Algal growth and biomass production in aquatic systems provides food for animals such as zooplankton, benthic invertebrates, and fish. When nutrients are in short supply, the algal production is low thereby limiting food availability to all higher levels in the food chain. In contrast, excessive nutrients in aquatic systems stimulate large algal blooms which contribute to the depletion of DO in bottom waters as the algal cells settle to the bottom and are decomposed by bacteria. This depletion of DO in highly productive systems (i.e., eutrophic) limits available coldwater habitat for fish during summer stratified periods by making bottom waters unsuitable for the fish and potentially lethal. The recommended DIN standard for PL is intended to balance these two competing needs of the coldwater fishery.

Our approach for promoting and protecting the fishery of PL through a single DIN standard deviates from typical WQS where total nitrogen (TN) is used to approximate available nitrogen for algal growth. It also deviates from individual standards for the different fractions which comprise DIN. Algae can utilize both nitrate and ammonium to support growth and the single DIN standard for PL takes that ability into account. Contrasting the availability of DIN to algae, TN includes several forms of nitrogen that are not available to algae for growth (over periods of days to years). We have chosen to regulate the growth stimulatory compounds directly, in this case DIN, rather than the TN pool, although a TN standard is also recommended for PL (see below). Separate standards are recommended for components of the DIN pool which are potentially toxic to aquatic life at concentrations similar to the total DIN standard. These are nitrite and un-ionized ammonia.

An empirically based eutrophication model was developed for PL to facilitate the determination of an appropriate level of DIN in PL (Lebo et al. 1994a). The model was based on mathematically defined relationships between different variables defined from available data for PL. In addition to the strong empirical relationship between DIN input to surface waters and algal production (see Figure III.1), a relationship between annual algal production and depletion of bottom water oxygen was also determined. These two relationships were linked together to provide a modeling tool to predict the maximum total DIN input to surface waters that will maintain well-oxygenated coldwater habitat for the fish population of PL. The maximum input of DIN to surface waters to support algal production was then partitioned between river loading, N_2 fixation during *Nodularia spumigena* blooms, and internal mixing processes which depend on the total Lake DIN concentration. This model was used to predict DIN loading needed to maintain dissolved oxygen at a control depth of 70 m at or above the standard of 6.0 mg/l. This resulted in a whole-Lake average concentration of approximately 95 µg DIN/l as measured at overturn. This value is supported by measured ambient concentrations in PL during the 1970s when algal production was higher but when DO was adequate.

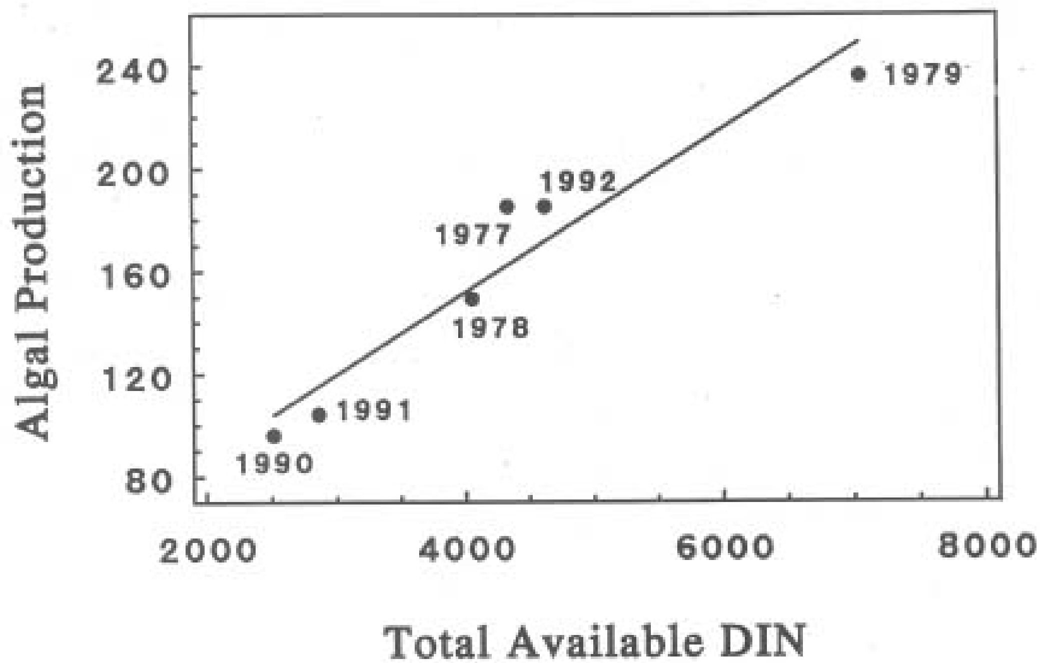

Figure III.1 Comparison of annual algal production in Pyramid Lake and total available DIN in the surface waters of the Lake. The numbers on the plot indicate the year from which the data point was derived. Units for the axes are grams carbon per square meter per year for algal production and metric tons of nitrogen for available DIN. For methods on how these numbers were determined, see Chapter 15 of Lebo et al. (1994a).

