NOTICES OF FINAL RULEMAKING

The Administrative Procedure Act requires the publication of the final rules of the state's agencies. Final rules are those which have appeared in the *Register* first as proposed rules and have been through the formal rulemaking process including approval by the Governor's Regulatory Review Council or the Attorney General. The Secretary of State shall publish the notice along with the Preamble and the full text in the next available issue of the *Register* after the final rules have been submitted for filing and publication.

NOTICE OF FINAL RULEMAKING

TITLE 18. ENVIRONMENTAL QUALITY

CHAPTER 11. DEPARTMENT OF ENVIRONMENTAL QUALITY WATER QUALITY STANDARDS

[R08-427]

PREAMBLE

1. **Sections Affected**	**Rulemaking Action**
R18-11-101	Amend
R18-11-102	Amend
R18-11-107	Amend
R18-11-107.01	New Section
R18-11-108	Amend
R18-11-108.01	New Section
R18-11-108.02	New Section
R18-11-108.03	New Section
R18-11-109	Amend
R18-11-110	Amend
R18-11-111	Amend
R18-11-112	Amend
R18-11-113	Amend
R18-11-114	Amend
R18-11-115	New Section
R18-11-116	Amend
R18-11-117	Amend
R18-11-118	Amend
R18-11-121	Amend
R18-11-122	Amend
R18-11-123	Amend
Appendix A	Amend
Table 1	Repeal
Table 1	New Section
Table 2	Repeal
Table 2	New Section
Table 3	Amend
Table 4	Amend
Table 5	Amend
Table 6	Renumber
Table 6	New Table
Table 7	Amend
Table 8	Amend
Table 9	Renumber
Table 9	Amend
Table 10	Renumber
Table 10	Amend
Table 11	Renumber
Table 11	Amend
Table 12	Renumber
Table 12	Amend

Table 13	Renumber
Table 13	Amend
Table 14	Renumber
Table 14	Amend
Table 15	Renumber
Table 15	Amend
Table 16	Amend
Table 17	Amend
Table 18	Repeal
Table 18	Renumber
Table 18	Amend
Table 19	Renumber
Table 19	New Table
Table 20	Amend
Table 21	Renumber
Table 21	Amend
Table 22	Renumber
Table 22	Amend
Table 23	Renumber
Table 23	Amend
Table 24	Renumber
Table 24	Amend
Table 25	Renumber
Table 25	Amend
Table 26	Renumber
Table 26	Amend
Appendix B	Amend
Appendix C	New Appendix

2. The specific authority for the rulemaking, including both the authorizing statute (general) and the statutes the rules are implementing (specific):

Authorizing statutes: A.R.S. §§ 49-202(A), 49-203(A)(1), 49-221, 49-222

Implementing statutes: A.R.S. §§ 49-221, 49-222

3. The effective date of the rules:

January 31, 2009

4. A list of all previous notices appearing in the *Register* addressing the final rulemaking:

Notice of Rulemaking Docket Opening: 14 A.A.R. 897, March 28, 2008

Notice of Proposed Rulemaking: 14 A.A.R. 1281, April 25, 2008

5. The name and address of agency personnel with whom persons may communicate regarding the rulemaking:

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6. An explanation of the rules, including the agency's reasons for initiating the rulemaking:

GENERAL EXPLANATION OF THIS RULEMAKING

Section 303(c) of the Clean Water Act requires all states to, where appropriate, adopt and revise water quality standards at least once every three years. States must preserve and protect the quality of navigable waters and adopt surface water quality standards by considering the following factors:

1. The protection of the public health and the environment;
2. The uses that have been made, are being made, or with reasonable probability may be made of the waters;
3. The provisions and requirements of the Clean Water Act, the Safe Drinking Water Act, and their implementing regulations;

4. The degree to which standards for one category of water could cause violations of standards for other hydrologically-connected water categories (for example, the Department must consider the degree to which surface water quality standards could cause violations of aquifer water quality standards);
5. Guidelines, action levels, or numeric criteria adopted or recommended by the U.S. Environmental Protection Agency (EPA) or any other federal agency; and
6. Any unique, physical, biological, or chemical properties of the waters.

A.R.S. § 49-222 authorizes the Department to adopt surface water quality standards that assure water quality, if attainable, that provides for protecting the public health and welfare; to develop standards to enhance the quality of water in Arizona; and to take into consideration the use and value of water for public water supplies, the propagation of fish and wildlife, and recreational, agricultural, industrial, and other purposes.

The Department is charged with adopting numeric surface water standards that establish numeric limits on the concentrations of each of the 126 toxic pollutants listed by EPA under § 307 of the Clean Water Act. In adopting numeric water quality standards, the Department may consider:

1. The effect of local water quality characteristics on the toxicity of pollutants;
2. The varying sensitivities of local affected aquatic populations to these pollutants; and
3. The extent to which the natural flow of the stream is perennial, intermittent, effluent-dependent, or ephemeral.

While the Department may consider these site-specific factors in establishing water quality standards for ephemeral waters and effluent-dependent waters, any water quality standard adopted must be consistent with the requirements of the Clean Water Act.

Section 303(c) of the Clean Water Act provides the basis in federal law for Arizona's surface water quality standards program. The key elements are:

1. A water quality standard is defined as consisting of the designated beneficial uses of a water body and water quality criteria necessary to support the designated uses;
2. The following minimum beneficial uses must be considered when establishing surface water quality standards under the Clean Water Act: 1) public water supply; 2) the propagation of fish, shellfish, and wildlife; 3) recreation; 4) agricultural uses; 5) industrial uses; and 6) navigation;
3. Arizona's water quality standards must protect public health and welfare, enhance the quality of water, and serve the purposes of the Clean Water Act;
4. The surface water quality standards rules must be reviewed at least once every three years using a process that includes public participation; and
5. A process exists for EPA review of the surface water quality standards adopted by the Department.

EPA requires that the Department specify appropriate uses to be achieved and protected in Arizona's surface waters. These designated uses include domestic water source (DWS), fish consumption (FC), full body contact recreation (FBC), partial body contact recreation (PBC), aquatic and wildlife (cold water) (A&Wc), aquatic and wildlife (warm water) (A&Ww), aquatic and wildlife (effluent-dependent water) (A&Wedw), aquatic and wildlife (ephemeral water) (A&We), agricultural irrigation (AgI), and agricultural livestock watering (AgL). Individual surface waters in Arizona and their respective designated uses are listed in Appendix B of this rulemaking.

The surface water quality standards for downstream surface waters must be considered when establishing designated uses for upstream waters. The Department must ensure that the water quality standards that are adopted for upstream water bodies also provide for the attainment and maintenance of the water quality standards for downstream waters. This concept is stated in R18-11-104(F).

The Department must adopt water quality criteria that are sufficient to protect water quality for the designated uses of Arizona's surface waters. Water quality criteria, numeric criteria, and narrative criteria must be based on a sound scientific rationale and must contain sufficient parameters or constituents to protect each designated use.

The Department has discretionary authority under 40 CFR 131.13 to include general policies that affect the application and implementation of the surface water quality standards in the rules. The Department has used this authority to adopt a mixing zone rule at R18-11-114, a variance rule at R18-11-122, and site specific standards in R18-11-115.

How Surface Water Quality Standards Impact Pollution Control in Arizona

Surface water quality standards are essential elements of several important water quality management programs including: Arizona Pollutant Discharge Elimination System (AZPDES) permitting; the § 305(b) water quality assessment and § 303(d) impaired water listing; and total maximum daily load (TMDL) programs.

AZPDES Permit Program

Surface water quality standards are used to regulate point source discharges of pollutants under the AZPDES permit program authorized under § 402 of the Clean Water Act. When technology-based permit limits required by the Clean Water Act are not sufficiently stringent to meet the applicable water quality standards, the Clean Water Act requires the development of more stringent, water quality-based effluent limits (WQBELs) in the AZPDES permit that are designed to ensure that the applicable surface water quality standards are met. The surface water quality standards rules play a critical role in the development of every AZPDES permit and provide the regulatory basis for the development of WQBELs which affect the levels of treatment that a discharger may be required to provide to control the discharge of pollutants to surface waters in Arizona.

Section 305(b) Water Quality Assessment and § 303(d) Impaired Water Listing

Section 305(b) of the Clean Water Act establishes a process to develop and report information on the quality of Arizona's surface waters. The Department developed a program to monitor surface waters within its boundaries, and a biennial report describing the status of water quality in Arizona rivers, streams, lakes, and reservoirs was prepared and submitted to EPA. The § 305(b) water quality assessment process is the primary means by which the Department evaluates whether water bodies in Arizona are meeting surface water quality standards, that progress has been made in maintaining and restoring surface water quality, and the extent of remaining water quality problems. The surface water quality standards play a central role in the § 305(b) water quality assessment process by providing the benchmarks used to assess water quality status. The surface water quality standards also provide the basis for the identification of water quality-limited or impaired waters in Arizona. Under § 303(d) of the Clean Water Act, the Department identifies and lists impaired waters that do not meet one or more of the surface water quality standards. The Clean Water Act requires the Department to develop total maximum daily load analyses (TMDLs) to restore water quality in those impaired waters.

Total Maximum Daily Load (TMDL) Program

Under § 303(d) of the Clean Water Act, the Department is required to develop TMDL analyses for impaired water bodies that do not meet one or more surface water quality standards. A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet surface water quality standards. The TMDL allocates that amount among the point and non-point sources in the watershed that discharge the pollutant of concern. A TMDL analysis starts with the identification of the pollutant(s) of concern and the surface water quality standards that must be attained to protect designated uses. A TMDL establishes a pollutant "budget" which is implemented through other Department water quality management programs such as the AZPDES permit program and the § 319 Non-Point Source Program. The ultimate goal of a TMDL is the restoration of water quality so that an impaired water attains applicable surface water quality standards.

Other Department Water Quality Management Programs That Depend on Surface Water Quality Standards

Section 319 of the Clean Water Act requires the Department to identify surface waters in Arizona that, without additional controls to control non-point sources of pollution cannot be reasonably expected to attain or maintain applicable water quality standards or the goals and requirements of the Clean Water Act. Management measures and best management practices (BMPs) are the primary mechanisms in § 319 of the Act to enable achievement of surface water quality standards. The Department administers the Water Quality Improvement Grant program that provides financial assistance to projects that control the discharge of pollutants to surface waters from non-point sources with a goal of achieving applicable water quality standards.

Under § 401 of the Clean Water Act, the Department may grant, condition, or deny water quality certification for a federally permitted or licensed activity that may result in a discharge to a surface water in Arizona. Congress intended that states use the § 401 water quality certification process to ensure that no federal license or permit is issued that would violate state-adopted water quality standards. The surface water quality standards that are the subject of this rulemaking are the basis for the § 401 water quality certification process. If the Department grants water quality certification for a federal license or permit, it is in effect saying that the regulated activity will not result in a violation of a surface water quality standard. The Department also may place conditions on § 401 certification to ensure compliance with the surface water quality standards. The Department may deny certification if an applicant for a federal permit or license has not demonstrated that the regulated activity will be protective of applicable water quality standards. If the Department denies water quality certification, the federal permitting or licensing agency is prohibited from issuing the permit or license. The Department conducts § 401 water quality certifications for a variety of federal programs including the § 404 dredge-and-fill permit program administered by the U.S. Army Corps of Engineers, permits for construction of new or expanded airport facilities regulated by the Federal Aviation Administration, and some power plants regulated by the Federal Energy Regulatory Commission (e.g., hydroelectric power plants).

Public Participation

An important element of the surface water quality standards review process is the involvement of those who may be affected by water quality standards decisions. Section 303(c) of the Clean Water Act requires that the Department hold at least one public hearing during the rulemaking process to consider changes to the standards. A.R.S. § 49-208 requires that the Department ensure adequate public participation in the development of new or revised surface water quality standards.

The Department invites the active involvement of citizens with an interest in surface water quality issues, the regulated community who may be affected by the state's water quality standards decisions, and federal, state, and local agencies and governments, including Indian tribes, who may have a stake in the outcome of the rulemaking process. The Department has, over the last several years, gone well beyond the minimum requirements for public participation in this rulemaking, holding numerous workshops and public meetings to discuss water quality standards issues, including the following:

June 4, 2008	Oral proceeding, Phoenix
May 19, 2008:	Oral proceeding, Tucson
April 25, 2008	Notice of Proposed Rulemaking re-published in *Arizona Administrative Register*
April 4, 2008	Notice of Proposed Rulemaking Published in *Arizona Administrative Register*
September 21, 2007	Stakeholder Meeting on R18-11-113(E) in Phoenix
September 13, 2007	Stakeholder meeting: Biocriteria
August 30, 2007	Stakeholder meeting: Narrative nutrient standard IPs
August 8, 2007	Stakeholder meeting in Phoenix to discuss final draft WQS rules
June, 12, 2007	Discussion of the Pinto Creek site-specific standard, Miami area
April 7, 2006	Meeting with PAG Environmental Protection Advisory Committee
March 2006	Discussion of the Yuma East Wetlands project, Yuma, Arizona
February 28, 2007	Informal stakeholder meeting
February 8, 2006	Stakeholder meeting re: Permit Flexibility R18-11-113(E)
November 29, 2005:	Stakeholder meeting re: Permit Flexibility R18-11-113(E)
November 16. 2005	Stakeholder meeting: Narrative Bottom Deposits Implementation Procedures
November 10, 2005	Informal stakeholder meeting: Biocriteria & Narrative Nutrient Standard Implementation
October-November, 2005	Informal stakeholder meetings on preliminary draft rules
August, 2005	ADEQ published preliminary draft rules for informal comment
July 18, 2005	Meeting with U.S. Fish & Wildlife Service
April 5, 2005	Kick-off meeting in Tucson
March 2005	Kick-off meeting in Phoenix
December 17, 2004	Stakeholder meeting: Antidegradation Implementation
July, 2004	Published request for input on rule issues
June 29, 2004	Stakeholder meeting: Antidegradation Implementation
November 25, 2003	Stakeholder meeting: Antidegradation Implementation

EPA Review of Arizona's Surface Water Quality Standards

The Department is required to submit new and revised water quality standards to the Region 9 Administrator of the EPA for review. The Department must submit final surface water quality standards rules to the Regional Administrator within 30 days of the date of the filing of the final rules with the Office of the Secretary of State. At that time, EPA Region 9 will review the rules to determine whether they are consistent with the requirements of the Clean Water Act and EPA's Water Quality Standards Regulation at 40 CFR 131.

The EPA review of the surface water quality standards rules consists of the following determinations:

1. Whether the designated uses are consistent with the requirements of the Clean Water Act;
2. Whether Arizona's surface water quality standards that do not include designated uses specified in § 101(a)(2) of the Clean Water Act are based upon appropriate technical and scientific data and analyses;
3. Whether the water quality criterion adequately maintains and protects water quality for the designated uses;
4. Whether the legal procedures were followed for adopting the surface water quality standards rules; and
5. Whether the surface water quality standards rules meet EPA minimum requirements specified in 40 CFR 131.6.

After completing the review, the EPA Regional Administrator may approve (in whole or in part), disapprove (in whole or in part), or conditionally approve (in whole or in part) Arizona's surface water quality standards. If the Regional Administrator makes the decision to approve (in whole or in part) the rulemaking, the decision must be made within 60 days of the date of receiving a complete submittal of the surface water quality standards rules and supporting documentation.

If the Regional Administrator determines that the surface water quality standards rules are inconsistent with the requirements of the Clean Water Act or federal water quality standards regulations, the Regional Administrator must disapprove the rules (in whole or in part) within 90 days of receiving the complete submittal of the surface water quality standards rules.

If the Regional Administrator disapproves a water quality standard, EPA must notify the Department in a letter that includes a statement of the reasons for the disapproval and specify the revisions that must be adopted to obtain full EPA approval of the surface water quality standards. Under § 303(c)(4) of the Clean Water Act, EPA may federally promulgate water quality standards if the Regional Administrator disapproves a water quality standard and the Department does not adopt the necessary revisions as specified by EPA. A state-adopted standard that EPA disapproves remains in effect until either: 1) The Department adopts the necessary revisions through the rulemaking process, or 2) EPA promulgates a federal water quality standard to supersede the disapproved water quality standard.

SECTION BY SECTION EXPLANATION OF THE RULES

R18-11-101. Definitions

This rulemaking makes minor, conforming, and editorial changes to the following definitions: "acute toxicity," "agricultural irrigation," "agricultural livestock watering," "annual mean," "aquatic and wildlife (cold water)," "Aquatic and wildlife (effluent-dependent water)," "Aquatic and wildlife (warm water)," "aquatic and wildlife (warm water)," "domestic water source," "ephemeral water," "existing use," "full-body contact," "intermittent water," "mixing zone," "oil," "perennial water," "pollutant," "practical quantitation limit," and "surface water."

The rulemaking combines all abbreviated terms (acronyms) with their defined counterparts.

The following are new terms used within the rulemaking and have been added to this Section: "Arizona Pollutant Discharge Elimination System (AZPDES)," "assimilative capacity," "critical flow condition," "deep lake," "reference condition," "regulated discharge," "riffle habitat," "run-habitat," "significant degradation," and "wadeable."

The rulemaking adds the five lake categories, "deep lake," "igneous lake," "sedimentary lake," "shallow lake," and "urban lake," identified in the narrative nutrient standard criteria rule at R18-11-108.03.

The term "outstanding Arizona water (OAW)," replaces the term "unique waters."

The rulemaking revises the term "effluent-dependent water" to clarify that effluent-dependent water is surface water that consists of point source discharges of wastewater to ephemeral water. The current definition states that effluent-dependent water consists of "discharges of treated wastewater." "Wastewater" is a broader term than "treated wastewater." For example, the "point source discharge of wastewater" would include the point source discharge of untreated cooling water from a power plant to ephemeral water. The revision clarifies that "point source discharge of wastewater" does not mean a point source discharge of stormwater.

The terms "National Pollutant Discharge Elimination System," "recreational uses," and "unique water" are no longer used and have been deleted from this Article. The term "ninetieth percentile" is still used within this Article, but only within R-18-11-109, therefore the term has been defined within that Section.

R18-11-102. Applicability

This Section has been reorganized and revised for clarity.

The following two new provisions in subsection (B) have been added to clarify the scope of the surface water quality standards rules:

1. Subsection (B)(3) makes clear that surface water quality standards do not apply to man-made cooling ponds if they are created outside of what would otherwise be considered a "surface water" or a "water of the United States."
2. Subsection (B)(4) makes clear that the surface water quality standards rules do not apply to surface waters located on Indian lands as Arizona does not have jurisdiction in Indian Country.

R18-11-107. Antidegradation

Federal water quality standards regulations require the Department to adopt a statewide antidegradation policy and identify the methods for implementing the policy. Both federal and state antidegradation policies establish a three-tiered framework of antidegradation protection to maintain and protect existing water quality. This framework is established in this rulemaking.

The basic purpose of the Tier 1 antidegradation policy is to maintain and protect existing water quality in Arizona's surface waters and to ensure that applicable surface water quality standards are attained.

Tier 2 maintains and protects existing water quality in Arizona's "high quality" surface waters by allowing the degradation of existing water quality in high quality surface water only under certain circumstances. This rule language is modeled on the federal Tier 2 regulation that applies to "high quality" surface waters with water quality that exceeds levels necessary to support the propagation of fish, shellfish, wildlife, and recreation in and on the water.

Tier 3 maintains and protects existing water quality in outstanding Arizona waters (OAWs). Currently, there are 20 OAWs that have been classified in rule. Two new OAWs have been added in this rulemaking.

Editorial changes have been made to this Section for clarity.

R18-11-107.01 Antidegradation Criteria

Federal water quality standards regulations require the Department to adopt a statewide antidegradation policy and to identify the methods for implementing the policy. Arizona's first statewide antidegradation policy at R18-11-107 was adopted in 1985. Although Arizona has had a statewide antidegradation policy in rule for more than 20 years, the Department has not identified methods for implementing the policy in rule. R18-11-107.01 is a new Section that satisfies the federal mandate to identify methods for implementing antidegradation. R18-11-107.01 is supported by a detailed guidance document entitled, "Antidegradation Implementation Procedures," Arizona Department of Environmental Quality (July 2007).

This Section contains the antidegradation criteria for each of the three tiers, and for reviews of general permits, § 404 dredge-and-fill permits, and AZPDES stormwater permits.

The antidegradation implementation procedures rule applies to "regulated discharges," defined at R18-11-101(35).

R18-11-108. Narrative Water Quality Standards

Narrative water quality standards are qualitative statements of desired water quality. The narrative water quality standards supplement the numeric water quality standards for specific pollutants and provide an important regulatory tool to maintain and protect the aesthetic qualities of Arizona's surface waters.

This rulemaking adds a new narrative standard in subsection (D), which is a tool to prevent dumping in Arizona surface waters by making it an enforceable water quality standard; and a new narrative standard in subsection (E), which implements the third prong of the primary goal of the Clean Water Act, to restore and maintain the chemical, physical, and biological integrity of the nation's waters.

R18-11-108.01. Narrative Biological Criteria

This Section implements the new biocriterion in R18-11-108(E) by providing the objective criteria for determining if the narrative biocriterion standard is being met. In the past, the Department has implemented a chemically-based water quality standards program that has focused almost exclusively on the maintenance and protection of the chemical integrity of Arizona's surface waters. However, a chemically-based water quality standards program alone cannot identify or adequately address all water quality problems that may result in impairment of the biological integrity of the state's surface waters. Biocriteria can detect water quality problems that a chemically-based water quality standards program may miss or underestimate. Biocriteria are valuable tools because they directly measure the biological condition of surface waters.

The biocriteria are based on the idea that the structure and function of aquatic biological communities provide important information about the overall quality of Arizona's surface waters and attainment of aquatic life designated uses. Existing biological communities in relatively pristine or minimally impacted surface waters in Arizona that have been subjected to little or no anthropogenic disturbance provide the best available examples of biological integrity. Measurements of the attributes, structure and function of the biological communities in minimally impacted surface waters provide the basis for establishing reference conditions that can be used to evaluate the biological condition of surface waters that have been subjected to relatively greater amounts of disturbance.

R18-11-108.02. Narrative Bottom-Deposits Criteria

This new Section implements R18-11-108(A)(1), which requires that surface waters "be free from pollutants in amounts or combinations that… settle to form bottom deposits that inhibit or prohibit the habitation, growth, or propagation of aquatic life." This narrative standard, commonly referred to as the "narrative bottom deposits standard," is intended to prevent excessive sedimentation and siltation in amounts that adversely affect aquatic life. Clean stream bottom substrates are essential for the health of many fish and benthic macroinvertebrate communities. Habitat degradation occurs when key stream habitat components such as spawning gravels and cobble surfaces are covered by fine sediment, decreasing inter-gravel oxygen transfer, and reducing or eliminating the quality and quantity of pool and interstitial habitat for fish, benthic macroinvertebrates, and algae. Excessive sediment and siltation adversely alters these habitats, suffocates fish eggs, and disrupts both aquatic communities and the food web dynamics.

This Section prescribes the objective criteria that will be used to determine whether there is a violation of the narrative bottom-deposits standard. Using separate criteria for warm and cold water streams, the Department will use the percentage of fine sediments in the riffle habitats of wadeable, perennial cold-water streams and the percentage of fine sediments in all stream habitats of wadeable, perennial warm-water streams to determine compliance with the narrative bottom deposits standard. The fine sediment thresholds are based on the scientific literature on sedimentation and siltation of streams.

R18-11-108.03. Narrative Nutrients Criteria

R18-11-108(A)(6) states that surface waters shall not contain pollutants in amounts or concentrations that cause the growth of algae or aquatic plants that inhibit or prohibit the habitation, growth, or propagation of other aquatic life or that impair recreational uses. This subsection is often called the "narrative nutrients standard" because it is intended to regulate nutrients that cause excessive growth of algae and plants in surface waters (e.g., total nitrogen and total phosphorus). This narrative nutrient standard is intended to address water quality problems associated with nutrient over-enrichment and accelerated rates of eutrophication of Arizona's lakes and reservoirs.

The narrative nutrient criteria and matrix in this new Section provide the objective criteria that will be used to determine whether there is a violation of the narrative nutrients standard at subsection (A)(6). The Department will use the chlorophyll-*a* criterion as the primary endpoint in combination with the other matrix variables for assessing support of aquatic and wildlife designated use with regard to nutrients in lakes and reservoirs that are listed in Appendix B and classified for application of the matrix (e.g., urban lake, deep lake).

R18-11-109. Numeric Water Quality Standards

This Section prescribes numeric water quality standards for bacteria, pH, temperature, suspended sediment concentration, dissolved oxygen, and nutrients.

The single sample maximum nitrate criterion of 10 mg/L that applies to the San Pedro River from Curtiss to Benson prescribed in R18-11-109(F)(10) has been repealed. The site-specific criterion of 10 mg/L is the same as the National Primary Drinking Water Maximum Contaminant Level for nitrate promulgated by EPA under the Safe Drinking Water Act. It is also the numeric criterion that the Department adopts to maintain and protect water quality for the domestic water source (DWS) designated use. The designated uses for the San Pedro River from Curtiss to Benson do not include a DWS designated use. DWS is not an existing or designated use of this reach of the San Pedro River. The most stringent numeric water quality standard for nitrate that currently applies to this reach of the San Pedro River is the full body contact recreation (FBC) criterion. The numeric FBC criterion for nitrate is 2,240 mg/L. Department research on the origin of current site-specific criterion of 10 mg/L shows that the source of the current standard appears to be a report prepared in September, 1985 by the Arizona Department of Environmental Health Services (ADHS), "San Pedro and Santa Cruz Rivers: Nutrient Standards Review." In this report, ADHS recommended that a single sample maximum nitrate standard of 10 mg/L be adopted for the San Pedro River because incidental ingestion of nitrate-enriched water during water-based recreation and consumption of alluvial groundwater further downstream could present a public health risk. The current FBC criterion of 2,240 mg/L in the surface water quality standards rules will protect public health from incidental ingestion of water associated with full body contact recreation.

The Department has repealed the numeric nutrient standards for four lakes (Roosevelt, Apache, Canyon, and Saguaro) under this Section and will apply the new narrative nutrient standard to protect these waterbodies.

R18-11-110. Salinity Standards for the Colorado River

This Section contains the salinity standards for the Colorado River as approved by the Colorado River Salinity Control Forum, which was formed in 1973 by the seven Colorado river basin states to develop standards and a basin-wide plan of implementation. The rulemaking updates the incorporation by reference.

R18-11-111. Analytical Methods

This Section contains the analytical methods that are necessary to determine compliance with a water quality standard.

Minor editorial changes have been made to this Section and statutory citations have been updated and added to allow the use of EPA-approved methods for analysis of water and wastewater.

R18-11-112. Outstanding Arizona Waters

This Section establishes the criteria for classifying a water as an outstanding Arizona water. The phrase "outstanding Arizona water" parallels EPA's term and more adequately describes the type of surface water intended to be protected under the Tier 3 antidegradation policy.

The reference to "unique waters" has been replaced throughout this rulemaking with "outstanding Arizona water (OAW)" to make the rule consistent with the terminology used in the federal antidegradation rule at 40 CFR 131.12 when referring to Tier 3 waters. 40 CFR 131.12 refers to "outstanding national resource waters" in the Tier 3 federal antidegradation policy and provides the highest level of antidegradation protection to them.

Davidson Canyon has been added to the list of OAWs. Davidson Canyon was nominated by the Pima County Regional Flood Control District and the Pima Association of Governments (PAG) Watershed Planning Department. Davidson Canyon contains perennial and intermittent reaches, is in a free-flowing condition, and the water quality data provided by PAG indicates that water quality is good. Davidson Canyon possesses attributes that make it of exceptional recreational and ecological significance. Davidson Canyon is one of the largest drainages in the Cienega Corridor and to Cienega Creek, which is already classified as an OAW. Davidson Canyon provides one of the most important wildlife migration corridors in Southern Arizona, linking the Santa Rita Mountains to the Rincon Mountains. The stream provides important riparian habitat for diverse flora and fauna, including priority vulnerable species listed under the Sonoran Desert Conservation Plan and threatened and endangered species or species of concern identified by the U.S. Fish & Wildlife Service, including the lowland leopard frog and the longfin dace. The Department notes that the nominated reach of Davidson Canyon, associated water rights, and surrounding lands are being acquired by Pima County as part of the Sonoran Desert Conservation Plan. The OAW classification of Davidson Canyon is consistent with and provides support for Pima County's conservation management goals and policies for this important riparian area.

Fossil Creek, a tributary of the Verde River, has been added to the list of OAWs. Fossil Creek was nominated for OAW classification by the Grand Canyon Chapter of the Sierra Club and others. Fossil Creek is perennial, in a free-flowing condition, and the available water quality data indicates the creek has excellent water quality. Fossil Creek is of exceptional ecological significance, providing habitat for a diversity of plant and animal life. Of particular importance is the fact that Fossil Creek provides habitat for a diverse assemblage of native fishes, including the Sonora sucker, desert sucker, headwater chub, round tail chub, speckled dace, and longfin dace. The restoration and long-term protection of native fish in Fossil Creek provides an exceptional opportunity to restore Arizona's declining native fish species and may increase the success of native fish restoration efforts in the Verde River watershed. The decision to classify Fossil Creek as an OAW is based largely on the information and data provide on current physical and biological conditions of Fossil Creek, which was provided in "Fossil Creek: State of the Watershed Report," Northern Arizona University (July 2005). This rulemaking delays the effective date for the Fossil Creek OAW classification until June 30, 2010 to allow the Arizona Public Service company to complete de-commissioning activities in the Fossil Creek watershed. This date is the final deadline approved by the Federal Energy Regulatory Commission to complete all decommissioning activities.

R18-11-113. Effluent-Dependent Waters

This Section establishes the effluent-dependent water standards. Effluent-dependent waters (EDWs) are a special category of surface waters created by the point source discharge of wastewater to an ephemeral water. An EDW is a surface water that, without a point source discharge of wastewater, would be an ephemeral water.

Any person may request that a surface water be classified as an EDW. There are three basic information requirements that must be met to support an EDW classification by rule. First, a person must submit a map and a description of the EDW. Second, the person must submit information demonstrating that the EDW consists of a point source discharge of wastewater. Finally, a person must submit information demonstrating that the receiving water is an ephemeral water. The Department may also propose surface waters for EDW classification on its own initiative.

The 36 EDWs currently listed in subsection (D) have been moved to Appendix B.

A subcategory of the aquatic and wildlife designated use has been developed for effluent-dependent waters (A&Wedw) and apply to all surface waters that are classified as EDWs by rule.

The phrase "discharge of treated wastewater" has been changed to "point source discharge of wastewater." This change allows the Director to classify ephemeral waters that receive point source discharges of untreated cooling water and other industrial process waters as effluent-dependent waters in addition to discharges of municipal and domestic wastewater.

New subsection (D) is subsection (E) in the current rule and requires that the permit-issuing authority use the water quality standards that apply to effluent-dependent waters to derive discharge limitations for a point source discharge from a wastewater treatment plant to an ephemeral water "that changes that ephemeral water into an effluent-dependent water." This phrase has been deleted to clarify that EDW standards will be used to derive discharge limitations for *all* point source discharges of wastewater to an ephemeral water. A point source discharge of wastewater to an ephemeral water changes the receiving ephemeral water into an effluent-dependent water. This position is based on the definitions of "effluent-dependent water" and "ephemeral water." Subsection (D) clarifies which discharges are not considered "wastewater" for purposes of this Section, including stormwater and similar discharges approved under a general permit.

In new subsection (E), language has been added to provide regulatory flexibility to apply only acute A&W(edw) standards to point source discharges of wastewater to ephemeral waters under certain circumstances. The Department recognizes that there may be infrequent, sporadic, or emergency point source discharges of wastewater to ephemeral waters where it is reasonable to conclude that chronic A&W(edw) standards are unnecessary. Acute and chronic A&W(edw) standards would be appropriate for continuous point source discharges of wastewater to an ephemeral water that create perennial EDWs or for intermittent point source discharges of wastewater that flow seasonally or regularly. Acute and chronic A&W(edw) standards are also appropriate to regulate a point source discharge to an ephemeral water where the water may reach a downstream surface water with chronic A&W standards. Also, chronic A&W(edw) standards are appropriate where the point source discharge of effluent creates an impoundment or semi-permanent ponds to permanent ponds within an ephemeral water. However, there may be point source discharges to ephemeral waters where the amount of flow, the frequency, or the duration of the discharge is such that it is unlikely that water may be present in the receiving ephemeral water for a sufficient period of time for organisms in the receiving water to be chronically exposed to pollutants.

This Section has been revised to provide flexibility so that acute A&Wedw standards can be applied on a case-by-case basis in AZPDES permits. Language has been added that provides regulatory flexibility by clarifying that AZPDES permits may establish alternative discharge limits derived from acute A&W(edw) or chronic A&W(edw) standards based on seasonal variations in the discharge.

R18-11-114. Mixing Zones

This Section lists the criteria for establishing a mixing zone and contains minor editorial and formatting changes.

A provision has been added to subsection (H) that prohibits zones of initial dilution in a mixing zone that are so large that they cause lethality to drifting organisms that pass through.

R18-11-115. Site-specific Standards

State and federal laws authorize the adoption of site-specific standards that reflect local environmental conditions. The federal water quality standards at 40 CFR 131.11(b)(1)(ii) provide the Department with the authority to adopt water quality criteria that are "modified to reflect site-specific conditions." Similarly, A.R.S. § 49-221(C)(6) directs the Director to consider "[a]ny unique physical, biological, or chemical properties of the waters" when establishing surface water quality standards. Under A.R.S. § 49-222(C), the Department may consider the effect of local water quality characteristics on the toxicity of specific pollutants and the varying sensitivities of local, affected aquatic populations to pollutants when setting numeric water quality standards. This Section provides specific authority for site-specific standards and identifies methods acceptable to the Department and EPA for their development. Site specific standards, like all surface water quality standards, must be based on a sound scientific rationale to protect the aquatic and wildlife designated use. This Section prescribes technically defensible methods for site-specific standard development.

R18-11-116. Resource Management Agencies

This Section establishes how resource management agencies are affected by this Article and contains minor editorial changes.

R18-11-117. Canals and Urban Park Lakes

This Section establishes standards for canals and urban park lakes and contains minor editorial changes.

R18-11-118. Dams and Flood Control Structures

This Section establishes standards for dams and flood control structures and contains minor editorial changes.

R18-11-121. Schedules of Compliance

This Section establishes schedules of compliance and contains minor editorial changes.

R18-11-122. Variances

This Section establishes water quality standard variances for a point source discharge and contains minor editorial changes.

R18-11-123. Discharge Prohibitions

This Section adds two new discharge prohibitions that prevent point source discharges of wastewater to listed ephemeral waters that flow onto the Ak Chin Indian Reservation.

Appendix A. Numeric Water Quality Criteria

Appendix A lists the numeric water quality standards. Tables 1 and 2 have been deleted and the information contained in those two tables has been combined into a new Table 1.

The numeric water quality criteria have been revised to reflect changes in criteria derivation methodologies, revised exposure assumptions, new information, and data on human health effects or new toxicity data that support a revision of aquatic life criteria. Specific revisions and the reasons for making the changes are indicated in the subsequent tables. Each table is organized by designated use, existing criteria, and adopted criteria for each parameter.

Methodologies for Deriving Criteria for the Domestic Water Source Designated Use

Numeric criteria to maintain and protect water quality for the Domestic Water Source (DWS) designated use are either Maximum Contaminant Levels (MCLs) established by EPA under the National Primary Drinking Water Regulations or values derived using EPA methods to protect human health. Where an MCL has been established for a pollutant, the MCL has been adopted as a criterion to protect water quality for the DWS designated use. Where MCLs were not available, the criteria were derived for the DWS designated use using the following equations:

For carcinogens:
$$\frac{70\ \text{kg} * 10^{-6}}{\text{OCSF} * 2\ \text{L/day}}$$

For non-carcinogens:
$$\frac{\text{Rfd} * \text{RSC} * 70\ \text{kg}}{2\ \text{L/day}}$$

In the carcinogen equation, 70 kg is the average weight of a human male in kilograms; 10^{-6} is the excess cancer risk level; OCSF is the oral cancer slope factor; and 2 L/day is the national average water consumption rate in liters per day.

In the non-carcinogen equation, Rfd is the reference dose; RSC is the relative source contribution factor, 70 kg is the average weight of a human male in kilograms and 2 L/day is the national average water consumption rate in liters per day. The relative source contribution factor is a way to account for other exposure pathways to a pollutant (e.g., food, inhalation, work exposure, etc.). There is little reliable information to assess the amount of exposure to a pollutant attributable to different exposure pathways. EPA uses a default RSC factor of 20 percent when developing MCLs. This assumes that 20 percent of a person's exposure to a pollutant is estimated to be through the ingestion of water. The Department used the same default RSC factor in deriving criteria for the DWS designated use.

Numeric criteria for the DWS designated use has been adopted using the following decision criteria:

1. MCLs, where available;
2. Where MCLs were not available, the DWS criterion was calculated using the appropriate procedure for carcinogens or non-carcinogens;
3. For carcinogens where an OCSF was not available but an Rfd was available, the non-carcinogen procedure and the Rfd were used to calculate a criterion;
4. For non-carcinogens, a criterion using available Rfds was used. If an Rfd was not available in the Integrated Risk Information System (IRIS) but a surrogate Rfd was available, such as a Minimum Risk Level (MRL) from the Agency for Toxic Substances Disease Registry (ATSDR), a criterion using the MRL as an Rfd was calculated;
5. Where an MCL, OCSF, Rfd or MRL was not available, a criterion for the DWS designated use was not derived.

The following table summarizes those pollutants where a change or repeal has been made to the numeric criteria for the DWS designated use.

Numeric Water Quality Standards for Domestic Water Source

Pollutant	Existing DWS Criterion (µg/L)	Adopted DWS Criterion (µg/L)	Reason for Change
Acenaphthylene	NNS	None	This pollutant has been removed from Appendix A because no numeric criteria exist for any designated use.
Acrylonitrile	0.07	0.06	The standard was calculated using the DWS method for carcinogens (OCSF = 5.40E-01).
Arsenic	50 T	10 T	A new MCL for arsenic has been adopted.
Benz(a)anthracene	0.048	0.005	The standard was calculated using the DWS method for carcinogens (OCSF = 7.30E+00).
3,4 Benzfluoranthene	0.048	0.005	The standard was calculated using the DWS method for carcinogens (OCSF = 7.30E+00).
Benzo(k)fluoranthene	0.048	0.005	The standard was calculated using the DWS method for carcinogens (OCSF = 7.30E+00).
Boron	630 T	1,400 T	The standard was calculated using the DWS method for non-carcinogens (Rfd = 2.00E-01).
Chlorine (total residual)	700	4,000	The maximum residual disinfection level (MRDL) for chlorine has been adopted from EPA's 1998 Final Rule for Disinfectants and Disinfection-By-Products.
Chloropyrifos	New parameter not in existing rules	21	The standard was calculated using the DWS method for non-carcinogens (Rfd = 3.00E-03).
Chromium III	10,500 T	None	The rulemaking removes the speciated form and relies on total chromium DWS criterion of 100.
Chrysene	0.479	0.005	The standard was calculated using the DWS method for carcinogens (OCSF = 7.30E+00).
Dibenz(ah)anthracene	0.048	0.005	The standard was calculated using the DWS method for carcinogens (OCSF = 7.30E+00).
p,p'-Dichlorodiphenyl dichloroethane (DDD)	0.15	0.1	DDT and its metabolites, DDD & DDE have been consolidated into a single listing. The DWS criterion for DDT (0.1 µg/L) has been adopted for DDD.
1,1-Dichloroethane	NNS	None	This pollutant has been removed from Appendix A because no numeric criteria exist for any designated use.
1,3-Dichloropropene	2	0.7	The standard was calculated using the DWS method for carcinogens (OCSF = 5.00E-02).
Endosulfan sulfate	NNS	42	The standard was calculated using the DWS method for non-carcinogens (Rfd = 6.00E-03).
Hexachlorobutadiene	0.45	0.4	The DWS criteria have been adopted using the first significant figure to the right of the decimal point.
Malathion	New parameter not in existing rules	140	The standard was calculated using the DWS method for non-carcinogens (Rfd = 2.00E-02).
o-Nitrophenol	NNS	None	This pollutant has been removed from Appendix A because no numeric criteria exist for any designated use.

Pollutant	Existing DWS Criterion (µg/L)	Adopted DWS Criterion (µg/L)	Reason for Change
Paraquat	New parameter not in existing rules	32	The standard was calculated using the DWS method for non-carcinogens (Rfd = 4.50E-03).
Permethrin	New parameter not in existing rules	350	The standard was calculated using the DWS method for non-carcinogens (Rfd = 5.00E-02).
Phenol	4,200	2,100	The standard was calculated using the DWS method for non-carcinogens (Rfd = 3.00E-01).
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	0.01	0.00003	The new MCL has been adopted.
Trihalomethanes (total)	100	80	The new MCL has been adopted.
Uranium	35 D	30 D	The new MCL has been adopted.

Methodologies for Deriving Criteria for the Fish Consumption Designated Use

Numeric water quality criteria for the fish consumption (FC) designated use were derived using the following equations:

For carcinogens:

$$\frac{70\ \text{kg} * 10^{-6}}{\text{OCSF} * 17.5\ \text{grams/day} * \text{BCF}}$$

For non-carcinogens:

$$\frac{\text{Rfd} * \text{RSC} * 70\ \text{kg}}{17.5\ \text{grams/day} * \text{BCF}}$$

In the carcinogen equation, 70 kg is the average weight of a human male in kilograms; 10^{-6} is the excess cancer risk level; OCSF is the oral cancer slope factor, 17.5 grams /day is the national average fish consumption rate, and BCF is a bioconcentration factor.

In the non-carcinogen equation, Rfd is the reference dose, RSC is the relative source contribution factor, 70 kg is the average weight of a human male in kilograms, 17.5 grams/day is the national average fish consumption rate, and BCF is the bioconcentration factor.

These equations differ from those used to calculate the existing fish consumption criteria in two ways. First, the default fish consumption rate was changed from 6.5 grams/day to 17.5 grams/day. The default fish consumption rate was changed to 17.5 grams/day for several reasons. The previous rate of 6.5 grams/day was based upon the national average fish consumption value EPA used to calculate fish consumption criteria for the 1980 ambient water quality criteria documents. EPA now recommends a fish consumption rate of 17.5 grams/day to adequately protect the general population of fish consumers. The 17.5 grams/day value is based on more recent fish consumption data obtained the U.S. Department of Agriculture 1994-1996 Continuing Survey of Food Intake by Individuals (CSFII). The CSFII is considered one of the best sources of current and unbiased information on the consumption of fish by the United States population. While 17.5 grams/day might be considered on the high end of national statistics for fish consumption, there is no reliable and statistically valid local or regional data on fish consumption to support the derivation of alternative fish consumption criteria for Arizona.

Second, the relative source contribution factor (RSC) was used to calculate numeric fish consumption criteria for non-carcinogens. A default RSC factor of 20 percent was used when calculating numeric fish consumption criteria. This means that the Department assumes that 20 percent of a person's exposure to a pollutant may come from the fish consumption exposure pathway. Previously, the Department had assumed that 100 percent of a person's exposure to a pollutant came through fish consumption. EPA recommends using the 20 percent relative source contribution factor when routes of exposure to a pollutant other than fish consumption are anticipated, but adequate data to quantify those exposures are lacking. In a few instances, EPA has data suggesting a higher RSC for a particular pollutant. In those instances, the actual RSC was used rather than the default 20 percent (e.g., antimony, cadmium). The use of a higher fish consumption rate of 17.5 grams/day and an RSC factor resulted in more stringent numeric criteria for the fish consumption designated use.

Third, EPA uses the 17.5 grams/day value when making its national criteria recommendations to protect human health. The following decision criterion is used to determine the numeric criteria for fish consumption designated use:

1. For carcinogens where an OCSF was available, a criterion was calculated using the procedure for carcinogens;
2. For carcinogens where an OCSF was not available but an Rfd was available, the non-carcinogen procedure was used and a criterion was calculated for the carcinogen using the Rfd or an Rfd surrogate;
3. For non-carcinogens, a criterion was calculated using available Rfd. If an Rfd was not available in the Integrated Risk Information System (IRIS) but a surrogate Rfd was available, such as a Minimum Risk Level (MRL) from the Agency for Toxic Substances Disease Registry (ATSDR), a criterion was calculated for the non-carcinogen using the MRL;

4. Where an OCSF, Rfd, or MRL was not available, a criterion was not derived for the fish consumption designated use. If the Department did not have a bioconcentration factor for a pollutant, a FC criterion was not calculated.

Methylmercury Fish Tissue Criterion

This rulemaking adopts a fish tissue criterion for methylmercury of 0.3 mg methylmercury/kg fish tissue to protect human health. This criterion is based on EPA's recommended national criterion for methylmercury in fish tissue, "Water Quality Criterion for the Protection of Human Health: Methylmercury," EPA-823-R-01-001 (January 2001). The criterion is expressed as a maximum concentration of methylmercury in fish and shellfish *tissue* to protect the consumers of fish and shellfish in the general population. It is not a water column value.

To assess health risks, EPA derived a reference dose (Rfd) for methylmercury. A reference dose is an estimate (with uncertainty of perhaps an order of magnitude) of a daily exposure to the human population (including sensitive sub groups) that is likely to be without an appreciable risk of adverse health effects during a lifetime. To derive the Rfd, EPA established a no observed adverse effect level (NOAEL) for developmental neurotoxicity and then divided the NOAEL by a numerical uncertainty factor of 10 to account for areas of variability and uncertainty in the risk estimate.

The consumption of contaminated fish and shellfish is the primary route of human exposure to methylmercury.

Methylmercury is highly toxic to humans and causes a number of adverse health effects. Health studies have demonstrated that methylmercury is a potent neurotoxin, particularly in developing organisms. The brain is the most sensitive organ for which suitable health effects data are available to quantify a dose-response relationship.

Mercury is found in the environment as a result of natural and human activities. During its movement among the atmosphere, land, and water, mercury undergoes a series of chemical transformations. One of these transformations is to an organic form of mercury called methylmercury. Methylmercury is easily absorbed into the living tissue of aquatic organisms and is not easily eliminated. Consequently, methylmercury accumulates in the tissues of predators as they age. The Department concluded that it is more appropriate to adopt a fish tissue criterion for methylmercury instead of a water column-based water quality standard. A fish tissue criterion for methylmercury is more directly tied to the Clean Water Act goal of protecting public health because it is based directly on the primary route of human exposure to methylmercury (i.e., fish consumption). Second, the concentration of methylmercury in fish tissue is easier to quantify and is less variable over time. Third, a fish tissue criterion is consistent with how fish consumption advisories are issued. Fish consumption advisories for mercury are based on the amount of methylmercury in fish tissue that is considered acceptable. The adoption of a fish tissue standard directly supports Department issuance of fish consumption advisories.

The following table presents the existing and amended criteria for the FC designated use. The table identifies the pollutant, the current FC criterion, the amended FC criterion, and the reasons for any changes. The table lists only those pollutants where a change or repeal has been made.