Pyramid Lake TN

The recommended total nitrogen (TN) standard for PL is designed to protect PL against excessive eutrophication and the corresponding water quality degradation which typically accompanies large algal blooms. In PL, TN is a poor predictor of available nitrogen to support algal growth due to high concentrations of dissolved organic nitrogen (DON) in PL; DON typically accounts for >85% of TN in PL and often contributes 90-95% of the total. Although the DON fraction in PL is poorly characterized, it is generally unavailable to algae until it is mineralized by bacteria to inorganic nutrients (i.e., DIN). A portion of the nitrogen bound in DON is a source of DIN to PL over longer time periods (months to years) through mineralization by bacteria, the PLPT recommends the TN concentration in PL does not increase to more than 1,000 µg/l (1 mg/l expressed as nitrogen). The TN standard is higher than typical concentrations of 600-800 µg/l that have been reported for PL (Galat and Verdin 1988; Lebo et al. 1992) and is designed to protect against the eutrophication of PL in the future.

Truckee River Nitrogen

The recommended nitrogen standards for the TR are identical to those adopted by the State of Nevada to protect beneficial uses in the River. Water quality in the lower TR has been severely impacted by high nutrient loading upstream of the Reservation. The excessive nutrient loading contributes to the development of a large biomass of attached algae in the River and a corresponding depletion of nighttime DO concentrations. Low DO levels in the River make it unsuitable habitat for coldwater fish species, especially when flow is inadequate.

Un-ionized ammonia is more toxic than ionized ammonia as pH increases. This condition could develop where the TR (pH 7.0-8.5) discharges to the PL delta (pH 9.0-9.5), which could potentially affect aquatic life. The delta provides habitat for cui-ui and LCT spawners, and also fry migrating to PL. Therefore, PL pH will be used to calculate the un-ionized ammonia component of total ammonia in TR water samples.

PHOSPHORUS

The concentration of phosphorus in aquatic systems has received both intense investigation and regulation over the past three decades due to its importance in stimulating algal growth. This interest in phosphorus is based on extensive scientific studies that have been conducted primarily in northern, temperate areas of North America and Europe. In those regions, scientists have shown there is often a direct relationship between algal biomass and the total concentration of phosphorus. A general relationship between algal biomass and phosphorus is expected since plants require a relatively large amount of phosphorus for growth. The problem with high algal biomass in aquatic systems is that it can contribute to the depletion of dissolved oxygen in bottom waters which is harmful to fish and other animals. This enhanced algal growth in lakes and rivers due to nutrient additions (primarily phosphorus and nitrogen) is called eutrophication and is generally undesirable in healthy systems. The regulatory interest in phosphorus and the corresponding movement to reduce phosphorus inputs to aquatic systems is based on its role in eutrophication.

Phosphorus limitations of algal growth, although often assumed, is not universally true. In semi-arid and mountainous regions in the western United States, the availability of nitrogen may be of equal or greater importance in limiting algal growth (e.g., Thornton and Rast 1989; Reuter et al. 1991). Indeed, Elser et al. (1990) surveyed published studies on the importance of nitrogen and phosphorus as factors stimulating algal growth in laboratory assays and concluded that nitrogen as a limiting factor was more important than previously recognized. In a majority of cases (~90%) the combined addition of nitrogen and phosphorus to lake water consistently produced larger stimulation than when either nutrient was added alone (Sterner and Elser 2002). Furthermore, investigations on nutrient cycling in streams of the western United States suggests that phosphorus can be supplied to the water through geochemical release from sediments and suspended particles (e.g., Grimm and Fisher 1986), including soil particles delivered by wind from surrounding terrain.

Pyramid Lake Phosphorus

For PL, the scientific evidence from studies cited above and from the projects discussed below overwhelmingly support the role of nitrogen for control of algal growth. PL is consistently low in the nitrogen fractions needed by algae compared with much higher phosphate concentrations (e.g., Reuter et al. 1993; Lebo et al. 1994b). This suggests a strong potential for nitrogen limitation of algal growth at all times. Further, algal cells showed a deficiency in nitrogen, particularly during the summer period when surface waters are isolated from deeper portions of PL due to seasonal warming of surface waters. Algal abundance in PL water was also shown to be stimulated by the addition of dissolved nitrogen in laboratory assays. Finally, the rate of annual algal production in PL was directly related to the amount of DIN (nitrate and ammonium) available to algae in the surface waters of PL. The conclusion from the eutrophication study of PL was that nitrogen is the primary factor controlling algal growth, so phosphorus is of secondary importance due to its naturally high concentration in PL water (Reuter et al. 1993).

The relative secondary importance of phosphorus in controlling algal growth suggests that regulation of phosphorus inputs to PL is of lesser importance to water quality. This finding contrasts with conventional wisdom about lakes but is consistent with other aquatic systems in arid regions of the western United States. It is noteworthy that PL does experience large blooms of the blue-green algae (cyanobacteria). Because blue-green algae can utilize atmospheric N_2 gas as a nitrogen source for growth, phosphorus may be a more important factor for the growth of cyanobacteria, especially *Nodularia spumigena* in PL and more recently *Microcystis*. It also appears that the annual bloom size for *N. spumigena* is strongly affected by regional weather patterns (Lebo et al. 1994b; C.L. Rhodes unpubl. data). This suggests that phosphorus concentration in PL is not a primary factor controlling the development *N. spumigena* blooms, but the phosphorus concentration should not increase substantially or it may become a factor in the future, especially with increasing temperatures. The recommended phosphorus standards for PL (Table II.1) are designed to protect against the accumulation of phosphorus in PL as a protective measure against stimulating algal growth and more sustained or enhanced cyanobacterial blooms. The PLPT recommends that concentrations of dissolved phosphate and total phosphorus in PL should not increase by more than 15% over current values observed in PL.

Truckee River Phosphorus

Algal growth in the TR, similar to PL, is also probably limited by the availability of nitrogen. An extensive computer modeling study of the TR conducted by Jim Brock and associates (Brock et al. 1992) showed that limiting the total loading of nitrogen to the River from point sources and diffuse (nonpoint) sources was essential to maintain adequate DO concentrations for the fish population. The problem with high algal densities is that algal respiration during nighttime depletes DO below values necessary for the fish populations in TR. It is important to note that the relative contribution of blue-green algae species to total algal population in the TR is unknown, with other types of algae potentially exhibiting occasions of phosphorus limitation or colimitation. To protect against the proliferation of algal populations in TR overall, the phosphorus concentration should not substantially increase.

In State of Nevada NAC 445A.1694 Truckee Region: TR at the Pyramid Lake Paiute Reservation, the WQS for total phosphates as P (TP) is an annual average of ≤0.05 mg/L. However, the WQS for TR on the PLIR is an annual average of dissolved reactive phosphorus (DRP) of ≤0.05 mg/L. The original justification for DRP formerly found on page 60 of the 2008 PLPT WQCP is sufficient for maintaining a DRP WQS:

> *The phosphorus standard recommended for the lower Truckee River on the Reservation is based on its secondary importance in regulating algal growth. The USEPA typically regulates phosphorus in aquatic systems as a total concentration, which assumes both particle-bound and dissolved forms of phosphorus are equally available to plants. However, the dissolved inorganic form of phosphorus (or phosphate) is the primary form of the nutrient used by algae to meet growth needs. An advantage of a phosphate standard rather than one for total phosphorus is that it regulates the availability of phosphorus to the algae, which is the intention of the standard. It also has the advantage that an increase in suspended sediment in the river (high particle-bound phosphorus concentration) will not cause a violation in the phosphorus standard simply due to increased turbidity (for which there is a different standard). The annual average phosphate concentration should be calculated as the mean of 12 monthly flow weighted average values.*

It is important to note that the State of Nevada WQS do not apply within the boundaries of the PLIR (Adopted Regulation of the State Environmental Commission, LCB File No. R093-13, December 2013). However, there is an expectation that the State of Nevada water quality TP standard on the TR at the Reservation boundary and the PLPT water quality DRP standard for the TR at the Reservation boundary should both establish essentially equivalent levels of protection.

The PLPT recognizes that concentrations of DRP and TP are highly variable on the TR. Therefore, data from the NDEP were used to establish a statistical relationship between the concentrations of these two phosphorus fractions, where orthophosphate-P (OP) is the DRP fraction. The statistical relationship established from these data show a ratio of OP:TP = 0.44 (Figures IV.1 and IV.2). Thus, a concentration of 0.05 mg/L TP is essentially equivalent to 0.022 mg/L DRP. The PLPT recommends a phosphorous standard for dissolved reactive phosphorous concentration that should not exceed an annual average of 0.022 mg/L.