Numeric Water Quality Standards for Fish Consumption

Pollutant	Existing FC Criterion (µg/L)	Adopted FC Criterion (µg/L)	Reason for Change
Acenapthene	2,670	198	The standard was calculated using FC method for non-carcinogens (Rfd = 6.00E-02); revised FC rate of 17.5 g/day; default Relative Source Contribution Factor (RSC) = 20 percent. Bioconcentration Factor (BCF = 242).
Acenaphthylene	NNS	None	This pollutant has been removed from Appendix A because no criteria exist for any designated use.
Acrolein	25	1.9	The standard was calculated using FC method for non-carcinogens (Rfd = 5.00E-04); revised FC rate of 17.5 g/day; default RSC = 20%; BCF = 215.
Acrylonitrile	0.7	0.2	The standard was calculated using FC method for carcinogens (OCSF = 5.40E-01); revised FC rate of 17.5 g/day; and BCF = 30.
Aldrin	0.0001	0.00005	The standard was calculated using FC method for carcinogens (OCSF = 1.70E+01); revised FC rate of 17.5 g/day; and BCF = 4,670.
Anthracene	1,000	74	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00E-01); revised FC rate of 17.5 g/day; and default RSC = 20%; BCF = 3,230.8.
Antimony	4,300 T	640 T	The standard was calculated using FC method for non-carcinogens (Rfd = 4.00E-04); revised FC rate of 17.5 g/day; RSC = 40%; BCF = 1.
Arsenic	1,450 T	80 T	The standard was calculated using FC method for carcinogens (OCSF = 1.50E+00); revised FC rate of 17.5 g/day; and BCF = 3.

Pollutant	Existing FC Criterion (µg/L)	Adopted FC Criterion (µg/L)	Reason for Change
Benz(a)anthracene	0.49	0.02	The standard was calculated using FC method for carcinogens (OCSF = 7.30E+00); revised FC rate of 17.5 g/day; and BCF = 30.
Benzene	140	114	The standard was calculated using FC method for carcinogens (OCSF = 3.50E-02); revised FC rate of 17.5 g/day; and BCF = 1.
3,4 Benzfluroanthene	0.49	0.02	The standard was calculated using FC method for carcinogens (OCSF = 7.30E+00); revised FC rate of 17.5 g/day; and BCF = 30.
Benzidine	0.001	0.0002	The standard was calculated using FC method for carcinogens (OCSF = 2.30E+02); revised FC rate of 17.5 g/day; and BCF = 87.5.
Benzo(a)pyrene	0.05	0.02	The standard was calculated using FC method for carcinogens (OCSF = 7.30E+00); revised FC rate of 17.5 g/day; and BCF = 30.
Benzo(ghi)perylene	NNS	None	This pollutant has been removed from Appendix A because no criteria exist for any designated use.
Benzo(k)fluoranthene	0.49	0.02	The standard was calculated using FC method for carcinogens (OCSF = 7.30E+00); revised FC rate of 17.5 g/day; and BCF = 30.
Beryllium	1,130 T	84 T	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 19.
Bis (2-chloroethoxy methane)	NNS	None	This pollutant has been removed from Appendix A because no criteria exist for any designated use.
Bis (2-chloroethyl) ether	1.4	0.5	The standard was calculated using FC method for carcinogens (OCSF = 1.10E+00); revised FC rate of 17.5 g/day; and Bioconcentration factor BCF = 6.9.
Bis (2-chloroisopropyl) ether	174,400	3,441	The standard was calculated using FC method for non-carcinogens (Rfd = 4.00 E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 9.3.
Bromodichloromethane	46	17	The standard was calculated using FC method for carcinogens (OCSF = 6.20E-02); revised FC rate of 17.5 g/day; and BCF = 3.8.
Bromoform	360	133	The standard was calculated using FC method for carcinogens (OCSF = 7.90E-03); revised FC rate of 17.5 g/day; and BCF = 3.8.
Bromomethane	4,020	299	The standard was calculated using FC method for non-carcinogens (Rfd = 1.40E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 3.8.
Butyl benzyl phthalate	5,200	386	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 414.
Carbon tetrachloride	4	2	The standard was calculated using FC method for carcinogens (OCSF = 1.30E-01); revised FC rate of 17.5 g/day; and BCF = 18.8.
Chlordane	0.002	0.0008	The standard was calculated using FC method for carcinogens (OCSF = 3.50E-01); revised FC rate of 17.5 g/day; and BCF = 14,100.
Chlorobenzene	20,900	1,553	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 10.3.
Chloroform	470	2,133	The standard was calculated using FC method for non-carcinogens (Rfd = 0.01); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 3.8.
2-Chloronapthalene	4,300	317	The standard was calculated using FC method for non-carcinogens (Rfd = 8.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 202.
2-Chlorophenol	400	30	The standard was calculated using FC method for non-carcinogens (Rfd = 5.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 134.
Chromium III	1,010,000 T	75,000 T	The standard was calculated using FC method for non-carcinogens (Rfd = 1.50E+00); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 16.
Chromium VI	2,000 T	150 T	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 16.

Pollutant	Existing FC Criterion (µg/L)	Adopted FC Criterion (µg/L)	Reason for Change
Chrysene	4.92	0.02	The standard was calculated using FC method for carcinogens (OCSF = 7.30E+00); revised FC rate of 17.5 g/day; and BCF = 30.
Cyanide (as free cyanide)	215,000 T	16,000 T	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 1.
Dalapon	161,500	8,000	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00 E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 3.
Dibenz(ah)anthracene	0.20	0.02	The standard was calculated using FC method for carcinogens (OCSF = 7.30E+00); revised FC rate of 17.5 g/day; and BCF = 30.
Dibromochloromethane	34	13	The standard was calculated using FC method for carcinogens (OCSF = 8.40E-02); revised FC rate of 17.5 g/day; and BCF = 3.80.
Dibutyl phthalate	12,100	899	The standard was calculated using FC method for non-carcinogens (Rfd = 1.00E-01); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 89.
1,2-Dichlorobenzene	2,800	205	The standard was calculated using FC method for non-carcinogens (Rfd = 9.00E-02); revised FC rate of 17.5 g/day; RSC = 20%: and BCF = 351.
1,4-Dichlorobenzene	77,500	5,755	The standard was calculated using FC method for non-carcinogens (Rfd = 0.4); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 55.6.
3,3'-Dichlorobenzidine	0.08	0.03	The standard was calculated using FC method for carcinogens (OCSF = 4.50E-01); revised FC rate of 17.5 g/day; and BCF = 312.
P,p'-Dichlorodiphenyl dichloroethane (DDD)	0.001	0.0002	The standard was calculated using FC method for carcinogens (OCSF = 3.40E-01; revised FC rate of 17.5 g/day; and BCF = 53,600.
P,p'-Dichlorodiphenyl dichloroethylene (DDE)	0.001	0.0002	The standard was calculated using FC method for carcinogens (OCSF = 3.40E-01); revised FC rate of 17.5 g/day; and BCF = 53,600.
P,p'-Dichlorodiphenyl trichloroethane (DDT)	0.0006	0.0002	The standard was calculated using FC method for carcinogens (OCSF = 3.40E-01); revised FC rate of 17.5 g/day; and BCF = 53,600.
1,1-Dichloroethane	NNS	None	This pollutant has been removed from Appendix A because no criteria exist for any designated use.
1,2-Dichloroethane	100	37	The standard was calculated using FC method for carcinogens (OCSF = 9.10E-02); revised FC rate of 17.5 g/day; and BCF = 1.2.
1,1-Dichloroethylene	320	7,143	The standard was calculated using FC method for non-carcinogens (Rfd = 5.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 5.6.
1,2-trans-Dichloroethylene	136,000	10,127	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 1.6.
Dichloromethane	1,600	593	The standard was calculated using FC method for carcinogens (OCSF = 7.50E-03); revised FC rate of 17.5 g/day; and BCF = 0.9.
2,4-Dichlorophenol	800	59	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 40.7.
1,2-Dichloropropane	236,000	17,518	The standard was calculated using FC method for non-carcinogens (Rfd = 0.09); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 4.1.
1,3-Dichloropropene	1,700	42	The standard was calculated using FC method for carcinogens (Rfd = 5.00E-02); revised FC rate of 17.5 g/day; and BCF = 1.9.
Dieldrin	0.0001	0.00005	The standard was calculated using FC method for carcinogens (OCSF = 1.60E+01); revised FC rate of 17.5 g/day; and BCF = 4,670.
Diethyl phthalate	118,000	8,767	The standard was calculated using FC method for non-carcinogens (Rfd = 8.00E-01); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 73.

Pollutant	Existing FC Criterion (µg/L)	Adopted FC Criterion (µg/L)	Reason for Change
Di(2-ethylhexyl)phthalate	7.4	3	The standard was calculated using FC method for carcinogens (OCSF = 1.40E-02); revised FC rate of 17.5 g/day; and BCF = 104.
2,4-Dimethylphenol	2,300	171	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 93.8.
4,6-Dinitro-o-cresol	7,800	582	The standard was calculated using FC method for non-carcinogens (Rfd = 4.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 5.5.
2,4-Dinitrophenol	14,400	1,067	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 1.5.
2,4-Dinitrotoluene	5,700	421	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 3.8.
1,2-Diphenylhydrazine	0.5	0.2	The standard was calculated using FC method for carcinogens (OCSF = 8.00E-01); revised FC rate of 17.5 g/day; and BCF = 24.9.
Endosulfan sulfate	NNS	18	The standard was calculated using FC method for non-carcinogens (Rfd = 6.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 270.
Endosulfan (total)	240	18	The standard was calculated using FC method for non-carcinogens (Rfd = 6.00E-03); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 270.
Endrin	0.8	0.06	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00E-04); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 3,970.
Ethylbenzene	28,700	2,133	The standard was calculated using FC method for non-carcinogens (Rfd = 1.00E-01); revised FC rate of 17.5 g/day; RSC = 20% and BCF = 37.5.
Ethyl chloride	NNS	None	This pollutant has been removed from Appendix A because no criteria exist for any designated use.
Fluoranthene	380	28	The standard was calculated using FC method for non-carcinogens (Rfd = 4.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 1,150.
Fluorene	14,400	1,067	The standard was calculated using FC method for non-carcinogens (Rfd = 4.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; BCF = 30.
Glyphosate	1,077,000	266,667	The standard was calculated using FC method for non-carcinogens (Rfd = 1.00E-01); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 0.3.
Heptachlor	0.0002	0.00008	The standard was calculated using FC method for carcinogens (OCSF = 4.50E+00); revised FC rate of 17.5 g/day; and BCF = 11,200.
Heptachlor epoxide	0.0001	0.00004	The standard was calculated using FC method for carcinogens (OCSF = 9.10E+00); revised FC rate of 17.5 g/day; and BCF = 11,200.
Hexachlorobenzene	0.001	0.0003	The standard was calculated using FC method for carcinogens (OCSF = 1.6); revised FC rate of 17.5 g/day; and BCF = 8,690.
Hexachlorobutadiene	50	18	The standard was calculated using FC method for carcinogens (OCSF = 7.80E-02); revised FC rate of 17.5 g/day; and BCF = 2.8.
Hexachlorocyclohexane alpha	0.01	0.005	The standard was calculated using FC method for carcinogens (OCSF = 6.30E+00); revised FC rate of 17.5 g/day; and BCF = 130.
Hexachlorocyclohexane gamma (lindane)	25	1.8	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00E-04); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 130.
Hexachlorocyclopentadiene	580	74	The standard was calculated using FC method for non-carcinogens (Rfd = 6.00E-04); revised FC rate of 17.5 g/day; RSC = 40%; and BCF = 130.
Hexachloroethane	9	3.3	The standard was calculated using FC method for carcinogens (OCSF = 1.40E-02); revised FC rate of 17.5 g/day; and BCF = 86.9.

Pollutant	Existing FC Criterion (µg/L)	Adopted FC Criterion (µg/L)	Reason for Change
Indeno (1,2,3-cd) pyrene	0.49	0.2	The standard was calculated using FC method for non-carcinogens (OCSF = 7.3E-01); revised FC rate of 17.5 g/day; and BCF = 30.
Isophorone	2,600	961	The standard was calculated using FC method for carcinogens (OCSF = 9.50E-04); revised FC rate of 17.5 g/day; and BCF = 4.4.
Mercury	0.6 T	None	Mrcury FC criterion was replaced with methylmercury fish tissue criterion.
Methylmercury	New parameter not in existing rules	Fish tissue criterion 0.3 mg/kg	Based on EPA § 304(a) national criteria recommendation for methylmercury in fish tissue.
Napthalene	20,500	1,524	The standard was calculated using FC method for non-carcinogens (Rfd =2.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 10.5.
Nickel	4,600 T	511 T	The standard was calculated using FC method for non-carcinogens (Rfd =2.00E-02); revised FC rate of 17.5 g/day; RSC = 30%; and BCF = 47.
Nitrobenzene	1,900	138	The standard was calculated using FC method for non-carcinogens (Rfd =5.00E-04); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 2.9.
o-Nitrophenol	NNS	None	This pollutant has been removed from Appendix A because no criteria exist for any designated use.
N-Nitrosodimethylamine	8	3	The standard was calculated using FC method for carcinogens (OCSF = 5.10E+01); revised FC rate of 17.5 g/day; and BCF = 0.026.
N-Nitrosodi-n-phenylamine	16	6	The standard was calculated using FC method for carcinogens (OCSF = 4.90E-03); revised FC rate of 17.5 g/day; and BCF = 136.
N-Nitrosodi-n-propylamine	1.4	0.5	The standard was calculated using FC method for carcinogens (OCSF = 7.00E+00); revised FC rate of 17.5 g/day; and BCF = 1.1.
Pentachlorophenol	1,000	370	The standard was calculated using FC method for carcinogens (OCSF = 1.20E-01); revised FC rate of 17.5 g/day; and BCF = 0.1.
Phenol	1,000	37	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00E-01); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 6,462.
Picloram	24,300	2,710	The standard was calculated using FC method for non-carcinogens (Rfd = 7.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 31.
Polychlorinated biphenyls (PCBs)	0.007	0.00006	The standard was calculated using FC method for carcinogens (OCSF = 2); revised FC rate of 17.5 g/day; and BCF = 31,200.
Pyrene	10,800	800	The standard was calculated using FC method for non-carcinogens (Rfd = 3.00E-02); revised FC rate of 17.5 g/day; and RSC = 20%. BCF = 30.
Selenium	9,000 T	667 T	The standard was calculated using FC method for non-carcinogens (Rfd =5.00E-03); revised FC rate of 17.5 g/day; and RSC = 20%. BCF = 6.
Silver	107,700 T	8,000 T	The standard was calculated using FC method for non-carcinogens (Rfd =5.00E-03); revised FC rate of 17.5 g/day; and RSC = 20%. BCF = 0.5.
Sulfides	NNS	None	Sulfides was replaced with hydrogen sulfide.
2,3,7,8-Tetrachlorodibenzo-p-dixoin	0.000000004	0.000000005	The standard was calculated using FC method for carcinogens (OCSF = 1.00E+07); revised FC rate of 17.5 g/day; and BCF = 5,000.
1,1,2,2-Tetrachloroethane	11	4	The standard was calculated using FC method for carcinogens (OCSF = 2.00E-01); revised FC rate of 17.5 g/day; and BCF = 5.
Tetrachloroethylene	3,500	261	The standard was calculated using FC method for non-carcinogens (Rfd =1.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 30.6.
Thallium	7.2 T	1 T	The standard was calculated using FC method for non-carcinogens (Rfd =8.00E-05); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 119.

Pollutant	Existing FC Criterion (µg/L)	Adopted FC Criterion (µg/L)	Reason for Change
Toluene	201,000	29,907	The standard was calculated using FC method for non-carcinogens (Rfd = 2.00E-01); revised FC rate of 17.5 g/day; RSC = 40%; and BCF = 10.7.
Toxaphene	0.001	0.0003	The standard was calculated using FC method for carcinogens (OCSF = 1.10E+00); revised FC rate of 17.5 g/day; and BCF = 13,100.
1,2,4-Trichlorobenzene	950	70	The standard was calculated using FC method for non-carcinogens (Rfd = 1.00E-02); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 114.
1,1,1 Trichloroethane	NNS	428,571	The standard was calculated using FC method for non-carcinogens (Rfd = 2.0E+00); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 5.6.
1,1,2-Trichloroethane	42	16	The standard was calculated using FC method for carcinogens (OCSF = 5.70E-02); revised FC rate of 17.5 g/day; and BCF = 4.5.
Trichloroethylene	203,200	29	The standard was calculated using FC method for carcinogens (OCSF = 1.3E-02); revised FC rate of 17.5 g/day; and BCF = 10.6.
2,4,6-Trichlorophenol	6.5	2	The standard was calculated using FC method for carcinogens (Rfd = 1.1E-02); revised FC rate of 17.5 g/day; and BCF = 150.
Vinyl Chloride	13	5	The standard was calculated using FC method for carcinogens (OCSF = 7.20E-01); revised FC rate of 17.5 g/day; and BCF = 1.2.
Zinc	69,000 T	5,106 T	The standard was calculated using FC method for non-carcinogens (Rfd = 0.3); revised FC rate of 17.5 g/day; RSC = 20%; and BCF = 47.

Methodologies for Deriving Criteria for the Full Body Contact Designated Use

The numeric water quality criteria for the full body contact (FBC) designated use was derived using the following equations:

For carcinogens:

$$\frac{70\text{ kg} * 10^{-6}}{\text{OCSF} * 15\text{ ml/day}}$$

For non-carcinogens:

$$\frac{\text{Rfd} * \text{RSC} * 70\text{ kg}}{15\text{ ml/day}}$$

In the carcinogen equation, 70 kg is the average weight of a human male in kilograms; 10^{-6} is the excess cancer risk level; OCSF is the oral cancer slope factor, and 15 ml/day is the incidental water ingestion rate in milliliters per day.

In the non-carcinogen equation, Rfd is the reference dose, RSC is the relative source contribution factor, 70 kg is the average weight of a human male in kilograms, and 15 ml/day is the incidental water ingestion rate in milliliters per day.

These equations differ from those used to calculate the existing full body contact criteria in two ways. First, the rulemaking changes the incidental water ingestion rate from 50 ml/day to 15 ml/day. The previous rate of 50 ml/day was based upon 1989 EPA recommendations for incidental water ingestion rate associated with swimming contained in "Exposure Factors Handbook," Exposure Assessment Group, EPA/600/8-89/043. (May, 1989), U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Washington, D.C. In 2000, EPA published a new guidance document that addresses incidental ingestion of water from recreational uses in "Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, EPA-822-B-00-004, (October 2000). While EPA does not make national criteria recommendations for recreational uses like FBC, EPA does suggest approaches to estimating exposure to pollutants through incidental ingestion during recreation. Literature on recreational exposure combined with assumptions about the average mouthful of water ingested for every hour of total body contact can be used to determine an incidental water ingestion rate. EPA now recommends an incidental ingestion rate of 10 ml/day. This estimate is based on an assumption that an individual may be in full body contact with water for 123 hours a year (representing one hour exposure per day throughout four summer months) and may ingest 30 ml of water per hour of swimming. EPA calculated the 10 ml/day value by multiplying 30 ml/hour by 123 hours per year and dividing the product by 365 days. Studies of recreational exposures suggest that there may be considerable variability in this incidental water ingestion rate. EPA notes that while the recommended value of 10 ml/day may be appropriate where full body contact recreational activities may occur daily during the summer months, states in warmer climates, like Arizona, may wish to use a higher incidental ingestion rate to protect their populations that may swim in surface waters for a greater portion of the year. The Department assumed that persons in Arizona could engage in full body contact recreational activities for more than four months in a year. The incidental water ingestion rate of 15 ml/day is based on the assumption that a person may engage in full body contact recreational activity for 180 hours per year (representing one hour exposure per day throughout six warm-weather months) and ingest 30 ml of water per hour. The 15 ml/day value is calculated by multiplying 30 ml/hour by 180 hours per year and dividing by 365.

Second, the relative source contribution factor (RSC) is used to calculate numeric full body contact criteria for non-carcinogens to account for other exposure pathways. A default RSC factor of 20 percent was used when calculating numeric FBC criteria unless EPA recommended a higher RSC (e.g., antimony, barium). The Department assumes that 20 percent of a person's exposure to a pollutant may come from incidental water ingestion while engaged in water-based recreation. Previously, the Department had calculated criteria assuming that 100 percent of a person's exposure to a pollutant came through a single exposure pathway, e.g., through full body contact recreation.

This rulemaking adopts numeric criteria for the full body contact designated use using the following decision criteria:

1. A criterion was calculated using the appropriate procedure for carcinogens or non-carcinogens;
2. For carcinogens where an OCSF was not available but an Rfd was available, the non-carcinogen procedure was used and a criterion was calculated for the carcinogen using the Rfd or a surrogate Rfd;
3. For non-carcinogens, a criterion was calculated using available Rfds. If an Rfd was not available in the Integrated Risk Information System (IRIS) but a surrogate Rfd was available, such as a Minimum Risk Level (MRL) from the Agency for Toxic Substances Disease Registry (ATSDR), a criterion for the non-carcinogen was calculated using the MRL;
4. Where an OCSF, Rfd or MRL was unavailable, a criterion was not derived for the full body contact designated use.
5. Where the calculated full body contact standard was more stringent than the Domestic Water Source standard for the same pollutant, the DWS value was used in place of the calculated PBC value. It is unlikely that an individual will be more at risk from incidental ingestion during recreational activities than through direct consumption.

Full Body Contact Criterion for Arsenic

Arsenic is categorized by the EPA as a Class A carcinogen (i.e., a demonstrated human carcinogen based on sufficient human epidemiological evidence (as opposed to animal studies)). Increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic.

Calculation of the FBC criteria using the standard equation above would yield new FBC criteria of 3 µg/L. This concentration was more stringent than the new drinking water MCL for arsenic of 10 µg/L and the arsenic criterion that was being considered to maintain and protect water quality in surface waters with the domestic water source (DWS) designated use (also 10 µg/L). The Department did not think it was reasonable to adopt a FBC criterion for arsenic that was more stringent than the new drinking water MCL or the proposed DWS criterion for arsenic, particularly when it was unlikely that persons engaged in full body contact recreational activity would be more highly exposed to arsenic through incidental ingestion of water than persons who are assumed to ingest 2 liters of drinking water each day.

In the 2000 Human Health Methodology guidance document described earlier in this section, EPA provides that states may use alternate minimum risk levels in standards derivation. It states that 10^{-6} and 10^{-5} are appropriate risk levels for health protection of the general population provided more highly exposed subpopulations do not exceed the 10^{-4} risk level. EPA allows states to adopt a water quality criterion for a pollutant based on an excess cancer risk level of 10^{-5} provided that the chosen risk level is protective of the most highly exposed populations and there is adequate public participation in the decision to use a risk level other than 10^{-6}. As noted earlier, the Department made conservative assumptions when choosing the exposure parameters for deriving criteria for the FBC designated use regarding the amount of time a person may swim in an Arizona lake or stream and the estimated amount of incidental ingestion. The Department believes it is unlikely that there is a highly exposed subpopulation in Arizona that is engaged in full body contact recreational activities in Arizona lakes and reservoirs for more than an hour a day for more than 6 months out of the year.

Based on EPA's guidance on excess cancer risk levels and the conservative assumptions of exposure, this rulemaking adopts the full body contact water quality criterion for arsenic based on an excess cancer risk level of 10^{-5}. The new FBC criterion for arsenic is calculated as follows:

$$\frac{70 \text{ kg} \times 10^{-5}}{1.5\text{E+00} \times 15 \text{ ml/day}} = 31\ \mu\text{g/L}$$ (The value has been rounded down to 30 µg/L)

It should be noted that the FBC criterion of 30 µg/L, while not as stringent as the drinking water MCL or the DWS criterion (10 µg/L), it is *more* stringent than the currently effective FBC criterion of 50 µg/L in rule.

The following table presents the existing and criteria for the FBC designated use. The table identifies the pollutant, the current FBC criterion, the FBC criterion, and the reasons for any changes. The use of a revised water ingestion rate and an RSC factor resulted in more stringent numeric criteria for the full body contact designated use. The table lists only those pollutants where a change or repeal has been made.

Numeric Water Quality Standards for Full Body Contact

Pollutant	Existing FBC Criterion (µg/L)	Adopted FBC Criterion (µg/L)	Reason for Change
Acenapthene	84,000	56,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 6.00E-02); revised FBC water ingestion rate of 15 ml/day and Relative Source Contribution Factor (RSC) = 20%.
Acrolein	700	467	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-04); revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
Alachlor	14,000	9,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-02); revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
Anthracene	420,000	280,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-01); revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
Antimony	560 T	747 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 4.00E-04); revised FBC water ingestion rate of 15 ml/day and RSC = 40%.
Arsenic	50 T	30 T	The standard was calculated using FBC method for carcinogens (OCSF = 1.5E+00); revised FBC water ingestion rate of 15 ml/day. The Department used 10^{-5} as the Excess Cancer Risk Level (ECRL) for arsenic.
Atrazine	49,000	32,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.50E-02); revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
Benz(a)anthracene	1.9	0.2	The standard was calculated using FBC method for carcinogens (OCSF = 7.30E+00); revised FBC water ingestion rate of 15 ml/day.
Benzo(ghi)perylene	NNS	None	This pollutant has been deleted from Appendix A because of a lack of criteria for any designated use.
Beryllium	2,800 T	1,867 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-03), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.
Bis(2-chloroethoxy) methane	NNS	None	This pollutant has been deleted from Appendix A because no criteria exist for any designated use.
Bis(2-chloroethyl) ether	1.3	1	The standard was calculated using FBC method for carcinogens (OCSF = 1.10E+00); revised FBC water ingestion rate of 15 ml/day.
Bis(2-chloroisopropyl) ether	56,000	37,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 4.00E-02); revised FBC rate of 15 ml/day; and RSC = 20%.
Boron	126,000 T	186,667 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-01), revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
Bromodichloromethane	TTHM	18,667	The standard was calculated using FBC method for carcinogens (OCSF = 6.20E-02); revised FBC water ingestion rate of 15 ml/day.
Bromomethane	2,000	1,307	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.40E-03), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.
Butyl benzyl phthalate	280,000	186,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-01), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.
Cadmium	700 T	700 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-04), revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
Carbofuran	7,000	4,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-03), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.
Chlorine (total residual)	140,000	4,000	The maximum residual disinfection level (MRDL) from EPA 1998 Final Rule for Disinfectants and Disinfection-By-Products has been adopted.
Chlorobenzene	28,000	18,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.
Chloroform	230	9,333	The standard was calculated using FBC method for non-carcinogens (Rfd =0.01), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.

Pollutant	Existing FBC Criterion (µg/L)	Adopted FBC Criterion (µg/L)	Reason for Change
2-Chloronapthalene	112,000	74,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 8.00E-02), revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
2-Chlorophenol	7,000	4,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-03), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.
Chloropyrifos	Not in existing rules	2,800	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-03), revised FBC water ingestion rate of 15 ml/day and RSC = 20%.
Chromium III	2,100,000 T	1,400,000 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.50E+00), revised FBC water ingestion rate of 15 ml/day; and RSC = 20%.
Chromium VI	4,200 T	2,800 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-03), revised FBC water ingestion rate of 15 ml/day, Relative Source Contribution Factor (RSC) = 20%.
Chromium (total)	100 T	None	No OCSF or Rfd exists to calculate a FBC criterion.
Cyanide (as free cyanide)	28,000 T	18,667 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Dalapon	42,000	28,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-02); revised FBC rate of 15 ml/day; and RSC = 20%.
Dibromochloromethane	TTHM	18,667	The standard was calculated using FBC method for carcinogens (OCSF = 8.40E-02); revised FBC water ingestion rate of 15 ml/day.
1,2-Dibromo-3-chloropropane	2,800	None	No OCSF or Rfd exists to calculate FBC criterion.
1,2-Dibromoethane	0.05	8,400	The standard was calculated using FBC method for non-carcinogens (Rfd = 9.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Dibutyl phthalate	140,000	93,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2-Dichlorobenzene	126,000	84,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 9.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,4-Dichlorobenzene	560,000	373,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 0.04), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
p,p’-Dichlorodiphenyl dichloroethane (DDD)	5.8	4	The standard was calculated using FBC method for carcinogens (OCSF = 3.40E-01); revised FBC water ingestion rate of 15 ml/day.
p,p’-Dichlorodiphenyl dichloroethylene (DDE)	4.1	4	The standard was calculated using FBC method for carcinogens (OCSF = 3.40E-01); revised FBC water ingestion rate of 15 ml/day.
p,p’-Dichlorodiphenyl trichloroethane (DDT)	4.1	4	The standard was calculated using FBC method for carcinogens (OCSF = 3.40E-01); revised FBC water ingestion rate of 15 ml/day.
1,1-Dichloroethylene	230	46,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2-trans-Dichloroethylene	28,000	18,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,4-Dichlorophenol	4,200	2,800	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,4-Dichlorophenoxyacetic acid (2,4-D)	14,000	9,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2-Dichloropropane	126,000	84,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 0.09); revised FBC water injection rate of 15 ml/day; and RSC = 20%.

Pollutant	Existing FBC Criterion (µg/L)	Adopted FBC Criterion (µg/L)	Reason for Change
Diethyl phthalate	1,120,000	746,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 8.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Di(2-ethylhexyl) adipate	1,200	560,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 6.00E-01); revised FBC water injection rate of 15 ml/day; and RSC = 20%.
Di(2-ethylhexyl)phthalate	100	1,200	The standard was calculated using FBC method for carcinogens (OCSF = 1.40E-02); revised FBC water ingestion rate of 15 ml/day.
2,4-Dimethylphenol	28.000	18,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
4,6-Dinitro-o-cresol	5,600	3,733	The standard was calculated using FBC method for non-carcinogens (Rfd = 4.00E-03); revised FBC water injection rate of 15 ml/day; and RSC = 20%.
2,4-Dinitrophenol	2,800	1,867	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-03), revised FBC water ingestion rate of 15 ml/day, RSC = 20%.
2,4-Dinitrotoluene	2,800	1,867	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Di-n-octyl phthalate	560,000	373,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 0.4); revised FBC water injection rate of 15 ml/day; and RSC = 20%.
Dinoseb	1,400	933	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-03); revised FBC water injection rate of 15 ml/day; and RSC = 20%.
Diquat	3,080	2,053	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.20E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Endosulfan sulfate	NNS	5,600	The standard was calculated using FBC method for non-carcinogens (Rfd = 6.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Endosulfan (total)	8,400	5,600	The standard was calculated using FBC method for non-carcinogens (Rfd = 6.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Endothall	28,000	18,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day, RSC = 20%.
Endrin	420	280	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-04), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Ethylbenzene	140,000	93,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Fluoranthene	56,000	37,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 4.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Fluorene	56,000	37,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 4.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Fluoride	84,000	140,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 6.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 50%.
Glyphosate	140,000	93,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Hexachlorocyclohexane gamma (lindane)	420	280	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-04), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Hexachlorocyclopentadiene	9,800	11,200	The standard was calculated using FBC method for non-carcinogens (Rfd = 6.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 40%.

Pollutant	Existing FBC Criterion (µg/L)	Adopted FBC Criterion (µg/L)	Reason for Change
Hexachloroethane	100	100	The standard was calculated using FBC method for carcinogens (OCSF = 1.40E-02); revised FBC water ingestion rate of 15 ml/day.
Malathion	Not in existing rules	18,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Manganese	196,000 T	130,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.40E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Mercury	420 T	280 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-04), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Methoxychlor	7,000	4,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Napthalene	28,000	18,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Nickel	28,000 T	28,000 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 30%.
Nitrate	2,240,000	3,733,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.60E+00), revised FBC water ingestion rate of 15 ml/day, and RSC = 50%.
Nitrite	140,000	233,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 50%.
Nitrobenzene	700	467	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-04), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Oxamyl	35,000	23,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.50E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Paraquat	Not in existing rules	4,200	The standard was calculated using FBC method for non-carcinogens (Rfd = 4.50E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Permethrin	Not in existing rules	46,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Phenol	840,000	280,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Picloram	98,000	65,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 7.00E-02); revised FBC water injection rate of 15 ml/day; and RSC = 20%.
Polychlorinated biphenyls (PCBs)	28	19	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-05); revised FBC water injection rate of 15 ml/day; and RSC = 20%.
Pyrene	42,000	28,000	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Selenium	7,000 T	4,667 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Silver	7,000 T	4,667 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Simazine	7,000	4,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 5.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.

Pollutant	Existing FBC Criterion (µg/L)	Adopted FBC Criterion (µg/L)	Reason for Change
Styrene	280,000	186,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,3,7,8-Tetrachlorodibenzo-p-dixoin	0.00009	0.00003	The standard was calculated using FBC method for carcinogens (OCSF = 1.00E+07); revised FBC water ingestion rate of 15 ml/day. Resultant value is more stringent than DWS so default to DWS.
Tetrachloroethylene	14,000	9,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Thallium	112 T	75 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 8.00E-05), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Toluene	280,000	373,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 2.00E-01), revised FBC water ingestion rate of 15 ml/day, and RSC = 40%.
1,2,4-Trichlorobenzene	14,000	9,333	The standard was calculated using FBC method for non-carcinogens (Rfd = 1.00E-02), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,1,1-Trichloroethane	200	1,866,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 2); revised FBC water injection rate of 15 ml/day; and RSC = 20%.
2,4,5-Trichlorophenoxy proprionic acid (2,4,5-TP)	11,200	7,467	The standard was calculated using FBC method for non-carcinogens (Rfd = 8.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Uranium	NNS	2,800	The standard was calculated using FBC method for non-carcinogens (Rfd = 3.00E-03), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Xylenes (total)	2,800,000	186,667	The standard was calculated using FBC method for non-carcinogens (Rfd = 0.2), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.
Zinc	420,000 T	280,000 T	The standard was calculated using FBC method for non-carcinogens (Rfd = 0.3), revised FBC water ingestion rate of 15 ml/day, and RSC = 20%.

Methodologies for Deriving Criteria for the Partial Body Contact Designated Use

The Department derived numeric water quality criteria for the partial body contact (PBC) designated use using the following equation:

$$\frac{\text{Rfd} * \text{RSC} * 70\text{ kg}}{15\text{ ml/day}}$$

In this equation, Rfd is the reference dose, RSC is the relative source contribution factor, 70 kg is the average weight of a human male in kilograms, and 15 ml/day is the incidental water ingestion rate in milliliters per day. The equation is the same equation used to derive numeric criteria for non-carcinogens for the full body contact designated use.

This equation is different from the methods the Department has used in previous rulemakings to calculate PBC criteria. When PBC criteria were originally proposed in 1992, the Department followed recommendations for water quality criteria for the PBC designated use developed by members of the regulated community and published in "Proposed Human Health Ambient Water Quality Standards for Arizona" (EBASCO Environmental, et. al 1990). EBASCO recommended a criteria development method for PBC that included using reference doses and average weight of the human male of 70 kg but with an incidental water ingestion rate of 0.5 liter (500 ml). In 2002, the Department revised the EBASCO methodology because it used what the Department considered to be an unreasonable incidental water ingestion rate of 500 ml to derive the PBC criteria (a rate that was 10 times higher than the incidental water ingestion rate used to calculate the FBC criteria in 1992). In 2002, the Department used the following equation to derive PBC criteria:

$$\frac{\text{Rfd} \times 70\text{ kg}}{50\text{ ml/day}}$$

This rulemaking revises the incidental water ingestion rate for both the FBC and PBC designated uses to 15 ml/day. The incidental water ingestion rate for the PBC designated use should not be higher than the rate used for the FBC designated use. In the absence of reliable data to derive PBC criteria based on dermal exposures or another incidental ingestion rate, the rulemaking relies on incidental water ingestion rate used in the FBC methodology to derive criteria for the PBC designated use.

The rulemaking adopts numeric criteria for the partial body contact designated use using the following decision criteria:

1. Calculate a criterion using the PBC equation using available Rfds. If an Rfd is not available in the Integrated Risk Information System (IRIS) but a surrogate Rfd is available, such as a Minimum Risk Level (MRL) from the Agency for Toxic Substances and Disease Registry (ATSDR), a PBC criterion is calculated using the MRL; and
2. A criterion for the partial body contact designated use was not derived if there was no Rfd or MRL.

The following table presents the existing and proposed criteria for the PBC designated use. The table identifies the pollutant, the current PBC criterion, the proposed PBC criterion, and the reasons for any proposed changes. The use of a revised water ingestion rate and an RSC factor resulted in more stringent numeric criteria for the partial body contact designated use. The table lists only those pollutants where a change or repeal has been made.

Numeric Water Quality Standards for Partial Body Contact

Pollutant	Existing PBC Criterion (µg/L)	Adopted PBC Criterion (µg/L)	Reason for Change
Acenapthene	84,000	56,000	The standard was calculated using PBC method (Rfd = 6.00E-02), revised PBC water ingestion rate of 15ml/day, and RSC = 20%.
Acrolein	700	467	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15ml/day, and RSC = 20%.
Acrylonitrile	56,000	37,333	The standard was calculated using PBC method (Rfd = 0.04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Alachlor	14,000	9,333	The standard was calculated using PBC method (Rfd = 1.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Aldrin	42	28	The standard was calculated using PBC method (Rfd 3.00E-05), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Anthracene	420,000	280,000	The standard was calculated using PBC method (Rfd = 3.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Antimony	560 T	747 T	The standard was calculated using PBC method (Rfd = 4.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 40%.
Arsenic	420 T	280 T	The standard was calculated using PBC method (Rfd = 3.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Atrazine	49,000	32,667	The standard was calculated using PBC method (Rfd = 3.50E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Benzene	93	3,733	The standard was calculated using PBC method (Rfd = 4.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Benzidine	4,200	2,800	The standard was calculated using PBC method (Rfd = 3.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Beryllium	2,800 T	1,867 T	The standard was calculated using PBC method (Rfd = 2.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Bis(2-chloroisopropyl) ether	56,000	37,333	The standard was calculated using PBC method (Rfd 4.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Boron	126,000 T	186,667	The standard was calculated using PBC method (Rfd = 2.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Bromodichloromethane	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day and RSC = 20%.
Bromoform	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.

Pollutant	Existing PBC Criterion (µg/L)	Adopted PBC Criterion (µg/L)	Reason for Change
Bromomethane	2,000	1,307	The standard was calculated using PBC method (Rfd = 1.40E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Butyl benzyl phthalate	280,000	186,667	The standard was calculated using PBC method (Rfd = 2.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Cadmium	700 T	700 T	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Carbofuran	7,000	4,667	The standard was calculated using PBC method (Rfd = 5.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Carbon tetrachloride	980	1,307	The standard was calculated using PBC method (Rfd = 7.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 40%.
Chlordane	700	467	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Chlorine (total residual)	140,000	4,000	The maximum residual disinfection level (MRDL) has been adopted from EPA's 1998 Final Rule for Disinfectants and Disinfection-By-Products. Proposed concentration is the level to avoid eye and skin irritation.
Chlorobenzene	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Chloroform	14,000	9,333	The standard was calculated using PBC method (Rfd = 0.01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2-Chloronapthalene	112,000	74,667	The standard was calculated using PBC method (Rfd = 8.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2-Chlorophenol	7,000	4,667	The standard was calculated using PBC method (Rfd = 5.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Chloropyrifos	Not in existing rules	2,800	The standard was calculated using PBC method (Rfd = 3.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Chromium III	2,100,000 T	1,400,000 T	The standard was calculated using PBC method (Rfd = 1.50E+00, revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Chromium VI	4,200 T	2,800 T	The standard was calculated using PBC method (Rfd = 3.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Chromium (total)	100 T	None	No Rfd or MRL exists to calculate a PBC criterion.
Cyanide (as free cyanide)	28,000 T	18,667 T	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Dalapon	42,000	28,000	The standard was calculated using PBC method (Rfd = 3.00E-02); revised PBC water ingestion rate of 15 ml/day and RSC = 20%.
Dibromochloromethane	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2-Dibromo-3-chloropropane	2,800	None	No Rfd or MRL exists to calculate a PBC method or criterion.
1,2-Dibromoethane	0.05	8,400	The standard was calculated using PBC method (Rfd = 9.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Dibutyl phthalate	140,000	93,333	The standard was calculated using PBC method (Rfd = 1.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.

Pollutant	Existing PBC Criterion (µg/L)	Adopted PBC Criterion (µg/L)	Reason for Change
1,2-Dichlorobenzene	126,000	84,000	The standard was calculated using PBC method (Rfd = 9.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,4-Dichlorobenzene	560,000	373,333	The standard was calculated using PBC method (Rfd = 0.4), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
p,p'-Dichlorodiphenyl dichloro-ethane (DDD)	5.8	467	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
p,p'-Dichlorodiphenyl dichloro-ethylene (DDE)	4.1	467	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
p,p'-Dichlorodiphenyl trichloro-ethane (DDT)	700	467	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2-Dichloroethane	280,000	186,667	The standard was calculated using PBC method (MRL = 2.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,1-Dichloroethylene	12,600	46,667	The standard was calculated using PBC method (Rfd = 5.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2-trans-Dichloroethylene	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Dichloromethane	84,000	56,000	The standard was calculated using PBC method (Rfd = 6.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,4-Dichlorophenol	4,200	2,800	The standard was calculated using PBC method (Rfd = 3.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,4-Dichlorophenoxyacetic acid (2,4-D)	14,000	9,333	The standard was calculated using PBC method (Rfd = 1.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2-Dichloropropane	126,000	84,000	The standard was calculated using PBC method (Rfd = 0.09), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,3-Dichloropropene	420	28,000	The standard was calculated using PBC method (Rfd = 3.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Dieldrin	70	47	The standard was calculated using PBC method (Rfd = 5.00E-05), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Diethyl phthalate	1,120,000	746,667	The standard was calculated using PBC method (Rfd = 8.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Di(2-ethylhexyl) adipate	840,000	560,000	The standard was calculated using PBC method (Rfd = 6.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Di(2-ethylhexyl)phthalate	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,4-Dimethylphenol	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
4,6-Dinitro-o-cresol	5,600	3,733	The standard was calculated using PBC method (Rfd = 0.004), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,4-Dinitrophenol	2,800	1,867	The standard was calculated using PBC method (Rfd = 2.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.

Pollutant	Existing PBC Criterion (µg/L)	Adopted PBC Criterion (µg/L)	Reason for Change
2,4-Dinitrotoluene	2,800	1,867	The standard was calculated using PBC method (Rfd = 2.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,6-Dinitrotoluene	5,600	3,733	The standard was calculated using PBC method (MRL = 4.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Di-n-octyl phthalate	560,000	373,333	The standard was calculated using PBC method (Rfd = 0.4), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Dinoseb	1,400	933	The standard was calculated using PBC method (Rfd = 1.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Diquat	3,080	2,053	The standard was calculated using PBC method (Rfd = 2.20E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Endosulfan sulfate	NNS	5,600	The standard was calculated using PBC method (Rfd = 6.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Endosulfan (total)	8,400	5,600	The standard was calculated using PBC method (Rfd = 6.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Endothall	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Endrin	420	280	The standard was calculated using PBC method (Rfd = 3.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Ethylbenzene	140,000	93,333	The standard was calculated using PBC method (Rfd = 1.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Fluoranthene	56,000	37,333	The standard was calculated using PBC method (Rfd = 4.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Fluorene	56,000	37,333	The standard was calculated using PBC method (Rfd = 4.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Fluoride	84,000	140,000	The standard was calculated using PBC method (Rfd = 6.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 50%.
Glyphosate	140,000	93,333	The standard was calculated using PBC method (Rfd = 1.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Heptachlor	700	467	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Heptachlor epoxide	18	12	The standard was calculated using PBC method (Rfd = 1.30E-05), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Hexachlorobenzene	1,120	747	The standard was calculated using PBC method (Rfd = 8.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Hexachlorobutadiene	280	187	The standard was calculated using PBC method (MRL = 2.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Hexachlorocyclohexane alpha	11,200	7,467	The standard was calculated using PBC method (MRL = 8.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Hexachlorocyclohexane beta	840	560	The standard was calculated using PBC method (MRL = 6.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.

Pollutant	Existing PBC Criterion (µg/L)	Adopted PBC Criterion (µg/L)	Reason for Change
Hexachlorocyclohexane gamma (lindane)	420	280	The standard was calculated using PBC method (Rfd = 3.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Hexachlorocyclopentadiene	9,800	11,200	The standard was calculated using PBC method (Rfd = 6.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 40%.
Hexachloroethane	1,400	933	The standard was calculated using PBC method (Rfd = 1.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Isophorone	280,000	186,667	The standard was calculated using PBC method (Rfd = 2.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Malathion	Not in existing rules	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Manganese	196,000 T	130,667	The standard was calculated using PBC method (Rfd = 1.40E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Mercury	420 T	280 T	The standard was calculated using PBC method (Rfd = 3.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Methoxychlor	7,000	4,667	The standard was calculated using PBC method (Rfd = 5.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Napthalene	28,000	18,667	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Nickel	28,000 T	28,000 T	The standard was calculated using PBC method (Rfd = 2.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 30%.
Nitrate	2,240,000	3,733,333	The standard was calculated using PBC method (Rfd = 1.60E+00), revised PBC water ingestion rate of 15 ml/day, and RSC = 50%.
Nitrite	140,000	233,333	The standard was calculated using PBC method (Rfd = 1.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 50%.
Nitrobenzene	700	467	The standard was calculated using PBC method (Rfd = 5.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
N-Nitrosodi-n-propylamine	133,000	88,667	The standard was calculated using PBC method (MRL = 9.5E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Oxamyl	35,000	23,333	The standard was calculated using PBC method (Rfd = 2.50E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Paraquat	Not in existing rules	4,200	The standard was calculated using PBC method (Rfd = 4.50E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Pentachlorophenol	42,000	28,000	The standard was calculated using PBC method (Rfd = 3.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Permethrin	Not in existing rules	46,667	The standard was calculated using PBC method (Rfd = 5.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Phenol	840,000	280,000	The standard was calculated using PBC method (Rfd = 3.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Picloram	98,000	65,333	The standard was calculated using PBC method (Rfd = 0.07), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.

Pollutant	Existing PBC Criterion (µg/L)	Adopted PBC Criterion (µg/L)	Reason for Change
Polychlorinated biphenyls (PCBs)	28	19	The standard was calculated using PBC method (Rfd = 2.00E-05), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Pyrene	42,000	28,000	The standard was calculated using PBC method (Rfd = 3.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Selenium	7,000 T	4,667 T	The standard was calculated using PBC method (Rfd = 5.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Silver	7,000 T	4,667 T	The standard was calculated using PBC method (Rfd = 5.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Simazine	7,000	4,667	The standard was calculated using PBC method (Rfd = 5.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Styrene	280,000	186,667	The standard was calculated using PBC method (Rfd = 2.00E-01), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,3,7,8-Tetrachlorodibenzo-p-dixoin	1.4	0.0009	The standard was calculated using PBC method (Rfd = 1.00E-09), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,1,2,2-Tetrachloroethane	56,000	93,333	The standard was calculated using PBC method (MRL = 0.04), revised PBC water ingestion rate of 15 ml/day, and RSC = 50%.
Tetrachloroethylene	14,000	9,333	The standard was calculated using PBC method (Rfd = 1.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.)
Thallium	112 T	75 T	The standard was calculated using PBC method (Rfd = 8.00E-05), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Toluene	280,000	373,333	The standard was calculated using PBC method (Rfd = 0.2), revised PBC water ingestion rate of 15 ml/day, and RSC = 40%.
Toxaphene	1,400	933	The standard was calculated using PBC method (MRL = 1.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,2,4-Trichlorobenzene	14,000	9,333	The standard was calculated using PBC method (Rfd = 1.00E-02), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,1,1-Trichloroethane	200	1,866,667	The standard was calculated using PBC method (Rfd = 2), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
1,1,2-Trichloroethane	5,600	3,733	The standard was calculated using PBC method (Rfd = 2), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Trichloroethylene	280,000	280	The standard was calculated using PBC method (Rfd = 3.00E-04), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
2,4,5-Trichlorophenoxy propri-onic acid (2,4,5-TP)	11,200	7,467	The standard was calculated using PBC method (Rfd = 8.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Uranium	NNS	2,800	The standard was calculated using PBC method (Rfd = 3.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Vinyl Chloride	4,200	2,800	The standard was calculated using PBC method (Rfd = 3.00E-03), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.
Xylenes (total)	2,800,000	186,667	The standard was calculated using PBC method (Rfd = 0.2), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.