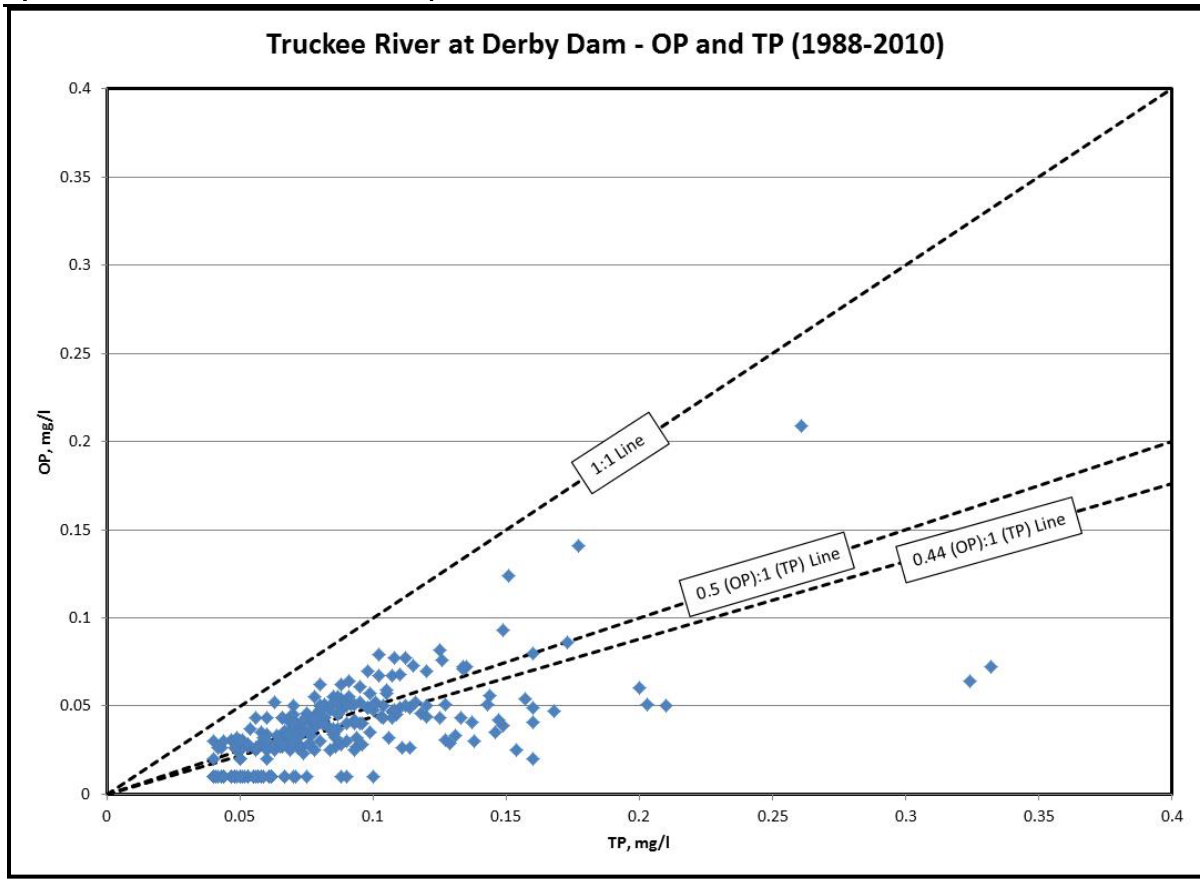

Figure IV.1 Statistical relationship between OP and TP on the Truckee River at Derby Dam, provided by the Nevada Division of Environmental Protection.

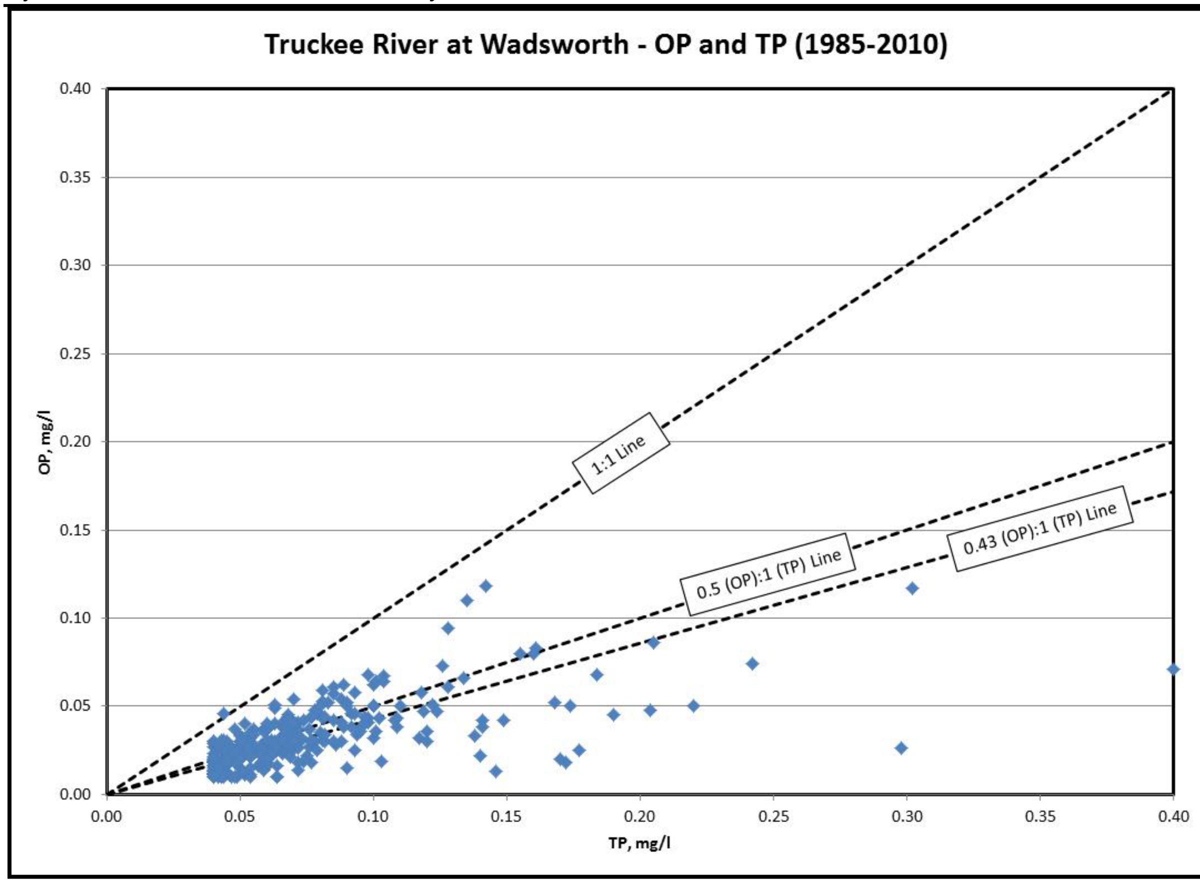

Figure IV.2 Statistical relationship between OP and TP on the Truckee River at Wadsworth, provided by the Nevada Division of Environmental Protection.

<u>TOXICS</u>

Under Section 304 (a) of the CWA, the USEPA publishes water quality criteria which consist of scientifically determined concentrations for specific chemicals in water which should not be exceeded if aquatic life and human health are to be protected. These USEPA-issued criteria are based on the latest scientific information available. Scientific understanding of toxics is an evolving discipline. If new scientific data becomes available to support a change in the numeric criteria adopted in the PLPT's WQS, which are more protective of human health and biological resources, these criteria can be changed. If adopted by states or tribes as part of their WQS, the USEPA will support the use of these criteria as being adequate to meet related beneficial uses. For the PLPT's WQS we use the recommended concentrations for toxic organic and metal pollutants as presented in the *Federal Register* Vol. 63, No. 237, Thursday, December 10, 1998. The exception is the human health criteria for mercury which is discussed in further detail below. All footnotes which appear in association with the specific compounds taken from the USEPA criteria in the document above also apply.

The concentrations presented in these criteria represent levels in water which should not be exceeded. A risk level of 10^{-6} is assumed for carcinogens unless otherwise noted and defines the probability that exposure will result in cancer during a lifetime. At a risk level of 10^{-6} an individual would have a 1 in 1,000,000 chance of developing cancer if exposed to the concentration higher than that expressed in the standard. For protection of freshwater aquatic life, criteria concentrations are given in terms of acute (CMC -- 1-hr average) and chronic (CCC -- 96-hr average) toxicity, with an acceptable exceedance frequency of once every three years. For human health, criteria concentrations are given in terms of conditions where organisms from the waterbody of concern are consumed and when both organisms and water are consumed. For the PLPT's WQS it is assumed that for PL and other Tribal waters, organisms (fish) are eaten, but water is not ingested. For toxic organic pollutants (Table II.7) and toxic metal pollutants (Table II.8), values not presented in the numeric standards are missing because the USEPA has not recommended a concentration for that particular compound.

For certain toxic metal pollutants, toxicity to aquatic life is in part mitigated by the hardness of the water (hardness defined as a measure of the calcium and magnesium salts present in water). For those metals the USEPA has derived an equation to determine the criterion concentration based on hardness (for hardness less than or equal to 400 mg/L). Priority pollutant metals criteria concentrations for almost all metals are expressed in terms of allowable dissolved metal following the USEPA (1998) guidance as it appears in the Federal Register (Vol. 63, No. 237, Thursday, December 10, 1998). Again, all footnotes apply regarding the use of these recommended equations.

Arsenic is a carcinogenic, priority pollutant metal. The PLPT has adopted the USEPA recommended criteria of 150 $\mu g \cdot L^{-1}$ and 340 $\mu g \cdot L^{-1}$ for freshwater aquatic life (CCC and CMC, respectively). However, background levels of arsenic can be elevated in certain regional waterbodies in this region due to natural geologic conditions. For example, in Steamboat Creek (an important tributary to the TR near Reno, Nevada), arsenic concentrations immediately downstream of Steamboat Hot Springs were as high as 1,400 $\mu g \cdot L^{-1}$ with an annual average of approximately 650 $\mu g \cdot L^{-1}$ (Reuter and Goldman 1993). At the confluence of the TR, the annual arsenic level in Steamboat Creek was still greater than 100 $\mu g \cdot L^{-1}$. Ambient concentrations in TR water were measured in August 1993 at a series of six stations between Interstate-80 and Marble Bluff Dam. This sampling was part of a larger effort supported by the NDEP to determine concentrations of toxic pollutants in both the River and Lake (done in cooperation with the PLPT, the University of California Limnological Research Group, USEPA, and EMSL Analytical, Inc.). TR concentrations ranged from 7.9 to 10.7 $\mu g \cdot L^{-1}$. Arsenic concentrations in PL were even higher at 107 and 118 $\mu g \cdot L^{-1}$ for samples taken at two independent stations. Given that PL has no outfall and accumulates solutes, these higher concentrations are not unexpected.

Arsenic in both the River and Lake come from regional, non-anthropogenic sources, and control of these levels is not necessarily feasible. Since there is insufficient data to fully know the seasonal and interannual variation in the elevated background concentrations of arsenic in PL and the TR, specific human health criteria for the consumption of fish and water or fish alone are not considered practical at this time.