Pollutant	Existing PBC Criterion (µg/L)	Adopted PBC Criterion (µg/L)	Reason for Change
Zinc	420,000 T	280,000 T	The standard was calculated using PBC method (Rfd = 0.3), revised PBC water ingestion rate of 15 ml/day, and RSC = 20%.

Numeric Water Quality Standards for Aquatic and Wildlife Designated Uses

Currently, there are numeric criteria for 98 pollutants to maintain and protect water quality for the aquatic life and wildlife (A&W) designated uses. This rulemaking establishes new criteria or revisions, to existing numeric A&W criteria for 59 parameters. In most cases, the § 304(a) national criteria recommendations to protect freshwater aquatic life have been adopted. The national criteria for total residual chlorine have been adopted and will provide for slightly less restrictive criteria for both acute and chronic aquatic life. The current water quality standards are: acute = 11 µg/L and chronic = 5 µg/L. This rulemaking changes these values to: acute = 11 µg/L and chronic = 19 µg/L.

New numeric water quality standards for previously unregulated pollutants include new A&W criteria for chloropyrifos, guthion, hydrogen sulfide, iron, malathion, mirex, paraquat, parathion, permethrin, and tributyltin. The numeric water quality criteria for "sulfides" have been repealed and replaced with numeric criteria for hydrogen sulfide. The current A&W criteria for beryllium has been repealed because EPA has withdrawn its national § 304(a) criteria recommendations for the pollutant.

Several pollutants have been amended by rounding existing criteria to the nearest whole number or to the first significant figure to the right of a decimal point.

No changes have been made to the current numeric water quality criteria for the aquatic and wildlife (ephemeral) (A&We) designated use.

Criteria for hardness-dependent metals

The numeric water quality standards for certain metals are expressed as a function of hardness because hardness can affect the toxicities of the metals to aquatic life. These "hardness-dependent" pollutants include cadmium, chromium III, copper, lead, nickel, silver, and zinc. Increasing hardness has the effect of decreasing the toxicity of the metals.

Currently, the numeric water quality criteria for these pollutants include a lower hardness cap of 25 mg/L. This hardness cap is based on an earlier EPA national criteria recommendation that when the hardness of freshwater is less than 25 mg/L, a hardness-dependent metals criterion should be calculated as if the hardness is 25 mg/L. EPA describes the available data for copper, zinc, and cadmium in the 1-25 mg/L range as "somewhat limited" and "quite limited" for silver, lead, chromium III, and nickel. EPA subsequently re-evaluated the limited available data in the current metals criteria documents and determined that the data were "inconclusive." EPA expressed concern that capping hardness at 25 mg/L without additional data or justification could result in metals criteria that provided less protection than that intended by EPA's "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," U.S. Environmental Protection Agency, Office of Research and Development, EPA 822/R-85-100, (1985).

EPA now recommends that hardness not be capped at 25 mg/L or any other hardness value on the lower end. The rulemaking removes the lower hardness cap for the hardness-dependent pollutants to include numeric metals criteria in the 1-25 hardness range.

The following table provides the dissolved acute and dissolved chronic criteria for the hardness-dependent metals. Individual tables are shown by metal type and designated use, and are calculated using the equation and appropriate hardness criterion.

HARDNESS-DEPENDENT DISSOLVED METALS CRITERIA

CHEMICAL	STANDARDS														FRESHWATER CONVERSION FACTORS (CF)	
	A&Wc				A&Ww				A&Wedw				A&We			
	Acute		Chronic		Acute		Chronic		Acute		Chronic		Acute		ACUTE	CHRONIC
	m_A	b_A	m_C	b_C	m_A	b_A	m_C	b_C	m_A	b_A	m_C	b_C	m_A	b_A		
Cadmium	1.0166	-3.924	0.7409	-4.719	1.0166	-2.561	0.7409	-3.894	1.0166	-2.561	0.7409	-3.894	1.0166	-1.497	1.136672-[(ln hardness)(0.041838)]	1.101672-[(ln hardness)(0.041838)]
Chromium III	0.8190	3.7256	0.8190	0.6848	0.8190	3.7256	0.8190	0.6848	0.8190	3.7256	0.8190	0.6848	0.8190	4.9361	0.316	0.860
Copper	0.9422	-1.7	0.8545	-1.702	0.9422	-1.7	0.8545	-1.702	0.9422	-1.7	0.8545	-1.702	0.9422	-1.1514	0.960	0.960
Lead	1.273	-1.460	1.273	-4.705	1.273	-1.460	1.273	-4.705	1.273	-1.460	1.273	-4.705	1.273	-0.7131	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]

Nickel	0.8460	2.255	0.8460	0.0584	0.8460	2.255	0.8460	0.0584	0.8460	2.255	0.8460	0.0584	0.8460	4.4389	0.998	0.997
Silver	1.72	-6.59			1.72	-6.59			1.72	-6.59			1.72	-6.59	0.85	--
Zinc	0.8473	0.884	0.8473	0.884	0.8473	0.884	0.8473	0.884	0.8473	0.884	0.8473	0.884	0.8473	3.1342	0.978	0.978

Hardness-dependent metals' criteria may be calculated from the following:
Acute (dissolved) = exp {mA [ln(hardness)]+ bA} (CF)
Chronic (dissolved) = exp {mC [ln(hardness)]+ bC} (CF)

Criteria for Pentachlorophenol

The criterion equation for pentachlorophenol requires the insertion of receiving water pH to develop the applicable water quality standards. This rulemaking uses three tables to show for pentachlorophenol standards. The equations to develop the water quality standards and companion tables are:

A&Wc acute standard: $e^{(1.005 (pH) - 4.830)}$

A&Wc chronic standard: $e^{(1.005 (pH) - 5.290)}$

A&Ww acute standard: $e^{(1.005 (pH) - 4.830)}$

A&Ww chronic standard: $e^{(1.005 (pH) - 5.290)}$

A&Wedw acute standard: $e^{(1.005 (pH) - 4.830)}$

A&Wedw chronic standard: $e^{(1.005 (pH) - 5.290)}$

A&We acute standard: $e^{(1.005 (pH) - 3.4306)}$

A&Wedw chronic criterion for dissolved mercury

The rulemaking revises the A&W(edw) chronic standard for dissolved mercury from 0.2 µg/L to 0.01 µg/L. The current A&W(edw) chronic criterion for dissolved mercury of 0.2 µg/L was adopted in 1992. The following documentation on the calculation of the A&W(edw) chronic criterion for mercury from 1992 explains how this criterion was derived:

"The proposed standard was based on toxicity to aquatic life. However, mercury has a propensity to accumulate in tissues of aquatic life to levels that may be harmful to wildlife or human consumers. These routes of exposure should also be considered in developing A&W standards. The EPA publication "Ambient Water Quality Criteria for Mercury – 1984," U.S. EPA, Office of Water, EPA 440/5-84-026 (January 1985) does not contain information regarding the effects of mercury on wildlife but does contain information on the effects of mercury on humans. Setting a standard based strictly on toxicity to aquatic life may not adequately protect wildlife. The rulemaking uses an FDA action level as a surrogate to protect wildlife. This seems appropriate because wildlife is more like humans than aquatic life. The mercury standard has been recalculated using the more appropriate Final Residue Value procedure. The equation used is:

$$\frac{\textbf{FDA action level}}{\textbf{(Bioconcentration factor)}}$$

Where the FDA action level for mercury is 1.0 mg/kg and the bioconcentration factor for mercury is 4,994 L/kg. (Criteria Document, p. 47), the recalculated A&Wedw chronic standard is 0.2 µg/L."

The methodology used in 1992 to recalculate the A&Wedw chronic criterion has been modified. An FDA action level as a surrogate value is no longer supported to protect aquatic life and wildlife in EDWs. The bioconcentration factor of 4,994 L/kg used in 1992 to calculate the chronic criterion significantly underestimates the bioaccumulation potential of mercury in the aquatic environment. More recent information indicates that concentrations of total mercury in fish at the top of the food chain may be as much as 10,000 to 100,000 times higher than the concentrations of inorganic mercury found in surrounding waters (Source: EPA Fact Sheet, "Mercury Update: Impact on Fish Advisories," EPA-823-F-99-016 (September, 1999).

The rulemaking adopts the same chronic criterion for dissolved mercury that was adopted for the A&Wc and A&Ww designated uses. The Department employed the EPA methodology described in the national "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," U.S. Environmental Protection Agency, Office of Research and Development, EPA 822/R-85-100, (1985) to derive water quality criteria for mercury. The Guidelines methodology calls for the calculation of a Final Residue Value [FRV] if a maximum permissible tissue concentration and at least one acceptable bioconcentration factor determined from an aquatic species are available. The Department calculated a FRV for mercury using data from EPA's National Ambient Water Quality Criteria Document for Mercury – 1984. The FRV of 0.012 µg/L became the A&Wc and the A&Ww criterion to protect against chronic toxicity from mercury. The Guidelines Methodology is a more appropriate method to derive A&Wedw chronic criteria than the use of FDA action levels to calculate the A&Wedw (chronic) criterion.

Numeric Criteria for Total Ammonia for Effluent-Dependent Waters

This rulemaking adopts numeric water quality criteria for total ammonia for the A&Wedw designated use. The Clean Water Act requires the Department to adopt water quality standards for all uses including effluent-dependent waters that contain sufficient parameters or constituents to protect designated uses. Ammonia is a major toxicant of concern in Arizona's effluent-dependent waters. There is a large body of scientific literature documenting ammonia toxicity to aquatic life, including toxicity to species that are known to inhabit effluent-dependent waters. Therefore, the Department adopted numeric criteria to protect aquatic life in EDWs. The adoption of numeric water quality criteria for ammonia for the A&Wedw designated use is necessary to protect the use and will provide an objective basis for the establishment of water quality-based effluent limits in AZPDES permits to control toxic discharges of ammonia in wastewater to Arizona's effluent-dependent waters.

The U.S. Fish & Wildlife Service has repeatedly recommended that the Department include ammonia as a pollutant to be regulated in Arizona's effluent-dependent waters, noting that Arizona's EDWs are vital components of southwestern desert ecosystems, providing valuable replacement habitat for threatened and endangered species, including the Gila topminnow, Yuma clapper rail, and the Southwestern willow flycatcher, and other native and migratory birds.

The ammonia criteria are based on "1999 Update of Ambient Water Quality Criteria for Ammonia," U.S. Environmental Protection Agency, Office of Water, EPA-822-R-99-014 (December 1999), EPA's most recent national § 304(a) criteria recommendations to protect freshwater aquatic life. The proposed ammonia criteria for A&Wedw, which consist of both acute and chronic criteria, are expressed as total ammonia concentrations (i.e., un-ionized ammonia (NH_3) + ionized ammonia (NH_4^+).

Acute

The § 304(a) criteria for total ammonia to protect against acute toxicity are dependent on pH and the presence or absence of salmonids (i.e., large trout). Where salmonids are present, EPA recommends that the acute criterion be calculated using the following equation:

$$\textbf{Acute criterion} = \frac{0.275}{1 + 10^{7.204-pH}} + \frac{39.0}{1 + 10^{7.204-pH}}$$

The acute criterion for total ammonia was calculated for the A&Wc designated use using the equation recommended by EPA above. The results may be found in the first column of Table 25 in the current rules. There are no revisions of acute A&Wc criteria in this rulemaking.

Where salmonid fish are not present, EPA recommends the calculation of acute criteria for total ammonia to protect aquatic life using the following equation:

$$\textbf{Acute criterion} = \frac{0.411}{1 + 10^{7.204-pH}} + \frac{58.4}{1 + 10^{7.204-pH}}$$

The acute criterion for total ammonia was calculated for the A&Ww and the A&Wedw designated uses using this equation. The results may be found in the second column of Table 25 in the current rules. There are no revisions to the resulting numeric criteria for the A&Ww (acute) designated use in this rulemaking.

This rulemaking applies the same numeric criteria for the A&Ww (acute) designated use to protect the A&Wedw (acute) designated use. The A&Wedw (acute) criteria has been recalculated using the EPA Guidelines methodology and adjusting the species toxicity datasets using representative species from effluent-dependent waters. The use of recalculation procedures did not result in any significant differences between A&Wedw and A&Ww acute criteria because the same species that are sensitive to ammonia toxicity that "drive" the criteria derivation are found in both warm surface waters and EDWs. The table below illustrates the minimal differences between the A&Ww(acute) criteria and the re-calculated A&Wedw (acute) criteria:

pH	Calculated A&Ww (in mg/L)	Recalculated A&Wedw (in mg/L)
6.5	47.6	48.9
6.6	45.7	46.9
6.7	43.5	44.6
6.8	41.0	42.0
6.9	38.2	39.2
7.0	35.2	36.1
7.1	32.0	32.9
7.2	28.8	29.6
7.3	25.6	26.2
7.4	22.4	23.0
7.5	19.4	19.9

7.6	16.6	17.0
7.7	14.1	14.5
7.8	11.8	12.2
7.9	9.9	10.1
8.0	8.2	8.4
8.1	6.8	7.0
8.2	5.6	5.7
8.3	4.6	4.7
8.4	3.8	3.9
8.5	3.1	3.2
8.6	2.6	2.7
8.7	2.1	2.2
8.8	1.8	1.8
8.9	1.5	1.6
9.0	1.3	1.3

<u>Chronic</u>

The A&W(chronic) criteria for total ammonia are dependent on both pH and temperature. The national § 304(a) recommendations for chronic toxicity for total ammonia that apply when early life stages of fish are expected to be present have been adopted because of the likelihood that early life stages of fish may be present in Arizona surface waters (including EDWs) at any time during the year. The following equation was used to calculate the chronic criteria for total ammonia for the A&Wc, A&Ww, and A&Wedw designated uses:

$$\textbf{Chronic criteria} = \left(\frac{0.0577}{1 + 10^{7.688 - \mathrm{pH}}} + \frac{2.487}{1 + 10^{\mathrm{pH} - 7.688}}\right) \times \textbf{MIN 2.85, 1.45} \times \mathbf{10}^{\mathbf{0.028 \times (25 - \mathit{T})}}$$

The results are found in Appendix A within Table 26. The chronic criteria are not species dependent and apply equally to the A&Wc, A&Ww, and A&Wedw designated uses. The chronic criteria for total ammonia become more stringent as temperature and pH values increase.

The following table shows proposed changes to the aquatic and wildlife criteria. The table identifies the pollutant, the current A&W criteria, the proposed A&W criteria, and the reasons for any proposed changes.

Numeric Water Quality Standards for Aquatic and Wildlife Designated Uses

Pollutant	Existing A&W Criteria (µg/L)	Adopted A&W Criteria (µg/L)	Reason for Change
Aldrin	A&W(c) acute: 2.0 A&W(w) acute: 2.0 A&Wedw acute: 2.0	A&W(c) acute: 3 A&W(w) acute: 3 A&Wedw acute: 3	Less stringent. The § 304(a) national criteria recommendations for aldrin have been adopted.
Ammonia	A&Wedw acute: NNS A&Wedw chronic: NNS	Acute and chronic A&Wedw criteria See Tables 25 and 26	The ammonia criteria for A&Wedw have been updated based on EPA's § 304(a) national criteria recommendations. See discussion under "Numeric Water Quality Standards for Aquatic and Wildlife Designated Uses" above.
Arsenic	A&Wc acute: 360 A&Ww acute: 360 A&Wedw acute: 360 A&Wc chronic: 190 A&Ww chronic: 190 A&Wedw chronic: 190	A&Wc acute: 340 A&Ww acute: 340 A&Wedw acute: 340 A&Wc chronic: 150 A&Ww chronic: 150 A&Wedw chronic: 150	More stringent. The § 304(a) national criteria recommendations for arsenic have been adopted.
Beryllium	A&Wc acute: 65 A&Ww acute: 65 A&Wedw acute: 65 A&Wc chronic: 5.3 A&Ww chronic: 5.3 A&Wedw chronic: 5.3	None	EPA has withdrawn its national § 304(a) criteria recommendations to protect aquatic life for beryllium.

Pollutant	Existing A&W Criteria (µg/L)	Adopted A&W Criteria (µg/L)	Reason for Change
Chlordane	A&Wc acute: 2.4 A&Ww acute 2.4 &Wedw acute: 2.4 A&Ww chronic: 0.21 A&Wedw chronic: 0.21	A&Wc acute: 2.4 A&Ww acute: 2.4 A&Wedw acute: 2.4 A&Ww chronic: 0.2 A&Wedw chronic: 0.2	The standard has been rounded to the first significant figure to the right of the decimal point.
Chlorine (total residual)	A&Wc acute: 11 A&Ww acute: 11 A&Wedw acute: 11 A&Wc chronic: 5 A&Ww chronic: 5 A&Wedw chronic: 5	A&Wc acute: 19 &Ww acute: 19 A&Wedw acute: 19 A&Wc chronic: 11 A&Ww chronic: 11 A&Wedw chronic: 11	Less stringent. The § 304(a) national criteria recommendations for chlorine have been adopted.
Chloropyrifos	None	A&Wc acute: 0.08 A&Ww acute: 0.08 A&Wedw acute: 0.08 A&Wc chronic: 0.04 A&Ww chronic: 0.04 A&Wedw chronic: 0.04	New parameter. The § 304(a) national criteria recommendations for chloropyrifos have been adopted.
p,p'-Dichlorodiphenyl dichloroethane (DDD)	A&Ww chronic: 0.02 A&Wedw chronic: 0.02	A&Ww chronic: 0.001 A&Wedw chronic: 0.001	More stringent. DDD and DDE have been consolidated with DDT. The more stringent chronic criterion for DDT (0.001) has been adopted for DDD. DDD is a daughter product of DDT. The criterion is based on EPA § 304(a) national criteria recommendations.
p,p'-Dichlorodiphenyl dichloroethylene (DDE)	A&Ww chronic: 0.02 A&Wedw chronic: 0.02	A&Ww chronic: 0.001 A&Wedw chronic: 0.001	More stringent. DDD and DDE has been consolidated with DDT. The more stringent chronic criterion for DDT (0.001) has been adopted for DDE. DDE is a daughter product of DDT. The criterion is based on EPA § 304(a) national criteria recommendations.
Dieldrin	A&Wc acute: 2.5 A&Ww acute: 2.5 A&Wedw acute: 2.5 A&Wc chronic: 0.002 A&Ww chronic: 0.002 A&Wedw chronic: 0.005	A&Wc acute: 0.2 A&Ww acute: 0.2 A&Wedw acute: 0.2 A&Wc chronic: 0.06 A&Ww chronic: 0.06 A&Wedw chronic: 0.06	The more stringent acute criteria and less stringent chronic criteria for dieldrin based on EPA § 304(a) national criteria recommendations have been adopted.
Endosulfan	A&Wc acute: 0.22 A&Ww acute: 0.22 A&Wedw acute: 0.22	A&Wc acute: 0.2 A&Ww acute: 0.2 A&Wedw acute: 0.2	The standard has been rounded to first significant figure to right of decimal point.
Endosulfan sulfate	A&Wc acute: 0.22 A&Ww acute: 0.22 A&Wedw acute: 0.22	A&Wc acute: 0.2 A&Ww acute: 0.2 A&Wedw acute: 0.2	The standard has been rounded to first significant figure to right of decimal point.
Endrin	A&Wc acute: 0.18 A&Ww acute: 0.18 A&Wedw acute: 0.18 A&Wc chronic: 0.002 A&Ww chronic: 0.002 A&Wedw chronic: 0.002	A&Wc acute: 0.09 A&Ww acute: 0.09 A&Wedw acute: 0.09 A&Wc chronic: 0.04 A&Ww chronic: 0.04 A&Wedw chronic: 0.04	The more stringent acute criteria and less stringent chronic criteria for endrin based on EPA § 304(a) national criteria recommendations have been adopted.
Endrin aldehyde	A&Wc acute: 0.18 A&Ww acute: 0.18 A&Wedw acute: 0.18 A&Wc chronic: 0.002 A&Ww chronic: 0.002 A&Wedw chronic: 0.002	A&Wc acute: 0.09 A&Ww acute: 0.09 A&Wedw acute: 0.09 A&Wc chronic: 0.04 A&Ww chronic: 0.04 A&Wedw chronic: 0.04	The rulemaking adopts more stringent acute criteria and less stringent chronic criteria for endrin aldehyde. Proposed criteria are based on EPA § 304(a) national criteria recommendations.
Guthion	None	A&Wc chronic: 0.01 A&Ww chronic: 0.01 A&Wedw chronic: 0.01	New parameter. The criteria are based on EPA § 304(a) national criteria recommendations.

Pollutant	Existing A&W Criteria (µg/L)	Adopted A&W Criteria (µg/L)	Reason for Change
Heptachlor	A&Wc acute: 0.52 A&Ww acute: 0.52 A&Wedw acute: 0.58 A&Wedw chronic: 0.013	A&Wc acute: 0.5 A&Ww acute: 0.5 A&Wedw acute: 0.6 A&Wedw chronic: 0.01	The standard has been rounded to first significant figure to right of decimal point.
Heptachlor epoxide	A&Wc acute: 0.52 A&Ww acute: 0.52 A&Wedw acute: 0.58 A&Wedw chronic: 0.013	A&Wc acute: 0.5 A&Ww acute: 0.5 A&Wedw acute: 0.6 A&Wedw chronic: 0.01	The standard has been rounded to first significant figure to right of decimal point.
Hexachlorobenzene	A&Ww acute: NNS A&Wedw acute: NNS A&Ww chronic: NNS A&Wedw chronic: NNS	A&Ww acute: 6 A&Wedw acute: 6 A&Ww chronic: 3.7 A&Wedw chronic: 3.7	The rulemaking adopts criteria for A&Ww and A&Wedw based on EPA § 304(a) national criteria recommendations.
Hexaclorocyclohexane gamma (lindane)	A&Wc acute: 2.0 A&Ww acute: 3.4 A&Wedw acute: 7.6 A&Wc chronic: 0.08 A&Ww chronic: 0.28 A&Wedw chronic: 0.61	A&Wc acute: 1 A&Ww acute: 1 A&Wedw acute: 1 A&Wc chronic: None A&Ww chronic: None A&Wedw chronic: None	Based on EPA § 304(a) national criteria recommendations, the more stringent acute criteria has been adopted and the chronic criteria for lindane has been repealed.
Hydrogen sulfide	None	A&Wc chronic: 2 A&Ww chronic: 2 A&Wedw chronic: 2	New pollutant. Replaces “sulfides.” Proposed criteria are based on EPA § 304(a) national criteria recommendations.
Iron	None	A&Wc chronic: 1,000 A&Ww chronic: 1,000 A&Wedw chronic: 1,000	New pollutant. The § 304(a) national criteria recommendations have been adopted.
Malathion	None	A&Wc chronic: 0.1 A&Ww chronic: 0.1 A&Wedw chronic: 0.1	New pollutant. The § 304(a) national criteria recommendations have been adopted.
Mercury	A&Wedw acute: 2.6 A&Wedw chronic: 0.2	A&Wedw acute: 2.4 A&Wedw chronic: 0.01	See discussion under “Numeric Water Quality Standards for Aquatic and Wildlife Designated Uses” above.
Methoxychlor	A&Wc chronic: NNS A&Ww chronic: NNS A&Wedw chronic: NNS	A&Wc chronic: 0.03 A&Ww chronic: 0.03 A&Wedw chronic: 0.03	The § 304(a) national criteria recommendations have been adopted.
Mirex	None	A&Wc chronic: 0.001 A&Ww chronic: 0.001 A&Wedw chronic: 0.001	Newly regulated pollutant. The § 304(a) national criteria recommendations have been adopted.
Parathion	None	A&Wc acute: 0.07 A&Ww acute: 0.07 A&Wedw acute: 0.07 A&Wc chronic: 0.01 A&Ww chronic: 0.01 A&Wedw chronic: 0.01	Newly regulated pollutant. The § 304(a) national criteria recommendations have been adopted.
Paraquat	None	A&Wc acute: 100 A&Ww acute: 100 A&Wedw acute: 100 A&Wc chronic: 54 A&Ww chronic: 54 A&Wedw chronic: 54	Newly regulated pollutant. The § 304(a) national criteria recommendations have been adopted.
Permethrin	None	A&Wc acute: 0.3 A&Ww acute: 0.3 A&Wedw acute: 0.3 A&Wc chronic: 0.2 A&Ww chronic: 0.2 A&Wedw chronic: 0.2	Newly regulated pollutant. The § 304(a) national criteria recommendations have been adopted.
Phenanthrene	A&Wedw acute: 54	A&Wedw acute: 30	The EPA § 304(a) national criteria recommendation for A&Wedw acute criterion have been adopted.

Pollutant	Existing A&W Criteria (µg/L)	Adopted A&W Criteria (µg/L)	Reason for Change
Selenium	A&Wc acute: 20 T A&Ww acute: 20 T A&Wedw acute: 50 T	A&Wc acute: None A&Ww acute: None A&Wedw acute: None	The § 304(a) national criteria recommendations for acute criteria, expressed as concentrations of selenate and selenite have been repealed.
Sulfides	A&Wc acute: 100 A&Ww acute: 100 A&Wedw acute: 100 A&We: 100	None	"Sulfides" has been replaced with "hydrodgen sulfide."
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	A&Wedw acute: 0.12 A&Wedw chronic: 0.01	A&Wedw acute: 0.1 A&Wedw chronic: 0.005	The A&Wedw acute standard has been rounded to the first significant figure to right of decimal point. The more stringent A&Wedw chronic criterion has been adopted to be consistent with EPA § 304(a) national criteria recommendations for dioxin.
Toxaphene	A&Wc acute: 0.73 A&Ww acute: 0.73 A&Wedw acute: 0.73 A&Wc chronic: 0.0002 A&Ww chronic: 0.02 A&Wedw chronic: 0.02	A&Wc acute: 0.7 A&Ww acute: 0.7 A&Wedw acute: 0.7 A&Wc chronic: 0.0002 A&Ww chronic: 0.0002 A&Wedw chronic: 0.0002	Acute criteria have been amended by rounding to the first significant figure to the right of the decimal point. The more stringent A&Ww chronic and A&Wedw chronic criteria have been adopted to be consistent with the § 304(a) national criteria recommendations for toxaphene.
Tributyltin	None	A&Wc acute: 0.5 A&Ww acute: 0.5 A&Wedw acute: 0.5 A&Wc chronic: 0.07 A&Ww chronic: 0.07 A&Wedw chronic: 0.07	Newly regulated pollutant. The § 304(a) national criteria recommendations for A&Wc, A&Ww and A&Wedw have been adopted.
1,2,4-Trichlorobenzene	A&Wedw acute: NNS A&Wedw chronic: NNS	A&Wedw acute: 1,700 A&Wedw chronic: 300	The current acute and chronic A&Ww criteria for A&Wedw have been adopted.

Appendix B. Surface Waters and Designated Uses

Appendix B lists surface waters and their designated uses. The geographic descriptions in Appendix B have been updated and reformatted. Lake categories have been added, when known.

The following 29 new effluent-dependent waters have been classified using information provided to the Department in the context of AZPDES permitting. The new effluent-dependent waters are created by point source discharges of wastewater to ephemeral waters. Information from AZPDES permit applications, fact sheets, and discharge monitoring reports for each point source document discharges of wastewater to the ephemeral waters.

1. Coconino Wash from the South Grand Canyon Sanitary District Tusayan WRF outfall to 1 km downstream.
2. Unnamed wash from Grand Canyon National Park Desert View WWTP to Cedar Canyon.
3. Unnamed wash from Valle Airpark WRF outfall to confluence with Spring Wash.
4. Tyson Wash from Town of Quartzsite WWTP to 1 km downstream.
5. Puerco River from Sanders Unified School District WWTP to 0.5 km downstream.
6. Unnamed wash from High Country Pines II WWTP to Turkey Draw to confluence with Black Canyon Creek.
7. Unnamed wash from Bison Ranch WWTP to Pierce Seep.
8. Unnamed wash from Black Mesa Ranger Station WWTP to confluence with Pierce Wash.
9. Bow and Arrow Wash and two unnamed washes, tributaries of the Rio de Flag from Estates at Pine Canyon Golf Course storage ponds 4I, 6E, and 10D.
10. Agua Fria River from City of Avondale WWTP to Gila River.
11. Andorra Wash from Town of Cave Creek WWTP outfall #1 to Cave Creek Wash.
12. Galloway Wash from Town of Cave Creek WWTP outfall #2 to confluence with Andorra Wash.
13. McMicken Wash from City of Peoria Jomax WWTP to Agua Fria River.
14. Mountain Valley Park ponds from Town of Prescott Valley WWTP outfall #002 to Navajo Wash.
15. Salt River from City of Mesa Northwest WWTP to Tempe Town Lake.

16. Siphon Draw from Superstition Mountains Community Facilities District WWTP to 6 km downstream.
17. Unnamed wash from City of Phoenix Cave Creek WRF to 0.5 km downstream.
18. Unnamed wash from North Florence WWTP, tributary to Gila River.
19. Wagner Wash from Town of Buckeye Festival Ranch WRF to 2 km downstream.
20. Black Wash from Pima County WWMD Avra Valley WWTP to Brawley Wash.
21. North Branch of Santa Cruz Wash from City of Casa Grande WRF to 1 km downstream.
22. Santa Rosa Wash from Palo Verde Utilities WWTP to Gila River Indian Reservation.
23. Unnamed wash from Arizona City Sanitary District WWTP to Santa Cruz Wash.
24. Unnamed wash from Saddlebrooke WWTP to Cañada del Oro.
25. Unnamed wash from Fort Huachuca WWTP to Soldier Creek to Babocomari River.
26. Pinal Creek from Lower Pinal Creek WTP to See Ranch Crossing.
27. Unnamed wash from Cobre Valley Plaza WWTP to Russell Gulch.
28. Unnamed wash from Sedona Venture WWTP to confluence with Dry Creek and Dry Creek for 0.5 km downstream.
29. Unnamed wash from Flagstaff Meadows WWTP to Volunteer Wash.

This rulemaking removes the Cholla Reservoir from Appendix B. In the early 1990s, the Cholla Reservoir, a manmade cooling pond for the Arizona Public Service Co. (APS) Cholla Power Plant near Joseph City, Arizona, was issued a National Pollutant Discharge Elimination System permit by EPA based on the agency's understanding that the reservoir had been constructed in a water of the United States. As a result of this understanding, the Cholla Reservoir was added to the state's list of surface waters in Appendix B. Recent investigation finds that the Cholla Reservoir is a 100 acre manmade impoundment constructed by APS in 1961. It is a terminal impoundment without any outflow to what would otherwise be considered a "water of the United States." The source of water for the Cholla Reservoir is pumped groundwater. As the Cholla Reservoir was not created by impounding any "water of the United States," nor was the reservoir created within a "water of the United States," the reservoir has been removed from Appendix B based on a new exclusion at R18-11-102(B)(3).

Appendix C. Site-Specific Standards

This new Appendix lists site-specific standards.

Site-Specific Standards for Yuma East Wetlands

The site-specific standards for total selenium and total residual chlorine for the Yuma East Wetlands Project are supported by a request by the City of Yuma to modify the two standards on grounds of net ecological benefit. The modification of the water quality standards for selenium and total residual chlorine will enable the City of Yuma to discharge spent filter backwash water from their Main Street Water Treatment Plant to the Yuma East Wetlands Project. The Yuma East Wetlands Project is a multi-million dollar river ecosystem restoration effort designed to restore, enhance, and augment riparian habitats for native and sensitive riparian plant and wildlife species, and to create natural history and cultural interpretation centers and recreational facilities along the Lower Colorado River. The restoration of these habitats depends upon the discharge of filter backwash water to maintain adequate flows of water in the wetlands, particularly during periods of low flow in the Colorado River. Without the discharge of the filter backwash water, the viability of a large portion of the Yuma Wetlands East Project would be jeopardized.

Under R18-11-106, the Director may modify a water quality standard on the grounds that there is a net ecological benefit associated with the discharge of effluent to support or create a riparian and aquatic habitat in an area where water resources are limited.

The Director has determined the conditions of R18-11-106 have been met to support modifications of the water quality standards for selenium and total residual chlorine and to allow the discharge of filter backwash water for flow augmentation in the Yuma East Wetlands on grounds of net ecological benefit

The environmental benefits associated with the discharge of filter backwash water to support the restoration of the Yuma East Wetlands outweigh the environmental costs associated with eliminating the discharge. The discharge of filter backwash water for flow augmentation is essential to the maintenance and restoration of open water and marshland habitats within the wetlands. Only the discharge of filter backwash water can assure the continual water flow necessary to maintain the marshes of the Yuma East Wetlands.

The cost of treatment to achieve compliance with the selenium and total residual chlorine standards are prohibitive and it would be more cost-effective to eliminate the discharge of the filter backwash water to the wetlands instead of installing the necessary treatment processes. Achieving compliance with the total residual chlorine standard would require the installation and operation of a dechlorination facility at the water treatment plant. The City of Yuma estimates that the capital cost of a de-chlorination facility is in excess of $1 million. The estimated cost of compliance with the selenium standard would require the installation of reverse osmosis or a similar treatment process to remove dissolved solids from the spent filter backwash water. The City of Yuma estimates the capital cost of selenium treatment to be $8.2 million with estimated operation and maintenance costs of $1.3 million per year and further describes these costs as "economically impossible." Moreover, it is feasible for the City of Yuma to completely eliminate the discharge of filter backwash to the Yuma East Wetlands. Spent filter backwash is currently recycled within the water treatment plant and is not discharged. There are no costs associated with maintaining the status quo of recycling the filter backwash water instead of discharging it to augment flows in the wetlands. The City of Yuma could avoid the compliance costs associated with meeting the selenium and chlorine standards by not discharging their filter backwash water to the wetlands. However, the success of the wetlands project would be jeopardized if the City of Yuma exercised that option.

The discharge of filter backwash water that meets the site-specific standards will not cause or contribute to a violation of a water quality standard for a downstream surface water. The concentration of total residual chlorine in the filter backwash water is not anticipated to cause or contribute to a violation of the chlorine standard that applies to the adjacent Colorado River. Concentrations of chlorine are expected to dissipate in the filter backwash water pipeline, at the point of discharge to the wetlands, and by retention within the wetlands and marsh habitats. With regard to selenium, the City of Yuma does not add or remove selenium from the filter backwash water at its water treatment plant. The concentration of selenium in the filter backwash water is the same as the concentration of selenium in its raw intake water from the Colorado River.

The City of Yuma demonstrated that it is implementing all practicable discharge control programs to reduce and limit the concentration of chlorine in its filter backwash water. The Department agrees with the City that there are no practicable discharge control programs that the City can implement to reduce selenium in its raw source water or in its filter backwash water.

The discharge of filter backwash water does not produce or contribute to the concentration of a bioaccumulative pollutant that is likely to be harmful to humans or wildlife through food chain concentration. This condition is met with regard to chlorine because chlorine is not a bioaccumulative pollutant. While selenium is a bioaccumulative pollutant, the discharge of filter backwash water does not produce or contribute to selenium concentrations in either the Yuma East Wetlands or in the Colorado River. The concentration of selenium in the filter backwash water is the same as that found in the raw source water from the Colorado River.

The rulemaking modifies the water quality standard applicable to this discharge for total residual chlorine to protect aquatic life from acute and chronic toxicity. The acute criterion is 33 µg/L and the chronic criterion is 20 µg/L. These criteria are based on EPA recalculation procedures and the species list for chlorine toxicity, which is located on the EPA web site at www.epa.gov/region7/water/chlorine. The only adjustment made in the recalculation procedure was to remove the organism *Daphnia magna* from the toxicity dataset. The resulting chlorine criteria, calculated from the modified dataset, are the criteria of 33 µg/L and 20 µg/L.

The rulemaking modifies chronic selenium criterion applicable to this discharge to protect aquatic life of 2.2 µg/L. This concentration is based on the highest selenium concentration that has been measured in the receiving water within the Yuma East Wetlands. This concentration represents the observed background concentration in the lower Colorado River. The site-specific criterion is slightly less stringent than the default A&Ww chronic criterion for selenium of 2 µg/L in the current rules and it is more stringent than EPA's 304(a) national recommended chronic criterion for selenium to protect freshwater aquatic life of 5 µg/L. The Department notes that the U.S. Fish & Wildlife Service has written a letter of support for the site-specific modifications of the selenium and chlorine standards for the Yuma East Wetlands project.

Site-Specific Standard for Copper for Rio de Flag

The site-specific dissolved copper standards for the Rio de Flag have been moved from R18-11-113(F) to Appendix C.

7. A reference to any study relevant to the rule that the agency reviewed and either relied on or did not rely on in its evaluation of or justification for the rule, where the public may obtain or review each study, all data underlying each study, and any analysis of each study and other supporting material:

"Antidegradation Implementation Procedures," Arizona Department of Environmental Quality, Water Quality Division, (July 2008)

Draft "Biocriteria Implementation Procedures," Arizona Department of Environmental Quality, Water Quality Division, (April 2008)

"Technical Support Documentation for the Narrative Biocriteria Standard," Arizona Department of Environmental Quality, Water Quality Division, (April 2007)

"Sediment in Streams: Sources, Biological Effects and Control," American Fisheries Society Monograph 7, American Fisheries Society, Bethesda, Maryland (1995)

Draft "Narrative Bottom Deposits Standard Implementation Procedures for Wadeable, Perennial Streams," Arizona Department of Environmental Quality, Water Quality Division, (April 2008)

Draft "Narrative Nutrient Standard Implementation Procedures for Lakes and Reservoirs (April 2008)

"Ambient Water Quality Criteria for Bacteria – 1986," U.S. Environmental Protection Agency, Office of Water, EPA 440/5-84-002 (January, 1986)

"Fossil Creek: State of the Watershed Report," Northern Arizona University (July 2005)

"Water Quality Criterion for the Protection of Human Health: Methylmercury," U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, EPA-823-R-01-001 (January 2001)

"Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health," U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, EPA-822-B-00-004, (October 2000)

"Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses," U.S. Environmental Protection Agency, Office of Research and Development, EPA 822/R-85-100, (1985)

"Ambient Water Quality Criteria for Mercury – 1984," U.S. Environmental Protection Agency, Office of Water, EPA 440/5-84-026 (January 1985)

"1999 Update of Ambient Water Quality Criteria for Ammonia," U.S. Environmental Protection Agency, Office of Water, EPA-822-R-99-014 (December 1999)

"Pinto Creek Site-Specific Water Quality Standard for Dissolved Copper," Arizona Department of Environmental Quality, Water Quality Division, (March 12, 2007)

"Lakes and Reservoirs Statistical and Modeling Analysis Report," Malcolm Pirnie, February 2005

"Addendum to Lakes and Reservoirs Statistical and Modeling Analysis," Malcolm Pirnie, February 2005

"Potential Nutrient-related Targets for Arizona Lakes and Reservoirs," Malcolm Pirnie, April 2005

"San Pedro and Santa Cruz Rivers: Nutrient Standards Review," Arizona Department of Environmental Health Services (ADHS) (September, 1985)

"An Exploration of Nutrient and Community Variables in Effluent Dependent Streams in Arizona," Arizona Department of Environmental Quality, OFR 05-09

8. A showing of good cause why the rules are necessary to promote a statewide interest if the rules will diminish a previous grant of authority of a political subdivision of this state:

The proposed amendments do not diminish a previous grant of authority of a political subdivision of this state.

9. The summary of the economic, small business, and consumer impact:

Water quality standards are provisions of state law required by the Clean Water Act, and require review and revision once every three years. These standards are implemented through various surface water programs at the Department, including the AZPDES permitting program, authorized under § 402 of the Clean Water Act for point source discharges of pollutants. Persons most affected by this rulemaking are AZPDES permittees. From an economic cost standpoint, permittees may experience costs through conditions established in future AZPDES permits to achieve the surface water quality standards of these rules. Some permittees, such as private and public wastewater utilities, mining operations, and electric utilities, may be required to make wastewater treatment changes to comply with new permit conditions to regulate their discharges.

In addition to costs, there are benefits to these rules. These rules ensure that clean water will be available as a source for drinking water, bathing, cooking, washing clothes, and is safe for swimming, fishing, boating, wading, or other water-based recreation. The rules also protect aquatic and riparian ecosystems that are dependent on a surface water. It is, however, much more difficult to quantify these benefits in monetary terms.

The Department does not require the costs of wastewater treatment to be submitted as part of the AZPDES permitting program, so any specific information on costs has been obtained from permittees or knowledgeable individuals in the area of wastewater treatment.

For purpose of this analysis, the Department defines annual costs or revenues on a cost-revenue scale as follows:

Minimal – less than $10,000

Moderate – $10,000 to $1 million

Substantial – more than $1 million

A. *Estimated Costs and Benefits to the Department of Environmental Quality.*

The Department may incur minimal costs in implementing this rulemaking. It is possible that new or revised water quality standards and new implementation procedures for narrative standards may lead to an increase in the number of surface waters that are identified as impaired waters. This may result in a corresponding increase in the number of Total Maximum Daily Loads (TMDLs) that the Department would be required to complete under the Clean Water Act. The Department does not anticipate any increase in FTEs or state funding to complete additional TMDLs.

There are some new costs for monitoring under narrative standards, but the Department expects these costs to reduce over time due to fewer sampling visits in the field. Narrative standard measurements provide a longer, more direct measure of the water quality and can show a recent history of the health of a surface water, instead of just a snapshot as with a chemical-based numeric standard. Accordingly, monitoring costs incurred by the Department may be reduced by this rulemaking.

B. ***Estimated Costs and Benefits to Political Subdivisions.***

Political subdivisions are affected by the rules if they own or operate sewage treatment plants, and their costs are discussed below in section C. There may be additional costs for some political subdivisions that have a pretreatment program under the Clean Water Act. The pretreatment program requires political subdivisions to control industrial wastewater discharged to the sanitary sewer before it is mingled with domestic sewage and discharged at the treatment facility. These facilities, called publicly-owned treatment works (POTW), have the authority to establish water quality standards and issue permits to industrial facilities that discharge pollutants to the sanitary sewer to control the industrial wastewater and ensure that water quality standards are met. POTWs may incur minimal-to-moderate costs in reviewing the new surface water quality standards to ensure their own compliance and to evaluate the need to change limits and controls on local industrial wastewater to ensure compliance under their AZPDES permit. If changes are necessary, a POTW would make necessary changes to its future permits issued to industrial facilities or through its local regulations.

Local industries generating industrial wastewater could indirectly be affected if the POTW requires changes in local limits in order to meet new surface water quality standards. Currently, 21 Arizona municipalities have pretreatment programs.

C. ***Businesses Directly Affected By the Rulemaking***

Surface water quality standards are implemented through various general and individual permits under the AZPDES permitting program, authorized under § 402 of the Clean Water Act and A.R.S. Title 49, Chapter 2, Article 3.1 for point source discharges of pollutants. Businesses affected by this rulemaking are AZPDES permittees who discharge as a point source to a water of the United States.

Below are the numbers of authorizations for the current five-year AZPDES general permits. Most of these permits are held by businesses:

AZPDES GENERAL PERMITS

General Permit Category	***# Per Category***
Multi-Sector General Permit (MSGP)	*1039*
Construction General Permit (CGP)	*3800*
Municipal Separate Storm Sewer System (MS4) (Phase II permits)	*41*
De Minimus General Permit	*472*

There are potential impacts to those discharging under an AZPDES general permit; however, the Department does not expect these rule changes to affect significantly large numbers of permittees. The De Minimus permit regulates minor discharges resulting from specified activities and is generally restricted to discharges containing minimum pollutant amounts. The other three general permits regulate stormwater discharges primarily by requiring the use of best management practices (BMPs) to lessen pollutants. These rules may impact a permittee if a surface water changes classification, such as ephemeral to effluent-dependent, or if a numeric standard becomes stricter. The rules also may impact a permittee if under the new narrative standards criteria, a water is listed as impaired under 18 A.A.C. 11, Article 6. A project located near an impaired or water that seeks general permit coverage, especially the CGP and De Minimus, could see increased monitoring requirements or additional BMPs being required to protect water quality. For example, a small or medium MS4 is not typically required to monitor under the current general permit. This would change if the MS4 had to determine the source of a pollutant if its stormwater discharge contributed to an exceedance of a new water quality standard. Any facility permitted under a general permit with discharges that are above a new water quality standard could lose eligibility under the general permit and be required to seek an individual permit with more specific requirements. The Department expects only minimal, if any, impact to each permittee discharging under general permits.

The outstanding Arizona water (OAW) classification can affect existing and potential facilities that discharge to an OAW. Tier 3 of the antidegradation rule prohibits a new or expanded point source directly discharging to an OAW. Antidegradation protection includes a tributary to, or upstream of, an OAW. An AZPDES applicant must demonstrate that the regulated discharge will not degrade existing water quality in the downstream OAW. OAW designation does not prohibit a discharge activity but it generally may make it more expensive in treatment costs or to divert a discharge.

The Department is designating two new surface waters as OAWs; Fossil Creek and Davidson Canyon. Fossil Creek is located on U.S. Forest Service land, with some of the area designated as a Wilderness Area. Arizona Public Service (APS) is discharging under an existing permit but will be ending its discharge activities in 2011. There are numerous closed mining claims along Fossil Creek even though mining has not been a reported historical activity in this area. Any holder of a closed mining claim in this area that seeks to reactivate a claim to develop mining will not be able to discharge to Fossil Creek in a manner that would degrade the existing water quality. Land use in this area is mainly grazing and recreation. While Arizona does not have a regulatory program to directly control nonpoint sources of pollution such as grazing, the intention of the Tier 3 antidegradation policy is that best management practices be developed and implemented to prevent the degradation of existing water quality in an OAW.

The Department is aware of a few mining claims in the area that would face limitations on discharging to Davidson Canyon or to any of its tributaries. The Department has no data that any sand and gravel or cement operation has been permitted in or around Davidson Canyon.

It is unclear what economic costs a potential discharger to these new OAWs would bear. Any potential costs of discharging to a designated OAW should be weighed with the benefits that come from increased tourism of the area, as further discussed below.

The Department believes that the changes in these rules will affect a relatively small number of existing AZPDES individual permittees, though costs may be moderate or substantial, depending on the specific case. Permit conditions are reviewed and revised as applicable when permittees apply for renewal, usually every five years. These permittees would incur costs if their discharge contains pollutants in a concentration that may result in an exceedance of a new surface water quality standard.

The Department has reviewed the comments regarding the economic impact of this rulemaking. While the comments present an apparent “worst case scenario”, the Department assumes that permittees affected by this rulemaking actually will exercise every lawful option to delay, defray, and minimize any costs to their business and consumers. Two options to delay, defray, or minimize costs are offered in existing rules. One, there is the opportunity to request a compliance schedule in a permit when a facility cannot meet a new water quality standard. This allows the facility time to evaluate, design and construct treatment or other means of meeting the new standard. R18-11-121 (Schedules of Compliance). In addition, R18-11-122 (Variances) allow the Department flexibility in issuing AZPDES permits when there has been a change in water quality standards. The Department currently has 33 variances for a variety of pollutants, though some are multiples on the same permitted facility. There are 11 other permits with compliance schedules to meet water quality standards for a variety of pollutants.

Under new provisions in R18-11-113(E) (Effluent-Dependent Waters), the Department has flexibility to conclude that acute-only standards are sufficiently protective for point source discharges of wastewater when the discharge is infrequent, sporadic, or an emergency. This will allow AZPDES permits to be written without chronic water quality standards when conditions are appropriate. If applicable, a discharger that provides adequate treatment will unlikely exceed acute standards, therefore this provision would likely result in cost savings to the discharger in not having to institute additional treatment measures to meet chronic standards. Under this provision, the permittee will need to have sufficient discharge and storage options such that surface water discharge was infrequent, sporadic or on an emergency basis.

The table below shows the number of AZPDES individual permits, broken down by category type. The individual permittees most likely to be affected by this rulemaking include owners of domestic wastewater treatment plants (sewage treatment plants), and some industries such as mining and electric power generation. Other industries could be impacted on a case-by-case basis, similar to how permittees of general permits could be impacted.

AZPDES INDIVIDUAL PERMITS

By Industry	# of Permits
Sewage treatment plants (municipal & private)	113
Drinking water treatment plants & well discharges	7
Power Generation	7
Mining	12
WQARF/Remediation projects	7
Miscellaneous (EPNG, Lakeside, Rio Salado, FD)	4
Fish hatcheries	4
Truck Stops	3
Marinas	2
Industrial (other)	1

Costs to Sewage Treatment Plants

Rule changes may require some sewage treatment plants to incur costs to meet water quality-based discharge limitations established in an AZPDES permit. There are possible minimal increased monitoring costs based on a new numeric standard, but a number of variable factors make it difficult to quantify any increased costs for public and privately owned sewage treatment plants.

Sewage treatment plants collect and treat wastewater, which is mostly sewage, and is as most people think, *"untreated wastes from toilets, baths, sinks, lavatories, laundries, other plumbing fixtures, and waste pumped from septic tanks in places of human habitation, employment, or recreation."* R18-9-101(35). Federal and state laws require primary and secondary treatment before the sewage is discharged to a receiving water. Basic treatment processes are physical (removes solids), biological (uses bacteria to consume organic matter), and chemical (chemicals used to create changes in pollutants or kill harmful organisms).

Compliance costs for a typical sewage treatment plant can be difficult to quantify because of the various contributing factors, including:

- Capital costs of new equipment and land;
- Operation and maintenance of new equipment;
- Waste capture and disposal, selling, or reuse;
- Change in production processes or inputs; and
- Maintenance changes in other equipment.

Whether treated sewage may cause an exceedance of a surface water quality standard to the receiving water depends on such factors as:

- Type or degree of treatment;
- Size of flow from the treatment plant;
- Characteristics of sewage from the treatment plant;
- Amount and quality of flow from industrial contributors and the status of pretreatment plans;
- Amount of flow in the receiving water that can be used for dilution;
- Quality of the receiving waters;
- Amount of mixing between the discharged sewage and receiving waters; and
- Uses of receiving waters.

Assuming a sewage treatment plant is faced with a discharge that has a reasonable potential to cause an exceedance under the new standards, a number of options exist to achieve compliance. A sewage treatment plant would first consider the feasibility of low cost options, and only consider the more costly options if necessary. If adjusting existing operations would not be feasible or would not be sufficient to achieve the desired reductions, the next lowest cost option could be controlling the source of the wastewater, such as contributions from industrial users. The feasibility of source control efforts depends on the make-up of the influent. For example, industrial discharges can be regulated through pretreatment regulations, but residential sources would have to be targeted through public outreach and education, which may have low participation rates and may not result in adequate reductions.

If the relatively low-cost options would not be sufficient for compliance, alternative discharge options or end-of-pipe treatment technologies may be necessary, such as diverting flow to recharge or reuse, land application, impoundments, or changing the outfall location to a different area with different water quality standards. The feasibility of each option would need to be considered; for example, an impoundment may not be feasible for a major facility with a large flow because the necessary amount of land may not be available. Remaining options come with greater capital expenditures, such as reducing the volume of discharge by reusing effluent, or installing treatment technology to reduce pollutants.

An example of the cost of a sewage treatment plant is the expansion of the City of Casa Grande Water Reclamation Facility. Due to a 68 percent growth in population, the facility is planning to double its capacity from 6 to 12 million gallons per day, and increase the effluent quality. It is reported that the expansion will cost $67,129,710 and includes preliminary treatment, anoxic/aerobic basins, secondary clarification and return activated sludge/waste, tertiary treatment, effluent pumping and conveyance system, and solids stream expansion. Notably, this expansion was planned before and separate from this rulemaking, so these actual costs cannot necessarily be attributed to these rules.

Another example is Pima County's major renovation and expansion of its regional wastewater system due to aging infrastructure, population growth, and necessary environmental compliance. Pima County is planning to construct a new water reclamation campus to replace its aging Roger Road water reclamation facility, which first operated in 1951. Costs of this new water reclamation facility are estimated at $235.2 million. Also, as discussed below, the costs of retrofitting a plant can be more than constructing a new one. Pima County plans to upgrade and expand its Ina Road water reclamation facility, designed in 1973, and constructed from 1975 to 1977. These costs are estimated at $244 million. However, these are gross project costs; the fraction of these costs that may be required to meet new surface water quality standards is not specified by the project proponent. This plan was developed in large part for compliance with existing water quality standards in Pima County's existing AZPDES permits for these facilities.

If a publicly-owned sewage treatment plant must incur costs to achieve compliance with these rules, then options exist for financial assistance. The Water Infrastructure Finance Authority (WIFA) is an independent agency in Arizona and is authorized to finance the construction, rehabilitation, and/or improvement of drinking water, wastewater, wastewater reclamation, and other water quality facilities/projects. Generally, WIFA offers borrowers below-market interest on loans for 100 percent of eligible project costs. As a "bond bank," WIFA is able to issue water quality bonds on behalf of communities for basic water infrastructure, providing significant savings due to lower interest rates and shared/reduced closing costs. WIFA is able to lower a borrower's interest costs to between 70 and 100 percent of WIFA's tax-exempt cost of borrowing. WIFA's principal tool for providing low-interest financial assistance for publicly and privately held sewer treatment plants is the Clean Water Revolving Fund, which is capitalized by contributions from the state and the U.S. Congress. In fiscal year 2007, WIFA executed loans in the amount of $133,448,342 to nine sewer treatment plants (or sewer-related projects). Three of the loans awarded were to communities with regulatory compliance issues. WIFA also manages a Technical Assistance (TA) program. The TA program offers pre-design and design grants to all eligible wastewater and drinking water systems. Both pre-design and design loans are available. The purpose of the TA program is to enhance project readiness to proceed with a WIFA project construction loan. In fiscal year 2007, WIFA provided $302,756 in grants for technical assistance to 11 sewer treatment plants.

Ammonia Standard

Based on comments received, the Department recognizes that changes in some rules will have more direct impact on sewage treatment plants than other rule changes.

The new numeric water quality standard for ammonia in surface waters with the A&W(edw) designated use may result in new water quality-based discharge limitations in AZPDES permits for sewage treatment plants discharging to existing effluent-dependent waters (EDW) or ephemeral streams, with accompanying costs. Ammonia, a regulated pollutant, is a component of total nitrogen. Total nitrogen in sewage is typically composed of ammonia, nitrate, organic nitrogen, and soluble organic nitrogen. With only primary and secondary wastewater treatment, nitrogen usually is not removed to a sufficient level. Nitrogen discharged into surface waters can consume and deplete the oxygen in the water, damaging aquatic fauna, which also need the oxygen. Nitrogen in the form of ammonia is highly toxic to aquatic life. For sewage treatment plants that have no other management options to achieve compliance with the ammonia standard, the most cost-effective method of ammonia removal is accomplished through the advanced treatment of biological nutrient removal (BNR) processes. The biological processes that remove the various forms of nitrogen from sewage are called nitrification and denitrification.

BNR Systems Overview

There are at least six common BNR treatment processes currently available to remove ammonia and nitrate from sewage. The BNR configuration that is appropriate for any particular sewage treatment plant depends on the target effluent quality (e.g., the applicable ammonia and nitrate criteria), sewage treatment plant operator experience, influent quality, and existing sewage treatment processes (if retrofitting an existing facility to meet the standards). In general, new sewage treatment plants have more flexibility and options when deciding which BNR system to implement because they are not constrained by existing treatment processes and sludge handling procedures. Retrofitting an existing sewage treatment plant to provide ammonia removal involves consideration of the following factors:

- Aeration basin size and configuration,
- Clarifier capacity,
- Type of aeration system,
- Sludge processing units, and
- Operator experience.

The aeration basin size and configuration of an existing sewage treatment plant dictates which BNR configurations are the most economical and feasible. If a sewage treatment plant has available excess capacity, it may reduce the need for construction of additional basins which may allow for a more complex BNR configuration. The need for additional basins may require the sewage treatment plant to purchase additional land if the space needed is not available. If land is not available, another BNR configuration will have to be considered. Clarifier capacity influences the effluent-suspended solids concentration, which affects effluent total nitrogen levels. Existing clarifiers may need to be modified to achieve target total nitrogen levels in the discharged effluent. Similarly, the sewage treatment plant will need to modify the existing aeration system to provide for aerobic and anaerobic zones in the sewage treatment train. The manner in which sludge is processed at an existing sewage treatment plant is important to the design of the BNR system. Sludge must be recycled within the sewage treatment process to provide the organisms and bacteria necessary for ammonia and nitrate removal and operators need to adjust treatment processes to compensate for changing conditions in the plant. BNR treatment processes are sensitive to influent conditions, including weather events and sludge processing. Sufficient operator skill and training are essential for achieving the target effluent concentrations of ammonia and total nitrogen.

BNR Systems Costs

BNR treatment systems will differ for new sewage treatment plants and retrofits. New plant BNR costs are based on estimated influent quality, target effluent quality, and available funding. Retrofit costs are more site-specific and may vary considerably for any given size category of sewage treatment plant. No economic studies have been conducted in Arizona to estimate the costs of upgrading sewage treatment plants to provide BNR. However, EPA conducted studies in Maryland and Connecticut for BNR upgrade costs, *Biological Nutrient Removal Processes and Costs,* which provides guidance as to potential costs associated with retrofitting existing sewage treatment plants in Arizona as may be required on a case-by-case basis as a result of this rulemaking. The capital costs ranged from a low of $1,375,866 for a 2.5 mgd (million gallons per day) plant to a high of $138,305,987, for a 180 mgd sewage treatment plant, all in 2006 dollars. The same EPA report provided costs for BNR upgrades to existing sewage treatment plants in Connecticut. The total costs of BNR retrofits ranged from $649,320 to $22,074,225.

These figures appear on the low end of what the Department has seen in informal communications with municipalities in recent years. Based on conversations with various municipalities, new plant costs for BNR technology in Arizona likely range from $6-12 per gallon while retrofit facilities may cost as little as $2-4 per gallon but likely average in the $6-8 per gallon range, which is in keeping with EPA's calculated average unit capital costs shown below. One example for which there are estimates for full nitrification and denitrification using the Modified Ludzack-Ettinger process, is the upgrade to the Nogales International Wastewater Treatment Plant. The project, currently 30 percent constructed, will cost over $62 million dollars for a 14.7 mgd facility. Costper-treatment gallon is approximately $4.40 and estimated annual operating costs are $5.3 million. Another example is the expansion of the Casa Grande Water Reclamation Facility, which as part of its $67 million costs, includes $4,239,724 for a nitrification/denitrification and BOD (biological oxygen demand) removal system.

The EPA study underscores that site-specific factors such as existing treatment system layout and space availability may cause costs to vary significantly between treatment plants with the same design capacities that are implementing the same type of BNR treatment upgrade. The study shows that despite this variability in costs, the unit cost per million gallons per day generally decreases as the size of the sewage treatment plant increases due to economies of scale. EPA calculated the following average unit capital costs for BNR upgrades at the Maryland and Connecticut sewage treatment plants:

Average Unit Capital Costs for BNR Upgrades at MD and CT Sewage Treatment Plants

Flow (in mgd)	Cost/mgd (in $2006)
> 0.1 – 1.0	$6,972,000
> 1.0 – 10.0	$1,742,000
> 10.0	$588,000

The Department expects similar average unit capital costs for sewage treatment upgrades to provide ammonia and nitrate removal for existing facilities in Arizona that do not already meet the new standard with flows of 100,000 gpd (gallons per day) or more. Small BNR systems of less than 0.1 mgd are usually pre-engineered, factory or field-assembled package plant systems. Capital costs for package plants for new small systems (<100,000 gpd) that can provide ammonia and nitrate removal will vary depending on the treatment process installed and the size of the package plant. Construction costs include all required facilities for a package plant on a new site and range from approximately $350,000 for a 4,000 gpd package plant to $1.5 million for a 100,000 gpd package plant. Annual operation and maintenance costs include labor, electricity, maintenance and repair, solids handling and disposal, administration, laboratory analytical costs, and chemical costs, and range from $25,000/year for the smallest plant (4,000 gpd) to over $160,000/year for the largest package plant (100,000 gpd).

The EPA study of BNR costs for retrofitting sewage treatment plants in Maryland and Connecticut suggests that the cost of upgrading existing sewage treatment plants in Arizona to provide BNR treatment to remove ammonia and nitrate from effluents may be substantial for some communities. However most sewage treatment plants have already incurred the costs for denitrification treatment upgrades due to mandates under their required aquifer protection permits (APP). See A.R.S. § 49-241(B)(10); A.A.C. R18-9-A202. As part of the APP process, a sewage treatment plant has to demonstrate that it will use Best Available Demonstrated Control Technology (BADCT). For sewage treatment plants, the treatment performance standards for BADCT are specified in rule at R18-9-B204 through B206. For most sewage treatment plants, BADCT requires nitrate removal to meet the aquifer water quality standard of 10 mg/L, which is the same as the surface water quality standard of 10,000 µg/L. See R18-11-406(B); 18 A.A.C. 11, Article 1, Appendix A, Table 1.

There are 36 EDWs currently identified in the rules that will be affected by the new numeric ammonia criteria for EDW. This rulemaking adds 29 new EDWs. Most facilities discharging to these areas already provide biological nutrient removal treatment, including nitrification to transform ammonia to nitrate and denitrification to meet the current BADCT requirements for the APP permitting program. The Department estimates that as many as 18 sewage treatment plants may be required, over a period of time, to retrofit their existing facility and upgrade unit treatment processes to meet numeric ammonia standards if they choose to continue discharging to surface waters. The Department expects that the additional reductions necessary to meet surface water quality standards will not require capital expenditures to the same level as initial upgrades to install BNR systems. Independent of this rulemaking, discharges under AZPDES permits are prohibited from being toxic to aquatic life. See R18-11-108(A)(5). Several of these 18 facilities have been discharging ammonia at a level showing toxicity to organisms. These facilities are required to consider the options discussed above, including additional treatment, despite the new ammonia standard.

Between the new water reclamation facility and the upgrade to the Ina Road facility, Pima County estimates that the new ammonia standard will cost $9,400 in total additional energy costs, increased chemical costs of methanol treatment of $37,800 annually and $300,000 for new storage, pumping and fire safety equipment. The Department considers these estimated increased energy costs to be minimal to moderate, and notes that in documentation submitted for its existing AZPDES permit, Pima County plans to use methanol as part of treatment. It is unclear how much of the estimated costs for methanol is necessary to meet the requirements of Pima County's existing AZPDES permit due to existing ammonia toxicity and how much is needed to meet the new ammonia standard.

Narrative Nutrient Standard Criteria in R18-11-108.03

A number of comments raised concerns about treatment requirements to use reclaimed water as source water in lakes and reservoirs, particularly in urban lakes. As noted in the response to comments, there is considerable misunderstanding about how the new narrative nutrient standard will be used to support AZPDES permitting. The matrix was not developed to be end-of-pipe limitations unless all other options fail. The standard will be applied in AZPDES permits, if necessary, once the assimilative capacity of the lake is determined and the target parameters chosen based on the in-lake water quality and the quality of the proposed discharge water.

Most lakes and reservoirs in Arizona are terminal systems, meaning they receive little inflow or discharge little outflow, or both. Basically what enters the lake stays and accumulates over time. Nutrients, such as nitrogen and phosphorus, naturally occur in all surface waters. The natural balance of these nutrients in a lake can be disrupted due to a wastewater discharge from a sewage treatment plant, which contains high levels of nitrogen and phosphorus. Too many nutrients means algae overgrowth, leading to high pH, low dissolved oxygen, and periodic fish kills. The amount of algae growth also depends on lake size, configuration, age, retention time and sources of inputs including stormwater, irrigation runoff, and discharge.

Nitrogen should be less of a concern in algae production because of the new ammonia standard for surface waters with the A&W(edw) designated use, as discussed above. However, phosphorus concentrations in reclaimed water tend to be higher than most lakes can assimilate without increased algae growth. A wastewater discharge with phosphorus concentrations in the 0.5 mg/l range allows the natural assimilation processes of a lake to better absorb this nutrient, allowing the lake to meet the target ranges in the rule matrix.

If necessary, there are basically three options a sewage treatment plant can choose in order to achieve the 0.5 mg/l phosphorus range for effluent discharging into the lake:

1. Retrofitting the existing sewage treatment plant to provide additional treatment;
2. Constructing a smaller treatment facility to reduce phosphorus before discharging to the lake; or
3. Treatment in the lake, such as chemicals or aeration.

The treatment options depend on certain factors:

1. How often will effluent be discharged into an urban lake?
2. How much effluent will be discharged into an urban lake?
3. What is the phosphorus level in the effluent?
4. What is the phosphorus level in the lake?
5. How much phosphorus needs to be reduced?

Determining the costs to comply with the new narrative nutrient criteria will require permittees to answer these key questions first and then weigh the various options to decide which set of options is the most cost-effective for its particular set of circumstances. Since each of these options is case-specific and dependent on factors such as volume of discharge, level of pollutants in the effluent, and quality of the receiving water, the Department presents a basic comparison of estimated costs by treatment option.

Treatment Options

If the choice is to retrofit an existing sewage treatment plant, there are a number of treatment technologies capable of reducing phosphorus in effluent to satisfactory levels. Two common technologies are:

- *Chemical addition with filtration:* This involves adding chemicals to wastewater with aluminum- or iron-based coagulants followed by tertiary filtration, which can reduce total phosphorus concentrations in the final effluent to very low levels. It requires a capital investment of chemical feed pumps, chemical storage and filters. Sludge production and disposal will increase.
- *Enhanced biological phosphorus removal (EBPR):* This is a biological process that promotes growth of organisms that attract phosphorus. Sewage treatment plants which utilize EBPR in the secondary treatment process can often reduce total phosphorus concentrations to 0.3 mg/l or less, depending on the quality of wastewater influent.

Below is a cost comparison of the two processes to upgrade flows at a 16 mgd sewage treatment plant. In this example, the plant upgrades for EBPR cost approximately $4.0 million, and reduce the phosphorus concentration in the effluent from 5 mg/L to 1.1 mg/L (an 80 percent reduction). A plant upgrade using chemical treatment alone can reduce phosphorus from 5 mg/l to 0.8 mg/l for $7.4 million in capital costs. These costs increase 600 percent, or to $44.4 million, in order to reduce phosphorus to 0.4 mg/l. A combination of the two processes can produce effluent with a phosphorus concentration of 0.8 mg/l for $11.4 million but reducing to 0.4 mg/l will cost nearly 4.5 times, or $45 million. The cost comparison underscores the importance of selecting the required phosphorus target reduction range.

Treatment Process	EBPR Only	Chemical Treatment Only		EPBR + Chemical Treatment	
Target Effluent Phosphorus (mg/L)	1.1	0.8	0.4	0.8	0.4
Total Capital Costs	$4,000,000	$7,440,000	$44,440,000	$11,440,000	$48,440,000
Annual O&M Costs	$1,870,000	$20,000,000	$50,000,000	$9,600,000	$37,000,000
Total Costs	$5,870,000	$27,440,000	$94,440,000	$21,040,000	$85,440,000

Instead of retrofitting the sewage treatment plant to treat the entire wastewater stream, a permittee may consider treating only that portion of the wastewater that will actually be discharged into the lake. The Department looked at the costs of treating 50,000 gallons per day of wastewater to a phosphorus concentration range of 0.5 mg/L. This assumes an average urban lake, which is about fifteen acres, 10 feet deep, requires approximately 50,000 gallons per day of makeup water during the summer months. The costs to build a 50,000 gpd wastewater treatment plant with chemical addition and sand filtration, capable of achieving a 96 percent removal of phosphorus to less than 0.5 mg/L would be $1.5 to $2 million.

Alternatively, a small wetlands system also can be used to treat the effluent, assuming sufficient land resources are available. Wetlands are highly effective at removing nutrients. The costs to construct a small wetlands system to treat 50,000 gpd of wastewater would be $250,000 to $500,000. Wetlands are not difficult to operate but do require periodic maintenance.

A final option to reducing phosphorus levels is in-lake treatment, which can be achieved with in-lake alum application, allowing coagulated material to settle to the bottom. An average urban lake of fifteen acres, 10 feet deep, would have a volume of 490 million gallons, and require approximately 1000 liquid gallons of aluminum sulfate (liquid being the preferred method of application). At $3 per gallon, the cost per treatment would be $3000 for the chemicals in addition to labor and materials costs. The average urban lake might require alum application about three to four times in the summer in order to remove 80 percent of the available phosphorus from the water column.

Power Generation and Mining

Power plants and mines are also likely to be affected by surface water quality rule changes. As with sewage treatment plants, some of the rule changes may require a permittee to incur costs to meet water quality-based discharge limitations established in an AZPDES permit. There are possible minimal increased monitoring costs based on a new numeric standard. However, as with the sewage treatment plants, economic challenges associated with wastewater disposal present themselves with and without this rulemaking.

Based on public comments, the greatest economic impact will come from the change in the EDW definition, which will require some permittees to treat their discharges to meet the chronic aquatic life criteria for the first time, instead of the more lenient standards for discharges that meet ephemeral water standards. Under the previous rule, permittees that did not treat their wastewater had been allowed to discharge higher levels of pollutants at levels that were not protective of aquatic life. The Department estimates that there at least seven permitted industrial facilities that will be impacted by the change in EDW definition. These permitted facilities will be eligible to request a compliance schedule or variance, as discussed above, to delay or defray costs.

This rulemaking clarifies that any discharge of "wastewater" to an ephemeral water will require use of EDW standards in the AZPDES permit and brings parity to all permitted discharges without distinguishing between treated and untreated discharges. With this change, all dischargers to the same waterbody will be held to the same water quality requirements. The Department acknowledges that some permittees may incur moderate to substantial costs to achieve compliance with the new surface water quality standards under the EDW definition, although it is difficult to quantify those costs. In general, power plants have not been required to treat cooling tower discharges, which due to cycling of water through the cooling processes results in increasingly higher concentrations of metals, total dissolved solids (TDS), and other pollutants. Mining facilities have implemented varying degrees of treatment, depending on the wastewater generated whether it is stormwater, process wastewater or mine dewatering. Dewatering is a commonly used method of coping with groundwater seepage, mine excavations intersecting aquifers or excessive rainfall on mining operations. These waters contain concentrated levels of metals from the mineralized area and/or TDS.

To determine what costs a permittee would incur to meet new water quality-based discharge limitations established in an AZPDES permit at some appropriate time in the future, the following factors would have to be examined including:

- What are the pollutants for the facility?
- Which pollutants present in the discharge have a reasonable potential to violate a new standard?
- What is the effect of this rulemaking on the previous wasteload allocation (i.e., what are the revised AZPDES permit limits considering the revised chemical criteria, changes to the stream designation, and elimination of protected flow provisions?)
- What are the existing effluent levels for each pollutant discharged under the current AZPDES permit?
- Are the industrial wastewater streams for an individual facility segregated before discharge and if so, what are the flow rates for each wastewater stream?

- Does the facility treat (or pre-treat) its wastewater and if so, what type of treatment technology is used?
- Where a reasonable potential to exceed a new standard exists, is additional treatment necessary or are there alternatives available such as source reduction or recovery to reduce the existing levels in the wastewater stream?
- What are the influent concentrations for each pollutant prior to any existing or anticipated treatment process?
- Is eliminating all discharges a cost-effective option?

Most permitted power plants and mining operations have some options as to where wastewater is discharged. Most power plants have more than one discharge location, with at least one location not being a water of the United States, where they can discharge at certain times of the year or under certain conditions. Mining operations generally are able to route waste streams to impoundments within the mine site, except maybe during storm weather events. Industries affected by this rulemaking will need to explore these options, as well as consider discharge volumes, duration of discharge, seasons, levels of pollutants, geography and other factors, in order to determine the most cost-effective, viable and environmentally protective option or combination of options.

For purposes of this rulemaking, the Department has looked at several scenarios that a power plant or a mine operation might consider if circumstances require the facility either to not discharge or to treat the waste stream to meet the new standards. Below is a brief description of the disposal and treatment options considered. Following each option is a discussion of how these options would impact each industry. While costs depend on the site and operation specifics, there are certain assumptions made to estimate impacts. For both mines and power plants, the Department assumes the pollutants of concern will be elevated metals and/or salts in the process water, dewatering water or cooling tower blowdown. The Department also assumes due to volume and quality of these waste streams, direct discharge to surface waters, injection into the aquifer, discharge to municipal sewers, or reusing the water within the facility are not viable options without treatment. These assumptions may or may not be accurate in all cases.

Storage and Evaporation Options

In many cases, the simplest method for disposing of unusable wastewater is storage and evaporation in lined surface impoundments. Lined evaporation ponds are a well developed and common method for disposing of industrial wastewaters and work extremely well in Arizona's arid climate. The costs associated with evaporation ponds are primarily the cost of land and necessary liners to protect the aquifer and facility security, such as fencing. Optimal depths are less than 40 inches, and operation and maintenance costs are relatively low. Periodic dredging and transport of sludge is an added, occasional cost. Ponds work well for small to moderate waste streams. Large ponds in an urban environment, especially where land prices are high, become less economically feasible. Cost modeling shows a rapid increase in costs with increases in the volume of wastewater and location. An evaporation pond sized to contain one million gallons per day of discharge for 30 days could cost upwards of $20 million if it were constructed today in the East Valley, given land prices estimated in excess of $200,000 per acre.

Impoundments can be used with other techniques. A new technology called Wind Aided Intensified evaporation may eventually prove appropriate for use in the southwest. It reduces the overall surface area of the ponds by increasing evaporation through the use of netting. This technology would reduce the footprint of the ponds and therefore reduce land costs but would have some additional capital costs for piping, pumps and netting materials. Impoundments also can be combined with chemical additions to provide various types of primary treatment to drop out metals and other pollutants. The types, amounts and costs of the chemicals are directly related to the pollutants of concern in the waste stream, such as metals, nutrients, and TDS.

Most mining operations are of such a scale that lined surface impoundments are generally the chosen method of disposal for excess process water that cannot be discharged under an AZPDES permit because of the low quality of the water. As most mines are in rural, undeveloped locations, land prices are generally not prohibitive. For mining operations with limited land for storage, especially in highly developed metropolitan areas or where discharges are too high, the wastewater may require treatment prior to disposal. Power plants in rural settings are able to utilize impoundments for wastewater disposal, but for those facilities in the metropolitan area, land prices may make large surface impoundments economically infeasible.

Treatment Options

The power plant industry, as well as municipalities, has been exploring zero liquid discharge systems, which use a variety of treatment techniques, often together with smaller surface impoundments, to treat, recycle and reuse all process wastewater leaving only the solids as a concentrate. Two technologies are discussed here, both of which are currently being used in the electric utility industry and could be transferred to other industries, including mining.

Brine concentrators convert highly saturated industrial wastewater, such as process cooling water, into distilled water for reuse, and a waste stream. The waste stream is typically five to 10 percent of the influent stream. For example, 100 gallons of highly saline wastewater would yield 90-95 gallons of distilled water (with low TDS) and five to 10 gallons of waste stream concentrate. The relatively small amount of waste stream concentrate can be disposed of in impoundments or, reduced to a dry solid through a process that makes solid crystal from the concentrate, which can then be disposed. The high quality water can be recycled within the plant or discharged under a permit. Brine concentrators can treat about 700 gallons per minute or 1.2 million gallons per day. A limiting factor is the cost of power to operate, which can range from 60-100 kilowatts per hour per 1,000 gallons of source water. These brine concentrators are reliable and not difficult to operate, but do require trained personnel to operate, as well as laboratory support.

Standard reverse osmosis (RO) is a separation process that uses pressure to force a solution through a membrane that retains the concentrate on one side and allows the higher quality water to pass to the other side. The membranes are specific to the pollutants of concern. Depending on the quality of water needed, RO systems can be constructed for multiple passes or arranged in series to achieve the necessary water quality. The concentrate is then disposed of in impoundments or by other means.

High Efficiency Reverse Osmosis (HERO) is a newer RO process that consists of three separate steps, but upon completion, the RO water (good water) is available for recycling within the plant as makeup water or can be discharged or injected into the aquifer under a permit. The concentrated RO water can be disposed of in impoundments or sent to a crystallizer to produce dry solid for landfilling. The HERO process has a lower energy requirement but does require specialized personnel to operate the system. The Griffith Energy Project near Kingman installed a HERO-based system in 2001. The plant is a 500 megawatt gas-fired, combined cycle unit. The Griffith facility is approximately the same size as the Salt River Project K-7 plant in South Tempe and half the size of the Salt River Project Santan plant in Gilbert. Initial findings at Griffith confirm the ability of the HERO system to reduce the volume of wastewater by nearly 90 percent. The system was designed to handle approximately 300 gallons per minute.

A cost comparison of the HERO with Evaporation Pond and Brine Concentrator with Evaporation Pond shows:

	HERO w/ Evaporation Pond $ x 1000	Brine Concentrator w/ Evaporation Pond $ x 1000
Total Direct Costs	6,450	7,375
Total Installed Costs[1]	8,400	9,365
Total Operating Costs (annual)	430	978

[1] includes direct and indirect costs

D. Estimated Costs and Benefits to Private and Public Employment.

Private and public employments are not affected directly by these rules.

E. Estimated Costs and Benefits to Consumers and the Public.

It is easy to describe qualitatively the benefits of clean water as a source for drinking water, bathing, cooking, washing clothes, and the inherent value of Arizona's rivers and lakes that are safe for swimming, fishing, boating, wading, or other water-based recreation. There is also value in maintaining aquatic and riparian ecosystems that are dependent on surface water. However it is much more difficult to quantify these benefits in monetary terms. Because these are comprehensive rule changes, it would be next to impossible to separate the benefits derived from each rule change from the overall benefit that surface water quality standards have in achieving clean water. There are some monetary examples, however, that help to demonstrate the value and benefit of these rules for ensuring clean water.

Recreation

According to the Arizona Department of Tourism, some of the top Arizona attractions revolve around water. The following table shows the 2007 attendance for some of Arizona's top water related-attractions.

ATTRACTION	ATTENDANCE
Tempe Town Lake	2,782,000
Glen Canyon National Recreation Area	1,894,114
Lake Mead National Recreation Area	1,824,297
London Bridge	1,500,000
Lake Pleasant Regional Park	697,479
Lake Havasu State Park	329,529
Slide Rock State Park	305,759

Clean water is an essential component that clearly relates to these economically important recreational activities. One example of the benefit of water quality standards for the designated use of full or partial body contact is the Ironman Marathon held in Tempe. The swimming portion of the marathon is a 2.4 mile swim in Tempe Town Lake. The 2008 Ironman had just over 2,000 participants from all over the world, competing for a $75,000 prize. According to the Tempe Convention and Visitors Bureau, the Ironman competition generated approximately $5.1 million in 2007.

Fishing

A 2002 study on the economic importance of fishing and hunting, sponsored by Arizona Game and Fish (AZGFD), showed that more than 255,000 anglers spend an estimated $831.5 million on equipment and trip-related expenditures annually. This spending supports more than 17,000 jobs, provides residents with $314 million in salary and wages, and generates more than $58 million in state tax revenue. Based on AZGFD's 2006-2007 Annual Report, 483,642 fishing licenses were purchased for 2006, generating part of the $14,740,686 revenue of hunting and fishing license sales for 2006.

Part of AZGFD's fishing program includes the Urban Fishing Program, which is supported by the sale of Urban Fishing Licenses and from fees from the city parks and recreation departments. During 2007, over $500,000 was spent on stocking over 200,000 pounds of keeper-size channel catfish, rainbow trout, and sunfish. Last year, over 55,000 urban anglers participated in fishing and accounted for over 650,000 angler recreation days. The number of urban fishing licenses for 2006 was 32,837. A constant challenge in Arizona's warm urban lakes is to monitor and manage pH levels and algae to ensure fish can be stocked. Out of the 21 urban lakes listed as part of the Urban Fishing Program, 10 are surface waters protected under these rules.

Other Monetary Benefits

Agriculture is another measure where clean water is an absolute necessity for ensuring agricultural productivity. As noted by the Arizona Department of Agriculture, Arizona agriculture produces cotton, durum wheat, alfalfa, various produce like head lettuce, leaf lettuce, broccoli, cantaloupe, watermelon, and citrus. Livestock also plays a big role in Arizona, both with cattle and sheep. The Department of Agriculture reports that agricultural sales in Arizona generate $2.2 trillion annually, with Yuma County generating $1,303,492,000. Although a percentage of agricultural productivity depends on groundwater, surface water quality standards help maintain and protect surface water quality for irrigation and livestock watering.

Another example of the value of clean water is the worth placed on Colorado River water, as demonstrated through the Central Arizona Project (CAP). One of Arizona's main sources of water is the Colorado River, in which water is transported through the CAP. This 336 mile long canal provides, on average, 1.4 million acre-feet (one acre-foot roughly equals 326,000 gallons) of water each year to nearly 2 million citizens and businesses in central and southern Arizona. In 2007, CAP delivered 1,700,203 acre-feet to its customers, generating $108.8 million in water operations and maintenance charges. Agricultural, and municipal and industrial water usage accounted for 975,635 acre-feet. CAP water rates for long-term contract customers is at $91 per acre-foot.

Quantifiable benefits also can be demonstrated as the cost avoided, such as for clean-up. The Department recently awarded a $54,978 grant to fund water quality improvement in Pima County for Lakeside Lake. This lake, filled mainly by reclaimed water, is a popular recreational and fishing location, but the lake has become increasingly eutrophic over the years. These conditions have resulted in noxious algal blooms, high pH, low dissolved oxygen, limited stocking, and periodic fish kills. A marked decline in water quality and several fish kills since the early 1990s led to citizen complaints and increased attention on the part of the City of Tucson, AZGFD, the University of Arizona, and the Department. The City of Tucson reports they spent $250,000 for installing an aeration system on the bottom of the lake, meant to improve water quality and alleviate stress on fishes. Declining conditions led AZGFD to stock trout only in the cooler months and catfish and other warm-water species in the summer months. Under the grant, Tucson will improve water quality in the lake by reducing drainage from surrounding park lands into the lake, providing bait disposal locations for people who fish, and occasionally treating the lake with alum, a chemical that will help reduce algae growth. Tucson will also remove debris from the lake and surrounding park.

Deriving both full and partial body contact criteria for non-carcinogenic compounds, changing the relative source contribution from 100 percent exposure to 20 percent, also results in more protective standards. The benefit of water quality standards for the designated use of full or partial body contact can be demonstrated as revenue lost, for instance, when Slide Rock Park closes due to exceedances of *E. coli*, which has occurred on average of 12 times annually.

Adding treatment, such as nitrification/denitrification, typically produces a better effluent quality, meaning lower level of pollutants, such as nitrates, but also other pollutants such as personal care products. Better effluent quality also allows more options for reuse, such as for irrigation purposes. Even though the Casa Grande Water Reclamation Facility expansion will cost $67,129,710, there is a recognized benefit of $14.5 million in total capital cost reduction in improving treatment for the overall liquids and solids process optimization.

Health Benefits

The most important benefit derived from the surface water quality standards is to the protection of humans for drinking water, swimming, and fish consumption. Deferred and avoided health care cost benefits associated with this rulemaking's incremental human health protections are real but unquantified. One change to the methodology for deriving standards for non-carcinogens for each of the human health designated uses, is the use of a relative source contribution (RSC) of less than 100 percent. The RSC is the amount of exposure from various sources or routes, such as drinking, swimming, or fish consumption. Setting the RSC at less than 100 percent acknowledges there may be additional routes of exposure for a pollutant besides that particular designated use. For example, humans can be affected by arsenic from a variety of sources including oral, dermal and aerial.

For example, in deriving the fish consumption criteria, the Department has adopted EPA's recommendations that resulted in two changes: 1) it increased the default fish consumption number from 6.5 to 17.5 grams/day to more adequately protect the general population of fish consumer, and 2) it changed the relative source contribution from 100 percent to 20 percent, acknowledging there may be additional routes of exposure for a pollutant besides ingestion of fish. Part of the changes regarding fish consumption include a new fish tissue standard for methylmercury (MeHg), an organic compound of mercury that bioaccumulates in fish and is one of the most toxic substances known to man. While MeHg has been linked to a variety of health effects, the primary risk arises from its toxicity to the nervous system, including the brain. Numerous health studies have demonstrated that methylmercury is a potent neurotoxin, particularly in developing organisms [EPA, 1997; ATSDR, 1999; NAS, 2000.]

Unborn children are as much as 10 times more susceptible than adults to its detrimental effects. The most common source of exposure to MeHg is from eating fish that contain the mercury. Upon ingestion by humans, MeHg is absorbed through the gastrointestinal tract and easily penetrates the blood-brain and placental barriers. Most at risk are infants and unborn children whose mothers consume fish containing MeHg during pregnancy or while nursing. If the tissues of a pregnant or breastfeeding woman are contaminated with mercury, a disproportionate amount of that mercury may be passed to the baby, where it can attack the developing nervous system. Chronic exposure to MeHg at elevated concentrations can cause developmental delays and learning disabilities and acute exposures may cause gross cranial defects, cerebral palsy, and a higher infant mortality rate.

One example of costs of MeHg exposure is developmental impacts on children. Using national blood mercury prevalence data from the Center for Disease Control, it is estimated that between 316,588 and 637,233 children each year have cord blood mercury levels greater than 5.8 µg/L, a level associated with loss of IQ. The resulting loss of intelligence causes diminished economic productivity that persists over the entire lifetime of these children. This lost productivity is the major cost of methylmercury toxicity, amounting to $8.7 billion annually, with a range of $2.2 to 43.8 billion (all costs are in 2000 U.S. dollars) (Trasande et al, 2005).

Adoption of the fish tissue standard is protective of human health and will aid the Department in notifying the public when it is not safe to consume fish from certain waterbodies. Costs avoided include reduced infant mortality and direct costs of medical care for exposure to mercury and MeHg, specifically neurological care for infants and children. Indirect costs of specialized education for children with learning disabilities may also be avoided.

The Department has also adopted the new Safe Drinking Water MCL for arsenic of 10 ppb for the domestic water source designated use. Inorganic arsenic has been recognized as a human poison since ancient times and EPA has found it to be a Class A carcinogen. Arsenic ingestion has been linked to a multitude of health effects, including cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. Nonlethal, but high doses, can cause noncancerous health effects include gastroenterological effects, shock, continuous pain, and vascular effects in humans. Other effects that have been reported include alterations in gastrointestinal, cardiovascular, hematological (e.g., anemia), pulmonary, neurological, immunological and reproductive/developmental function. High dosages of arsenic of 70 to 280 mg for 50% of adults weighing 70 kg are lethal. Increased risks of lung and bladder cancer and of arsenic-associated skin lesions have been observed at drinking-water arsenic concentrations of less than 0.05 mg/L. Children are exposed to arsenic in the same ways that adults are. Since children tend to eat or drink less of a variety of foods and beverages than do adults, ingestion of contaminated food, juice or infant formula made with arsenic-contaminated water may represent a significant source of exposure. There is some evidence that exposure to arsenic in early life (including gestation and early childhood) may increase mortality in young adults.

The 1999 National Academy of Science report found that the lifetime risk of dying from cancer due to arsenic in drinking water is generally lower for people drinking low levels of arsenic in tap water (NAS, 1999). A recent study from Finland (Kurttio et al., 1999) found that Finns who drank water containing low levels of arsenic (<0.1 ppb) had about a 50 percent lower risk of getting bladder cancer than their countrymen who drank water containing higher levels (>0.1 ppb – 0.5 ppb). People who consumed water with 0.5 ppb arsenic had more than a 140 percent increase in bladder cancer rates, compared to those drinking at levels less and 0.1 ppb. Similar reductions in risk are found for other types of cancers and cardiovascular diseases at increasingly lower levels of arsenic (BEST, 2001). Costs avoided include direct costs of medical care for exposure to arsenic. EPA estimated the value of the benefits of adopting the 10 ppb arsenic standard for drinking water to range from as high as $90 million for bladder cancer to $384 million for lung cancer.

These are two examples of human health and cost benefits that may be expected to result from more protective water quality standards like those adopted in this rulemaking. Though the standards in these rules are incrementally more protective of human heath then the previous standards, the Department believes the overall benefits of the rules outweighs the costs.

<u>Indirect Costs to Consumers and General Public</u>

The Department recognizes that permittees, especially sewage treatment plants, may pass their direct costs onto their customers, taxpayers or both. If sewage treatment plant upgrades are required to comply with new or revised water quality standards, this can result in an indirect cost to some business, industry, and consumers paying higher utility bills for sewer services, or more for commodities. In particular, customers served by sewage treatment plants that discharge to effluent-dependent waters may be affected by the adoption of numeric water quality standards that will limit discharges of ammonia, but only if the discharge is not currently toxic, as described above.

Sewage treatment plant upgrades are typically financed through rate increases or bonding. Publicly-owned sewage treatment plants also have a financing option of low-interest loans through WIFA. Consumers could see increased taxes and municipal debt financing due to public sewage treatment plant compliance with more stringent standards. Municipal operators of sewage treatment plants typically pay the debt service on bonds or WIFA loans through increases in sewer rates and sewer connection fees for customers in the local community. It is difficult to estimate the costs to consumers and the general public, but cost of sewer services will increase for those sewage treatment plants that are required to upgrade treatment.

An example of how a customer may be affected, the Nogales International Wastewater Treatment Plant projects a sewage treatment rate increase from $6.75 to $9.96 for the base fee over a period of 10 years and an increase in the sewer rate from $1.17 to $1.71 for every 1,000 gallons over the same period. The City of Casa Grande has low sewer rates of $11.98 per month, but collects and uses development fees to help pay for new sewage treatment facilities. Pima County estimates that its customers' monthly sewer bills will increase annually for a period of 15 years, starting at $21.56 and projected to be $46.05. The annual percent change increase that a customer could see ranges from 16.9 to 1.7, with five years at zero. Pima County connection fees would also increase, with the annual percent change ranging from 19.9 to a low of 1.7, again with four years at zero. Connection fees start at $6,364 and are projected to climb to $12,494.

F. Estimated Costs and Benefits to State Revenues.

There are no fees associated with these rules. This rulemaking is expected to have no impact on state revenues.

Requirements of A.R.S. § 41-1035.

The Department defines a small business as a privately-owned permitted facility that discharges less than 1 million gallons per day. The Department calculates that about 25 out of the 160 individual permittees would qualify as a small business. For a sewage treatment plant, this facility would serve a community of no more than 10,000.

1. *Establish less stringent compliance and reporting requirements for small businesses.*
   The rules do not establish any reporting requirements.
2. *Establish less stringent compliance or reporting schedules or deadlines for small businesses.*
   The rules authorize schedules of compliance in A.A.C. R18-11-121, which allows a facility time to evaluate, design, and construct treatment or other means of meeting a new standard. (The Department is prohibited by federal law from establishing less stringent compliance schedules for small businesses under 40 CFR 122.47.) The rules do not establish any reporting schedules or deadlines for small businesses.
3. *Consolidate or simplify the rule's compliance and reporting requirements for small businesses.*
   The rulemaking does not prescribe reporting requirements.
4. *Establish performance standards for small businesses to replace design and operational standards.*
   The rules do not establish design or operational standards for small businesses.
5. *Exempt small businesses from any or all requirements of the rule.*
   Water quality standards are provisions of state law required by the federal Clean Water Act. The Department has no authority to exempt small businesses from the requirement to comply with surface water quality standards. However, as explained in Section C above, the rules provide other methods for reducing the immediate impact for dischargers, including small businesses, such as the compliance schedules and variances.

10. A description of the changes between the proposed rules, including supplemental notices, and final rules (if applicable):

Rulemaking changes made as a result of responses to comments are described in item 11. Conforming, grammatical, formatting, and other minor changes have been made throughout the rule package by the Department and as suggested by the Governor's Regulatory Review Council (G.R.R.C.) staff and have not been addressed in items 10 or 11.

The following changes are the result of Department review and are addressed in this section for the benefit of the reader.

The proposed rulemaking used the term "municipal park" throughout the rulemaking when referring to specific lakes. This final rulemaking changed the terminology from "municipal park" lake to "urban" lake.

The term "pollutant of concern" used in R18-11-107.01 refers to pollutants with either a numeric or narrative water quality standards and has been defined in R18-11-107.01(B)(4) and the remaining subsection has been renumbered. Because the term "pollutant of concern," found in R18-11-114(D)(7) and R18-11-122(F)(3) does not pertain to antidegradation, it has been clarified is each case.

R18-11-101. Definitions

The Department believes that by revising the language of the term "designated use" in the proposed rulemaking, the meaning of the term was changed or could be understood in a different manner. The original definition has been retained.

The term "wastewater," used in this rulemaking, has the commonly understood meaning. The term is further clarified in this Section as to which types of discharge are not considered wastewater.

R18-11-107.01. Antidegradation Criteria

The phrase "under an individual AZPDES permit" was added to subsections (B)(3) and (B)(3)(c) to clarify that the antidegradation review only applied to an individual AZPDES permit.

The stem sentence in subsection (C)(3)(a) conflicts with the rest of the subsection. The actions required for an alternative analysis are covered within subsections (C)(3)(a)(i) through (iv). The following language has been removed from the rule: *"The person shall demonstrate that there are no reasonable, cost-effective, less-degrading, or non-degrading alternatives to the regulated discharge"*

R18-11-108.03. Narrative Nutrient Criteria For Lakes And Reservoirs

The Department believes that the term "lacustrine" (of or related to the lake") is too general a term in this instance and that the term "limnetic" (of or occurring in the deeper, open waters of lakes or ponds, away from the shore) was more appropriate. Subsection (B) has been revised as follows: *(B)(2)(c)(v) A nuisance algal bloom is present in the limnetic portion of the lake or reservoir; or*

Appendix B

The name of the surface water proposed as "Unnamed Wash," in the Colorado – Lower Gila (CL) watershed located at "Town of Quartzsite WWTP outfall at 33°42'30"/114°13'14" to 1 km downstream at 33°42'30"/114°13'45"" has been corrected to "Tyson Wash."

The location of the Gila River (EDW) in the Middle Gila watershed has been corrected as follows: *From the confluence with the Salt River to the Gillespie Dam at 33°13'45"/112°46'07"*

The location of the Unnamed Wash in the Middle Gila watershed has been corrected as follows: *North Florence WWTP outfall at 33°03'49.54"/111°23'13.28" to confluence with Gila River at 33°02'59"/111°23'15"*

The name of the surface water segment proposed as "Santa Cruz Wash (EDW)" in the Santa Cruz – Rio Magdalena – Rio Sonoyta watershed, located at "Palo Verde Utilities WWTP outfall at 33°04'20"/112°01'47" to the Gila River Indian Reservation" has been corrected to the "Santa Rose Wash." The surface water and designated use information about the corrected Santa Rose Wash has been positioned above the "Santa Rose Wash" located "Below Tohono O'odham Indian Reservation to the Ak Chin Indian Reservation."

11. A summary of the comments made regarding the rule and the agency response to them:

All comments in this section are, for the most part, presented as received. Extraneous or repetitive information has been omitted, as appropriate.

GENERAL COMMENTS

Comment #1

Sandy Bahr, Sierra Club Grand Canyon Chapter

While Pharmaceuticals and Personal Care Products (PPCPs) are not addressed in the proposed surface water quality standards, they are a significant public concern and should be addressed in the next Triennial Review. In the meantime, we recommend that the ADEQ implement testing for at least some of these products to begin to assess their occurrence in Arizona waters and that it continue to support research at the universities. These products are found in treated municipal wastewater that is discharged into Arizona waters, so it is something that should be considered and evaluated.

J. Adrianne Settimo

Pharmaceuticals and Person Care Products (PPCPs) have become a significant public concern. Trace levels of these products can be found in treated municipal wastewater that is being discharged into Arizona waters. Released wastewater "creates an aquatic environment that supports wetlands and stream-side vegetation or may recharge the groundwater."