Mercury, and specifically mercury bioaccumulation in fish, has become one of the single most critical water pollution issues throughout much of the United States and internationally. The primary source of this mercury problem, for the majority of the world, is atmospheric in nature, with accelerated loading during the past century of trace amounts of atmospheric mercury derived from generalized, global industrial sources. However, in California and Nevada, the mercury problem is greatly exacerbated by the historic legacy of mining. Extensive use of mercury in gold and silver mining on both slopes of the Sierra Nevada have resulted in wide-ranging, bulk mercury contamination that dominates mercury loading and bioaccumulation to this day in affected drainages (Slotton, Ayers 2004).

High levels of mercury bioaccumulation have been described in a tributary to the Truckee, Steamboat Creek (Slotton and Ayers 2002). The possibility was raised that elevated mercury loading and bioaccumulation may be an issue for the fisheries downstream of PL. In response, an assessment study of mercury and mercury bioaccumulation in PL and the lower TR was conducted by Dr. Darell Slotton and Shaun Ayers (UC Davis Environmental Mercury Laboratory) in cooperation with the PLPT and the USEPA.

The initial study found mercury at some levels of concern in lake fish, particularly the larger LCT. Muscle mercury was found above the USEPA criterion level of 0.30 ppm in 56% of adult trout sampled and in 100% of the trout over 18 inches in length. Concentrations ranged to 0.74 ppm, exceeding the World Health Organization consumption guideline of 0.50 ppm in 16% of samples. The initial assessment study also characterized mercury in the other primary fish species of PL and in small fish and aquatic insect bioindicator species in the lower TR. Sampling of the inflowing River, Lake bottom sediments, and Lake geothermal waters indicated that the elevated mercury in the system was not primarily derived from sources within tribal land, but was instead apparently mainly derived from the upstream TR (above the PLIR). Potential mobilization and downstream transport of mercury from human development activities in the Steamboat Creek drainage suggests the advisability for monitoring of water and fish tissue on PLIR.

The PLPT has adopted the fresh water aquatic CMC and CCC concentrations as suggested by the USEPA (1998), and the human health criteria of mercury for fish consumption based on the results of the UC Davis study on PL fish (see Table II.6).

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APPENDIX A – PARAMETERS FOR CALCULATING FRESHWATER DISSOLVED METALS CRITERIA THAT ARE HARDNESS-DEPENDENT

Metal	m_a	b_a	m_c	b_c	CF-Acute	CF-Chronic
admium	1.0166	-3.924	0.7409	-4.719	1.136672-[ln(hard-	1.101672-[ln(hard-
Chromium III	0.8190	3.7256	0.8190	0.64848	0.316	0.860
Copper	0.9422	-1.700	0.8545	-1.702	0.960	0.960
Lead	1.273	-1.469	1.273	-4.705	1.46203-[ln(hard-ness)(0.041838)]	1. 46203-[ln(hard-ness)(0.041838)]
Chromium III	0.8190	3.7256	0.8190	0.64848	0.316	0.860
Copper	0.9422	-1.700	0.8545	-1.702	0.960	0.960
Lead	1.273	-1.469	1.273	-4.705	1.46203-[ln(hard-ness)(0.145712)]	1. 46203-[ln(hard-ness)(0.145712)]
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Silver	1.72	-6.52	---	---	0.85	---
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

APPENDIX B – MERCURY CRITERION CALCULATIONS FOR PYRAMID LAKE LAHONTAN CUTTHROAT TROUT

Dr. Darell Slotton (Research Scientist - UC Davis, California)

USEPA has established a fish tissue-based water quality criterion for mercury, recognizing that human exposure to toxic methylmercury comes almost entirely through consumption of fish. This criterion is directed at watersheds across the country and the fish that are taken through angling and other means, supplementing store-bought seafood. The National Criterion of 0.30 ppm mercury in edible fish tissue is based on these national averages:

- The standardized angling-related diet is defined as the consumption rate of angling catch by the 90th percentile of people, which national censusing found to be 17.5 g/day.
- The average consumer is estimated to additionally consume 12.5 g/day of commercial fish, which also contains some methylmercury.
- 0.30 ppm (the Criterion level) = the safe <u>average</u> Hg concentration of angling catch, for people that additionally consume the national average 12.5 g/day of commercial fish.

The angling-related catch diet is assumed to consist of a mixture of fish of different trophic levels and different mercury concentrations. The 0.30 ppm Criterion is intended to be the *average* concentration of the mixed types. The Criterion calculation includes the mercury concentration of each fish type, multiplied by that type's percentage in the overall angling diet. For 4 types of fish (F1, F2, F3, and F4), the basic National Criterion equation is:

0.30 ppm = (%F1 x F1conc) + (%F2 x F2conc) + (%F3 x F3conc) + (%F4 x F4conc)

This equation can be used to determine the acceptable individual Hg concentrations for each fish type (F1conc, F2conc, F3conc, and F4conc), averaging to the National Criterion of 0.30 ppm.