Although the issue of PPCPs is relatively new, "scientists have detected some of the chemicals at levels linked to adverse impacts on the reproductive systems of certain species of fish and frogs that depend on waters influenced by treated wastewater." Id.

The possibility that PPCPs may have adverse impacts on humans at higher levels, and water containing PPCPs may be recharging groundwater is cause for concern. Science has not yet determined what impact long-term exposure to low levels of pharmaceuticals will have on humans, let alone what impact this exposure will have on wildlife.

The first step in assessing how big of an issue PPCPs are in Arizona's water resources is to implement a testing program. Therefore, the testing of (at least) aquifer water should be added to the proposed rule. If levels of PPCPs are higher than trace amounts, action should then be taken to correct the situation.

Response: PPCPs belong to a category of emerging pollutants that have recently come to the attention of scientists, federal and state regulators, and the public. The Department shares the commenter's concerns about the potential impact of PPCPs that are making their way into Arizona's rivers, streams, lakes, and reservoirs. Increased monitoring and better analytical test methods have increased awareness of the presence of PPCPs in surface water and highlighted the need for more information about their potential risks to human health and the environment. Research has just begun and little data currently exists about the consequences of PPCPs on human health or aquatic life. Currently, there is no basis for developing scientifically defensible water quality standards for PPCPs. The Department will follow the development of the regulation and science concerning these pollutants. Although the Department does not have detailed plans for where and when testing for these pollutants will occur, the Department has conceptual plans to conduct environmental testing over the coming years and will continue to support university research on this matter as resources allow.

Comment #2

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ has failed to revise A.A.C. R18-11-106, net ecological benefit (NEB) to facilitate its intended use within Arizona.

As Pima County and ADEQ staff have previously discussed and agreed, providing ADEQ with the information and demonstrations requested by this rule section, in order to provide the Department with grounds to modify an existing standard, may be impossible to achieve for many projects given the general and vague nature of the current rule language. It was obviously not the intent of the Department to create a rule that essentially could never be used for its intended purpose.

ADEQ staff has previously suggested that this rule could be used to allow a modification of standards to address the short comings of the current water quality standards, to properly regulate riparian habitat restoration projects such as the Kino Ecological Restoration Project (KERP). However, upon investigation by Pima County of the demonstrations required by the rule, it became obvious that the rule was not written in a sufficiently clear and reasonable way, so that the information and demonstrations can actually be made.

Pima County, at the invitation of ADEQ staff, has previously communicated with ADEQ on these issues in a letter dated January 26, 2006 (Attachment #6). This letter discusses the background of this rule language and makes suggestions for modifying the rule language consistent with EPA guidance, in a way that will make it usable for its intended purpose in Arizona. Pima County asks ADEQ to consider these issues and revise the NEB language to address these concerns.

In addition we have attached comments from Dr. Ben Parkhurst (Attachment #2) discussing how the state of Wyoming has modified its water quality standards rules and produced implementation policies (Attachment #7) that have allowed the net ecological benefit concept to be used extensively is the state. We ask ADEQ to adopt similar rules and implementation policies for Arizona to address the problems with the Arizona NEB rule.

Response: "Net Ecological Benefit" is a difficult determination for the very reasons the commenter points to: the comparison and evaluation of social value that a project may have versus the monetary costs of either not performing the project or meeting the current surface water quality standards required by the Clean Water Act and the rules. This is a complex issue that is not unique to Arizona and has been a point of discussion in other state and EPA water quality forums. As noted, the Department reviewed Pima County's January 26, 2006 letter, other stakeholder comments, and held discussions with stakeholders, however the Department is not proposing changes to the Net Ecological Benefit rule at this time. The Department has approved modifications to water quality standards for the Yuma East Wetlands discharge in this rulemaking under R18-11-106, illustrating that the current rule can be used.

JURISDICTION

Comment #3

Sydney Hay, Arizona Mining Association

As reflected in the existing and proposed definition of "surface water," the standards in A.A.C. R18-11-101 et seq. are intended to apply to waters of the United States as that term is defined pursuant to the CWA ("CWA"). As ADEQ is aware, the extent of CWA jurisdiction is uncertain after the decision of the United States Supreme Court in *Rapanos* v. *United States*, 547 U.S. 715 (2006). Subsequent to that decision, EPA and the Corps of Engineers issued guidance entitled "CWA Jurisdiction Following the U.S. Supreme Court's decision in *Rapanos* v. *United States & Carabell* v. *United States* (June 2007) (the "Guidance"). Pursuant to the Guidance "traditional navigable waters" ("TNWs"), reasonably permanent tributaries of TNWs, and other tributaries with a "significant nexus" to TNWs remain regulated under the CWA. By contrast, swales or erosional features (*e.g.,* small washes characterized by low volume, infrequent, or short duration flow) are generally not considered jurisdictional.

In a state such as Arizona, where many "waters" are ephemeral washes, the Guidance may result in some waters previously considered jurisdictional no longer being so considered. At this point, it is simply too early to tell what the ultimate ramifications of the decision and the Guidance will be in Arizona. For example, the agencies have not yet fully identified the extent of TNWs within the state, nor clearly defined how the presence or absence of a "significant nexus" to such TNWs will be measured.

The AMA believes that the triennial review needs to account for this jurisdictional uncertainty. Currently, the definition of "surface water" is broader on its face than the corresponding EPA and Corps definitions (*e.g.,* by specifically including "ephemeral" streams in the "other waters" category), and ADEQ has not proposed any changes to that definition. *See* A.A.C. R18-11-101(43)(c). The blanket inclusion of ephemeral streams is unwarranted, particularly after *Rapanos*.

In light of the foregoing, the AMA suggests that the most efficient way to address the issue in the triennial review is as follows: (1) modify the definition of "surface water" to simply provide that a surface water means a "navigable water" as that is the term is defined in A.R.S. § 49-201(22), since "navigable water" is the term used in the governing statutes, specifically A.R.S. §§ 49-221(A) (authority to adopt surface water quality standards) & 49-255(2) (definition of "discharge" for AZPDES program); and (2) add language clarifying that the designated uses in Appendix B apply "if and to the extent that each listed water or reach constitutes a surface water." *(The tributary rule (A.A.C.R. 18-11-105) already applies on its face only to a "surface water" and so would not need to be modified if the changes to the definition of "surface water" outlined above were adopted. Absent those or similar changes, however, the tributary rule would be subject to challenge by virtue of its apparent classification of every single tributary as a regulated "water of the United States" under the CWA.)*

The AMA recognizes that ADEQ has authority to adopt surface water quality standards for non-navigable waters pursuant to A.R.S. § 49-221(B), but the Department has not proposed doing so and any such proposal would need to be accompanied by a separate analysis of the economic, social and environmental costs and benefits associated with any such standards. Absent such a proposal and accompanying analysis, the AMA believes that the approach suggested above is the most logical one given the current climate of uncertainty

Response: The Department does not agree that the current rule language needs to be changed as a result of the *Rapanos* decision and federal guidance. The federal guidance document pertains to the Clean Water Act § 404 program and is not rule. The Department is required to establish standards under section 303 of the Clean Water Act. Nothing in the *Rapanos* decision or the Guidance applies to section 303.

The Department agrees that the proposed surface water quality standards are intended to apply to surface waters or waters of the United States. However, the Department disagrees that it should modify the current definition of surface water in response to the *Rapanos* decision and does not believe it is necessary to revise the definition of surface water to provide that a surface water is a navigable water. The term navigable water is defined in A.R.S. § 49-201(22). The current definition of surface water already states that it means a water of the United States, which defines navigable water under both state and federal law.

The Department disagrees that language should be added to the definition of surface water to provide that the surface water quality standards apply "if and to the extent that each listed water or reach constitutes a surface water." The suggested language is unnecessary because A.A.C. R18-11-102(A) already states that the water quality standards in 18 A.A.C. 11, Article 1 apply to surface waters. The listing of a water body in Appendix B of this rulemaking is a Department determination that the listed water body is a surface water as defined under A.A.C. R18-11-101(41). The water quality standards of 18 A.A.C. 11, Article 1 have applied to surface waters since 1992. No change has been made to the rule.

Comment #4

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

One of SMCFD's primary concerns is based upon the U.S. Supreme Court's ruling in *Rapanos* v. *U.S.*, 126 S.Ct. 2208 (2006). In *Rapanos*, the Supreme Court held that the jurisdictional term "navigable waters" under the CWA includes only relatively permanent, standing or flowing bodies of water, not intermittent or ephemeral flows of water lacking a significant nexus with waters of the United States. Although *Rapanos* involved consideration of the Army Corps of Engineers' regulation of wetlands under section 404(a) of the CWA, the same definition of navigable waters applies to National Pollutant Discharge Elimination System ("NPDES") permits under section 402 of the CWA. *See* 33 U.S. §§ 1311(a), 1342(a), and 1362(7); *see also* A.R.S. § 49-201(22) ("'Navigable waters' means the water of the United States as defined by section 502(7) of the CWA."). In addition, the *Rapanos* decision makes clear that tributaries to waters of the United States that are not themselves waters of the United States, are viewed as "point sources" of discharge into waters of the United States only if the contaminant-laden waters in the tributary ultimately reach jurisdictional waters. *Rapanos*, 126 S.Ct. at 2228.

Siphon Draw is not a Water of the United States

SMCFD operates a wastewater treatment plant that intermittently discharges treated wastewater (or "effluent") to an unnamed wash that is tributary to "Siphon Draw." A stretch of Siphon Draw is proposed in this rulemaking for listing as an "effluent-dependent water" simply because it receives drainage from SMCFD's treatment plant. *See* Appendix B of the proposed rules. Siphon Draw is an ephemeral wash that historically drained precipitation from the Superstition Mountains. The historic drainage of Siphon Draw was significantly altered by the construction of the Central Arizona Project's ("CAP's") canal, and intervening residential development and flood control structures.

Historically, I understand ADEQ has taken the position that SMCFD's discharge is jurisdictional because Siphon Draw is a tributary to Queen Creek, but this is incorrect. Siphon Draw was not historically, and is not today, a tributary of Queen Creek. *See* Exhibit C, January 16, 2001 letter from Tom Haws, P.E. to Ed Grabek. Even if we assume there were drainage patterns leading miles and miles from the SMCFD plant area to a navigable water (presumably the Gila River), which is not the case, the *Rapanos* decision makes clear that tributary status alone is not enough to invoke CWA jurisdiction – there must be proof that contaminant-laden waters ultimately reach covered waters.

In the case of Siphon Draw, which even with development changes is at most a lengthy ephemeral wash, none of SMCFD's discharges reach a water of the United States. Further, there is no evidence of a significant nexus of SMCFD's discharge with any navigable water.

Response: The Department received a number of comments concerning Clean Water Act (CWA) jurisdiction in the aftermath of the *Rapanos* decision. As noted in the comment, *Rapanos* was a plurality decision where the Supreme Court justices could not agree and as a result, issued five separate opinions, with no single opinion commanding a majority of the Court. *Rapanos* was a wetlands decision related to the provisions of section 404, not the NPDES program under § 402 of the CWA. The *Rapanos* Guidance, which is not in rule, specifically states in footnote 17, that it "focuses only on those provisions of the agencies' regulations at issue in *Rapanos* – 33 CFR 328.3(a)(1), (a)(5), and (a)(7)," which are the federal regulations for the 404 permitting program administered by the Army Corps of Engineers. Furthermore when EPA commented on this rulemaking, it did not note any concerns with jurisdiction issues. Irrespective of the *Rapanos* decision there are other factors of importance in Clean Water Act jurisdiction determination including a history of federal Clean Water Act case law that was not affected by *Rapanos*, including the tributary rule, commerce clauses, and interstate waters provisions. The Department appreciates that this is an important matter to stakeholders, as it is to the Department. In specific response to this comment, the Department does not concur that Siphon Draw has been removed from jurisdiction under the Clean Water Act.

Under the tributary rule, R18-11-105, all ephemeral tributaries have applicable surface water quality standards and are subject to section 402 permitting requirements for point source dischargers. Under R18-11-113, the Director shall classify a surface water as an effluent-dependent water by rule, which the Department is doing with this rulemaking. R18-11-113(E) requires the Department to use A&Wedw standards for a point source discharge of wastewater to an ephemeral water. Superstition Mountains Community Facilities District (SMCFD) has an individual AZPDES permit that authorizes the discharge of 2.1 million gallons per day (mgd) of treated effluent to Siphon Draw. That permit is written to be protective of aquatic life and body contact uses. While SMCFD can direct discharges to underground storage basins, there is nothing restricting the District from discharging the full 2.1 mgd, 365 days a year to Siphon Draw. The SMCFD discharge has an effluent-dependent ecosystem.

The Department disagrees with the commenter on the issue of Siphon Draw. The Department considers ephemeral waters to be surface waters as defined under R18-11-101(41). Siphon Draw is being classified as an effluent-dependent water and is listed in Appendix B in this rulemaking because it meets the definition of effluent-dependent water. The identified reach of Siphon Draw that the Department proposes to classify as an effluent-dependent water is from the SMCFD WWTP outfall to a location that is approximately 6 km downstream from the outfall.

Comment #5

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

We understand from comments made at a previous stakeholder meeting that ADEQ believes it has authority under A.R.S. § 49-221(B) to expand the jurisdiction of the AZPDES program to apply to state waters that are not jurisdictional under the federal CWA. However, ADEQ also suggested that it does not intend to exercise this authority. ADEQ's non-specific authority to create water quality standards for "waters of the State" in 49-221(B), and even its specific authority to require persons otherwise covered by permit programs to conduct monitoring in state waters [see A.R.S. § 49-203(B)(2)], is not accompanied by any specific authority to implement those standards, and interpretation of § 49-221(B) in the manner suggested contravenes the limitations on ADEQ's powers in § 49-203(A)(2) (permit program can be no more stringent that the requirements of the CWA). *See also* A.R.S. § 49-202 (section provides no specific authority to control discharges to state waters); A.R.S. § 49-231 (TMDL authorizing statutes define "surface water quality standard" to include only standards adopted for navigable waters); and A.R.S. § 49-201(41) (definition of "waters of the state"). Since it does not appear the Department can include waters of the state in the AZPDES program rules and permit, and since the Department does not intend to exercise that jurisdiction anyway, then it is critical the Department conform its surface water quality rules to recognize only that jurisdiction permitted under the CWA for "navigable waters." In SMCFD's case, this will require that ADEQ amend the proposed Appendix B to remove Siphon Draw.

Response: The Department disagrees that Siphon Draw should be removed from Appendix B for the reasons outlined in Response #4. The Department adopted the surface water quality standards in 18 A.A.C 11, Article 1 under the statutory authorities provided at A.R.S. §§ 49-221(A) and 49-222. These statutes provide authority for the Department to adopt water quality standards for navigable waters or waters of the United States as defined by the Clean Water Act. For nearly 30 years, the Department has considered, based on the Clean Water Act, its regulations and applicable law, tributary ephemeral and intermittent waters to be waters of the United States and thus navigable waters. The Department has adopted surface water quality standards for both categories of surface water. The Arizona Legislature considers ephemeral waters and intermittent waters to be navigable waters. The Legislature has specifically directed the Department to consider the effect of local water quality characteristics "…and the extent to which the natural flow of the stream is intermittent or ephemeral" when setting numeric standards for the quality of navigable waters. (A.R.S. § 49-221(C)).

Comment #6

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

The Arizona Legislature in A.R.S. § 49-255.01(B) authorized the Department to promulgate rules for the AZPDES program consistent with the CWA, but the same provision prohibits the Department from adopting requirements more stringent than the CWA. If the Department applies AZPDES permit requirements to waters other than navigable waters as interpreted by the Supreme Court in *Rapanos*, then the Department is applying more stringent requirements than the CWA in violation of the prohibition in 49-255.01(B). The definition of "surface water" greatly exceeds the jurisdiction recognized in *Rapanos*, and exceeds the Department's rulemaking mandate in A.R.S. § 49-255.01(B).

Response: The Department disagrees with the commenter's interpretation of the requirements of A.R.S. § 49-255.01 or that the Department is violating its requirements by adopting the surface water quality standards in this rulemaking. A.R.S. § 49-255.01 governs the adoption of rules for the administration of the AZPDES permit program and does not apply to the adoption of the surface water quality standards rules that are the subject of this rulemaking. It is clear that A.R.S. § 49-255.01(B) prohibits the Department from adopting any AZPDES permit program rules that are more stringent or conflict with any requirement of the Clean Water Act. A.R.S. § 49-255.01 does not apply to the adoption of surface water quality standards. See Response #5.

Comment #7

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The proposed revisions to Arizona's SWQS raise several substantial jurisdictional and other related issues. For example, notwithstanding recent U.S. Supreme Court decisions directly affecting the validity of the federal regulatory definition of "waters of the United States," ADEQ nevertheless continues to use an expanded version of this regulatory definition to define the waters subject to the state's SWQS. ADEQ continues to use this expanded definition notwithstanding the statutory provisions in A.R.S. §§ 49-221(A) and 49-222 (giving ADEQ authority to adopt standards for "navigable waters"), in A.R.S. § 49-255.01(B) (prohibiting ADEQ from adopting any requirement associated with the AZPDES permit program that is more stringent than or conflicts with any requirement of the federal CWA), and in A.R.S. § 49-201(22) (defining "navigable waters" as "the waters of the United States as defined by section 502(7) of the Clean Water Cct (33 U.S.C. 1362(7)).").

Jim F. DuBois, City of Tucson – Department of Transportation

This definition of surface water encompasses more than the waters governed by the CWA, i.e., navigable waters or waters of the U.S.

Claire L. Zucker, Pima Association of Governments (PAG)

The definition for surface water should be consistent with federal definitions under the CWA. The definition in the rule for "surface water" includes as a Water of the U.S., all other waters such as rivers streams (intermittent or ephemeral), creeks, wash, draw etc. where the degradation or destruction of which could affect interstate or foreign commerce. It also includes all tributaries of these waters.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ's proposed definition of "surface waters" is inconsistent with the *Rapanos* decision because it goes beyond the scope of the CWA and therefore under Arizona law is beyond the statutory authority of ADEQ and must be revised (A.R.S. § 41-1052(C)(5)). ADEQ continues to use this expanded definition notwithstanding the statutory directives provided in A.R.S. §§ 49-221(A) and 49-222 (giving ADEQ authority to adopt standards for "navigable waters"), in A.R.S. § 49-255.01(B) (prohibiting ADEQ from adopting any requirement associated with the AZPDES permit program that is more stringent than or conflicts with any requirement of the federal CWA), and in A.R.S. § 49-201(22) (defining "navigable waters" as "the waters of the United States as defined by section 502(7) of the CWA (33 United States Code section 1362(7))."). ADEQ must revise its definition to apply only to those waters that are in fact "navigable waters" defined as "waters of the United States" within the CWA.

In light of ADEQ's failure to address these issues in this proposed rulemaking and the fact that a proper assessment of these issues by ADEQ would involve a significant amount of additional research and discussion with stakeholders, Pima County recommends that ADEQ withdraw those provisions of the rulemaking at this time.

Response: The Department did not propose any substantive revisions to the definition of surface water in this rulemaking and disagrees that it is using an expanded regulatory definition of surface water to define water bodies subject to regulation under the surface water quality standards rules. On the contrary, the Department proposes to use the same definition for surface water that it has used since 1992. The Department's decision not to revise the current definition of surface water is inaccurately characterized by the commenter as an expansion of the current regulatory definition. In fact, there has been no expansion of the regulatory definition of surface water and the agency's interpretation of the definition remains the same. See Responses #5 and #6. The Department proposed only minor editorial revisions to the definition of surface water to conform internal cross-references and the rule numbering within the definition. The current definition of surface water at R18-11-101(41) is based on, and consistent with, the regulatory definition of water of the United States that may be found in current EPA NPDES regulations at 40 CFR 122.2. See Responses #3, #4, and #5.

Comment #8

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The recent Ninth Circuit Court of Appeals decision in *Friends of Pinto Creek* v. *EPA*, 504 F.3d 1007 (9th Cir. 2007) has potentially significant implications for the regulated community in Arizona, including municipalities, industrial dischargers, and construction and development companies. Under the court's reasoning, new dischargers cannot be permitted unless and until they have demonstrated sufficient loading capacity for the constituent at issue and have developed compliance schedules designed to bring the waterbody into compliance with SWQS. The court further clarified its opinion that establishing a TMDL alone does not satisfy the requirement to demonstrate loading capacity. The result of this decision, assuming it is not overturned, is that it likely could ban new potential discharges to impaired waters, regardless of the nature of such discharges. The implications of the *Friends of Pinto Creek* case call for caution in proposing rules which could expand listings of impaired waters, particularly those noted below in this section.

Response: See Responses #3, #4, 5, and #7 regarding the comments on jurisdictional issues. These rules will not, by definition, "expand listings of impaired waters." Discussion of impaired waters listings and related permitting implications is beyond the scope of this rulemaking and is more appropriately raised in the context of the Impaired Water Identification rules at 18 A.A.C. 11, Article 6 or the AZPDES Program rules at 18 A.A.C. 9, Article 9.

Comment #9

Claire L. Zucker, Pima Association of Governments (PAG)

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Many surface waters impacted by this rulemaking are excluded from CWA authority under *Solid Waste Agency of Northern Cook County* v. *United States Corps of Engineers*, 531 U.S. 159 (2001) (*"SWANCC"*). In *SWANCC*, the Court held that non-navigable, intrastate and isolated (i.e., not adjacent to open water) waters are not "navigable waters" for CWA purposes, even though those ponds were arguably connected to interstate commerce. 531 U.S. at 168. Many urban lakes, and many surface waters, such as waters located within the closed Willcox Playa basin, qualify as isolated, non-navigable, intrastate waters, and thus should be non-jurisdictional in accordance with *SWANCC*. Importantly, the District of the District of Columbia recently interpreted a federal regulation defining "waters of the United States" which is even more limited than ADEQ's proposed definition of "surface water" as an overly expansive interpretation of the applicability of the CWA. *See American Petroleum Institute et al.* v. *Johnson*, 2008 WL 834435 (D.C.Cir. 2008). The decision in *Johnson* emphasized the ruling in *SWANCC* – that the CWA does not extend to the full extent of Congress' powers under the Commerce Clause of the U.S. Constitution, and thus a water may not be regulated under the CWA based only on its connection to interstate commerce.

ADEQ's proposed definition of "surface waters" is inconsistent with *Rapanos* and *SWANCC,* because it expands on the jurisdictional scope of regulations which those cases limited. ADEQ, to be consistent with law and not exceed its statutory authority, must refrain from establishing designated uses, SWQS or otherwise regulating those waters which are either (i) not relatively permanent tributaries to traditional navigable waters or navigable waters; (ii) wetlands which do not directly abut traditional navigable waters; or (iii) waters which are non-navigable, intrastate and isolated. ADEQ therefore should revise its definition of "surface water" proposed as R18-11-101(41), to apply only to navigable waters, defined as "waters of the United States" under the CWA. In the alternative, the Coalition requests that ADEQ explain its basis for asserting CWA jurisdiction over those waters affected by this rulemaking and remove the terms "ephemeral stream" and "wash" from its definition to be consistent with the federal regulatory definition, and remove all isolated urban lakes and all other isolated waters, including for example all surface waters in the closed Willcox Playa basin from regulation under this proposed rule. These suggested revisions would allow ADEQ to avoid extending its regulatory authority over waters deemed non-jurisdictional in light of *Rapanos* and *SWANCC*, and thus avoid violation of its obligations under A.R.S. § 41-1052(C)(5) to ensure that this rulemaking complies with applicable law and does not exceed its statutory authority.

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ is only authorized to adopt water quality standards for navigable waters. Given the jurisdictional uncertainty and other implications of the proposed revisions to Arizona's SWQS, ADEQ should consider postponing portions of the proposed SWQS rule pending resolution and further discussions on these key issues.

Matthew Oller, Flood Control District of Maricopa County

The District also adopts the Water Quality Coalition comments on the jurisdictional uncertainty after the Rapanos decision as it is unclear what Waters of the U.S. are.

Robert S. Lynch, Irrigation & Electrical Districts Association of Arizona

The current definition of "surface water" in R18-11-101(41) does not comply with either the *SWANNC* or *Rapanos* decisions of the United State Supreme Court. The definition needs some clarification and revision for it to be consistent with this applicable case law.

Response: The Department disagrees with the suggested changes to the rule and refers readers to Responses #3, #4, #5, #7, and #8, which deal with jurisdiction, surface waters, and case law. Both effluent-dependent waters and ephemeral waters are included in Arizona's definition of "surface water," both have designated uses and numeric and narrative criteria developed to protect their designated uses and EPA has approved the Department's water quality standards. These waters are subject to Clean Water Act section 305(b) assessments, 303(d) listing, and 402 permitting requirements. The *Rapanos* decision has limited applicability, and does not apply to the state's adoption of surface water quality standards.

R18-11-101. DEFINITIONS

R18-11-101(5) and- (8); Aquatic and wildlife (cold water) (A&Wc); Aquatic and wildlife (warm water) (A&Ww)

Comment #10

Sandy Bahr, Sierra Club Grand Canyon Chapter

While we support the overall definitions of aquatic and wildlife (cold water) and aquatic and wildlife (warm water), we remain concerned about using the 5000 foot elevation as an absolute cut off to distinguish these uses. As our comments indicated in the last Triennial Review, we recommend that the ADEQ also consider other mitigating factors, such as whether or not there is significant shading of a particular stream, water temperatures, and whether or not there is a cold-water macroinvertebrate community present. Under certain conditions, a lower elevation stream may support a cold water aquatic community. For example, our members have noted the presence of trout in Spring Creek, a tributary of Tonto Creek, at an elevation of 4200 feet. A warm-water designation for this creek and others similar to it would be inappropriate. For those reasons, we again recommend some greater flexibility in these definitions.

Response: The use of the 5000 foot elevation for applying the A&Ww and A&Wc designated uses was adopted in 2002. The 5000 foot elevation is applied as a general "rule of thumb" for the appropriate designation of the A&Wc and A&Ww uses. The Department agrees that there may be some exceptions to the use of the 5000 foot elevation contour, which is why the Department used the phrase "generally occurring" in both definitions of the A&Wc and A&Ww designated uses. The Department believes the use of the phase, "generally occurring" in the definitions provides the needed flexibility to make appropriate use designations. For example, the Department adopted the A&Wc designated use for the Colorado River below Glen Canyon Dam even though it is at an elevation of approximately 3000 feet because it receives cold water discharged from Glen Canyon Dam and Lake Powell.

Macroinvertebrates found in streams across Arizona contain cold water and warm water bioindicator species. The distribution of macroinvertebrate species and presence of cold water taxa in streams at various elevations led to the general conclusion that most cold water bioindicator species are found in streams at elevations greater than 5000 feet (Spindler, 1996).

R18-11-101(5) - (8); Aquatic and wildlife (cold water) (A&Wc), Aquatic and wildlife (effluent-dependent water) (A&Wedw), Aquatic and wildlife (ephemeral) (A&We), Aquatic and wildlife (warm water) (A&Ww)

Comment #11

Robert Hollander, City of Phoenix

The Water Services Department requests that the existing definitions be retained. The proposed definitions imply uses that may be put to the waters as the result of a single species. Section 5 of the Preamble on page 1283 indicates, among other things, that "The Department may consider … 2. The varying sensitivities of **local affected aquatic populations** to these pollutants;" **[emphasis added]**. Therefore, the designated use should be based on "aquatic populations" not a single species and that the species should be "local." The existing definitions better articulate this requirement.

Response: The Department did not intend to substantively change the existing rule. The change had been proposed to conform to rule writing conventions. The Department agrees with the commenter and the Department will use the plural form rather than the singular form for "animal, plant, or other warm-water organism" in R18-11-101(5) through (8):

5. *"Aquatic and wildlife (cold water) (A&Wc)" means the use of a surface water by animals, plants, or other cold-water organisms, generally occurring at ~~elevations~~ an elevation greater than 5000 feet, for habitation, growth, or propagation.*
6. *"Aquatic and wildlife (effluent-dependent water) (A&Wedw)" means the use of an effluent-dependent water by animals, plants, or organisms for habitation, growth, or propagation.*
7. *"Aquatic and wildlife (ephemeral water) (A&We)" means the use of an ephemeral water by animals, plants, or organisms, excluding fish, for habitation, growth, or propagation.*

8. *"Aquatic and wildlife (warm water) (A&Ww)" means the use of a surface water by animals, plants, or other warm-water organisms, generally occurring at ~~elevations~~ an elevation less than 5000 feet, for habitation, growth, or propagation.*

R18-11-101(6) & (7); Aquatic and wildlife (effluent-dependent water) (A&Wedw) and Aquatic and wildlife (ephemeral) (A&We)

Comment #12

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

The definitions of "aquatic and wildlife (effluent-dependent water)" and "aquatic and wildlife (ephemeral)" are the same, except (1) one use is described as an "effluent-dependent water" and one is described as an "ephemeral water" and (2) the ephemeral definition specifically excludes fish. If an effluent-dependent water (as that term is defined in the current proposed rules) has insufficient volume and flow to sustain fish, does ADEQ intend to apply the aquatic and wildlife (effluent-dependent water) use to that water? If so, why?

Response: The definitions of "aquatic and wildlife (ephemeral)" and "aquatic and wildlife (effluent-dependent water") designated uses are expressed in general terms that are intended to convey the idea that the two designated uses are established to maintain and protect water quality for the animals, plants, and other organisms that inhabit or could inhabit effluent-dependent waters and ephemeral waters. The definition of "aquatic and wildlife (effluent-dependent water)" does not include a reference to "fish" and the presence of fish is not necessary for the Department to classify a water body as an effluent-dependent water. The Department has adopted the aquatic and wildlife (effluent-dependent water) designated use for EDWs that have fish and those that do not. However, all EDWs have animals, plants, and other organisms that deserve water quality protection through the adoption of appropriate water quality standards.

The commenter points out that the definition of "aquatic and wildlife (ephemeral)" includes the phrase, "excluding fish." This phrase was included when the designated use was originally adopted in 1992 and is not changed in this rulemaking. The Department had included language in an attempt to clarify that the "aquatic and wildlife (ephemeral)" designated use was not intended to protect fish. The "excluding fish" language was intended to convey that the method and the toxicity datasets that the Department used to derive the numeric water quality criteria for the A&We designated use did not include fish species.

R18-11-101(14); Deep lake

Comment #13

Claire L. Zucker, Pima Association of Governments (PAG)

A deep lake is defined as a lake or reservoir with an average depth of over 6 meters, whereas a shallow lake is defined as a lake or reservoir with an average depth of less than 3 meters. There is no definition for a lake with depths between that of a shallow and deep lake.

Response: A lake that is neither "deep" nor "shallow," nor located within an urban context, according to the definitions, will default to either "igneous" or "sedimentary" depending upon which geology and/or soils predominates. See Response #77.

R18-11-101(17); Effluent-dependent water (EDW)

Comment #14

Sydney Hay, Arizona Mining Association

The proposed revisions to the definition of "effluent-dependent water" (A.A.C. R18-11-101(17)) would delete the term "treated" before "wastewater," which is itself an undefined term.

Response: The commenter is correct that the term "wastewater" is not a defined term in R18-11-101. Since it is not specifically defined in the surface water quality rules, it should be given its commonly understood meaning. Wastewater includes water that has been used for washing, flushing, or in a manufacturing process, and so contains waste materials, dissolved or suspended matter or other pollutants. Whether treated or not, wastewater discharges contain pollutants and must meet appropriate and protective water quality standards.

Comment #15

Claire L. Zucker, Pima Association of Governments (PAG)

ADEQ removed the term treated as a modifier of wastewater in the definition for an effluent dependant water (EDW). Removing this term makes industrial discharges subject to Aquatic and Wildlife effluent dependant water (A&W edw) standards. The A&W edw water quality standards are specifically created for application to treated wastewater discharges, and may not be appropriate or intended for application to various industrial discharges. PAG asks if public outreach was conducted to inform industrial dischargers and to give them an opportunity to comment on the proposed regulations.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition:

ADEQ proposes to define an "effluent-dependent water" ("EDW") as "a surface water, classified under R18-11-113, that consists of a point source discharge of wastewater. An effluent-dependent water is a surface water that, without the point source discharge of wastewater, would be an ephemeral water." Proposed R18-11-101(17). The proposed revision removes the word "treated" as a modifier of the word "wastewater" from the current EDW definition. This revision would effectively allow an ephemeral water which receives any discharge other than stormwater to be treated as an EDW. But ADEQ provides no explanation as to why such a "level playing field" is desirable or sensible. Effluent from a WWTP is quite different from many, if not most, industrial discharges. Effluent from a wastewater treatment plant is treated differently under the current EDW definition because it is different. Indeed, EDW criteria are based on assumptions of discharges from WWTPs.

Response: The Department does not agree that the A&Wedw standards are "specifically created" to apply to domestic wastewater discharges. More accurately, these standards were created to be protective of aquatic life in intermittently or perennially wet environments. The term 'treated' was likely included because the vast majority of dischargers under AZPDES permits are publicly owned treatment works (POTWs) or domestic wastewater treatment plants that are not allowed to discharge untreated wastewater. However, in applying the rule in permits, it is clear that some facilities may discharge water that is not sufficiently protective into waterbodies simply because of an artificial regulatory distinction. The purpose of having a surface water quality standards is to protect the waterbody for designated uses. This level of protection should not change depending on the source of the wastewater; either the standard is met or it is not. If water is supplied in any consistent basis in a desert environment, aquatic (and non-aquatic) life will use this critical resource. A discharge needs to be of adequate quality to protect that life and promote a healthy aquatic community. The term "treated" has been removed throughout the rulemaking. This revision will correct this inequity and will protect aquatic environments that should exist in waterbodies regardless of the source of the wastewater.

Under the current rule, an effluent-dependent water may be created by the discharge of treated wastewater from a municipal or domestic wastewater treatment plant or by the discharge of treated wastewater from an industrial facility to an ephemeral water. The Department interprets both the current and the proposed definitions of "effluent-dependent water" as applying to point source discharges of wastewater from both sewage treatment plants and industrial facilities.

Public notice and opportunity to comment on this issue was provided to the regulated community through the publication of the Notice of Proposed Rulemaking. The Department received numerous comments specifically addressing proposed revisions to the definition of effluent-dependent water from several persons representing industrial dischargers, including the Salt River Project and the Surface Water Quality Standards Coalition (representing over 5000 members of the Arizona Chamber of Commerce and Industry and the Greater Phoenix Chamber of Commerce).

Comment #16

Jim F. DuBois, City of Tucson – Department of Transportation

The proposed definition drops "treated" as an adjective for "wastewater." ADEQ states in their explanation of the rule that their intent is to expand the EDW approach to regulate industrial discharges in addition to treated domestic and municipal wastewater. The City of Tucson believes that ADEQ should continue with its traditional approach of using EDW provisions only for discharge of treated domestic and municipal wastewater effluent.

Since "wastewater" is an undefined term and could be viewed as virtually any point source discharge, many surface waters become eligible to be regulated as EDWs under the proposed rule. Such an approach could, in effect, characterize many of the "receiving waters" of stormwater MS4s from ephemeral to EDW, merely by the presence of industrial, DeMinimus, or other types of point sources. If an MS4's "receiving water" becomes regulated as an EDW, the standards used to assess BMP performance would change. While it doesn't appear to be the intent of the rule to apply EDW standards generally to stormwater discharges, the rule could be applied in that manner.

Claire L. Zucker, Pima Association of Governments (PAG)

The definition provided in the rule does not specify how much effluent, or for how long effluent is discharged before the stream reach is considered to be an EDW. Therefore, any amount of discharge could trigger A&W edw water standards. The mere presence of an AZPDES industrial discharge on an ephemeral water body could be used by ADEQ to require all dischargers to that water body to comply with A&Wedw standards.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ failed to appropriately evaluate the application of these proposed rules to storm water discharges. It is generally recognized by the aquatic scientific community that storm water runoff events create a substantially unique ecosystem in receiving waters in the arid West. The standards that have been developed for non arid West aquatic ecosystems may well be inappropriate during arid West storm water events. ADEQ should have, in this Triennial Review, rationally evaluated the appropriateness of applying these Standards to storm water discharges.

Response: See Response #15 regarding deletion of the term "treated" from the definition. The changes proposed in R18-11-113 relating to the application of EDW standards to point source discharges of wastewater were not intended to encompass stormwater discharges or de minimus discharges. Stormwater flows are short-term and in response only to precipitation events; this is consistent with the definition of ephemeral flow. This would cover certain 'other allowable' discharges that are permitted under the construction and the multi-sector general permit for stormwater. Likewise due to the unique nature of discharges authorized under the De Minimus General Permit (AZG2004-001) there may be instances where the use of ephemeral standards may continue to be adequate, and in response to comments to retain flexibility for this limited class. The following language has been added to R18-11-101 to clarify the Department's original intent:

48. *"Wastewater" does not mean:*
   1. *Stormwater;*
   2. *Discharges authorized under the De Minimus General Permit;*
   3. *Other allowable non-stormwater discharges permitted under the Construction General Permit or the Multi-sector General Permit; or*
   4. *Stormwater discharges from a municipal storm sewer system (MS4) containing incidental amounts of non-stormwater that the MS4 is not required to prohibit.*

Ephemeral waters that flow only in direct response to precipitation because they receive point source discharges of stormwater regulated under a MS4 permit are ephemeral waters as defined in R18-11-101(18) and the A&W(ephemeral) standards apply. The formal reclassification of an ephemeral water to an EDW that will affect an MS4 permit, will be done through rulemaking. Until or unless reclassified, those streams remain ephemeral for purposes of the MS4 program. The rule language has been revised to cover incidental amounts of other discharges that the MS4 is not required to prohibit in its illicit discharge detection and elimination program under 40 CFR 122.26(d)(2(iv)(B)(1). These include, but are not limited to, air conditioning condensate, foundation or footing drains not contaminated with process materials, irrigation, and street wash water.

The commenter correctly notes that the MS4 permits tie assessment of BMP performance to the surface water quality standards and designated uses of the waters receiving the stormwater discharges. However, R18-11-113(D) relates to the standard of protection for which individual discharge permits will be written and does not constitute a formal change in designation of a waterbody. Discharges of wastewater to an ephemeral wash may be required to meet EDW standards in permit limits, but the wash remains ephemeral until changed by rulemaking. An MS4 discharging stormwater to such a wash would only be responsible for evaluating discharges with respect to ephemeral standards unless and until the receiving water is otherwise designated by rule.

The Department does not have sufficient data to support the adoption of "wet-weather" standards that would apply to Arizona surface waters only during stormwater runoff events. Given the unavailability of wet weather standards, the default water quality standards apply to Arizona surface waters during storm events. AZPDES permitting staff will continue to work with all the MS4 permittees to develop renewal permits and work with the regulated community to clarify rules that are protective of the environment and reflective of local conditions.

Comment #17

Kevin Wanttaja, Salt River Project

SRP is submitting comments regarding the proposed change to the definition of effluent-dependent water (EDW) and how implementation of the EDW rule under R18-11-113 will adversely impact SRP's facilities.

ADEQ proposes to define an effluent-dependent water (EDW) as *"a surface water, classified under R18-11-113, that consists of a point source discharge of wastewater. An effluent-dependent water is a surface water that, without the point source discharge of wastewater, would be an ephemeral water."* The proposed revision removes the word "treated" from the current EDW definition so that any industrial discharge to an ephemeral water, except stormwater, would be reclassified as a discharge to an effluent-dependent water. In the rulemaking preamble, ADEQ provides an example of how the revised definition would be applied.

In each example, ADEQ identifies *untreated cooling water from a power plant; untreated cooling water;* and *wastewater from a power plant* as the regulatory triggers that would require the receiving water's designated use to be reclassified from ephemeral to EDW. No other industries are specifically named in the proposed rulemaking.

In reviewing a list of 181 Major/Minor AZPDES permits currently in service, only 6 permits were issued to steam-electric facilities (< 4% of the total). Of the 6 permits, SRP identified only 2 that currently discharge to an ephemeral water body: SRP's Kyrene Unit K7 and Santan generating stations. Yet, ADEQ justifies the proposed rulemaking by stating, *"changes in this rule making also level the playing field between businesses and municipalities that are point source dischargers."*

Furthermore, ADEQ states, "*With this change, an industrial facility will be held to the same water quality requirements as the municipal discharger to the same waterbody."*

Municipal dischargers are different than other discharges. The initial EDW definition and rule were created because municipal effluents typically contain higher concentrations of conventional and non-conventional pollutants than other dischargers. *(Conventional pollutants include biological oxygen demand, total suspended solids, fecal coliform, pH and oil and grease. Non-conventional pollutants include toxicity, chemical oxygen demand, metals and organic compounds not on the priority pollutant list, radioactivity and color.)* Municipal effluents are also known to contain higher concentrations of ammonia, phosphate and often-times measurable concentrations of endocrine disruptors, pharmaceuticals, polybrominated diphenyl ethers (PBDE) and perfluorinaated acids (PFAs) — chemicals which are not commonly found in steam-electric effluents.

In comparison, permitted steam-electric facilities are required to meet stringent discharge requirements for pH, free available chlorine, total chromium and zinc and must be free from any of the 126 priority pollutants.

ADEQ provides no other justification in the preamble for re-defining the EDW definition or R18-11-113 rule change. Nor has ADEQ published the location of the administrative record or technical support document that provides the foundation or basis to support the proposed rulemaking

If the proposed EDW definition and EDW rule is promulgated, and A&Wedw criteria applied, SRP's Kyrene Unit K7 and Santan generating stations may lose their ability to discharge. If these facilities cannot discharge, they cannot generate electrical energy needed by SRP's 920,000 customers. This critical issue is not discussed anywhere in the rulemaking especially in the section titled, "*The preliminary summary of the economic, small business, and consumer impact.*"

For these reasons, SRP again requests ADEQ to postpone the proposed changes and continue to implement the EDW definition and rule promulgated on March 29, 2002.

Response: See response #15. The effluent limitation guidelines (ELGs) referenced by the commenter, are industry standards promulgated by rule which in themselves, and are not necessarily protective of human health and aquatic life. For example, the 'stringent' ELGs for a steam electric power plant require pH to be between 6-9, similar to surface water quality standards; however, total chromium can be 200 ppb which is above all surface water quality standards, except possibly ephemeral standards depending on hardness and total to dissolved ratios; total zinc can be 1000 ppb which is above all aquatic and wildlife water quality standards except possibly ephemeral, depending on hardness and total to dissolved ratios; and Free Available Chlorine can range from 200-500 ppb, which are levels that are toxic to aquatic life and significantly above total chlorine limits. The Clean Water Act requires permits to include discharge limits based on both ELGs and water quality standards, the lower of which drives discharge limits at the outfall. (40 CFR 122.44(d))

For qualifying dischargers, the rules provide for variances from certain standards if all provisions of R18-11-122 are met. Another option would be the development of a use attainability analysis (UAA) to remove a designated use that is not an existing use, or to adopt a subcategory of a designated use if it can be demonstrated that the existing designated use cannot be attained for one or more factors outlined in 40 CFR 131.10(g). These factors include controls that are more stringent than those required by § 301(b) and § 306 of the Clean Water Act are necessary to attain the use and that implementation of the controls would result in substantial and widespread economic and social impact. Considering all the options available to address SRP's concerns, the Department anticipates that SRP will not be required to eliminate its discharge immediately, if at all, and will continue to provide reliable electricity to its customers from its Kyrene and San Tan generating stations.

Comment #18

Claire L. Zucker, Pima Association of Governments (PAG)

In March 2004, the state issued a De Minimus General Permit (No. AZG2004-001), which permits discharge of pollutants associated with potable and reclaimed water systems. The permit also allows ADEQ to review and approve other case-by-case short-term and/or low volume discharges that are considered De Minimus. Under the currently proposed rule, all discharges of wastewater, including some of those clearly considered acceptable under the De Minimus permit would trigger A&W edw water quality standards. Therefore the proposed rules appear to conflict with the intent of the De Minimus permit and language should be added to clarify that the De Minimus discharges do not invoke EDW status.

PAG recommends leaving the word treated in the rule to avoid some of the complications stated above.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

This proposed revision of the EDW definition also runs counter to current and long-standing ADEQ permitting practices. For example, ADEQ currently makes available a De Minimis General Permit under its AZPDES program (Permit No. AZG2004-001) for de minimis discharges with low pollutant levels. Under the proposed EDW definition, such permitted discharges, no matter how insignificant in amount or environmental impact, would result in transforming a water otherwise classified as ephemeral into an EDW for SWQS and AZPDES permitting purposes. Permittees would have no incentive to seek de minimis permit authorization, because by so doing they would effectively convert their receiving water into an EDW under the proposed definition.

Response: See Response #16.

Comment #19

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

The definition of "effluent-dependent water" consists of a point source discharge of "wastewater." It appears from ADEQ's explanation of the use of the term "wastewater" that it is intended to apply to any liquid discharge, of any type, volume, and frequency. The definition fails to provide rational criteria distinguishing effluent-dependent waters from ephemeral waters at the point stream flow enters a water of the United States. Although ADEQ proposes to add flow criteria in rule subsection R18-11-113(E) that would authorize, but not require, ADEQ to apply acute effluent-dependent water standards to "sporadic, infrequent, or emergency point source discharges," this new definition language in R18-11-101(17) fails to recognize that ephemeral waters receiving point source discharges may not, in fact, be "effluent-dependent" at the point they enter a water of the United States.

Since the definition of "effluent-dependent water" is to be used by ADEQ to apply more stringent surface water quality standards to point source discharges to ephemeral waters because those waters with the addition of discharges gain characteristics of intermittent or perennial flows and may have little or no dilution at the point where they contribute to a water of the United States, this definition needs to provide criteria for volume, frequency, and dilution of flow at the point where the tributary joins a water of the United States.

Response: The Department disagrees that the proposed definition of effluent-dependent water fails to provide rational criteria for distinguishing between effluent-dependent waters and ephemeral water, both of which are waters of the United States. The proposed definition provides a bright-line criterion that clearly distinguishes the two categories of surface water. The defining characteristic that distinguishes an EDW from an ephemeral water is the presence of a point source discharge of wastewater to an ephemeral water.

The difference between ephemeral waters and effluent-dependent waters is best understood by reading the regulatory definitions of ephemeral water and effluent-dependent water together. A comparison highlights the distinguishing characteristic between the two categories. Ephemeral waters and effluent-dependent waters are defined primarily by their flow characteristics. An ephemeral water is defined as a surface water that has a channel that is at all times above the water table (i.e., a normally dry watercourse such as a wash), and that flows only in direct response to precipitation (See R18-11-101(18)). By contrast, an effluent-dependent water is a normally dry watercourse that contains flow that is the result of a point source discharge of wastewater to the normally dry channel. The difference between the two types of surface water is the source of flow; i.e., the presence or absence of wastewater or effluent. Since the distinction between the two is based on hydrology, the Department disagrees that the definition of effluent-dependent water needs to provide criteria for a minimum volume of treated wastewater, a minimum frequency of discharge, or the availability of receiving water for dilution.

Comment #20

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

A similar issue arises with respect to stormwater permitting. ADEQ has represented in stakeholder meetings that it will interpret the proposed EDW definition such that any ephemeral water receiving any discharge, other than stormwater, will be treated as an EDW for SWQS purposes. However, stormwater permits authorize certain non-stormwater discharges. For example, the current Small MS4 General Permit authorizes certain "occasional incidental non-stormwater discharges," such as water line flushing, pumped groundwater, discharges from potable water sources, foundation drains, air conditioning condensate, and other discharges not identified as "significant contributors of pollutants." (Permit No. AZG2002-002). Similarly, the Construction General permit allows for certain non-stormwater discharges, including discharges from firefighting activities, air conditioning or compressor condensate, and water used in drilling, coring or compacting soil. (Permit No. AZG2008-001). In light of the proposed EDW definition, it is unclear how such permitted non-stormwater discharges would be treated.

The Coalition, in light of the above discussion offers a suggested definition:

> *Effluent-dependent water" means a surface water that consists of discharges of treated wastewater that the Director determines create a significant aquatic ecosystem in terms of size and location that would otherwise not exist due to flows from precipitation events alone. An effluent-dependent water is a surface water that, without the discharge of treated wastewater creating a significant aquatic ecosystem that would otherwise not exist due to flows from precipitation events alone, would be an ephemeral water.*

Response: The Department cannot support the Coalition's recommended definition of effluent-dependent water (EDW) because it requires a subjective determination of the significance of an aquatic ecosystem created by the discharge of "treated" wastewater before the Department could designate a surface water as an EDW. A definition of EDW that relies on a determination of a "significant aquatic ecosystem" cannot be practically implemented. In the absence of clearly defined and objective significance tests, the determination of significance becomes little more than a subjective value judgment raising a danger of inconsistent decision-making when classifying EDWs.

The Department has reviewed the comments regarding the incidental authorized discharges under several of the general permits and individual MS4 permits and has modified the rule language in R18-11-113(D). See Response #16.

Comment #21

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ should similarly revise R18-11-113(C) by either inserting the modifier "treated" before the term "wastewater," or by defining the term "wastewater" in that Section to mean effluent discharges from a WWTP. Additionally, ADEQ could simply replace the term "wastewater" in the proposed definition with the term "reclaimed water" as defined in A.R.S. § 49-201(31), which would make EDW regulation more consistent with Aquifer Protection Permit and reclaimed water use regulations.

Response: The Department disagrees with the comment that the application of these standards should be only to municipal sewage plants. See Responses #15 and #16.

The Department disagrees with the suggestion that the term "wastewater" be replaced with the term "reclaimed water." Reclaimed water quality standards were not intended to be protective of surface water or aquatic and wildlife. In particular, reclaimed water often contains residual disinfection byproducts, such as chlorine and metals, which are toxic to aquatic life.

Comment #22

J Adrianne Settimo

Substituting the term "wastewater" for "discharges of treated wastewater," under R18-11-113, is too broad and fails to adequately protect surface water quality. The term "wastewater," as stated by the ADEQ indicates that "untreated cooling water and other industrial process waters" and "discharges of municipal and domestic wastewater," will be allowed to enter ephemeral waters, classifying them as effluent-dependent waters. *See*, R18-11-113. Making standards more flexible to allow untreated wastewater into ephemeral waters, *proposed rule* at R18-11-113, only puts public health and welfare and "water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water," in jeopardy. Water Quality Standards, 40 CFR 131.2 (2007). Broadening the term allows waters possibly containing chemicals, including potential carcinogens and other pollutants to enter waterways. The proposed rule should not be adopted as it would potentially degrade the quality of water downstream of these ephemeral waters.

Response: The comment suggests a misunderstanding of the rule proposal. Under the current regulations, untreated wastewaters may discharge and are being discharged into waters under ephemeral water quality standards that are not appropriate or protective for these discharges. The current regulations are flawed precisely because they allow more pollutants to be discharged and less protective standards to be met simply because they are untreated. This rulemaking rectifies this by regulating these discharges in the same manner as treated discharges — thus they would need to meet a higher level of protection under these new rules. See Response #17. In some cases, dischargers may have to treat their wastewater or find other disposal options besides discharge to a surface water.

The proposed revisions are intended to clarify how A&Wedw standards are applied to any point source discharges of wastewater (except stormwater) to ephemeral waters that create effluent-dependent waters. Point source discharges of "wastewater," "treated wastewater," "untreated cooling water," and "other industrial process waters" to ephemeral waters, and to EDWs remain subject to regulation under the AZPDES permit program which controls the discharge of pollutants to Arizona's surface waters.

R18-11-101(20); Fish consumption

Comment #23

Janet Hashimoto, Chief; EPA Monitoring & Assessment Office

The proposed rule would narrow the definition of Fish Consumption (FC) as a beneficial use (Section R18-11-101.20). The current FC definition broadly includes "harvesting aquatic organisms for consumption," such as "fish, clams, turtles, crayfish, and frogs" whereas the proposed new definition would pertain strictly to fish. The FC definition affects which water bodies can qualify for protection under ADEQ standards for human consumption of aquatic organisms. By narrowing the definition, ADEQ would preclude determination of water body impairment on the basis of human consumption of pollutant-contaminated aquatic organisms other than fish.

Even if ADEQ currently only relies on consumption of fish to designate water bodies for FC, the proposed rule does not provide a rationale as to why narrowing the definition is warranted. In the future, ADEQ or other interested parties may identify water bodies in which humans are consuming aquatic organisms other than fish. A broad definition of fish consumption is not without precedent in other areas; for example, several California Regional boards have established a commercial or sport fishing (CMM) beneficial use that pertains not only to fish but to shellfish and other organisms intended for human consumption or bait purposes.

Response: The Department agrees. While fish are the only organisms that are currently being sampled in support of the fish consumption designated use, it is important to address the possibility that other aquatic organisms are being harvested and consumed or may be in the future. Except for the added acronym of the term, "fish consumption," the original definition will remain unchanged.

R18-11-101(24); Igneous lake

Comment #24

Claire L. Zucker, Pima Association of Governments (PAG)

An igneous lake would be one that is floored by igneous geology and soils including volcanic or plutonic igneous materials.

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

The definition in rule of "igneous lake" uses the criteria of "volcanic or basaltic," whereas the guidance document says "volcanic/granitic lithology." ADEQ shouldn't use conflicting definitions and should get the geologic terms straight. If the important factor is the permeability of the rock beneath the lake, the rule should just distinguish between hard rock substrate and soft rock/alluvial substrate.

Response: The Department agrees there is need for clarification and the definition has been revised as follows:

24. *"Igneous lake" means a lake located in volcanic, basaltic, or granitic geology and soils."*

R18-11-101(28); Outstanding Arizona Water

Comment #25

Claire L. Zucker, Pima Association of Governments (PAG)

The definition for "Outstanding Arizona Water" should match the previous definition of a Unique Water and be written as follows "Outstanding Arizona Water means a surface water that is classified as an outstanding state resource water by the Director under R18-11-112." This clear definition removes any ambiguity about which waters are designated as OAW. By including some explanatory information in the definitions Section, but not all of the information in R18-11-112, contradicting interpretations about what constitutes an OAW might be introduced.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ proposes to use the term "Outstanding Arizona Water" ("OAW") in lieu of the term "unique water" in its proposed SWQS. This definition fails to address the most important characteristic of an OAW – that the water has been designated an OAW by ADEQ pursuant to the proposed R18-11-112. The criteria (a) – (c) in the proposed OAW definition are already adequately addressed under the OAW designation criteria in R18-11-112. The current definition suggests that a water could qualify as an OAW without being designated as such, which would eliminate essential public participation in making such designations. The OAW definition would also confuse permittees as to particular permit conditions that would apply only to OAWs, and give rise to potential conflicts with the language in R18-11-112. ADEQ should revise the definition of OAW to mean "a surface water that is classified as an outstanding state resource water by the Director under R18-11-112."

Sydney Hay, Arizona Mining Association

The AMA concurs with the Coalition's comment that the proposed new definition of outstanding Arizona water ("OAW") at A.A.C. R18-11-101(28) suggests that waters may qualify as OAWs even without being classified by rule, which is inconsistent with the text of A.A.C. R18-11-112(A). The AMA supports the Coalition's suggested revision to that definition.

Response: The Department agrees that an OAW must be classified by the Director through formal rulemaking and has revised the definition of OAW as follows:

28. *"Outstanding Arizona Water (OAW)" means a surface water that is classified as an outstanding state resource water by the Director under R18-11-112.*

Comment #26

Sandy Bahr, Sierra Club Grand Canyon Chapter

We are supportive of the name change for "Unique Water" to "Outstanding Arizona Water" as it does accurately describe the nature of the waters listed.

Response: The Department appreciates the Sierra Club's support for the Department's proposed change in terminology from "unique water" to "Outstanding Arizona Water." The Department agrees that it more accurately describes the nature of surface waters that are classified as outstanding state resource waters and the term is more consistent with the terminology used in federal regulations to describe waters that are protected under Tier 3 of the federal antidegradation policy.

R18-11-101(29); Partial-body contact (PBC)

Comment #27

Sandy Bahr, Sierra Club Grand Canyon Chapter

We remain concerned about the Partial Body Contact designation and continue to support a Full Body Contact designation for all water bodies in which people recreate. Especially for children, there is no real practical difference between Partial and Full Body Contact. Our designated uses and standards should be set to protect the most vulnerable.

To simplify the standards and to promote better understanding of the rule and better water quality overall, we suggest designating all of Arizona's surface water for full body contact (FBC) recreation use and to eliminate the partial body contact (PBC) designated use and standards, unless it is clear that children do not have access to the area. Because there is almost no difference between partial body contact and full body contact when it comes to children, we think the most protective standards possible should apply to all of these surface waters in order to adequately protect the health of young children. We would like the Department to build in some kind of safety factor in determining these limits and would rather see it default to the higher standards. Unfortunately, most of the standards are established based on the average weight of a human adult male (70 kilograms).

Response: The Department did not make a substantive change to the definition of "partial body contact recreation" in this rulemaking nor did the Department adopt the full body contact designated use for all surface waters in Arizona where people may recreate. To derive PBC criteria, the methodology for non-carcinogenic pollutants was used. This results in few differences between the two sets of numeric water quality criteria for the two designated uses.

The Department appreciates the commenter's concerns but believes there is sufficient evidence that a PBC standard is warranted, especially in Arizona where many of our streams are intermittent or ephemeral and many urban lakes are managed for incidental contact.

While the functional differences between full body contact and partial body contact have narrowed due to the adoption of more realistic exposure assumptions, the Department believes it is important to continue to differentiate between the two uses due to the influence of flow on the overall probability of exposure. For created waterbodies such as listed canals and most effluent-dependent streams, full body contact is not considered an appropriate use. In ephemeral waterbodies, the random and episodic nature of the flow precludes "chronic" consumption (small amounts over a long period of time) and severely limits the likelihood for carcinogenic exposure. It is only in perennial rivers, streams, and lakes that recreational full body contact is likely to occur. See Response #145 for more discussion on how standards are derived for these two designated uses. See Response #127 for discussion on safety factors in risk analysis.

R18-11-101(31); Pollutant

Comment #28

Jim F. DuBois, City of Tucson – Department of Transportation

The ADEQ should not diverge from the statutory wording for this term [pollutant]. In doing so, it seems that "substances and chemicals" was dropped. The terms "other agricultural chemicals," "munitions" and "petroleum products" are awkward when converted to the singular. ADEQ should consider deleting this definition and simply relying on the statutory definition of A.R.S. § 49-201(29).

Response: The current definition mirrors statutory language. The Department has restated the current definition using italics and the statutory citation, following rule writing guidelines. No change has been made to the rule.

R18-11-101(35); Regulated discharge; R18-11-107.01

Comment #29

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Under proposed R18-11-101(35), ADEQ defines a "regulated discharge" triggering antidegradation review as a "point source discharge regulated under an AZPDES permit, a discharge regulated by a § 404 permit, and any discharge authorized by a federal permit or license that is subject to state water quality certification under § 401 of the CWA." The proposed definition of "regulated discharge" violates the statutory restriction on ADEQ authority to impose more stringent requirements than the CWA and related federal regulations. See A.R.S. § 49-255.01(B). This definition is also inconsistent with EPA guidance entitled "Tier 2 Antidegradation Reviews and Significance Thresholds," (August 10, 2005) (copy enclosed as Attachment A). The Coalition recommends that ADEQ revise this definition to be consistent with EPA's approach – that only new or expanded point source discharges under AZPDES or new or expanded discharges under sections 401 and 404 of the CWA qualify as "regulated discharges" for purposes of antidegradation review.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ's proposed antidegradation definition is inconsistent with Arizona law.

The proposed definition of "regulated discharge" found at A.A.C. R18-11-101(35) is more restrictive than the CWA and therefore violates A.R.S. § 49-255.01(B) that limits ADEQ authority to those requirements found within the CWA. The proposed definition is also inconsistent with the EPA guidance entitled Tier 2 Antidegradation Reviews and Significance Thresholds, August 10, 2005 (Attachment #10). Pima County requests that ADEQ revise its proposed definition to be consistent with EPA guidance which stipulates that only new or expanded point source discharges under AZPES or new or expanded discharges under sections 401 and 404 of the CWA qualify as "regulated discharges" for purposes of antidegradation review.

David E. McNeil, City of Tempe

ADEQ has indicated in stakeholder meetings that antidegradation review applies to all facility seeking permit coverage. Tempe is unaware of any other state that extends antidegradation review beyond new or expanded facilities and ADEQ has not clearly explained how antidegradation review would apply to existing facilities seeking permit renewal. The only suggestion made by ADEQ staff during the stakeholder process in response to questions regarding how and when antidegradation review would apply to existing facilities was that it could be applied when standards were changed. Tempe is very concerned with the suggestion implying that if 20% of assimilative capacity for a pollutant is consumed for a Tier 2 water body, and a standard becomes more stringent, that a discharger might be forced to completely redesign and rebuild a treatment facility in order to accommodate the reduction in assimilative capacity resulting from the standards change. There is no way for a municipality to anticipate all future changes in a standard when designing a treatment facility to meet current and future antidegradation requirements. Tempe requests a clear explanation of how and when antidegradation will be applied to existing facilities, and recommends limiting this rule to new, expanded, or reconstructed facilities.

Sydney Hay, Arizona Mining Association

The AMA fully supports the Coalition comments on antidegradation, particularly the comment that antidegradation review should apply only to new or modified discharges (i.e., increased or new pollutant loadings), not to renewals of existing permits with no changes (or to aspects of an existing discharge that will not be changed). To the best of the AMA's knowledge, that is how EPA and neighboring states implement antidegradation reviews. The AMA does not even understand how an antidegradation review of an existing discharge would be conducted, especially given that applicable standards likely would have changed over the life of the discharge (making analysis of assimilative capacity in the past a moving target).

Response: The Department disagrees that the proposed definition of "regulated discharge" in the surface water quality standards rules violates any statutory restriction found in A.R.S. § 49-255.01(B). A.R.S. § 49-255.01(B) does not apply to the adoption of the surface water quality standards rules under § 303(c) of the Clean Water Act (CWA). Rather, it applies to the Department adoption of rules regarding the AZPDES permit program.

The Department disagrees that the proposed definition of "regulated discharge" is more stringent than, or conflicts with, any requirement of the Clean Water Act. There is nothing in the Clean Water Act that defines "regulated discharges" and the Department's definition simply summarizes applicable CWA regulations.

The Department has reviewed the comments and revisited EPA guidance document titled *Tier 2 Antidegradation Reviews and Significance Thresholds* and has changed the rule to limit the Tier 2 antidegradation tier to "new or expanded" point source discharges. R18-11-107.01(B)(3) has been revised as follows to modify when the Tier 2 antidegradation review is triggered:

3. *Antidegradation review. Any person proposing a new or expanded regulated discharge under an individual AZPDES permit that causes significant degradation shall provide the Department with the following information:*

R18-11-101(40); Significant degradation; R18-11-107.01(B)(2)

Comment #30

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Additionally, ADEQ's proposed definition of "significant degradation" under R18-11-101(40) ties the calculation of significant degradation of Tier 2 waters to the "critical flow conditions," which is defined as "the lowest flow over seven consecutive days that has a probability of occurring once in 10 years." This definition also provides that significant degradation includes (a) the consumption of 20 percent or more of the available assimilative capacity for a pollutant of concern at critical flow conditions, or (b) any consumption of assimilative capacity beyond the cumulative cap of 50 percent of assimilative capacity. This language is redundant with, and arguably inconsistent with, the provision proposed in R18-11-107.01(B)(2) regarding significant degradation. The Coalition recommends that the definition of "significant degradation" be deleted or that ADEQ simply reference the language in R18-11-107.01(B)(2) as the definition.

Response: The Department disagrees that the proposed definition of "significant degradation" should be deleted and that it is redundant or inconsistent with the provisions of A.A.C. R18-11-107.01(B)(2). The term "significant degradation" is an essential term used in the proposed antidegradation implementation rule at R18-11-107.01. Since it is actually used in the rules relating to Tier 2 antidegradation implementation procedures, a definition is useful to help the regulated community and the general public read and understand the rules. The term "significant degradation" has a specific meaning outside the normal, common meanings of the words that make up the phrase. No change has been made.

The Department agrees that "critical flow condition" is an important concept for significant degradation and has revised R18-11-107.01(B)(2) as follows:

2. *A regulated discharge that meets the following criteria, at critical flow conditions, does not cause significant degradation:*

Comment #31

Sandy Bahr, Sierra Club Grand Canyon Chapter

The definition of "Significant degradation" is troublesome in that it allows one discharge to consume as much as 20 percent of the assimilative capacity for a pollutant under conditions in which only 50 percent of the assimilative capacity is remaining. This definition is not protective of the surface water quality standards or the designated uses, especially in light of the rapid growth in Arizona. We strongly recommend that the ADEQ reconsider this proposal and instead implement the original definition the agency proposed which defined significant degradation as less than 10 percent of the assimilative capacity for a pollutant.

Response: The comment appears to reflect a misunderstanding of the Department's proposals regarding the significant degradation thresholds that trigger comprehensive Tier 2 antidegradation review procedures. The intent of the Tier 2 antidegradation policy is to maintain and protect existing water quality in Arizona's high quality surface waters. The Tier 2 antidegradation policy does not allow significant degradation of existing water quality without making demonstrations that: 1) there are no reasonable, cost-effective alternatives to lowering water quality, and 2) that allowing degradation is necessary to accommodate important social and economic development. The purpose of the Tier 2 antidegradation policy is to limit degradation of high quality surface waters and the consumption of available assimilative capacity in those waters.

The Department chose to target Arizona's Tier 2 antidegradation policy on regulated discharges that result in significant degradation of high quality surface waters. The Department has some discretion in determining what constitutes significant degradation that triggers detailed antidegradation review procedures. The Department followed EPA guidance and defined significant degradation in terms of the percent consumption of available assimilative capacity for pollutants in high quality surface waters. The Department proposed to define significant degradation as either: 1) the consumption of 20 percent of the assimilative capacity for a pollutant by a regulated discharge, or 2) the consumption of any percentage of assimilative capacity by a regulated discharge once 50 permit of the assimilative capacity for a pollutant has been used. The second significance threshold is often called a cumulative cap on the use of the total assimilative capacity of a surface water. Once 50 percent of the total assimilative capacity has been consumed in a high quality surface water, any use of available assimilative capacity constitutes significant degradation. On the other hand, if more than 50 percent of the total assimilative capacity for a pollutant is available in a high quality surface water, then a regulated discharge may consume up to 20 percent of the available assimilative capacity for a pollutant before the lowering of water quality is considered significant degradation. The allowable consumption of up to 20 percent of available assimilative capacity only applies when more than 50 percent of the total assimilative capacity remains available in the surface water. The adopted 20 percent significant degradation threshold coupled with a cumulative cap represents a reasonable approach that maintains and protects existing water quality in high quality surface waters without unnecessarily triggering detailed Tier 2 antidegradation review requirements on regulated discharges.

EPA has recognized that states may adopt significance thresholds as part of their Tier 2 antidegradation implementation policies [*See* EPA policy memorandum by Ephraim S. King, *Tier 2 Antidegradation Reviews and Significance Thresholds*, U.S. Environmental Protection Agency, Office of Water (August 10, 2005)]. EPA has afforded states discretion in determining what constitutes significant degradation for purposes of Tier 2 antidegradation reviews. EPA has accepted a number of approaches to defining significance thresholds that trigger comprehensive Tier 2 antidegradation reviews. States have adopted significance thresholds that range from five percent of assimilative capacity to as much as 33 percent of assimilative capacity. The adopted significance thresholds are well within ranges that have been approved by EPA. Moreover, the Department's approach of combining the 20 percent significance threshold with a cumulative cap of 50 percent is an approach that has been recommended by EPA.

R18-11-101(42); Total nitrogen

Comment #32

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

The proposed definition of Total Nitrogen is inaccurate and should be revised to eliminate a reference to ammonia (NH_3).

Response: The Department did not propose any revisions to the definition of "total nitrogen" in this rulemaking. The Department disagrees that the definition should be revised to eliminate ammonia. Total nitrogen includes the following forms of nitrogen that are of greatest interest in water and wastewater. These forms are, in order of decreasing oxidation state, nitrate, nitrite, ammonia and organic ammonia. All of these forms of nitrogen, as well as nitrogen gas, are biochemically interconvertible and are components of the nitrogen cycle. They are all elements of total nitrogen.

R18-11-101(45); Urban lake

Comment #33

Jim F. DuBois, City of Tucson – Department of Transportation

The use of the term "small" renders this definition subjective. ADEQ's guidance document for narrative nutrients in lakes doesn't seem to restrict this category by size. ADEQ should delete or quantify this modifier.

Response: The Department agrees that urban lakes are defined by their location, not by their size. The definition as been modified as follows.

45. "Urban lake" means a manmade lake within an urban landscape.

R18-11-101(47); Wadeable stream

Comment #34

Robert S. Lynch, Irrigation & Electrical Districts Association of Arizona:

"Wadeable stream" is new, but according to the definition, a wadeable stream could be 8.5 feet deep (8.5' x 1 c.f.s. = 8.5). Later, in R18-11-118.01, the rule refers to a wadeable perennial stream. Are these streams different? If so, the definitions should be clarified.

Robert A. Hollander, City of Phoenix

Wherever the term "wadeable stream" is used throughout the rules (e.g. R18-11-108.01, R18-11-108.02, R18-11-108.03) it is always linked to "perennial." Therefore, the definition should include the term "perennial," such as "'Wadeable stream' means a perennial stream where the product of the water depth in feet multiplied by the velocity of the water in feet per second is less than nine."

Response: The Department agrees that the definition of "wadeable stream" should be clarified. The proposed definition of "wadeable" was based on a "rule of thumb" that Department water quality monitoring staff used to determine whether a stream could be safely waded. However, the rule of thumb was not helpful to the general public.

The term "wadeable" has been defined rather than the phrase "wadeable stream." The word "stream" has been removed from the phrase to avoid any potential confusion over whether there is a difference between "wadeable stream" and "wadeable, perennial stream." By removing the word, "stream," the separate modifiers, "wadeable" and "perennial" are each defined in the definition Section. These separate definitions help the public understand where the proposed biocriteria and narrative bottom deposits standards apply. The definition, which had been proposed as: "[w]adeable stream means a stream where the product of the water depth in feet multiplied by the velocity of the water in feet per second is less than nine," has been revised as follows:

47. "Wadeable" means a surface water can be safely crossed on foot and sampled without a boat.

R18-11-102. APPLICABILITY

Comment #35

Fred H. Gray, City of Tucson – Parks and Recreation Department

ADEQ has removed from applicability certain types of manmade impoundments. However, another type of manmade impoundment that should not be governed by these rules is impoundments storing reclaimed water for beneficial use. ADEQ should include storage impoundments used for reclaimed water.

Claire L. Zucker, Pima Association of Governments (PAG)

ADEQ has removed from applicability certain types of manmade impoundments; however, impoundments storing reclaimed water for beneficial use should also be exempted from these rules. Storage impoundments used for reclaimed water are comparable to impoundments that are part of the waste treatment system. Reclaimed water permits cover reclaimed storage ponds and require discharge to them to meet reclaimed water quality standards, making surface water quality standards inappropriate for these facilities.

Jim F. DuBois, City of Tucson – Department of Transportation

ADEQ has removed from applicability certain types of manmade impoundments. However, one significant type of manmade impoundment, which should not be regulated by this rule, has not been included in R18-11-101(A) – impoundments storing reclaimed water for beneficial use. ADEQ should list reclaimed water storage impoundments in this subsection among the instances in which the proposed rule does not apply. This type of facility is comparable to impoundments that are part of the waste treatment system, which are currently excluded under R18-11-102(B)(1). Reclaimed water permits already cover reclaimed storage ponds and require discharge into them to meet reclaimed water quality standards. Surface water quality standards are inappropriate for these facilities, and ADEQ should exclude them from applicability.

Response: The Department disagrees. The exemption in R18-11-102 is patterned after language in 40 CFR 122.2. Discharges to reclaimed ponds that are built in a water of the United States (WUS) are not exempt, and will continue to be regulated according to the provisions of the Clean Water Act. Reclaimed standards are not, and were not intended to be, protective of surface waters or aquatic life. In particular, reclaimed water often contains residual disinfectants, such as chlorine, that are incompatible with aquatic life. Reclaimed waters may contain high concentrations of metals and other pollutants above the standards and that may be toxic to aquatic life.

Comment #36

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ provides in its proposed R18-11-102(B)(2) to exempt from the SWQS rule any "man-made surface impoundment and associated ditches and conveyances used in the extraction, beneficiation, or processing of metallic ores that *is not a surface water* or is located in an area that once was a surface water but no longer remains a surface water because it has been and remains legally converted." [emphasis added]. This exemption is circular – its suggests that an impoundment used for mineral processing is not a surface water unless it is a surface water. ADEQ should therefore remove from this Section the following language: "is not a surface water or" to avoid confusion as to which surface impoundments are exempt from SWQS regulation. ADEQ should also include storage impoundments used for reclaimed water among the instances in which the proposed rule does not apply. This type of facility is comparable to impoundments that are part of the waste treatment system. Reclaimed water permits cover reclaimed storage ponds and require discharge to them to meet reclaimed water quality standards. Surface water quality standards are therefore inappropriate for these facilities, and only serve to frustrate water conservation efforts relying on reclaimed water.

Response: The Department adopted editorial revisions only to the current exclusion for mining impoundments and associated ditches and conveyances at R18-11-102(B) in this rulemaking. While the Department agrees that the cited phrase "that is not a surface water or is located in an area that once was a surface water but no longer remains a surface water because it has been and remains legally converted" is somewhat circular, the Department disagrees that it should be removed from the final rules. A review of the history of the mining impoundment exclusion is necessary to understand the reasons for not revising the circular language cited in the comment.

The Department originally proposed the mining impoundments exclusion in the 1992 rulemaking of surface water quality standards. The original language of the mining impoundments exclusion was similar to the current R18-11-102(B)(2) with one important difference. As originally proposed and adopted, the mining impoundment exclusion exempted certain mining impoundments from water quality standards provided discharges from those impoundments were permitted under the NPDES permit program. The mining impoundments exclusion did not include language limiting the excluded mining impoundments to those that were created outside what would otherwise be considered waters of the United States.

In September 1993, EPA disapproved the mining impoundments exclusion as proposed by the Department. EPA disapproved the exclusion on the ground that it excluded entire categories of mining-related impoundments without any regard as to whether specific impoundments were waters of the United States. In disapproving the exclusion, EPA Region 9 stated in its disapproval letter that Arizona must either repeal the mining impoundment exclusion or "otherwise revise its regulations in order that those impoundments which are waters of the United States are governed by appropriate water quality standards."

The Department subsequently proposed the repeal of the mining impoundments exclusion to resolve EPA's disapproval of that provision. The proposed repeal was strongly opposed by the Arizona Mining Association and led to a stakeholder effort to explore the second alternative offered by EPA Region 9 to resolve the disapproval; i.e., the appropriate revision of the language of the mining impoundments exclusion. There was an extensive stakeholder effort in 1995-1996 to come up with acceptable language that would appropriately limit the mining impoundments exclusion. The language that the commenter states is circular is the revised language that was acceptable to EPA and resolved its concerns. EPA approved the current language of the mining impoundments exclusion by letter to the Department dated April 26, 1996. No change has been made to the rule.

R18-11-107.01 ANTIDEGRADATION CRITERIA

Comment #37

Claire L. Zucker, Pima Association of Governments (PAG)

Several of our member jurisdictions are concerned that the Antidegradation Implementation Procedures are not yet ready for inclusion in the rule. They feel that the previously released guidance document is much better and should continue to be used rather than putting new language into rule. The term "baseline water quality" aptly describes the water quality of streams for the purposes of applying antidegradation rules, and should be used instead of the term "existing water quality" throughout this Section.

Response: The Department is required by federal regulation to develop and adopt a statewide antidegradation policy and to identify methods for implementing the antidegradation policy (See 40 CFR 131.12). The statewide antidegradation policy for Arizona is prescribed in the surface water quality standards rules at A.A.C. R18-11-107. Versions of the antidegradation policy have been in Arizona's water quality standards rules since 1968 [*See* Section 6-2-5, *Water Quality Standards for Surface Waters in Arizona*, State Department of Health, Water Quality Control Council, July, 1968.] While Arizona has had an antidegradation policy in rule for 40 years, the Department has not identified methods for implementing Arizona's antidegradation policy in rule. EPA has recommended since 1986 that the Department identify methods for implementing the statewide antidegradation policy. The Department has produced several antidegradation implementation procedures guidance documents over the last 20 years. This rulemaking adopts antidegradation policy implementation criteria based on the updated guidance document (*Antidegradation Implementation Procedures* (April, 2008)).

The lack of antidegradation implementation procedures in rule was identified by EPA as a deficiency of the water quality standards rules during the 1992 rulemaking. The U.S. Fish & Wildlife Service notified the Department through the consultation process under § 7 of the Endangered Species Act that the lack of antidegradation implementation procedures for the antidegradation rule could result in an incidental take of threatened and endangered species. Other stakeholders in the 1992 rulemaking expressed concern that the preparation and adoption of the Department *Implementation Guidelines for the State of Arizona Antidegradation Standard* should be subject to formal rulemaking procedures because they believed that the guidelines qualified as rules under the Arizona Administrative Procedures Act. The Department agrees that antidegradation implementation procedures are necessary elements of the water quality standards program and that they are required by EPA regulations implementing the Clean Water Act.

The Department responded to comments received in the 1992 rulemaking that antidegradation implementation procedures should initially be contained in guidance documents and that the Department could subsequently make decisions regarding which procedures should be incorporated into rule after gaining some practical experience. Sixteen years later, the Department has written a comprehensive Antidegradation Implementation Procedures guidance document and, for the first time, proposes to adopt elements of the guidance document as objective bases for determining compliance with the Antidegradation Rule (R18-11-107.01). The Department disagrees that the antidegradation criteria are not ready for inclusion in rule after more than 20 years of development.

The Department received numerous comments on the Implementation Procedures for the Narrative Standards which are outside the context of this rulemaking. The implementation procedures will be adopted as policy when finalized. The Department has provided responses to those comments directly to the authors and will contact them to participate in upcoming worksessions for the Impaired Waters Identification rule and AZPDES permit program rulemakings, as appropriate. To avoid any confusion, the Department is modifying the title of the rule to read: *Antidegradation Criteria.*

R18-11-107.01(A)

Comment #38

Karlene Martorana, (Ryley Carlock & Applewhite) Irrigation Districts

The Proposed Rules appear to attempt to regulate all canals through Tier 1 of the antidegradation rules, Proposed Rules R18-11-107 and R18-11-107.01, and the Antidegradation Implementation Procedures.

By law, these regulations can only regulate water in canals to the extent that the canal otherwise qualifies as "surface water." However, the Tier 1 protection appears to attempt to directly regulate water in canals by prohibiting degradation of the water quality and by requiring that water quality standards be achieved. The Antidegradation Implementation Procedures state that Tier 1 protection constitutes the "default protection level" for all surface waters, including canals. Through the Antidegradation Implementation Procedures and the antidegradation rules, it appears that ADEQ is attempting to exercise jurisdiction over the water in all canals.

However, ADEQ does not have jurisdictional authority to regulate water in all canals. Pursuant to A.R.S. § 49-221, ADEQ can implement water quality standards only for "navigable waters." The Arizona Revised Statutes incorporate the definition of "navigable waters" from the CWA. A.R.S. § 49-201. The CWA defines "navigable waters" as "waters of the United States, including the territorial seas." 33 U.S.C. 1362(7). The Proposed Rules define "surface water" as a "water of the United States."

The definition does not contain any changes from the current definition, and it is very similar to the definition of "waters of the United States" found at 33 CFR 328.3 and 40 CFR 230.3. Most canals do not fit into this definition of surface water. Most canals are not used for interstate or foreign commerce or recreational purposes, nor are they an interstate water, a river or stream, an impoundment or a tributary to a surface water. When a canal does not fit into ADEQ's definition of "surface water" or the definition of "water of the United States," that canal is not a "navigable water" and ADEQ does not have authority to regulate the water in such canals.

For the reasons stated above, we request that ADEQ clarify the Proposed Rules to only apply to canals that otherwise qualify as "surface water."

Robert S. Lynch, Irrigation & Electrical Districts Association of Arizona

R18-11-107.01 attempts to redefine "surface water," and includes "canals" despite the definition of "surface water" in R18-11-101 (which doesn't mention canals). Only those canals listed in Appendix B have been treated as surface waters and the provision of "canal" in R18-11-107.01 should include a limitation to "as listed in Appendix B."

Response: The Department does not intend to expand the regulation of canals through this anti-degradation provision. The Department agrees that not all canals are regulated and would not be subject to this provision. Canals that are not listed specifically in Appendix B of the standards rule will continue to be evaluated on a case-by-case basis as issues arise to determine if they otherwise qualify as a surface water.

The Department agrees to clarify the references to a canal in R18-11-107.01(A)(1)(e) and R18-11-107.01(A)(3) by adding the phrase, "listed in Appendix B" after "a canal" to each of the cited references. There was no intent to regulate water quality in all canals or to exercise jurisdiction over the water in all canals by including the reference to canals in R18-11-107.01(A)(1)(e). The Department's intent was to clarify how antidegradation is implemented for those canals that are regulated as surface waters and identified in Appendix B of the surface water quality standards rules. The following subsections have been revised as follows:

R18-11-107.01(A)(1)(e)

A canal listed in Appendix B.

R18-11-107.01(A)(3)

Except as provided in subsections (E) and (F), Tier 1 antidegradation review requirements are satisfied for a point source discharge regulated under an individual AZPDES permit to an ephemeral water, effluent-dependent water, intermittent water, or a canal listed in Appendix B, provided water quality-based effluent limitations *designed to achieve compliance with applicable surface water quality standards are established in the permit and technology-based requirements of the Clean Water Act for the point source discharge are met.*

Comment #39

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

The proposed antidegradation rule appears to apply to all "intermittent waters," "ephemeral waters," and "canals" regardless of their connection to a water of the United States. The rule should clarify that antidegradation protection applies only to intermittent waters, ephemeral waters, and canals that are waters of the United States.

Response: The Department disagrees that the antidegradation rules should include additional language to clarify where the antidegradation rule applies. The Department addresses applicability of the surface water quality standards rules, including the antidegradation rules, in R18-11-102 (A), which clearly states that the surface water quality standards (including antidegradation) apply to "surface waters" (defined in R18-11-101(41)).

R18-11-107.01(A)(2)

Comment #40

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ provides in proposed R18-11-107.01(A)(2) that a "regulated discharge shall not cause a violation of a surface water quality standard or a wasteload allocation established in a total maximum daily load under 11 A.A.C. 6." It is not clear what is meant by causing a violation of a wasteload allocation established in a total maximum daily load. In other relevant contexts, regulations and/or permits refer to a discharge being "consistent" with a wasteload allocation and associated total maximum daily load (*see* Arizona's Construction General Permit (Part I.D.4.b); EPA's Construction General Permit (Part 1.3(C)(5)(a)); and EPA's 2000 Multi-Sector General Permit (Part 1.2.3.8.2). Also, the reference to 11 A.A.C. 6 appears to be mistaken. Based on these observations, the language in proposed R18-11-107.01(A)(2) should read instead as follows: "A regulated discharge shall not cause a violation of a surface water quality standard and shall be consistent with any applicable wasteload allocation established in a total maximum daily load under Arizona Administrative Code, 18 A.A.C 18, Article 6."

ADEQ provides in proposed R18-11-107.01(A)(3) that "Tier 1 antidegradation review requirements are satisfied for a point source discharge regulated under an AZPDES permit" to certain waters as long as "water quality-based effluent limitations designed to achieve compliance with applicable surface water quality standards are established in the permit." The language suggests that any point source discharge regulated under an AZPDES permit would have to include water quality-based effluent limitations in order to satisfy Tier 1 antidegradation requirements. The Coalition does not believe that this is the intent of this language especially given the competing language in proposed R18-11-107.01(E) and R18-11-107.01(F) addressing certain individual and general stormwater permits. Accordingly, to clarify the scope of the language in proposed R18-11-107.01(A)(3), this subsection should be revised as follows: "Except as provided in subsections (E) and (F), Tier 1 antidegradation review requirements are satisfied for a point source discharge of wastewater regulated under an individual AZPDES permit to an ephemeral water, effluent-dependent water, or a canal provided water quality-based effluent limitations designed to achieve compliance with applicable surface water quality standards are established in the permit and technology-based requirements of the CWA for the point source discharge are met."

Response: The Department agrees the language in R18-11-107.01(A)(2) needs clarification to account for TMDLs authored by either the Department or EPA. The language has been revised as follows:

2. *A regulated discharge shall not cause a violation of a surface water quality standard or a wasteload allocation in a total maximum daily load approved by EPA.*

The Department agrees that the language of R18-11-107.01(A)(3) should be revised to clarify that the provision applies to point source discharges regulated under individual AZPDES permits and does not apply to AZPDES general permits and storm water permits. The commenter is correct that the Department intends to take a different approach to antidegradation implementation for AZPDES storm water permits and general permits and a clarification is necessary. The Department made the revisions to R18-11-107.01(A)(3) as recommended by the commenter with two differences. The Department did not add the unnecessary modifying phrase, "of wastewater" after point source discharge and retained "intermittent water" as one of surface waters specified in R18-11-107.01(A)(3). The rule has been revised s follows:

3. *Except as provided in subsections (E) and (F), Tier 1 antidegradation review requirements are satisfied for a point source discharge regulated under an individual AZPDES permit to an ephemeral water, effluent-dependent water, intermittent water, or a canal listed in Appendix B provided water quality-based effluent limitations designed to achieve compliance with applicable surface water quality standards are established in the permit and technology-based requirements of the Clean Water Act for the point source discharge are met.*

R18-11-107.01(B)

Comment #41

Sandy Bahr, Sierra Club Grand Canyon Chapter

We are concerned about how the baseline water quality will be established by a person seeking to discharge into any perennial water. How will this be accomplished, and how will the agency ensure that the entity seeking to degrade the water will provide the most accurate information? There should be strong quality control requirements on this.

We support the public participation requirements in this Section, although, considering that this Section allows for degradation of water quality, a public hearing should also be required.

Response: The Department addresses how baseline water quality will be established in Chapter 4 of the associated Antidegradation Implementation Procedures (April 2008) guidance document. Chapter 4 contains a summary of the Department's approach to determining baseline water quality, a description of the baseline water quality assessment procedures, sampling locations and protocols, pollutants of concern, and how the Department will interpret data to establish baseline water quality. The Department believes it is more appropriate to place the procedures related to determining baseline water quality in guidance document versus rule.

The Department appreciates the Sierra Club's support for the public participation procedures that the Department proposed for Tier 2 antidegradation reviews. The Department does not agree that a public hearing should be required for all Tier 2 antidegradation reviews. The proposed rule provides for public notice and an opportunity to comment on Tier 2 antidegradation reviews of regulated discharges that cause significant degradation. The proposed rule gives persons an opportunity to request a public hearing, but does not require a public hearing in all cases.

Comment #42

Robert S. Lynch, Irrigation & Electrical Districts Association of Arizona

Under R18-11-107.01(B), a person may explain that degradation of water has occurred because of environmental justice or social issues. Although vague as to what that means, is the converse true -- that a person may oppose the Director's finding of allowable degradation based upon environmental justice issues?

Response: Persons may comment in support or opposition to a regulated discharge and the Department antidegradation review. R18-11-107(B)(4) does not limit public comments, so persons may oppose a Tier 2 antidegradation review on environmental justice grounds.

R18-11-107.01(C)(1)

Comment #43

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Also in connection with general permits, proposed R18-11-107.01(C)(1), establishing Tier 3 protection, should be narrowed in its application from a "direct tributary" to an OAW to 1/4 mile of an OAW, to be consistent with the Department's recently issued Construction General Stormwater Permit (see Part I.D.4).

Sydney Hay, Arizona Mining Association

The AMA also agrees with the Coalition that the language in proposed A.A.C. R18-11-107.01(C)(1), applying Tier 3 antidegradation protection to any tributary to an OAW, is overbroad. This provision potentially greatly expands the universe of Tier 3 protection, since a single OAW may have numerous direct tributaries and those tributaries may not possess the characteristics of the OAW. Moreover, not every activity in a direct tributary will affect an OAW. The expansion of Tier 3 protection, and the requirement to demonstrate no impact on the OAW as a result of activities occurring in a direct tributary (proposed A.A.C. R18-11-107.01(C)(3)), should apply only to activities occurring within a reasonable proximity of the nearest reach designated as an OAW.

Claire L. Zucker, Pima Association of Governments (PAG)

The Tier 3 protection applies to a surface water that is an OAW or is a direct tributary to an OAW. However, the rule does not define how far upstream that protection should extend or what constitutes a direct tributary.

Response: The Department disagrees that the scope of Tier 3 antidegradation protection for individual permits should be narrowed to only those tributaries within 1/4 mile of an OAW. The purpose of Tier 3 antidegradation protection is to maintain and protect existing water quality in OAWs. The establishment of a limit in terms of a specified distance to an OAW would be arbitrary and inconsistent with the general purpose of protecting existing water quality in OAWs and prohibiting degradation.

The Department agrees that the meaning of "direct tributary" is open to interpretation. A person who proposes a regulated discharge to a tributary of an OAW must demonstrate that the regulated discharge will not degrade existing water quality in the downstream OAW. This distance will vary depending on the specifics of a discharge scenario. Any discharge that is determined to affect the quality of water in an OAW must be reviewed under Tier 3. If the Department determines the discharge to the tributary will not affect the OAW, antidegradation review will proceed based on the appropriate tier of the tributary.

The Department deleted the word "direct tributary" in both R18-11-107.01(C)(1) and (C)(3) and revised the rule as follows:

1. Tier 3 antidegradation protection applies only *to an OAW listed in R18-11-112(G).*

3. A person seeking authorization for a regulated discharge to a tributary to, or upstream of, an OAW shall demonstrate in a permit application or in other documentation submitted to the Department that the regulated discharge will not degrade existing water quality in the downstream OAW.

R18-11-107.01(D)

Comment #44

Sydney Hay, Arizona Mining Association

Antidegradation review for Section 404 permits involving the discharge of fill material should focus on the effect of the fill on water quality in surface waters outside the area of fill. In one sense, the fill itself could be considered degradation, but such activities have been explicitly authorized under Section 404 of the CWA if the relevant regulations are complied with (Corps regulations, EPA's Section 404(b)(1) guidelines). This is how antidegradation reviews have been conducted in the past, but with the significantly expanded rule language on this topic, this point should be explicitly stated in the rule language itself.

Response: The Department agrees that an antidegradation review of § 404 permits involving the discharge of fill to a surface water should focus on a review of the effect on surface water quality outside of the area of fill. The Department agrees that any discharge of fill could be considered degradation per se if the Department literally applied the requirements of the antidegradation rule; however, such a position is illogical because fill activities are clearly authorized by the Clean Water Act. EPA specifically addressed the applicability of antidegradation requirements to dredge-and-fill activities authorized under § 404 of the Clean Water Act in a guidance document called *Questions and Answers on Antidegradation* (EPA, 1985). The Department agrees with the following statement in the guidance document:

"Since a literal interpretation of the antidegradation policy could result in preventing the issuance of any wetland fill permit under Section 404 of the Clean Water Act, and it is logical to assume that Congress intended some such permits to be granted within the framework of the Act, EPA interprets 40 CFR 131.12(a)(1) of the antidegradation policy to be satisfied with regard to fills in wetlands if the discharge did not result in "significant degradation" to the aquatic ecosystem as defined under Section 230.10(c) of the Section 404(b)(1) guidelines."

Arizona's antidegradation policy does not prohibit dredge-and-fill activities that are authorized by a permit issued under § 404 of the Clean Water Act. Like EPA, the Department interprets its state antidegradation policy to be satisfied with regard to activities authorized by a § 404 permit provided the discharge of fill to a surface water does not result in "significant degradation" to the aquatic ecosystem as defined by § 230.1(c) of the § 404(b)(1) Guidelines.

The Department disagrees that the details of how the Department will conduct an antidegradation review of § 404 permits should be explicitly stated in R18-11-107.01. The proposed rule states, at R18-11-107.01(D), that the Department will conduct the antidegradation review of a § 404 permit as part of the § 401 water quality certification process. Reviews of individual § 404 permits will be conducted on a case-by-case basis. The Department's *Antidegradation Implementation Procedures* guidance document, dated April 2008, provides some of the requested detail on how the Department will conduct antidegradation reviews of individual and nationwide § 404 permits.

R18-11-107.01(D) has been revised as follows to clarify how antidegradation reviews of § 404 permits will be conducted:

D. Antidegradation review of a § 404 permit. The Director shall conduct the antidegradation review of any discharge authorized under a nationwide or regional § 404 permit as part of the § 401 water quality certification prior to issuance of the nationwide or regional permit. A regulated discharge authorized by a § 404 permit does not require an individual antidegradation review unless the discharge may degrade existing water quality in an OAW or a water listed on the 303(d) List of impaired waters. For regulated discharges that may degrade water quality in an OAW or a water listed on the 303(d) List of impaired waters, the Director shall conduct the antidegradation review as part of the § 401 water quality certification process.

R18-11-107.01(E)

Comment #45

Claire L. Zucker, Pima Association of Governments (PAG)

For AZPDES stormwater permits, the permittee is in compliance with their MS4 permit if they develop a Stormwater Management Plan that contains Best Management Practices to reduce pollutant levels to the Maximum Extent Practicable (MEP). The additional requirement stated in this rule "conducting monitoring activities of discharge water quality" should be deleted because it is more stringent than the AZPDES permit program requirements and not all MS4 permittees are required to monitor.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Under proposed R18-11-107.01(E), ADEQ provides that an individual MS4 general stormwater permittee meets antidegradation requirements "if the permittee complies with the permit, including developing a stormwater management plan containing controls that reduce the level of pollutants in stormwater discharges to the maximum extent practicable and conducting monitoring activities of discharge water quality." All language following "maximum extent practicable" in that Section should be deleted, as certain permits may not require monitoring, and compliance with the MS4 stormwater permit should be adequate to meet antidegradation requirements. Additionally, that language violates the statutory limit that the AZPDES program be no more stringent than the federal NPDES permit program. A.R.S. § 49-255.01(B). Furthermore, this Section should provide that it establishes all applicable antidegradation review for individual MS4s notwithstanding any other potentially applicable language elsewhere in the proposed rule. The title of this Section should also be revised to clarify that it applies only to individual MS4 permits, not to all AZPDES stormwater permits.

Response: Though the Department will continue to require municipal stormwater monitoring to determine BMP effectiveness and progress towards attaining standards, the Department has removed this requirement from the rule to meet antidegradation criteria. Monitoring in and of itself does not achieve water quality protection. R18-11-107.01(E) has been revised as follows:

(E) *Antidegradation review of an AZPDES stormwater permit. An individual stormwater permit for a municipal separate storm sewer system (MS4) meets antidegradation requirements if the permittee complies with the permit, including developing a stormwater management plan containing controls that reduce the level of pollutants in stormwater discharges to the maximum extent practicable.*

R18-11-107.01(F)

Comment #46

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Also in connection with antidegradation review for AZPDES stormwater permitting, ADEQ proposed that a person seeking authorization to discharge under a general permit is not required to undergo an individual antidegradation review at the time the Notice of Intent ("NOI") is submitted unless the discharge may affect an OAW or an impaired water under CWA § 303(d). See proposed R18-11-107.01(F). If antidegradation review is conducted after issuance of the permit, such review may impose additional conditions which are more appropriately imposed on a general permit through the initial issuance process. ADEQ should therefore revise this Section so that antidegradation review occurs only at the time of issuance of the general permit, and never at the time of submittal of an NOI, including for discharges to an OAW or impaired water. This approach would be consistent with ADEQ's recently reissued Construction General Permit (see Parts I.D.4 & 5), which simply inserts additional provisions in the permit (not individual antidegradation review requirements) in the event of potential discharges to impaired or unique waters.