Typically, the equation is calculated in terms of multiple fish *trophic levels*, separating species that feed on different food types and thus accumulate different levels of mercury. At Pyramid Lake, virtually all of the fishing take and consumption consists of Lahontan cutthroat trout. A substantial amount of information exists for different size groups of these trout. *Therefore, the Criterion equation can be calculated in relation to the different size classes of trout, just as the equation is often solved for different species of fish or different trophic levels.*

To solve the equation, it is first necessary to estimate relative catch percentages for each of the fish groups in the equation. Creel surveys at Pyramid Lake have tracked keeper percentages of trout by size class for the past 10 years (Table 1). The great majority of these fish are from the 16-19" main legal catch window, with a small percentage taken in the second, upper window of >24". Many of these largest fish are kept for trophy mounting rather than consumption. The creel survey keeper percentage data are separated into three one-inch size classes within the 16-19" main catch window, plus the >24" fish. Average percentages of keepers (Table 2), based on the ten-year record, are:

16-17": 27.0%

17-18": 37.4%

18-19": 28.9%

>24": 6.7%

To account for the fact that many of the >24 inch fish are kept for trophy mounting rather than consumption, the creel percentages have been adjusted to exclude 25% of the kept fish >24 inches in length from consumption considerations:

16-17”: **27.5%**

17-18”: **38.1%**

18-19”: **29.4%**

>24”: **5.0%**

These catch consumption percentages can be used directly in the criterion calculation.

Knowing the catch percentages for each size class, there are still four unknowns in the equation: F1conc, F2conc, F3conc, and F4conc. To solve this type of algebra equation, it is necessary to convert the different unknowns into terms of one single unknown. To do this, estimates are needed of the ratios of typical Hg concentrations between fish of the different sizes.

Relative mercury concentrations between the identified size classes can be determined from extensive (n=50/yr) large trout mercury analyses from each of three recent years (2001, 2003, and 2004; Fig. 4). These annual samplings included fish distributed across the range of potential keeper sizes, defining size:mercury relationships for each year, typically an exponential function. For each year, the mercury concentration associated with each of the sizes in question was calculated (Table 3), together with the concentration ratios between the key size classes (Table 4). Ratios were based on the 17-18” trout size class (specified as 17.5” in calculations), which is at the center of the main catch window of 16-19”. *This mid-range 17.5” index size will be used as the criterion regulatory target.* Average mercury concentration ratios from the three years of data, in terms of the 17.5” mid-sized trout benchmark, are:

16-17” (16.5”) conc.: **0.892** x 17-18” (17.5’) conc.

17-18” (17.5”) conc.: **1.000** x 17-18” (17.5’) conc.

18-19” (18.5”) conc.: **1.121** x 17-18” (17.5’) conc.

>24” conc.: **2.984** x 17-18” (17.5’) conc.

In the calculations that follow, the criterion equation is solved in terms of the 17-18” trout size class (17.5”). Concentrations are in ng mercury per gram, or ppb. 300 ng/g (ppb) = 0.30 µg/g (ppm).

Mercury Criterion Calculations for 17.5” Index Size Pyramid Lake Lahontan Cutthroat Trout

300 ppb = (27.5% x 16-17”conc)

+ (38.1% x 17-18”conc)

+ (29.4% x 18-19”conc)

+ (5.0% x >24”conc)

300 ppb = (27.5% x (0.892 x 17-18”conc))

+ (38.1% x 17-18”conc)

+ (29.4% x (1.121 x 17-18”conc))

+ (5.0% x (2.984 x 17-18”conc))

300 ppb = (0.245 x 17-18"conc)

+ (0.381 x 17-18"conc)

+ (0.330 x 17-18"conc)

+ (0.150 x 17-18"conc)

300 ppb = (0.245 + 0.381 + 0.330 + 0.150) x 17-18"conc

300 ppb = 1.106 x 17-18"conc

300 ppb / 1.106 = 17-18"conc

271 ppb = 17-18"conc (0.27 ppm)

What this means is that a normalized concentration for the index size of 17.5" (the middle of the 16-19" main catch window) at or below 271 ppb (0.271 ppm) would reflect an overall, average diet that is consistent with the 0.30 ppm National Criterion.

This can be determined by analyzing mercury across a range of trout sizes, as has been done in recent years, defining a size:mercury relationship, and determining what mercury concentration corresponds to the 17.5" index size. In 2001, the normalized index size corresponded to 268 ppb (0.268 ppm), essentially at the Criterion level. In 2003, the index concentration was substantially lower at 150 ppb (0.150 ppm). There was a further decline in 2004 to 109 ppb (0.109 ppm).

Table 1. Pyramid Lake creel census data for Lahontan cutthroat trout from different size classes, 1996-2005.

Size Class	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05
16-17 in	34.7%	37.5%	36.4%	36.8%	40.0%	24.2%	12.3%	8.0%	11.3%
17-18 in	36.8%	30.8%	35.0%	33.5%	34.0%	52.0%	46.5%	32.7%	33.1%
>24 in	5.3%	11.3%	7.9%	10.5%	8.0%	2.8%	3.2%	4.5%	6.8%

Table 2. Reduced mean creel census data, 1996-2005.

Means adjusted to account for estimated 25%

of retained fish >24 inches used for trophy

mounting rather than consumption.

Size Class	Mean Percentages	Adjusted Means

16-17 in	27.0%	**27.5%**
17-18 in	37.4%	**38.1%**
18-19 in	28.9%	**29.4%**
>24 in	6.7%	**5.0%**

Table 3. Regression equations for fish muscle mercury concentration vs. size (fork length) in 2001, 2003, and 2004. Equation-calculated normalized mercury concentrations for 16.5 inch, 17.5 inch, and 18.5 inch sizes (midpoints of the 3 inch-classes within the main 16-19 inch legal catch window. For the >24 inch upper size window, mercury concentrations in all annual individuals above 24 inches were averaged. Regressions based on n = 50 individual analyses per year. Concentrations in ng Hg per gram = ppb (= ppm/1000)

Year	Regression equation	16.5 in	17.5 in	18.5 in	>24 in*
2001	58.614 x exp(0.0868 x length)	245	268	292	561
2003	13.092 x exp(0.1395 x length)	131	150	173	546
2004	15.188 x exp(0.1125 x length)	97	109	122	351

Table 4. Mercury concentration proportions in relation to the 17.5 inch index size.

Year	16.5 in	17.5 in	18.5 in	>24 in*
2001	0.914	1.000	1.090	2.093
2003	0.873	1.000	1.153	3.640
2004	0.890	1.000	1.119	3.220
Mean ratios	0.892	1.000	1.121	2.984

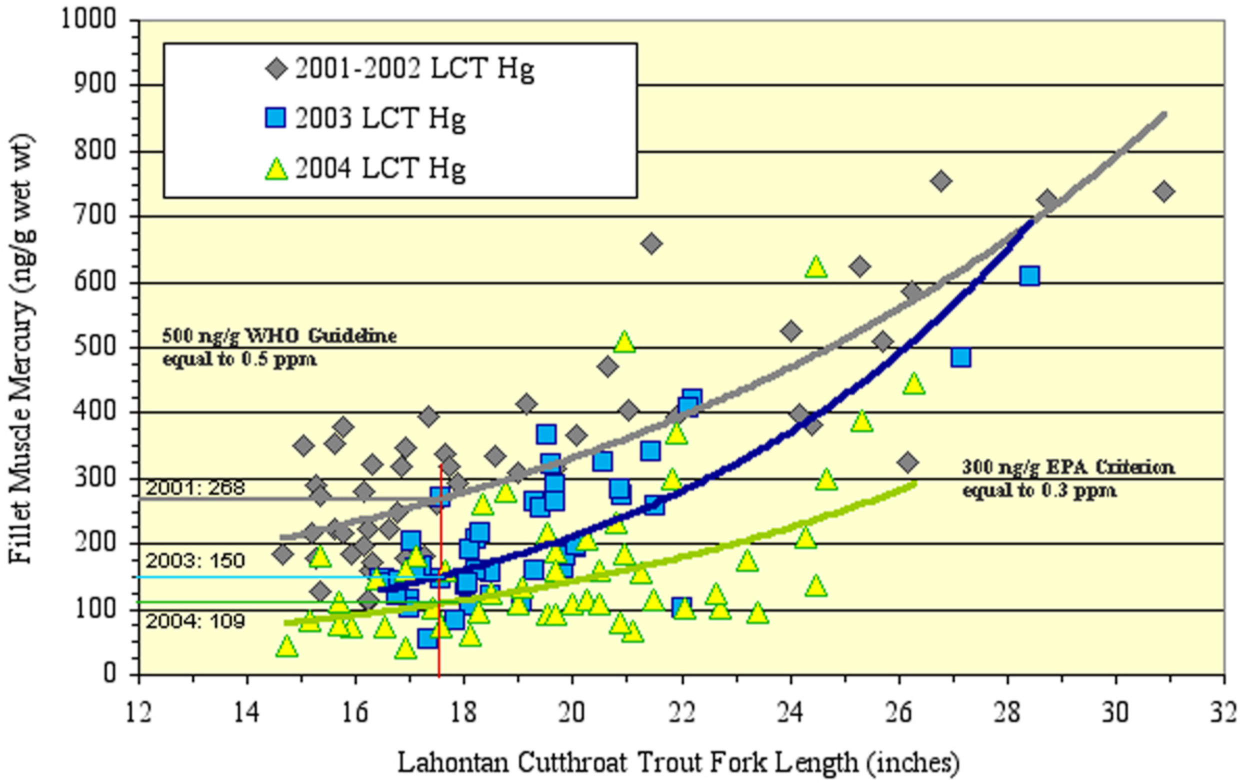

Figure 1. Pyramid Lake Lahontan cutthroat trout size vs. muscle mercury, 2001-2004. Including best fit trend curves for each year and trend-normalized mercury concentration for 17.5 inch index size. n = 50 individual analyses per year. Main legal catch window = 16-19 inches. Secondary catch window = >24 inches. Concentrations in ng Hg per g = ppb (= ppm/1000).

APPENDIX C – RESOLUTION NUMBER PL31-05 OF THE PYRAMID LAKE PAIUTE TRIBE OF THE PYRAMID LAKE RESERVATION

(WATER QUALITY ORDINANCE)