Sydney Hay, Arizona Mining Association

The provision requiring individual antidegradation review of general permit authorizations for activities that "may affect" an OAW or an impaired water (proposed A.A.C. R18-11-107.01(F)) is vague and overly broad (e.g., for impaired waters, the provision should be limited to activities discharging the pollutant for which the water is listed).

Anti-degradation evaluations are made on a pollutant- by-pollutant basis and are not limited to pollutants that are causing impairments. As such, a limitation of this provision as proposed would be inappropriate**.**

Response: The Department disagrees that the language of R18-11-107.01(F) should be limited with regard to antidegradation review of discharges authorized by general permit to OAWs or impaired waters. While general permits are typically written for a class of discharger (e.g., facility) that involves the same or substantially similar types of operations or pollutants, it is difficult to develop a general permit that is adequately protective for impaired waters, waters meeting standards, and waters of exceptional quality.

It is the Department's intention to review only individual Notices of Intent (NOIs) that may degrade OAWs or impaired waters, and condition them, if appropriate, to protect these waters and satisfy antidegradation similar to how the Department has written the Construction Stormwater General Permit and the De Minimus General Permit. Other alternatives might be to exclude these discharges from coverage under general permits, however, the Department generally considers this 'blended' approach to be adequately protective and of benefit to both the permittee and the agency in terms of process.

The Department agrees that "may affect" may be overly broad. The Department revised R18-11-107.01(F) and replaced "may affect an OAW" with the phrase "may degrade existing water quality in an OAW."

F. *Antidegradation review of a general permit. The Director shall conduct the antidegradation review of a regulated discharge authorized by a general permit at the time the general permit is issued or renewed. A person seeking authorization to discharge under a general permit is not required to undergo an individual antidegradation review at the time the Notice of Intent is submitted unless the discharge may degrade existing water quality in an OAW or a water listed on the 303(d) List of impaired waters.*

R18-11-108. NARRATIVE WATER QUALITY STANDARDS

R18-11-108(A)(1)

Comment #47

Robert A. Hollander, City of Phoenix

This Section requires that surface waters "be free from pollutants in amounts or combinations that…settle to form bottom deposits that inhibit or prohibit the habitation, growth, or propagation of aquatic life." This standard is intended to prevent excessive sedimentation and siltation in amounts that may adversely affect aquatic life.

If the standard is directed at solids, and to be consistent with R18-11-108.02.B, R18-11-108.A.1, it should state "be free from sedimentation and siltation in amounts…" As proposed it could include toxics, which is not the intent of this standard.

Response: The Department believes that the current standard, as written, is clear, understandable and accomplishes this intent. There is little risk of R18-11-108(A)(1) being inappropriately applied to regulate toxic pollutants in surface waters because a different narrative standard specifically requires that surface waters be free from pollutants in amounts or combinations that are toxic to humans, animals, plants, or other organisms [*See* R18-11-108(A)(5)].

R18-11-108(D)

Comment #48

Sydney Hay, Arizona Mining Association

The proposed new standard prohibiting refuse and similar materials being placed in surface waters or on their banks (proposed A.A.C. R18-11-108(D)) suffers from numerous problems. (1) The proposed standard is awkwardly worded, starting out as a "free from" standard but ending with the words "or onto its banks," which do not fit with anything preceding that phrase. (2) ADEQ admits that this is intended as a "tool to prevent dumping," see 14 A.A.R. at 1287. As such, it is best addressed in the solid waste rules currently in process at ADEQ, not the water quality standards. (3) To the extent the standard applies to the "banks" of surface waters, such areas are likely outside the jurisdictional surface waters and thus are not subject to surface water quality standards. (4) Such a provision is unnecessary, as dumping of refuse or solid waste today is likely in violation not only of the AZPDES program, but also the APP program and the existing solid waste rules. There is no "gap" that needs to be filled by adopting a new standard. (5) The standard, if adopted, could have unintended (and undesirable) consequences; for example, it could be construed to prohibit the use of waste rock or overburden from a mine site in any capacity in bank stabilization efforts. For all these reasons, this proposed new standard should not be adopted.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

This narrative standard violates ADEQ's obligations under A.R.S. § 41-1052 to ensure that this rulemaking complies with applicable law and does not exceed its statutory authority. As noted above, and as ADEQ acknowledged in its rulemaking, ADEQ's derives its authority to establish SWQS pursuant to the CWA, which scope is limited only to navigable waters. However, this narrative standard expressly applies to the "banks" of streams, which do not form part of a navigable water. Indeed, the term "banks" is itself vague and ambiguous.

This standard is unnecessary. ADEQ already prohibits wildcat dumping and regulates disposal of solid wastes. *See* A.R.S. § 49-701 et seq. Additionally most municipalities in the state prohibit littering and unpermitted dumping of refuse or rubbish. As such, this proposed narrative standard provides no additional protection, but is simply unnecessarily redundant with other well-established programs accomplishing the same effect.

Matthew Oller, Flood Control District of Maricopa County

The District has an interest in the "rubbish" provision proposes in R18-11-108(D). The District tends to believe that it is beyond the jurisdiction of ADEQ to adopt a rule that applies to the "banks" of watercourses, as opposed to the waters. This could be a problem with projects that are using native material for bank stabilization. It is not clear who would have the responsibility to clean it up. The terms are not defined, and there are other programs to govern trash (as opposed to floatables, which are in SWQS).

Response: The Department believes that the dumping of trash in Arizona's surface waters is a significant water quality problem that is appropriately addressed by the surface water quality standards rules. It is true that there may be other regulatory programs that address the problem of illegal dumping (e.g., solid waste rules). However, the existence of other authorities that provide regulatory tools to address illegal dumping (i.e., by the solid waste program) is not an argument for not using the authority provided under the water quality standards program to maintain and protect the biological, chemical and physical integrity of Arizona's surface waters.

The Department disagrees that regulation of the banks of surface waters is "outside…jurisdictional surface waters" and not subject to regulation under the water quality standards program. Improperly placed or managed waste on stream banks has the potential to impact surface water quality and therefore the Department believes it can be regulated under this Article. The Department agrees that last phrase in R18-11-108(D), "…into a surface water or onto its banks," is inconsistent with the construction of the other narratives. The last phrase of subsection (D) has been stricken and reworded for clarity as follows:

D. *A surface water shall not contain solid waste such as refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, appliances, or tires.*

The Department disagrees that the narrative standard is unnecessary because it may be addressed by the AZPDES permit or APP programs. The AZPDES permit program regulates point source discharges to surface waters in Arizona and not non-point source discharges of trash and garbage. The APP program regulates discharges of pollutants to ground water. Neither regulatory program addresses illegal dumping of trash and garbage in or adjacent to surface waters that may affect water quality. While the Department may agree that solid waste program rules address illegal dumping, the existence of solid waste program regulations does not preclude the Department from addressing the problem through appropriate water quality regulation. The proposed narrative water quality standard supplements Department solid waste regulations and other local ordinances that prohibit illegal dumping and littering. The adoption of R18-11-108(D) supports implementation of other Department water quality management programs such as the § 319 grant program to address the problem.

The proposed narrative water quality standard is clearly intended to address the significant problem of using Arizona surface waters as illegal dumpsites for trash, garbage, and other refuse or the illegal use of tires, abandoned cars, or old and discarded appliances for bank stabilization efforts. The new narrative standard is not intended to prohibit or prevent properly authorized bank stabilization efforts (e.g. such as those authorized by a § 404 permit).

The Department disagrees that the new narrative standard will create any barriers to properly authorized bank stabilization projects using native materials. The plain language of the proposed narrative standard states that it is intended keep surface waters free from "solid waste such as refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, appliances, or tires." This language cannot reasonably be interpreted to preclude the use of native materials for bank stabilization projects. It is not a deficiency for the proposed narrative standard to be silent regarding who has responsibility for cleaning up the trash in a surface water. The Department's enforcement statutes for water quality control, at A.R.S. §§ 49-261 through 49-263, assign responsibility for the violation of the proposed "free from" trash standard to the person who violates the standard. The person who places refuse, rubbish, etc. into a surface water would be responsible under R18-11-120.

Comment # 49

Claire L. Zucker, Pima Association of Governments (PAG)

Wildcat dumping and trash accumulation along waterways is a widespread problem that is very difficult, if not impossible, to correct completely. If the occurrence of trash and debris on the banks of a stream were used to indicate impairment of that stream, then most, if not all, streams in Arizona would probably be considered impaired. Jurisdictions do not have the resources to ensure that all refuse stays out of the waterways at all times, so this rule should be changed to indicate that refuse (and other stated materials) should be reduced to the Maximum Extent Practicable. In addition, the CWA regulates water quality and it does not have jurisdiction over areas adjacent to waterways such as stream banks. Furthermore, the term "banks" is not defined and it is unclear what constitutes a "bank" and therefore how far outside of the waterway, this rule would apply. This rule would be particularly difficult to implement in the urban park environment.

Jim F. DuBois, City of Tucson – Department of Transportation

This proposed Section establishes a narrative standard for refuse, rubbish, demolition or construction debris, trash, garbage, etc., which is so stringent that virtually every watercourse in the state will not meet it. For example, park areas that comprise the banks of urban lakes and watercourses would be out of compliance with this standard, if any littering were to occur. The standard does not recognize that many of these areas are already managed for public use with BMPs to control trash. Also, there are already solid waste regulations that apply. ADEQ should delete this provision. If ADEQ insists on this type of narrative, the agency should establish some specific measure of the presence of the listed solid wastes that protects against an impairment of human health or aquatic and wildlife use, rather than simply using the proposed "shall not contain" prescription.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ proposes a new and unprecedented narrative water quality standard in R18-11-108(D). In that Section, ADEQ provides that a surface water "shall not contain refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, appliances, tires, or other solid waste into a surface water or onto its banks." This proposed standard is problematic for several reasons. First, ADEQ provides no definition of "refuse, rubbish, demolition or construction debris." The regulation is therefore vague, ambiguous, and subject to an overly broad application. For instance, many projects, pursuant to state or federal permits, utilize construction material or other materials for bank stabilization. Presumably these measures would violate SWQS, despite having the effect of preserving the integrity and quality of the stream. Furthermore, this new narrative standard would prove unworkable, in that nearly every watercourse in the state would be out of compliance to some degree.

Response: The Department appreciates the recognition that wildcat dumping and trash accumulation along Arizona's waterways are a widespread problem. The fact that wildcat dumping is a widespread problem that will be difficult to correct is not reason to ignore the problem. The Department does not intend to hold local jurisdictions responsible for ensuring that trash and refuse stay out of surface waters. A person who causes a violation of proposed "free from" trash narrative standard is the person who will be held responsible for a violation. The Department disagrees that the standard should be expressed as the commenter recommends (i.e., that refuse and trash should be reduced "to the maximum extent practicable.") The water quality goal for Arizona surface waters should be that they be maintained free from trash and rubbish. The Department does not believe it is appropriate to set a lesser water quality standard that accepts levels of trash accumulation based on a reduction to the maximum extent practicable. The standard needs to be protective of water quality. How it is implemented depends on the requirements of each water quality permitting program. The adoption of a narrative water quality standard that addresses wildcat dumping will allow the Department to focus water quality management programs, other than just enforcement, on the problem. For example, the Department could better direct Clean Water Act § 319 grant funds to fund nonpoint source pollution control and watershed clean-up projects to address this problem. See Response #48.

The Department has adopted other narrative and numeric water quality standards to protect human health and aquatic life. Narrative standards such as R18-11-108(D) supplement the numeric water quality standards to protect human health (DWS, FC, FBC and PBC) and aquatic life (A&Wc, A&Ww, A&Wedw and A&We). It is similar in nature to other narrative water quality standards that describe general water quality goals such as surface waters shall be free from objectionable odors, or cause off-flavor in drinking water or aquatic organisms, or change the color of a surface water from natural background color. The narrative standard is intended primarily to protect the aesthetic qualities of Arizona surface waters. While it is not the intent of this new narrative to be used for waterbody assessment, before the Department could use this narrative standard in determining a waterbody as impaired for solid waste, it must develop implementation procedures that identify the specific basis for determining that a violation of R18-11-108(D) exists under A.R.S § 49-232(F).

R18-11-108(D) has been revised to clarify that 'refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, appliances, and tires" are components of solid waste.

Comment #50

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

This narrative standard is unwieldy in its application. How would ADEQ establish TMDLs for "refuse, rubbish, demolition, or construction debris"? How would such "discharges" be treated in permits? How would this standard be enforced, as storm events frequently result in debris and rubbish being washed up to banks or into rivers? How would such storm events resulting in "exceedances" of this narrative standard comport with stormwater permits? This narrative standard is inconsistent with the purpose and history of the CWA and ADEQ surface water quality regulation, and would prove unworkable in its application in the TMDL and permitting contexts. For this reason, and for those discussed above, the Coalition recommends that ADEQ delete R18-11-108(D) from its proposed SWQS.

Response: The Department disagrees that the proposed narrative standard should be withdrawn because there are questions about how the standard will be implemented in the Department water quality management programs. The proposed "free from" narrative standard at R18-11-108(D) is no different than other narrative standards. AZPDES-permitted discharges will be required to comply with applicable water quality standards. This means that an AZPDES-permitted point source discharge will not be allowed to discharge solid waste including refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, or appliances into a surface water. AZPDES MS4 permits will be written to control the discharges of solid waste… to the "maximum extent practicable." Before the Department can list a water as impaired based on that new narrative standard, a prerequisite to a TMDL, the Department must develop implementation procedures that identify the specific basis for determining that a violation of R18-11-108(D) exists. Aspects of the implementation procedures may then be promulgated in a future rulemaking.

The Department disagrees that the R18-11-108(D) is inconsistent with the history of the Clean Water Act or the Department's surface water quality regulations. On the contrary, there is a long history of this type of regulation by EPA and at the state level. Similar "free-from" narrative standards to address the aesthetic qualities of surface waters have been a part of water quality standards regulations since the enactment of the modern Clean Water Act (See *Quality Criteria for Water, U.S. Environmental Protection Agency* (July, 1976)(the "Red Book"). See Response #49. No change has been made to the rule.

R18-11-108(D) and (E)

Comment #51

Sandy Bahr, Sierra Club Grand Canyon Chapter

The Sierra Club supports the changes in the Narrative Water Quality Standards including the addition of subsection (D), which prevents dumping of trash and debris in Arizona's surface waters, and the addition of subsection (E), establishing that a wadeable perennial stream support and maintain a community of organisms having a taxa richness. This will help further the goal of the Clean Water Act to restore the biological integrity of the nation's waters. Preventing trash in the standards is also appropriate. Recently, we learned of a total maximum daily load (TMDL) that was developed relative to trash in California. This may be something that the ADEQ would consider for the future in order to help address this growing problem.

Response: The Department appreciates the support of the Sierra Club for the proposed adoption of the narrative standards at R18-11-108(D) and (E).

R18-11-108(E)

Comment #52

Robert A. Hollander, City of Phoenix

Insert "…with A&Wc or A&Ww designated uses…" after "A wadeable, perennial stream…" to communicate that the narrative biological standard applies to wadeable, perennial streams with those designated uses as proposed at R18-11-108.01(A).

Response: The Department does not believe that including the phrase "with the A&Wc or A&Ww designated uses" in R18-11-108(E) is necessary. The proposed standard at R18-11-108(E) is already limited in its application to wadeable, perennial streams and R18-11-108.01(A)(1) explicitly states that R18-11-108(E) applies to "a wadeable perennial stream with either an aquatic and wildlife (cold water) or an aquatic and wildlife (warm water) designated use." No change has been made to the rule.

NARRATIVE WATER QUALITY CRITERIA

The Department is adopting a new narrative standard for biological integrity and narrative criteria for three narrative standards: biological integrity (R18-11-108(E)); bottom deposits (R18-11-108(A)(1)); and nutrients (R18-11-108(A)(6)). The criteria translate the narrative standard into objective bases that the Department can use for determining if the standard is being met.

With the proposed rule, the Department disseminated draft Implementation Procedures to explain the derivation of each criterion and the use of the criterion in assessment, listing, and development of water-quality based limits for AZPDES permits. A.R.S. § 49-232(F) requires the Department to adopt implementation procedures that specifically identify the basis for determining that a violation of the narrative or biological criteria exists. The procedures, when finalized, will provide this guidance and will be adopted as substantive policy.

The Department received numerous comments on the Implementation Procedures for the Narrative Standards, which are outside the context of this rulemaking. The Department has provided responses to those comments directly to the authors and will contact them to participate in upcoming work sessions for the Impaired Waters Identification rule and AZPDES permit program rulemakings, as appropriate.

Comment #53

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ has drastically revised its approach to the narrative bottom deposits, biocriteria, and nutrient standards by establishing proposed objective criteria for determining compliance with each. Indeed, ADEQ's proposed changes to the narrative standard are so revolutionary in their reliance on objective criteria that the Coalition questions whether these proposed standards still qualify as "narrative." The proposed adoption of objective criteria would overturn years of operating under a more subjective approach and make obsolete agency guidance upon which the regulated community has relied for some time.

The proposed narrative standards represent such a drastic and significant change, and require such detailed technical investigation in order to understand their potential ramifications, that the Coalition requests that the narrative biocriteria, bottom deposits, and nutrient standard concepts (proposed R18-11-108.01, R18-11-108.02, & R18-11-108.03) be (1) removed from the current triennial review package, and (2) addressed in the standards as appropriate during the next triennial review period based on implementation through the draft narrative standard guidance documents.

However, if ADEQ proceeds with this planned approach to narrative standards, the Coalition requests that ADEQ delete from its narrative water quality standard sections (proposed R18-11-108.01 through R18-11-108.03) any reference to "implementation procedures." These proposed regulations provide objective criteria for determining compliance with narrative SWQS. They do not provide "implementation procedures" for purposes of TMDLs as required in A.R.S. § 49-232(F). Referring to these criteria as "implementation procedures" serves only to confuse the regulated community as to these criteria versus true TMDL implementation procedures promulgated pursuant to statute.

Response: The Department disagrees that the new biocriteria and narrative bottom deposits and nutrient standards rules should be withdrawn. The Department agrees that the proposed narrative bottom deposits, biocriteria and narrative nutrient standards and their associated criteria rules at R18-11-108.01, R18-11-108.02 and R18-11-108.03 represent a new hybrid approach to surface water quality standards regulation because it combines narrative water quality standards with objective criteria that translate the narrative water quality standards that the Department can use for compliance and assessment purposes. The Department believes that the development of the narrative translators for these three narrative standards is an improvement over the more subjective approach. The lack of objective criteria for determining whether a violation of a narrative standard exists has been an obstacle to consistent Department implementation of the narrative water quality standards in the past. The adoption of objective criteria will provide greater regulatory certainty to the regulated community regarding whether or not the narrative standards are violated and they will provide more specific and objective criteria that the Department staff can use to fairly and consistently apply the standards. The Department proposed R18-11-101.01, R18-11-108.02 and R18-11-108.03 to specifically identify the objective bases for determining that the narrative biocriterion at R18-11-108(E), the narrative bottom deposits standard at R18-11-108(A)(1) or the narrative nutrient standard at R18-11-108(A)(6) are being met.

The Department agrees that the references to implementation procedures in R18-11-108.01, R18-11-108.02 and R18-11-108.03 may be confusing. The rules are more appropriately titled with the term "criteria," which establish the objective bases for determining if the water quality standard is being met. The narrative standards Section titles have been revised as follows:

R18-11-108.01 <u>*Narrative Biological Criteria for Wadeable, Perennial Streams*</u>
R18-11-108.02 <u>*Narrative Bottom Deposit Criteria for Wadeable, Perennial Streams*</u>
R18-11-108.03 <u>*Narrative Nutrient Criteria for Lakes and Reservoirs*</u>

<u>R18-11-108.01. NARRATIVE BIOLOGICAL CRITERIA FOR WADEABLE, PERENNIAL STREAMS</u>

<u>Comment #54</u>

<u>Robert R. Ressler, Pinal Creek Group (PCG)</u>

The proposed narrative biocriteria standard and associated implementation procedures in A.A.C. R18-11-108(E) and R18-11-108.01 are key issues for the PCG. PCG believes that the threshold for compliance is inappropriate.

<u>Response:</u> The thresholds for compliance with the proposed biocriteria have been developed following the EPA *Rapid Bioassessment Protocols* guidance document (Barbour et al, 1999) and are based on empirical data. The 25th and 10th percentiles of the reference macroinvertebrate community were selected based on the ability of the Arizona warm and cold water Indexes of Biological Integrity (IBI) to detect differences between prior selected reference sites and stressed stream sites and biological communities.

These biological indexes or biocriteria encompass spatial and temporal variability of aquatic life in Arizona perennial, wadeable stream habitats. The IBIs were based on a robust dataset of macroinvertebrate samples collected from every major watershed across Arizona over a five-year period (1992-97). Approximately 400 samples were collected statewide to develop the warm water and cold water Indexes (WW IBI 221 samples from 112 sites with 61 reference sites; CW IBI 180 samples from 79 sites with 43 reference sites). These IBIs were developed and tested using EPA methodology in two biocriteria technical reports (Gerritsen & Leppo, 1998; Leppo & Gerritsen, 2000) and were updated in the technical support documentation for the narrative biocriteria standard (ADEQ, 2007). See Responses #55 and 56.

<u>Comment #55</u>

<u>Benjamin R. Parkhurst, HAF, Inc., on behalf of the Pinal Creek Group</u>

The language in the narrative biocriterion is clear and unambiguous, and effective and logical given the associated implementation guidance.

The major issue I have with the accuracy of the indices is with the use of the 25th percentile as the threshold for identifying impairment. No evidence has been presented that shows that the 25th percentile is the threshold for impairment. Otherwise, I believe the indices are technically sound and accurately defined.

I also don't agree that the methods will distinguish well between impacted and non-impacted sites. This is because setting the criterion at the 25th percentile of reference sites largely is arbitrary and most likely will result in about 25% of unimpaired sites being identified as impaired. By definition, reference sites are unimpaired.

<u>Joseph S. Volosin, Parametrix, on behalf on the Pinal Creek Group</u>

The selection of the 25th percentile as the biocriteria threshold for warmwater streams does not seem justified based on the Biocriteria TSD (ADEQ 2007a). Selection of this threshold is critical because it has the potential to identify any type of reach (reference or stressed) as impaired 25 percent of the time thus resulting in incorrect assessments. In fact, as stated in the Biocriteria TSD, 23 percent (77 percent, n = 98/128 attained) of the *a-priori* warmwater reference site streams did not attain the 25 percentile (ADEQ 2007a). This is an acceptance of a relatively high Type 1 error rate when the 25th percentile is used to describe a significant difference (Newman 1995). Would it be acceptable to have a chemical analysis be incorrect 25 percent of the time? A lower Type I error rate exists when the accepted percentile is smaller, such as the 10th percentile (Newman 1995).

<u>Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition</u>

On a technical front, ADEQ provides no explanation for the election of the 25th percentile as its threshold standard in this narrative standard. Indeed, using the 25th percentile of reference streams as the threshold means that 25% of all "unimpacted" reference streams would be classified as violating the proposed biocriteria standard and, by inference, at least 25% of unimpacted, non-reference streams will be similarly classified as violating the standard. A reference stream with a low percentile (i.e., < 25th percentile) score could be impacted from unknown sources. Also, ADEQ states in its draft guidance document (dated April 2008) on the narrative biocritiera standard that the odds of making a Type 1 false positive error are "very low." However, the odds of a false positive are 25%, a scientifically unacceptable error rate. The use of the 25th percentile of reference streams, particularly in light of a proposed reliance on a single bioassessment sample, is therefore fundamentally flawed.

Response: The macroinvertebrate indexes of biological integrity are composed of several metrics or characteristics of the stream bottom dwelling macroinvertebrate community. These metrics are tested for ability to discriminate between a-priori reference (undisturbed waterbodies) and stressed (disturbed waterbodies) samples. Reference macroinvertebrate samples are collected from pre-screened sites that meet landscape and reach scale physico-chemical parameters for reference condition. The most powerful metrics in four categories (richness, composition, tolerance, and trophic status) are selected for inclusion in a multi-metric index. A threshold is then selected which best represents the statistical difference between reference and stressed samples and which is based on the reference distribution of IBI scores. A box and whisker plot of the distribution of reference versus stressed samples is typically used to display the distribution of IBI scores and determine a reference threshold which best discriminates reference samples from stressed (Barbour et al., 1999). The initial development and testing of the IBIs was conducted by TetraTech for the Department in a rigorous analysis using approximately 100 reference samples each for the cold water and warm water indexes. The statistic that best represented the separation of reference and stressed Arizona samples was the 25th percentile of the reference distribution.

The 25th percentile of the reference IBI distribution distinguishes well between 75 percent of the reference samples and 75 percent of the stressed samples in our dataset. While it is true that the Department is accepting up to a 25 percent Type I error rate in the initial reference dataset, there are reasons why this rate is acceptable. The EPA has recommended a quartile/percentile scoring approach for biocritiera thresholds since the 1999 EPA Rapid Bioassessment Protocols manual (Barbour et al, 1999). The 25th percentile value is often found to be the lowest quartile at which good discrimination between a-priori designated reference and stressed sites can be determined. According to the EPA Summary of States' Bioassessment Programs, eleven other states have selected the 25th percentile of reference condition as their IBI threshold.

While a 25 percent error rate seems high, biologists recognize that there is more inherent variability in stream ecosystems and biological communities than in water chemistry. The Department acknowledges that many of the reference sites in the lower quartile were only the best available stream sites in a region and not the least impaired reference sites, because pristine sampling sites were non-existent. There were many reference samples in the lower quartile that were initially used in IBI development which will now be exempted from application of biocriteria for various reasons. There were samples in the dataset from streams which were collected from bedrock or travertine dominated habitats, for which biocriteria are now not applicable. There were samples which are now thought to have been impaired due to collection following the extreme floods of 1993. These samples (10 of 13 impaired warm water reference samples and 8 of 12 cold water impaired reference samples) were stressed due to natural conditions and will be exempted from application of the narrative biocriterion.

The variability in reference quality in the lower quartile of reference condition is acceptable as natural variation in the reference sample population and selection of a lower percentile target would increase the Type II error rate. Setting the biocriterion at a lower percentile (such as the 5th percentile) would result in more false negatives. At the 10th percentile, an estimated false negative rate of 48 percent occurs among the warm water samples in the Department's dataset. The Department must balance the risk of false positive (Type I) errors as well as false negatives (Type II). The thresholds established balance those risks most effectively, with the 10th percentile as the absolute lowest threshold for a violation, the 25th percentile as the minimum threshold for protecting the aquatic life use, and 10-25th percentile as inconclusive when a verification sample is required.

Comment #56

Joseph S. Volosin, Parametrix, on behalf on the Pinal Creek Group

Some reference sites could be defined as violating the new biocriteria standard, if after a single sample collection event, the ADEQ Warmwater IBI score is below the 10 percentile (i.e., 39 for ADEQ Warmwater sites).

Based on spring collected samples from 1992 to 2003, 10 percent of reference sites were determined to have scores less than the ADEQ Warmwater IBI score. Therefore, about 13 reference sites could have been determined to be violating the new biocriteria standard. Determining that a reference site exceeds the new biocriteria standard does not seem appropriate. Therefore, what is the justification for the 10th percentile as the absolute threshold for determining whether the new biocriteria standard is violated? As this is equivalent to saying that the reference sites (which represent sites minimally affected by human activity) are violating applicable standards 10 percent of the time, there needs to be a more complete explanation of what the biocriterion seeks to protect, what constitutes an actual violation of the standard, and how to differentiate impacts from human activity from natural variability. As discussed in the IP, "The naturally occurring biological diversity becomes the primary reference condition used to measure and assess attainment of aquatic life goals." In as much reference sites define the range of naturally occurring biological diversity, there is no logical rationale for a site within the range for the reference condition to be considered in violation for attainment of aquatic life goals. Why should not the entire ADEQ Warmwater IBI range for reference streams be considered attaining and anything below that range not attaining?

Response: The rationale for using the 10th percentile as the threshold for determining that the biocriterion is violated is that the majority of stressed samples in a box and whisker plot analysis fell below the 10th percentile of reference condition. This suggests that samples with IBI scores in this range (<10th percentile) are equivalent to samples that are a-priori known stressed sites, thus they do not achieve biointegrity and are violating the biocriterion. For discussion of why some of the "reference samples" are violating the biocriterion, see Response #55.

Comment #57

Joseph S. Volosin, Parametrix, on behalf on the Pinal Creek Group

ADEQ Warmwater IBI scores for reference sites are compared to those for stressed sites in Figure 5 of the Technical Support Documentation for the Narrative Biocriteria Standard (ADEQ 2006c). The comparison is for the 1992 to 2003 data. What is the sample number for each of the site class categories compared? Should there not be a similar number of stressed sites to compare to reference sites so that the sample numbers are balanced? Similar sample sizes would support a more robust statistical comparison than in the present situation with unequal sample sizes for unpaired samples (Steel and Torrie 1960). A larger sample size may be needed to support the conclusions that the 10th percentile is the absolute threshold for a standard violation determination and that the 25th percentile is the minimum threshold for a standard violation determination for Arizona warmwater sites.

As there was not a significant difference between sites designated as reference and those as non-reference, why not combine the data to derive the ADEQ Warmwater IBI scores?

Response: The table below provides the number of samples in each of the site class categories shown in Figure 5 of the technical support documentation for the Narrative Biocriteria Standard. The number of a-priori identified reference sites is greater than the number of stressed sites and samples, due to the concentration of effort to develop reference sites during the first few years of biocriteria research effort. The concentrated effort on "reference condition" was necessary because the Indexes of Biological Integrity are ultimately based on robust reference conditions, not stressed conditions. While a larger number of stressed samples would be ideal, 30 samples are generally considered a large enough sample size to make inferences about stream conditions. A larger sample size is not needed to support the use of the 10th percentile as the threshold for a standards violation determination because this quantile reflects such a low percentage of reference conditions and approximates the median of stressed samples in the warm water distribution and approximates the 75th percentile in the cold water distribution of stressed samples.

Number of sites	Warm water
Reference (a-priori)	131
Non-reference + unknown	189
Stressed (a-priori)	30
Total number of sites	350

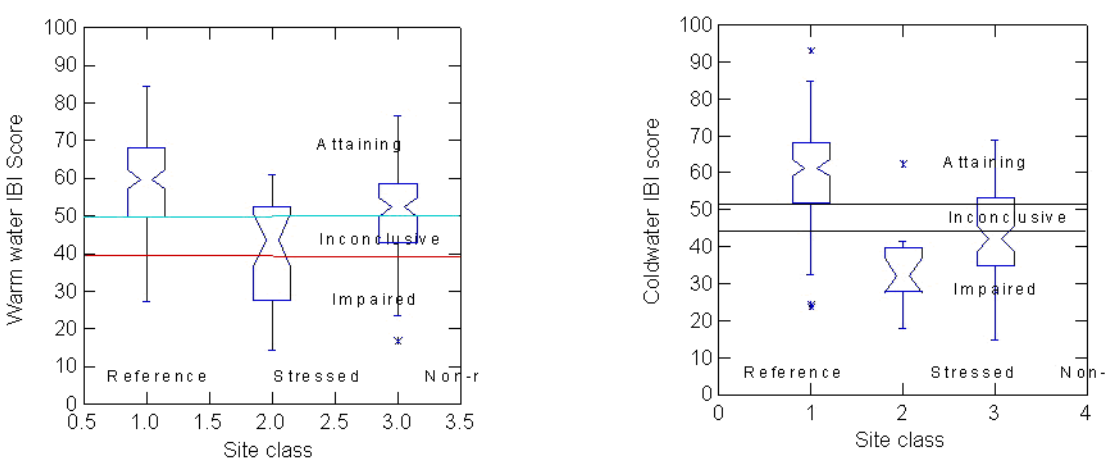

Figure X. Box plot distribution of reference and stressed Arizona Index of Biological Integrity scores for warm water and cold water, with proposed biocriteria thresholds (ADEQ, 2007).

The suggestion to use non-reference condition as the basis for the biocriterion is not valid. Non-reference is not a scientifically defensible approach to setting biocriteria thresholds. Developing reference condition is critical to the interpretation of biological surveys. EPA guidance states the "the reference condition establishes the basis for making comparisons and for detecting use impairment…" Following EPA guidance in the Rapid Bioassessment Protocols (Barbour et al., 1999), the Department dedicated three years of data collection effort into developing a dataset of reference site macroinvertebrate samples by which to create indexes of biological integrity to make biological assessments. Using non-reference sites to establish thresholds is not a technically valid approach.

Comment #58

Joseph S. Volosin, Parametrix, on behalf on the Pinal Creek Group

Because streams have a fair amount of variability over time and space, a single sample event is inappropriate to evaluate the biological integrity of the entire site. Between-year and within-riffle differences can be fairly high for some sites. The condition of the macroinvertebrate community may not necessarily be reflected in the results of a single sample. More than one sample is needed to evaluate the initial and verification sample (if needed). For any particular site, multiple samples should be collected over time and for each sample collection event. Therefore, multiple samples in each of two seasons should be the minimal sample number collected to evaluate biotic integrity.

An understanding of this variability is especially needed when a site is scored near the threshold (Barbour et al. 1999). Furthermore, the variability around a single sample should be known and taken in to account even for reference samples by understanding the standard deviation of repeated measures for streams (Barbour et al. 1999). Therefore, single sample variability should be taken into account as described in Parametrix (2006).

Response: Streams do have natural variability over space and time. The Department methods and the IBIs have encompassed that variation by sampling more than 100 cold and warm water reference sites statewide and over a five-year period for inclusion in the Indexes of biological integrity. In addition, a large amount of natural variation is controlled by the sampling protocols (specified sampling habitat, collecting season, standardized methods), and lab taxonomy protocols (genus level standard taxonomy and standardized lab protocols). The Department has found low variability in repeat reference samples collected during the early 1990s, with a standard deviation of the reference site IBI scores of seven percent (Gerritsen & Leppo, 1998). However, some year-to-year variation in IBI scores is natural because of flooding or drought conditions. When these conditions result in an impaired bioassessment score, the assessment process will evaluate the cause as natural. Riffle-to-riffle variability is not an issue because the Department sampling method specifically calls for compositing within the available riffle habitats in the reach. Compositing over $9m^2$ (a much larger area than most state bioassessment methods) of stream bottom maximizes the taxa richness estimate for the study reach and reduces the amount of variability between samples.

The Department made a large investment in developing robust IBIs that encompass spatial and temporal variability in reference stream macroinvertebrates and represent a composite condition by which to measure single samples from study sites. A single sample is sufficient for determining whether the biological integrity standard has been met for the following reasons: 1) a single macroinvertebrate sample represents long term, ongoing conditions because they reside in streams year-round, 2) Department sampling protocols limit variability by targeting specific habitat, collection period, and sampling conditions, 3) the Department Indexes of Biological Integrity are robust tools, including metrics from four categories of structural and functional measures that limits variability associated with a single metric approach; 4) a large, statewide reference dataset collected over a six-year period was used to develop the reference thresholds; and 5) the 10th percentile of reference will be used as the threshold for identifying impairment for a single macroinvertebrate sample. This is a very low threshold at which there is a high certainty of correctly identified impairment.

The supporting documents that describe the development of the IBIs include references to two different time periods. The abstract for the "Development and Testing of a Biological Index for Warmwater Streams of Arizona" states that the warm water IBI is based on the analysis of benthic macroinvertebrate data collected from 1992-1997 (five years). The abstract for the "Development and Testing of A Biological Index for Coldwater Streams of Arizona" states that the coldwater IBI is based on the analysis of macroinvertebrate data collected by ADEQ from 1992-<u>1998</u> (a six-year period). See Response #55.

Comment #59

Joseph S. Volosin, Parametrix, on behalf on the Pinal Creek Group

In Table 1 of the Biocriteria TSD, the discriminatory power of the separate metrics are evaluated by comparing "ref" (reference) and "edw" (effluent dominated) streams. If effluent dominated streams are not to be evaluated under the implementation of the narrative biocriteria standard, then why are effluent dominated streams used to evaluate the discriminatory power of the separate metrics? Should not *a-priori* stressed sites be used to evaluate the discriminatory power of the separate metrics?

Response: Macroinvertebrate samples from effluent-dependent waters were used in the IBI analysis because they were known to be stressed from high nutrient concentrations and possibly other contaminants. Samples from known stressed sites and multiple stressors are a necessary dataset for testing the discriminatory ability of the IBI to detect impairment of biological integrity. The effluent-dependent streams in the Department's dataset fit the stream class the IBI was designed for: perennial, wadeable streams. Samples from sediment stressed sites in wadeable, perennial streams were used in the stressed sample dataset. The proposed biocriteria do not apply to effluent-dependent streams because the Department does not know what the attainable biological integrity of these water bodies is.

Comment #60

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The draft guidance document (dated April 2008) for the narrative biocriteria standard includes application elements that are not specified in R18-11-108.01, but are critical components of the proposed biological standard. These additional application elements include that wadeable, perennial streams must contain fast-flowing riffle or run habitat, not be dominated by bedrock or travertine, and be sampled during the spring index period. These additional elements should be included in the rule to clarify that if these elements are not present the narrative biological standard is not applicable. Further, the inclusion of these additional elements will help to ensure that the narrative biological standard proposed by ADEQ in R18-11-108(E) applies only to wadeable, perennial streams capable of supporting the type of fauna intended to be protected by the proposed rule

Response: The language in the biocriteria rule is clear and concise. The language regarding wadeable and perennial is included in the rule to specify the appropriate stream type to which one of the IBIs will apply. However, the other application elements are part of the broader sampling methodology that is discussed in the Implementation Plan guidance document and the sampling procedures are fully disclosed in the appendix of the guidance document. It is unnecessary to address all the sampling methodology in rule, especially when it is provided in an approved QAPP (ADEQ, 2006). No change has been made to the rule.

Comment #61

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ should revise proposed R18-11-108.01 as follows:

R18-11-108.01 Narrative Biological Standard ~~Implementation Procedures~~

A. *The narrative biological standard ~~implementation procedures~~ in R18-11-108(E) ~~this Section apply~~ applies only during the spring index period (April-May for warm water streams and May-June for cold water streams) to a wadeable, perennial stream with fast-flowing riffle or run habitat with a heterogeneous substrate that is not dominated by bedrock or travertine and the wadeable, perennial stream has either an aquatic and wildlife (cold water) or an aquatic and wildlife (warm water) designated use.*

B. *The biological standard in R18-11-108(E) is met when a bioassessment result, as measured by the Arizona Index of Biological Integrity (IBI) for cold or warm water is:*
   1. *Greater than or equal to the 25th percentile of reference condition, or*
   2. *Greater than the 10th percentile of reference condition and less than the 25th percentile of reference condition and a verification bioassessment result is greater than or equal to the 25th percentile of reference condition.*

C. *Arizona Index of Biological Integrity (IBI) scores.*

	Index of Biological Integrity Scores	
Bioassessment Result	*A&We*	*A&Ww*
Greater than or equal to the 25th percentile of reference conditions	*Š52*	*Š50*
Greater than the 10th and less than the 25th percentile of reference condition	*46 - 51*	*40 - 49*

D. *A violation of the biological standard in R18-11-108(E) shall be determined based on the IBI goal in subsection (B) and the biocriteria implementation procedures adopted by the Department in accordance with A.R.S. § 49-232(F).*

E. *Application or use of the biological standard in any AZPDES permit shall be as described in the biocriteria implementation procedures adopted by the Department in accordance with A.R.S. § 49-232(F).*

Response: The Department disagrees that R18-11-108.01 should be revised as recommended by the Coalition. The objective criteria for determining whether the narrative biocriteria standard is met are prescribed in the rule at R18-11-108.01(B) and (C). The Department agrees that compliance with the proposed biocriteria standard is determined from bioassessment results as measured by the Arizona Indexes of Biological Integrity for cold or warm water streams. However, the Department does not agree that this compliance determination is dependent on the adoption of "biocriteria implementation procedures adopted by the Department in accordance with A.R.S. § 49-232(F)." The proposed rule already states how the Department will determine compliance with the narrative biocriteria standard. There is no need to refer to other implementation procedures adopted under A.R.S. § 49-232(F).

The Department disagrees with the commenter's addition of new subsection (E). The Department is adopting surface water quality standards rules, not rules for the AZPDES permit program. The appropriate place for rules addressing implementation of biocriteria in AZPDES permits are the AZPDES permit rules found in 18 A.A.C. 9, Article 9.

Comment #62

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ also fails to disclose whether it performed a truly independent analysis of its methods in selecting data sets providing the basis of its biocriteria standard. A data set should be comprised of a priori unclassified, impacted and no-impacted, non-reference sites, and ADEQ should have then determined how well its methods correctly identified sites that would be meeting or not meeting the proposed biocriteria standard.

The Coalition therefore recommends that ADEQ explain its methods for selecting data sets.

Response: A complete discussion of how the Indexes of Biological Integrity for macroinvertebrates were developed is provided in the "Technical Support Documentation for the Narrative Biocriteria Standard" (ADEQ, 2007). The analytical methodology for developing the reference condition dataset is provided as well as the rationale for testing and development of the Indexes. The statistical analysis was conducted by TetraTech Inc., for the Department and followed standard EPA statistical approaches for development and testing of IBIs. This included development of the Indexes using one dataset (statewide), then independently testing the resulting Index using a separate and independent dataset (Verde River basin).

Comment #63

Sandy Bahr, Sierra Club Grand Canyon Chapter

This provision adds a new important aspect to the surface water quality standards and will aid the ADEQ substantially in working toward the goal of restoring biological integrity to our surface waters. The health and diversity of the biological community can provide important information on how the surface water system is functioning.

Response: The Department appreciates the comment.

Comment #64

Sydney Hay, Arizona Mining Association

On their face, the new implementation procedures ("IPs") associated with the narrative biological integrity criterion apply to any wadeable perennial stream with a cold water or warm water aquatic life use designation (i.e., any water that is not ephemeral or EDW). See proposed A.A.C. R18-11-108.01(A). However, the draft implementation procedures themselves (p. 3) include additional applicability factors that are not, but should be, specified in the rule. These criteria are: (1) presence of fast-flowing riffle or run habitat; (2) water is not dominated by bedrock or travertine; and (3) sampling occurs during the spring index period. The rule should make clear that these factors must be present in order to assess compliance with the biological criterion.

Response: The Department disagrees that the proposed R18-11-108.01(A) should include additional applicability factors based on the sampling protocols described in the draft implementation procedures document. The proposed rule clearly states that the narrative biocriteria standard applies to wadeable, perennial streams with the A&Wc or A&Ww designated use. No change has been made to the rule.

R18-11-108.02. NARRATIVE BOTTOM DEPOSIT CRITERIA FOR WADEABLE, PERENNIAL STREAMS

Comment #65

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Similar to the proposed narrative biocriteria standard language, ADEQ should clarify that the proposed narrative bottom deposits criteria apply only to wadeable, perennial streams, and that they do not constitute "implementation procedures" as that term is understood in the TMDL context. As such, the Coalition recommends that ADEQ revise its proposed R18-11-108.02 as follows:

R18-11-108.02. Narrative Bottom Deposits Standard Implementation ~~*Procedures*~~

A. The narrative bottom deposit ~~*implementation procedures*~~ *standard* ~~*in this Section*~~ *applies only* ~~*apply*~~ *to wadeable, perennial streams with an aquatic and wildlife (cold water) or an aquatic and wildlife (warm water) designated use.*

B. The narrative water quality standard for bottom deposits at R18-11-108(A)(1) is met when:

1. The percentage of fine sediments in the riffle habitats of a wadeable, perennial stream with an A&Wc designated use, as determined by a riffle pebble count, is less than or equal to 30 percent.

2. The percentage of fine sediments in the riffle and run habitats of a wadeable, perennial stream with an A&Ww designated use, as determined by a reach level pebble count, is equal to or less than 50 percent.

C. A violation of the narrative bottom deposits standard at R18-11-108(A)(1) shall be determined based on the criteria in subsection (B) and the narrative bottom deposits standard implementation procedures adopted by the Department in accordance with A.R.S. § 49-232(F).

D. Application or use of the narrative bottom deposits standard criteria in any AZPDES permit shall be as described in the narrative bottom deposits standard implementation procedures adopted by the Department in accordance with A.R.S. § 49-232(F).

Response: The Department will change the Section title to be clear that this rule is not the implementation procedure that will be adopted as agency guidance and that this rule applies only to wadeable, perennial streams. See Response #53. The language for A&Ww streams has been revised to eliminate the reference to "riffle and run" and replaced with "all stream habitats." The Department does not agree that the language proposed to be added in subsections (C) and (D) is necessary for the clarity or implementation of the rule for the same reasons stated in Response #61. The Department has revised the rule as follows:

R18-11-108.02. Narrative Bottom Deposit Criteria for Wadeable, Perennial Streams

A. The narrative bottom deposit criteria in this Section apply to wadeable, perennial streams with an aquatic and wildlife (cold water) or an aquatic and wildlife (warm water) designated use.

B. *The narrative water quality standard for bottom deposits at R18-11-108(A)(1) is met in perennial waters when:*
   1. *The percentage of fine sediments in the riffle habitats of a wadeable, perennial stream with an A&Wc designated use, as determined by a riffle pebble count, is less than or equal to 30 percent.*
   2. *The percentage of fine sediments in all stream habitats of a wadeable, perennial stream with an A&Ww designated use, as determined by a reach level pebble count, is equal to or less than 50 percent.*

Comment #66

Sandy Bahr, Sierra Club Grand Canyon Chapter

We are supportive of this change in the standards as it again helps to implement the goal of restoring biological integrity to our surface waters. Sedimentation of our streams and rivers can adversely affect the benthic macroinvertebrate community, a key component of a healthy surface water, and greater sedimentation can adversely affect species of trout. The Sierra Club has participated in one training and has also done at least one field trip using the procedures outlined in the *Narrative Bottom Deposits Standard Implementation Procedures for Wadeable, Perennial Streams, April 2008*. These procedures are clear and relatively easy to implement in the field. They will help to determine the biological condition of our state's wadeable streams.

Response: The Department appreciates the comment.

Comment #67

Sydney Hay, Arizona Mining Association

The standard applies on its face to any wadeable, perennial stream. See proposed A.A.C. R18-11-108.02(A). The draft IPs make clear that the standard only makes sense in the context of riffle and run habitat, as that is the environment in which high sediment can adversely affect benthic macroinvertebrates and other organisms using stream bottoms (e.g., fish laying eggs). This should be made explicit clear in the applicability Section of the rule (R18-11-108.02(A)). Absent such clarification, the procedures could be applied to a "water" such as the tunnel and lined channel at the Asarco Ray Mine (which as noted above carry an aquatic life designation), even though those areas lack riffle or run habitat and thus logically should not be subject to these IPs.

Response: The Department disagrees with the suggestion that language relating to riffle and run habitats be added to the applicability subsection in R18-11-108.02(A). The Department believes that the recommended language limiting the applicability of the narrative bottom standard is unnecessary because the target sampling habitats are specified in R18-11-108.02(B). See Response #65. The narrative bottom deposits standard applies to wadeable, perennial streams with natural substrates and not to concrete-lined tunnels and channels such as those constructed at the Asarco Ray Mine. The Department could not follow either the riffle pebble count or the reach level sampling protocol in such a highly modified system.

R18-11-108.03. NARRATIVE NUTRIENT CRITERIA FOR LAKES AND RESERVOIRS

Comment #68

Janet Hashimoto, Chief; EPA Monitoring & Assessment Office

We commend ADEQ's development of implementation procedures for narrative nutrient standards for lakes and reservoirs as an important step to advance the quality of nutrient assessments. The implementation procedures proposed in Section R18-11-108.03 follow EPA's national guidance and include a weight-of-evidence matrix providing the basis for interpreting the narrative nutrient standards. ADEQ has created five functional lake classes, along with nutrient threshold values expressed as ranges of chlorophyll-*a*, Secchi depth, total nitrogen, total Kjeldahl nitrogen (TKN), total phosphorus, percent blue-green algae, and total count of blue-green algae.

To accompany the proposed rule text, ADEQ developed draft guidance titled "Narrative Nutrient Standard Implementation Procedures for Lakes and Reservoirs," April 2007 to be used for both ambient water quality assessment and permit compliance purposes. The guidance does not specify the method by which to translate narrative nutrient standards into numeric limits for inclusion in National Pollutant Discharge Elimination System (NPDES) permits.

Because ADEQ has concurrently proposed to eliminate numeric nutrient limits for some water bodies (Theodore Roosevelt, Apache, Canyon, Saguaro, and San Pedro River from Curtiss to Benson) per Section R18-11-109.E, permit writers would need to rely on the narrative nutrient guidance to set numeric limits for NPDES permitted facilities located in these watersheds. We are concerned with the elimination of numeric standards absent a detailed procedure for translating the proposed narrative nutrient standards into permit limits.

The rule should include the frequency of nutrient exposure, e.g., average peak season value, which is currently only specified in the guidance.

Response: The Department appreciates EPA's support for developing the narrative nutrient standard but disagrees that these permitting details should be included in the standard. They are appropriately included in the implementation procedures and ultimately in the AZPDES permit program rules. The narrative standard guidance documents are still being developed for the assessment, listing, and permitting program. Those processes are independent of surface water quality standards and should not affect adoption of this standard.

The Department received a number of comments concerning use of the narrative nutrient matrix in AZPDES permits. While the implementation procedures guidance documents are not being adopted as part of this rulemaking, it is clear from the comments that the Department has not adequately described in the draft guidance document how it envisions use of the matrix in AZPDES permits. A review of the latest version of the guidance documents released in April 2008, finds several inconsistencies in the permitting section that no doubt caused reader confusion. While the guidance document is not being adopted as rule, a brief discussion of the permitting process is outlined in this response. The Department continues to refine its initial approach outlined in the April 2008 draft IP and intends to develop a loading approach tailored to meet a lake-specific biomass target. The Department does not envision application of the narrative nutrient matrix (Numeric Targets Table) as end-of-pipe limits in AZPDES permits, at least initially. Proposed nutrient discharges will involve a number of steps including determining: the receiving water assimilative capacity, existing nutrient loads, and proposed loads (including any necessary lake management activities). This information would be used to determine the appropriate size of the mixing zone and to develop an appropriate monitoring plan to determine if the narrative nutrient standard is being attained in a lake or reservoir.

As noted earlier, the Department has provided detailed responses to comments about the implementation guidance to the authors and will encourage those commenters to participate in future work sessions to finalize those documents.

Since this narrative nutrient standard only applies to lakes and reservoirs, removal of the nitrate standard on the San Pedro River is not at issue (see Response #87). If a permit for discharge to one of the four lakes identified by the commenter is submitted to the Department before the implementation procedures are finalized, the Department standards and permitting staff will work with the permittee to obtain the needed data to determine if the narrative nutrient standard is being met and to develop the appropriate permit conditions, including in-lake monitoring if needed, to ensure the standard is being attained in the lake. Currently there are three AZPDES permits for discharges to lakes. Two permits are small wastewater treatment plants (WWTP) at the marinas at Roosevelt and Canyon Lakes and the third permit is the discharge of reclaimed water to Lakeside Lake in Tucson. The Department will incorporate the provision of the narrative nutrient criteria in the renewal permits as appropriate.

While the rule currently has the frequency of exposure, the Department agrees that the language should be clarified and has revised the first paragraph of R18-11-108.03(B) as follows:

B. *The narrative water quality standard for nutrients at R18-11-108(A)(6) is met if, based on a minimum of two sample events conducted during the peak season for lake productivity, the results show an average chlorophyll-a value below the applicable threshold for designated use and lake category in subsection (D).*

Comment #69

David E. McNeil, City of Tempe

The Department has proposed to establish numeric criteria for implementation of the existing narrative water quality standard requiring surface waters to "not contain pollutants in amounts or combinations that cause the growth of algae or aquatic plants that inhibit or prohibit the habitation, growth, or propagation of other aquatic life or that impair recreational uses" (R18-11-108.A(6)), also known as the "narrative nutrient standard." The City of Tempe opposes the establishment of the numeric criteria, as proposed, for several reasons:

Many states have had challenges implementing the narrative nutrient standard due to the relationships between causal and response variables that are unique to each water body. Accordingly, EPA has responded to recent correspondence from both the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) and the National Resources Defense Council (NRDC) urging EPA to establish technology-based nutrient criteria by initiating the development of guidance on nutrient removal technology. Pending completion and distribution of this guidance to the states, which is expected in August, proceeding with the promulgation of nutrient criteria in Arizona is premature. The upcoming guidance should provide valuable information regarding the costs and feasibility of implementing nutrient removal technology, and may even suggest the use of technology-based criteria in lieu of numeric translators for the narrative standard.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

For example, many states have struggled to implement narrative nutrient standards due to the relationship between the causal and response variables unique to each waterbody. As such, the Association of State and Interstate Water Pollution Control Administrators ("ASIWPCA") and the National Resources Defense Council ("NRDC") have urged EPA to establish technology-based nutrient criteria through the development of guidance on nutrient removal technology. EPA has responded that it intends to provide such guidance. ADEQ therefore should delay finalization of any narrative nutrient standard pending issuance of EPA's guidance on implementation of nutrient removal technology.

Response: The Department agrees that it has been challenging to develop criteria that translate the narrative nutrient standard into objective criteria that can be measured to determine whether the narrative standard is met. However, the Department disagrees that it is "premature" for the Department to propose numeric translators for Arizona lakes and reservoirs in this rulemaking.

The Department will follow efforts by EPA, ASIWPCA and the NRDC to develop technology-based standards to control the discharge of nutrients. However, the potential future development of technology-based nutrient standards is not a substitute for the water quality-based approach developed by the Department to protect Arizona's lakes and reservoirs with this new standard.

Comment #70

David E. McNeil, City of Tempe

The proposed approach establishes chlorophyll-*a* as the primary criteria which, in concentrations below the numeric target range established in subsection D, indicates attainment of the nutrient standard. Weight-of-evidence criteria such as nitrogen and phosphorous are only evaluated for assessment purposes if chlorophyll-*a* is above the lower end of the target range. This approach to the narrative standard concludes that the response variable of chlorophyll-*a* is, by itself, a good indicator of attainment.

The complex relationship between different causal variables and chlorophyll-*a* makes such a demonstration of assimilative capacity implausible. In addition, a limitation on the extent of chlorophyll-*a* response amounts to the inappropriate establishment of an antidegradation requirement for the narrative standard. Any attempt to preempt impairment by requiring dischargers to meet target thresholds for causal variables also ignores a lake manager's authority and ability to attain the standard by managing the response variables using physical, biological, or chemical control of weeds and algae as established in A.A.C. R18-11-117. Accordingly, the proposed rule should specify that it is to be used for lake assessment only, and shall not be used to establish effluent limitations in the absence of a TMDL.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The determination of assimilative capacity is nearly impossible due to the complex relationship between causal variables. Also, ADEQ's limitation on the degree of chlorophyll-*a* response amounts to an inappropriate establishment of an antidegradation standard through the draft guidance document. Furthermore, ADEQ's efforts to prevent impairment by requiring permittees to meet target thresholds for causal variables fails to consider a lake manager's ability, under A.A.C. R18-11-117, to manage response variables using physical, biological, or chemical controls to attain SWQS.

ADEQ should clarify that the proposed narrative nutrient standard applies only to lake assessment, and is not relied upon in promulgating discharge limits absents ADEQ's establishment of a total maximum daily load ("TMDL") for the lake in question.

Response: The Department is adopting the chlorophyll-*a* criterion as the primary endpoint for meeting the narrative nutrient standard (except when the lake is designated as a shallow lake outside of the urban context – see rule clarification below). Chlorophyll-*a* is an EPA-approved surrogate for aquatic plant biomass and is included in the *National Nutrient Criteria established for Lakes and Reservoirs* in 2001/2002. The Department disagrees that the limitation on the degree of chlorophyll-*a* response is an antidegradation standard. It is a primary end-point for meeting the standard as established in EPA documents and scientific literature. Although the causal-response relationship is complex and always in flux, chlorophyll-*a*, in combination with the standards for dissolved oxygen (DO), pH, and ammonia, is considered to be the most feasible alternative in assessing support of aquatic and wildlife designated use with regard to nutrients. The Department disagrees that determination of assimilative capacity is impossible. It is similar to determining standards attainment at the edge of a mixing zone. The mixing zone rule has been in the standards since 1992 and a number of permits have been written with them. See Response #68.

The Department disagrees that the proposed narrative nutrient standard applies only to assessments and cannot be used to establish effluent limitations in the absence of a TMDL. Narrative standards are independently applicable in determining whether a waterbody is meeting its designated uses. However, how the narrative nutrient standard and matrix is to be used in assessments, impaired waters listings and in discharge permits is still under development and will be discussed in the context of guidance documents and in the appropriate rulemakings.

To clarify the standard for shallow lakes outside of an urban context, the following minor revisions to R18-11-108.03(B)(3) have been made:

3. *For a shallow lake. In addition to meeting the mean chlorophyll-a concentrations in (B)(1) or (2) above, submerged aquatic vegetation covers 50 percent or less of the lake bottom and there is less than a 5 mg/L swing in diel dissolved oxygen concentration measured within the photic zone*.

Comment #71

David E. McNeil, City of Tempe

The establishment of Total Nitrogen as supporting criteria for chlorophyll-*a* concentrations to assess compliance with the narrative nutrient criteria is not supported by the 2005 Statistical Modeling and Analysis Report. While the data supports a strong positive correlation between TKN and chlorophyll-*a*, the data also establishes that the correlation between Total Nitrogen and chlorophyll-*a* is only moderate (Report, p. 4-13; p. 4-28;) and that the correlation between chlorophyll-*a* and nitrate as well as nitrate-plus-nitrite is weak (Report, p. 4-4; p. 5-1). The data also indicates that TKN generally comprises upwards of 70% of Total Nitrogen (Report, Table B-2) and that the correlation between TKN and Total Nitrogen is one of the strongest observed correlations (Report, Table 4-2). This demonstrates that the moderate correlation between Total Nitrogen and chlorophyll-*a* is incidental to the TKN/chlorophyll-*a* correlation, and not demonstrative of a causal relationship. Concentrations of Nitrogen species other than TKN are not statistically correlated with nutrient impairment, making the use of Total Nitrogen as supporting criteria arbitrary.

The use of the remaining nutrient targets independently as supporting criteria for chlorophyll-*a* concentrations to assess compliance with the narrative nutrient criteria is also not supported by the Statistical and Modeling Analysis Report. As described above, any correlation between Total Nitrogen and chlorophyll-*a* appears to be incidental to the TKN/chlorophyll-*a* correlation, making the use of Total Nitrogen as supporting criteria for chlorophyll-*a* arbitrary in the absence of elevated TKN. The report also concludes that the strong correlation between TKN and chlorophyll-*a* is partially derived from (TKN's) correlation with Total Phosphorous (Report, p. 4-14). In addition, Total Phosphorous becomes much more of a causal factor when TKN (and accordingly Total Nitrogen) concentrations decrease (Report, p. 4-4). This information demonstrates that TKN and Total Phosphorous have a synergistic rather than independent effect on chlorophyll-*a*. Accordingly, the use of TKN and Total Phosphorous target ranges independently as supporting factors in assessing compliance with the narrative nutrient criteria is arbitrary. The language in proposed A.A.C. R18-11-108.03(B)(2)(c)(vi) should exclude Total Nitrogen, and the word "or" should be replaced with "and."

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ's establishment of target criteria for Total Nitrogen is erroneous, because the correlation between Total Nitrogen and chlorophyll-*a* established in ADEQ's statistical modeling report is incidental to the TKN-chlorophyll-*a* concentration.

Response: The *Statistical and Modeling Analysis Report* by Malcolm Pirnie is comprised of various data analysis techniques applied to Arizona lake and reservoir data. The goal was three-fold: 1) develop a lake/reservoir classification system to support nutrient-related initiatives, 2) derive numeric and non-numeric endpoints for assessment, and 3) incorporate these elements into formal implementation procedures for assessment of lake conditions and determination of compliance with the narrative nutrient standard. The analyses discussed in this report laid the empirical foundation for the second document, *Potential Nutrient-related Targets for Arizona Lakes and Reservoir,* which culminated in the matrix of threshold values proposed in this rulemaking. It is important to understand that the threshold ranges for specific nutrients were derived from empirical relationships found in Arizona lake data. The ranges for total P, total N, TKN, and secchi depth are not intended to be predictive of chlorophyll-*a*, but are used as corollary information in a weight-of evidence evaluation for determining evidence of nutrient-related impairment (see R18-11-108.03(B)(2)). These supporting thresholds are there for the reviewer/evaluator so that if/when future data do not reflect these ranges, it may be a trigger for further investigation. Regardless, comparison of future data to these threshold ranges will be used to solidify or possibly to refine our understanding of lake classes and/or how a lake that falls in multiple classes may respond.

The inclusion of total nitrogen in the matrix is intentional. The commenter is correct in saying that TKN was found to have the most powerful correlation to chlorophyll-*a*, but this may or may not be equally predictive. Including total nitrogen and TKN allows the evaluation of nitrate+nitrite-N by subtraction when comparing assessment data with matrix thresholds. In addition, along with TKN, the Department will evaluate ammonia values in combination with TKN values and other event-related lake data to track relationships between physical, chemical and biological conditions. No change has been made to the rule.

Comment #72

David E. McNeil, City of Tempe

The use of DO and pH standards as supporting criteria for chlorophyll-*a* concentrations to assess compliance with the narrative nutrient criteria is not supported by ADEQ's February 2005 Statistical and Modeling Analysis Report. Specifically, the Summary and Conclusions section of this report indicate that "dissolved oxygen and pH concentrations were also largely independent of other parameters, and did not even correlate strongly with algal chlorophyll-*a*." The DO and pH standards are stand-alone criteria, exceedances of which constitute an exceedance of numeric standards. There is no reason or basis for establishing these criteria as supporting criteria for the response variable of chlorophyll-*a*, especially when causality has not been established.

There are many issues regarding the proposed narrative nutrient standard that warrant removal of the standard from the current revision of water quality standards. Alternatively, Tempe requests that chlorophyll-*a* be established as stand-alone criteria with a standard at the upper end of the target thresholds presented in the rule. If a lake is listed for narrative nutrients based on chlorophyll-*a*, a study of the causal factors specific to a water body could then be undertaken through the TMDL process.

Response: The Department disagrees that the proposed narrative nutrient standard should be removed or reduced to a stand-alone chlorophyll-*a* criterion**.** While the Department agrees that an exceedance of the upper end of the target thresholds for chlorophyll-*a* represents an exceedance of the narrative nutrient standard, an exceedance of the narrative nutrient standard is also demonstrated when chlorophyll-*a* concentrations are within the range of thresholds presented in the matrix and there is other evidence of nutrient-related impairments such as exceedances of target thresholds for dissolved oxygen, pH, Secchi depth, total nitrogen, total phosphorus, and blue-green algae.

While the standards for dissolved oxygen (DO) and pH do stand alone, they are also relevant to aquatic ecosystem function and nutrient cycling. DO and pH are related to productivity (rate of biomass production and are therefore relevant to biomass and to the narrative nutrient standard. The matrix includes these parameters in the weight of evidence (see R18-11-108.03(B)(2) and (B)(3)) used to determine whether a chlorophyll-*a* value within the target range may or may not be correlated with exceedances of DO and/or pH, secchi depth, blue-green algae, TKN, TP, or TN above the corresponding ranges. The ammonia standard is not cited specifically, but ammonia also is relevant, as it is the preferred nitrogen form over nitrate for uptake, as is orthophospate. So correlation is not causation, but is used to inform further investigation.

Comment #73

Robert A. Hollander, City of Phoenix

The Water Services Department requests that park lakes that include reclaimed water should be excluded from meeting the proposed nutrient criteria. There should be no public health impact using reclaimed water in park lakes with a partial body contact (PBC) designated use especially since reclaimed water used for these purposes in Arizona must meet the restricted use pathogen requirements under an Aquifer Protection Permit. Many golf courses that use reclaimed water for irrigation store excess reclaimed water for future use in those lakes. The nutrients in reclaimed water are essential for adequate irrigation and one of the benefits of using reclaimed water. This could have a major capital and operation and maintenance cost impact on water utilities for further treatment facilities and on water resources if the lakes have to be filled with potable water. Please see the comments, to the Preamble above, regarding the use of reclaimed water. The proposed rule could eliminate the option of using reclaimed water in park lakes.

Response: The narrative nutrient standard for urban lakes will only apply to those lakes classified in Appendix B of the surface water quality standards, not to every impoundment storing reclaimed water. The lakes listed in Appendix B have met the criteria for waters of the United States and must be protected for aquatic life support and, at a minimum, for partial body contact. The list of lakes to which the narrative nutrient standard applies is further limited to those lakes that have been "classified" according to the controlling lake characteristic (e.g., igneous, sedimentary, urban). The commenter is correct in that many golf courses store excess irrigation water in golf course lakes but the Department believes the vast majority of these lakes are not waters of the United States and this new narrative nutrient standard would not apply to these impoundments. See Response #77.

Comment #74

David E. McNeil, City of Tempe

Because nutrient removal to the target ranges established in the proposed narrative nutrient standard is unachievable without employing reverse osmosis or other similar technology, the rule in conjunction with the April 2008 draft IP creates an effective prohibition on the beneficial reuse of reclaimed water in Arizona's lakes. The rule and IP are inconsiderate of the challenges that Arizona faces in ensuring a sustainable water supply into the future. As water stewards, it is our responsibility to prepare for cyclical droughts as well as reductions in water supply induced by climate change. The effective prohibition on the use of reclaimed water in lakes is contrary to EPA's March 2008 draft "National Water Program Strategy: Response to Climate Change," which outlines the need to consider water sustainability in making regulatory decisions such as changes in standards or more stringent permit limits, and emphasizes the need to promote the recycling and reuse of water. Establishing discharge-prohibitive permit limits for causal variables despite every indication of a healthy water body based on an assessment of the response variable is not true to EPA's Climate Change Strategy, lacks foresight, and fails our commitment to water stewardship.

Response: The Clean Water Act requires criteria that are protective of the waterbody's highest and best designated uses. That is why the proposed chlorophyll-*a* criteria have been tiered from Domestic Water Source (DWS) down through full body contact to Aquatic and Wildlife (A&W) endpoints. Use of lakes as reclaimed storage impoundments is an ancillary use that may not be compatible with the lake's ability to handle nutrient inputs and still meet the appropriate standards for the designated uses of the lake. As long as a lake carries (at a minimum) A&W designated use, the impact of nutrient loading must be considered because the narrative standard at R18-11-108(A)(6) was adopted to ensure the protection of aquatic life and recreational uses.

Most reclaimed water impoundments that are created in a waters of the United States would likely be classified as A&W urban. This matrix category has the least stringent range for protection allowing up to 50 *u*g/L for chlorophyll-*a*. An upper threshold of 50 *u*g/L for chlorophyll-*a* is designed to keep the lake from becoming hyper-eutrophic while meeting DO and pH standards. Lakeside Lake in Tucson, is the only lake that received reclaimed water that had a sufficiently robust data set for use in the statistical analysis. For the time period modeled, Lakeside Lake was found to be marginally attaining its designated uses but required active in-lake treatment to greatly reduce phosphorus.

The matrix does not require attainment of target values at end of pipe. Rather, it is an assessment of the lake's ability to assimilate nutrient inputs. Use of reclaimed water as source water for a lake may be considered on a case-by-case basis, however, current levels of nutrients in reclaimed water are orders of magnitude higher than those found in surface water. The case-by-case determination will, to the degree possible, recognize that impacts of a reclaimed water discharge may vary with factors including size of the impoundment, quality of other source water, retention time, surface area, prevailing wind direction or currents, depth as well as the volume, setting, climatic conditions, suspended particulate matter, nutrient species present and total load, and timing of the proposed reclaimed water discharge. It is expected that lakes proposed for use of reclaimed water as source water will require moderate-to-intensive management to meet A&W and contact recreation standards. Even without reclaimed water, many of these systems require chemical, physical, or biological management on some level. The narrative nutrient matrix is an active and pre-emptive approach to ensuring attainment of the designated uses to protect human health, aquatic life, and wildlife. See Response #68.

Comment #75

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ's proposed narrative nutrient standard implementation procedures at R18-11-108.03 establishes unnecessarily strict nitrogen and phosphorus targets for Arizona lakes and reservoirs.

Pima County believes for the reasons detailed in our attached letter the proposed nitrogen and phosphorus target levels, which create a strict numeric prohibition, are not scientifically defensible. This proposed rule would effectively create a prohibition of use of reclaimed water into Arizona lakes due to the incorporation of the proposed nitrogen and phosphorus limits into discharge permits. These limits would be imposed even if a true measure of lake impairment could not be verified with chlorophyll-*a* measurements. In light of the number of waters in Arizona that are being created as part of ecological restoration projects, that need sources of water such as reclaimed water to allow them to remain viable and healthily without the wasteful use of scarce groundwater, ADEQ should carefully consider the recommendations of our attached letter and modify its implementation procedure to accommodate the use of reclaimed water in Arizona lakes under certain circumstances. Most Arizona constructed wastewater treatment facilities cannot treat effluent to meet the nitrogen and phosphorus limits proposed in this rule and therefore valuable ecological restoration projects in Arizona will potentially not be accomplished as a result.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ's proposed narrative nutrient criteria creates an effective prohibition on the use of reclaimed water in Arizona's lakes by mandating the use of nitrogen and phosphorus targets to establish permit limits for all discharges, even if the response variable (chlorophyll-*a*) concentrations are not indicative of impairment. Without costly treatment processes, no reclaimed water plant can meet the nutrient limits that will be established for all plants in the state based on the proposed procedure (i.e., 1.2 to 1.5 ppm for Total Nitrogen; 0.07 to 0.1 ppm for Total Phosphorus). ADEQ's proposal therefore has potentially paralyzing consequences with regard to future water management and water conservation methods in recycling water in Arizona, particularly for municipalities which operate WWTPs.

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

ADEQ's proposed narrative nutrient criteria make it nearly impossible to use reclaimed water in Arizona's lakes and are contrary to the state's drought management and sustainable water management objectives for replacing groundwater and other sources with reclaimed. The rule could be used by permit writers to require nitrogen and phosphorus targets as permit discharge limits, even if the response variable (chlorophyll-*a*) concentrations are not indicative of impairment. Without more costly treatment than most denitrifying wastewater plants achieve, reclaimed water cannot generally meet the nutrient limits that would be based on the proposed procedure (i.e., 1.2 to 1.5 ppm for Total Nitrogen; 0.07 to 0.1 ppm for Total Phosphorus). The proposed rule, therefore, has downside impacts on both cost and water conservation that have not been considered in ADEQ's estimated costs and benefits.

Response: The Department disagrees that the numeric thresholds for total nitrogen and total phosphorus are unnecessarily strict and scientifically indefensible. The thresholds are based on the statistical analysis of empirical data obtained from Arizona lakes and reservoirs and summarized in the *Lakes and Reservoirs Statistical and Modeling Analysis Report,* which provided the technical supports for the adopted rule. The analyses discussed in this report laid the empirical foundation for the second document, *Potential Nutrient-related Targets for Arizona Lakes and Reservoir,* which culminated in the matrix of threshold values adopted in this rulemaking.

The Department also disagrees that the translator procedures for the narrative nutrient standard will make it nearly impossible to discharge reclaimed water into an Arizona lake regulated under the proposed surface water quality standards or to a lake and reservoir that is part of ecological restoration project. See response #74. The proposed numeric targets for total nitrogen and total phosphorus in the table at R18-11-108.03(D) do not create a strict numeric prohibitions as they are not independently enforceable numeric water quality standards. Rather, they represent secondary criteria that are intended to be used in combination with the primary response variable, chlorophyll-*a*, to determine whether the narrative nutrient standard is attained or not. The numeric targets for total nitrogen and total phosphorus in the matrix in R18-11-108.03(D) will be applied using a weight-of-evidence approach to determine the "sufficient assimilative capacity," as increasing nutrient load will trigger increased productivity, change in biomass, and possible negative shifts in aquatic community structure and function. Weight-of-evidence (see R18-11-108.03(B)(2) and (B)(3)) in this context refers to the application of matrix thresholds taken together as a set of parameters that inform the Department's determination as to whether there is excessive plant and algae growth that inhibits or prohibits the habitation, growth, or propagation of aquatic life or that impairs recreational uses proscribed under R18-11-108(A)(6). It is clear from the language of the adopted rule and the Department guidance that the numeric target levels were never meant to be stand-alone nutrient standards.

A point source discharge of reclaimed water into a lake regulated as a surface water may require higher levels of treatment to reduce nutrient loads before the reclaimed water can be used as a source of water in a lake. For some lakes, a higher level of treatment may be necessary to maintain and protect water quality for the lake's designated uses. This may be the case where reclaimed water is a sole source or a significant percentage of the water for an urban lake. For example, a small point source discharge of treated wastewater to a large lake such as Lake Roosevelt presents a very different set of facts from an urban lake that is created entirely of reclaimed water (e.g. Lakeside Lake in Tucson) or one where the use of reclaimed water is being considered (e.g. Tempe Town Lake).

The Department supports the reuse of reclaimed water for beneficial use. As the commenters are aware, the Department has adopted reclaimed water quality standards for the direct reuse of reclaimed water and has established a reuse permit program to regulate the direct reuse of reclaimed water for recreational and landscape impoundments and for other reuse applications. The Department designed the reclaimed water quality standards and the reuse permit program to encourage the direct reuse of reclaimed water. However, the existence of Department programs to regulate the direct reuse of reclaimed water does not replace or substitute for the surface water quality standards program and the AZPDES permit program which regulates the discharge of pollutants to waters of the United States under the Clean Water Act.

Comment #76

David E. McNeil, City of Tempe

The establishment of standards that will result in extreme nutrient limits in AZPDES should be further scrutinized in the context of carbon footprint, greenhouse gas emissions, and sustainability. EPA's March 2008 draft "National Water Program Strategy: Response to Climate Change" points out that energy use by drinking water and wastewater facilities accounts for three percent of energy consumption in the United States, resulting in emissions of approximately 116 billion pounds of CO_2 per year. The technology necessary to reduce nutrients to unrealistic and unnecessary levels will undoubtedly increase energy usage and greenhouse gas contributions from wastewater utilities. ADEQ's "General Explanation of This Rulemaking" in section 5 of the rule states that ADEQ is required to "adopt surface water quality standards by considering (certain) factors," including "the provisions and requirements of the Clean Air Act." In developing proposed standards and implementation procedures for narrative nutrients, ADEQ has not satisfied this mandate, and has failed to consider the full costs associated with the proposed rulemaking. ADEQ's proposal also falls contrary to Arizona's Climate Change Action Plan developed by Governor Napolitano's Climate Change Advisory Group in 2006.

Response: The Department appreciates the commenter's reference to state and federal efforts to address climate change. However, the comment relates only very generally to impacts of nutrient removal technology and not to state, local and facility specific impacts of this rule. In fact, as climate change impacts the southwestern United States, the Department expects longer term and higher impact droughts and higher temperatures, both of which may impact lake and reservoir quality, especially with respect to nutrient impacts. This rule will help protect Arizona's lakes and reservoirs from these impacts.

Comment #77

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

Distinctions between lake categories are unclear, and a lake could fall into multiple categories. ADEQ should clarify how to identify the single controlling lake characteristic that will define each lake for narrative nutrient standard purposes, i.e., depth, substrate, or urban setting. Alternatively, identifying the lake type could be left subjective, if ADEQ only relied upon their guidance document without rule criteria.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

First, in establishing the criteria, ADEQ differentiates between deep, shallow, urban, igneous and sedimentary lakes. However, the definitions of these types of lakes are not mutually exclusive – for example, an igneous lake can be shallow or deep. ADEQ must establish in the rules or by guidance some way of establishing what the controlling lake characteristic is that will define the lake for narrative nutrient standard purposes.

Response: R18-11-108.03(A) states that the criteria in the rule apply only to lakes and reservoirs that are categorized in Appendix B. Appendix B includes a column that specifically identifies each lake or reservoir and its corresponding lake category. The lake category in Appendix B establishes the controlling lake characteristic that the Department will use for implementing the narrative nutrient standard. Not all lakes and reservoirs in Appendix B are classified. The Department cannot use the criteria in R18-11-108.03 for any unlisted or unclassified lake.

The lake classification system does account for multiple categories; however, each lake in Appendix B is assigned its primary category for assessment purposes. Any non-urban lake with an average depth > 18 ft is classified as a "deep" lake. Any lake created in an urban environment is classified as "urban." Any non-urban lake with an average depth < 12 feet is classified as a "shallow" lake. The remaining lakes are classified based on the parent geology in which they are situated. The deep, shallow, and urban classifications are the primary drivers for lake character; igneous and sedimentary are actually secondary, but if the lake does not fall into one of the primary categories, the default assignation is geology and soils based. See Response #13.

Comment #78

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

There is a statement in the guidance document about lakes with reclaimed water that says, "Lakes with reclaimed water carry only the partial body contact (PBC) designated use." However, there is no separate category of lakes (in the matrix) with reclaimed water and no mention of PBC for the nutrient standard in the proposed rule.

Response: The adopted rulemaking accidentally omitted the PBC category from the Numeric Targets for the Lakes and Reserviors Table. A lake having either full body contact (FBC) or partial body contact (PBC) as a designated use will have to meet the same target endpoints. See Response #68.

There are few lakes listed in Appendix B with reclaimed water as a source water component, let alone effluent-dependent. These waters carry both A&Wedw and PBC designated uses. The matrix driver for these effluent dependent waterbodies will be the A&Wedw category; lakes that use reclaimed water as part of the source water, would use the A&Ww urban category. Because of the relatively high nutrient content of reclaimed water, it is generally less suited as source water for impoundments designated as fisheries. The increase in lake productivity would require aggressive treatment and lake management. The FBC use is contraindicated for reclaimed source water for several reasons: high biomass, high turbidity, high pH, algal toxins or irritants, and growth of bacteria. To date, all waters listed as A&Wedw also carry PBC use. Lakes created in waters of the United States that receive reclaimed water will have to meet A&W Urban chlorophyll targets as those are more stringent than the PBC targets.

As a result of the above comment, the following two typographical errors and three omissions were discovered in the matrix table and have been corrected.

NUMERIC TARGETS FOR LAKES AND RESERVOIRS										
Designated Use	Lake Category	Chl-*a* (µg/L)	Secchi Depth (m)	Total Phosphorus (µg/L)	Total Nitrogen (mg/L)	Total Kjehldal Nitrogen (TKN) (mg/L)	Blue-Green Algae (per ml)	Blue-Green Algae (% of total count)	Dissolved Oxygen (mg/L)	pH (SU)
FBC and PBC	Deep	10-15	1.5-2.5	70-90	1.2-1.4	1.0-1.1	20,000			6.5-9.0
A&Wedw	All	30-50	0.7-1.0	~~125-165~~ 125-160	1.7-1.9	1.4-1.7		$\leq$50	6.0 (top m)	~~6.5-6.0~~ 6.5- 9.0

Comment #79

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

In the table of subsection (D), there appears to be no reason for establishing ranges for Secchi depth, phosphorus, and the two forms of nitrogen. The proposed rule makes no use of this "middle ground," and it adds confusion to express a range in the table.

Response: The commenter appears to misunderstand how the matrix works. See more detailed explanation on how the matrix will be used in Responses #70, #71 and #72. Inclusion of the nutrient and secchi ranges in the matrix is warranted as they inform the weight-of-evidence decision of potential nutrient-related impairment when the chlorophyll-*a* concentration is within the target range. R18-11-108.03(B)(2)(c) cites conditions that, if violated, inform that the narrative nutrient standard is not being met.

Comment #80

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

In the table of subsection D, the very restrictive values (in some cases even more stringent than the aquatic and wildlife protected uses) for nitrogen under DWS and FBC uses do not seem to be justified by the drinking water standard of 10 mg/l for nitrate. If the limits for these uses are meant to protect human health, they should be set based upon the drinking water standard.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The nitrogen values proposed in the table under R18-11-108.03 are overly stringent; in particular for the drinking water source designated use, because the safe drinking water standard for nitrate (10 mg/L) is a much more relaxed standard than that being applied to the untreated source water.

Response: The nutrient ranges in the matrix represent ambient surface water values that correspond to the chlorophyll-*a* targets and can still support the specific designated uses. In the case of Domestic Water Source (DWS) use, drinking water is only part of the potential use, but the ranges conservatively reflect those levels of nitrogen that would impact formation of total trihalomethane compounds. Typical nitrate levels in surface water are three orders of magnitude less than the 10 mg/L specified to protect human health. Further, 10 mg/L of nitrate in surface water would greatly exacerbate lake productivity and increased biomass and would likely result in the surface water being unsuitable for drinking.

Comment #81

Claire L. Zucker, Pima Association of Governments (PAG)

PAG's jurisdictional members feel that it is premature to incorporate the Narrative Nutrient Standard Implementation Procedures into the rule at this time. The draft implementation procedures were released in mid-April leaving very little time for jurisdictions to work with ADEQ by reviewing and potentially appealing the procedures before the final rules were issued on April 25, 2008. There are also many inconsistencies between the rule and the guidance document. For example, the table shown in R18-11-108.03 D may be interpreted as containing numeric, not narrative, standards, because it loses the subjective approach laid out in ADEQ's guidance document. In addition, the statement in R18-11-108.03(B)(2)(c) that there shall be "no evidence" of various nutrient related impairments, contrasts with the language in subsection 4.4, Applicability of Matrix, in ADEQ's guidance document that recommends applying a "weight of evidence" approach to these various factors. Rather than including this section in the rule at this time, it would be more appropriate to use the guidance for a period of time, to solicit stakeholder input, and then, if appropriate, elevate the procedures into rule.

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

The table of subsection D becomes a numeric, not a narrative, standard, because it loses the subjective approach of ADEQ's guidance document. R18-11-108.03(B)(2)(c) states that there shall be no evidence of nutrient related impairment. However, in subsection 4.4 of ADEQ's guidance document, it says to apply a weight-of-the-evidence approach to these various factors of the matrix. ADEQ's guidance is set up for lake managers to use best professional judgment, an approach that is lost in translation to the rule.

Response: The Department disagrees that it is premature to propose R18-11-108.03 to implement the narrative nutrient standard for lakes and reservoirs. The adopted rule and the associated guidance document have been in development for several years. Similar preliminary draft rules and guidance documents have been informally discussed in public meetings going back to the spring of 2004. Lake program staff and the contractor, Malcolm Pirnie, presented several project updates on development of the lake classification system and narrative nutrient targets in meetings held at ADEQ: March 2004; November 2004; April 2005; and September 2006. Additional meeting were held where working drafts of the Implementation Procedures were made available during review sessions of the adopted rule.

To the extent there are any inconsistencies between the adopted rule and the associated Department guidance document titled "Draft Narrative Nutrient Standard Implementation Procedures for Lakes and Reservoirs (April 2008), the rule controls. The associated guidance document explains the rationale and approach to the development of the provisions in R18-11-108.03. See Responses #71, #72, #75 and #79 regarding the weight-of-evidence approach.

Comment #82

Sandy Bahr, Sierra Club Grand Canyon Chapter

We support addition of these implementation procedures as they will help with implementation of this standard and better ensure protection of lakes and reservoirs in Appendix B by limiting the nutrients that contribute to the excessive growth of algae. Including rivers and streams in future standards is also an important consideration.

Response: The Department appreciates the comment and agrees that the development of the adopted procedures to translate the narrative nutrient standard for lakes and reservoirs is both timely and necessary to maintain and protect Arizona's lakes' and reservoirs' water quality and to prevent accelerated eutrophication (excessive algae and weeds) and nutrient-related impairments in Arizona's lakes and reservoirs.

R18-11-109. NUMERIC WATER QUALITY STANDARDS

R18-11-109(A)

Comment #83

Jim F. DuBois, City of Tucson – Department of Transportation

ADEQ has adjusted the partial body contact standard for E. coli in R18-11-109(A), without explanation. It appears that FBC and PBC standards for E. coli listed in R18-11-109(A) are not based on the same ingestion criteria used for the constituents listed in Appendix A, creating inconsistency in the rule.

E. coli standards for PBC will be applied in MS4 stormwater permits. Because of widespread natural wildlife impacts on stormwater, these levels could be exceeded quite frequently. ADEQ has not factored such likely costs into the rule's cost-benefit evaluation. In the past, these E coli standards may have been appropriate to gauge the impact of domestic and municipal wastewater, but they do not reflect the natural variability seen in stormwater sources. ADEQ should clarify that these standards only apply when there is a direct human source of pathogens. Also, ADEQ should consider revising the description of the geometric mean to reflect the frequency of sampling expected for stormwater flows of four samples over a period of two years.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The definition of partial body contact proposed in this rulemaking states that the exposure is such that "ingestion of the water is not likely." In fact, ADEQ, in this proposed rule, has adjusted the partial body contact standard for *E. coli* without explanation. It appears that the full body contact and partial body contact standards for *E. coli* are not based on the same ingestion criteria used for the constituents listed in Appendix A of the proposed rule, evidencing an inconsistency in ADEQ's application of ingestion rates between these two designated uses. ADEQ should eliminate the ingestion rate criteria for partial body contact, or at the very least, ADEQ should adopt the same assumptions for partial body contact incidental ingestion rate as those relied upon by EPA.

Response: The *E. coli* criteria in R18-11-109(A) were not derived, and never have been derived, using the same criteria derivation methodologies and water ingestion exposure assumptions used to derive numeric criteria for pollutants listed in Appendix A. The *E. coli* criteria are based on EPA's national criteria recommendations for bacteria (See *Ambient Water Quality Criteria for Bacteria* – 1986, U.S. Environmental Protection Agency, Office of Water, EPA 440/5-84-002, January 1986), which are based on an estimate of bacterial indicator counts and an acceptable swimming-related rate of gastrointestinal illness obtained from EPA human health effects studies. The *E. coli* standards are not ingestion-based standards. The proposed changes are minor modifications to comport with national criteria.

The Department disagrees that the change to the *E. coli* standards will result in any significant increased costs to Phase I MS4s as the Department is adopting only minor revisions to the currently effective standards for *E. coli.* that have been effective since 2002. The Department adopts the *E. coli* standards to protect human health no matter the potential source of the *E. coli*. Water quality criteria, including the *E. coli* criteria, are adopted to maintain and protect water quality for designated uses.

The Department disagrees with the suggestion to revise the averaging period for the calculation of the geometric mean to reflect the frequency of sampling expected for stormwater flows of four samples over a period of two years. The proposed sampling period of four samples in 30 days is based on EPA recommendations regarding the appropriate averaging period for calculating the geometric mean. There is no technical or statistical basis for using a two-year averaging period. There is flexibility within the permitting program to tailor sampling frequency to the needs of the situation, but the Department disagrees that the standard should be restricted as the commenter suggests.

R18-11-109(C)(1)

Comment #84

Claire L. Zucker, Pima Association of Governments (PAG)

Our region is concerned about the suspended sediment concentration limits for surface waters. Arid streams naturally carry large sediment loads during storm events. The state has struck the provision that the standard only applies to surface water that is at, or near, base flow conditions and does not apply to surface water during or soon after a precipitation event. We feel this should be placed back in the rule. Sediment transport is a necessary part of our ecological balance in our natural alluvial systems and should be allowed in stormflow, which may extend beyond the 48 hours of a local stormflow event as stipulated in the rule.

Also, changing the way in which the standard is expressed to a median value, instead of a geometric mean, precludes an allowance for natural variation in the system.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ has removed the provision that the standard only applies to surface water that is at, or near base flow conditions and does not apply to surface water during or soon after a precipitation event. This provision should be included in the rule. Streams in Pima County have suffered significant erosion, sometimes causing severe undercutting of flood control structures. This phenomenon has been linked to clear water scour, which occurs when flowing waters are deprived of sediment and as a result they pick up fine-grained materials along the watercourse. This occurrence is aggravated by standards that impose limits on suspended sediments in naturally flowing waters. Sediment transport is a necessary part of our ecological balance in natural alluvial systems and should be allowed in storm flow, which may extend beyond the 48 hours of a local storm flow event as provided in the rule.

Jim F. DuBois, City of Tucson – Department of Transportation

ADEQ has provided no technical justification for the change in this standard. ADEQ should not change from a geometric mean to a median value, because there is a need to allow for the natural variability of Arizona's alluvial stream systems. Also, ADEQ should retain the current rule language about the standard only applying to a stream that is "at or near its base flow." Furthermore, ADEQ should clarify that this standard does not apply to ephemeral water under any circumstance, because there is no such thing as base flow in ephemeral waters as defined in the rule.

Response: Suspended sediment is an important water quality parameter, and the control of excessive sediment and siltation is critically important to the maintenance and protection of water quality for the growth and propagation of aquatic life. The Department adopted the SSC criteria for the A&Wc and A&Ww designated uses primarily to protect aquatic life in perennial and intermittent streams. The SSC standards do not apply to ephemeral waters that flow only in direct response to storm events and transport large amounts of sediment. The Department did provide a technical justification for revision of the SSC during the informal rulemaking process and expands on it here. The current SSC standard is intended to control excessive levels of suspended sediment in surface waters to protect aquatic life (i.e., A&Wc and A&Ww).

The Department disagrees that the expression of the standard as a median concentration precludes consideration of natural variability of SSC concentrations in surface waters. The median and the geometric mean are both ways of expressing the central tendency of a dataset. The median value is actually a better measure of the center of a numerical dataset because it is not influenced by outliers (i.e., very large or very small values in the data set that may be atypical). A median is the point at which there are an equal number of data points whose values lie above and below the median value. The median represents the actual middle of any data set.

The Department has proposed revisions to the current SSC standard for several reasons. First, the U.S. Fish & Wildlife Service had questioned whether the current SSC numeric criterion of 80 mg/L adequately protected aquatic life in cold water streams. Second, the current SSC standard was expressed as a geometric mean calculated from a minimum of four sample results. The expression as a geometric mean raised questions regarding what averaging period should be used when calculating the geometric mean. The current SSC standard is silent on this point. Finally, the applicability of the current SSC standard is unclear. The current standard applies only "at or near base flow" and does not apply "soon after a precipitation event." The Department does not have operational definitions of at or near base flow or soon after a precipitation event to interpret the current standard. For most surface waters, there are no long-term flow data or gage data that can be used to reliably determine base flow conditions. For all of these reasons, the Department revised the SSC standard in this rulemaking.

The Department expressed the SSC criterion as a chronic criterion to protect aquatic organisms from long-term (i.e., chronic) exposures to suspended sediment. Most of the published reports on the biological effects of suspended sediment on aquatic organisms address chronic exposures. The scientific literature the Department reviewed did not support the proposal of an acute SSC criterion. The literature suggests that fish can tolerate exposures to very high concentrations of suspended sediment (e.g., > 100,000 mg /L) for short periods of time). There is little or no data or information on acute or short-term effects of suspended sediment on aquatic organisms. For these reasons, the Department adopted a SSC criterion expressed as a median value. A median is a better way to express the central tendency of the data, particularly when working with relatively small datasets.

Neither the current nor the adopted suspended sediment concentration standards apply to ephemeral or effluent-dependent waters**.** Only the A&Wc and A&Ww designated uses have criteria for suspended sediment.

Comment #85

David E. McNeil, City of Tempe

Suspended sediment concentration is an antiquated term and laboratory analysis that has been replaced with total suspended solids (TSS). ADHS has confirmed there is a method for "Determining Sediment Concentration in Water Samples" that is different from residue non-filterable methods. Determining Sediment Concentration in Water Samples is ASTM method D 3977-97 and does not contain the term "suspended" sediment. It should be noted that ADEQ has replaced the term "suspended sediment concentration" with "total suspended solids" in the newly proposed MS4 permits. Accordingly, this change should be made to the water quality standards.

Response: The Department does not agree that SSC is an antiquated term that has been replaced by TSS. SSC remains the most accurate way to measure sediments in water. The inclusion of TSS in MS4 stormwater permits was made to allow permittees to use a quicker and easier method that can serve as an indicator of sediment pollution. However, permit conditions do not drive water quality standards, rather the opposite is true. The presence of an alternative monitoring approach within an AZPDES permit is not justification for a standards change.

The Department expressed the standards as suspended sediment concentration (SSC) for several reasons. First, the analytical method for measuring SSC, ASTM D3977-97, "Standard Test Method for Determining Sediment Concentration in Water Samples," is the U.S. Geological Survey (USGS) standard method for determining the concentration of suspended sediment in surface water samples. Second, the measurement of SSC is the most accurate way to measure the total amount of suspended sediment in an ambient surface water sample. Studies on the accuracy of the SSC analytical method by ASTM and the USGS Survey Branch of Quality Systems (Gordon, et. al 2000) have shown that SSC analysis represents a more accurate and reliable measure of suspended sediment than the measurement of total suspended solids or turbidity.

Differences between total suspended solids (TSS) and suspended sediment concentration analyses have been investigated by the USGS (See Gray, John R., et. al, "Comparability of Suspended Sediment Concentration and Total Suspended Solids Data," Water Resources Investigation Report 00-4191, U.S. Dept. of Interior, U.S. Geological Survey (August, 2000)). The USGS investigated differences in the data produced by TSS and SSC analyses by studying 3,235 paired TSS and SSC samples and 14,466 data pairs from the USGS NWIS database. The USGS concluded from the statistical analyses of the paired samples that the data produced by the SSC technique is more reliable than data produced by TSS analysis.

For these reasons, the Department expressed the standard as suspended sediment concentration and not as total suspended solids.

Comment #86

Steven L. Spangle, Field Supervisor, U.S. Fish And Wildlife Service

We are encouraged to see ADEQ propose the revision of its suspended sediment concentration (SSC) standard. The SSC standard replaced the turbidity standard during the 2002 triennial review. We concluded this change was likely to adversely affect fishes in Arizona (USFWS 2004), particularly salmonids. The SSC standard in A&Wc and A&Ww was 80 mg/L. ADEQ has proposed to lower the SSC standard in A&Wc from 80 mg/L to 25 mg/L. The newly adopted narrative bottom deposits standard implementation procedures will augment the SSC standard and should help strengthen the protection of the aquatic environment against the harmful effects of excessive sediment. Hopefully, after several years of data collection, the narrative bottom deposit standard will be expanded for use in ephemeral and intermittent streams and will be added in future triennial reviews.

Response: The Department appreciates the comment.

R18-11-109(F)

Comment #87

J. Adrianne Settimo

The fast growing city of Benson is highly dependent on groundwater sources for drinking, agriculture, industrial use and riparian habitat. Benson is located in the San Pedro watershed basin. Lowering the numeric water quality standards from 10mg/L of nitrate, to Full Body Contact ("FBC") criterion, under proposed rule R18-11-109, would put water used for drinking at risk as well as public health. Not only could "incidental ingestion of nitrate-enriched water during water-based recreation" occur, ingestion could also take place through the consumption of alluvial groundwater located downstream. ADEQ fails to show that lower standards will not adversely affect the public through FBC and the consumption of alluvial groundwater affected by lowered numeric water quality standards. The proposed rule should not be adopted by the ADEQ.

Janet Hashimoto, Chief; EPA Monitoring & Assessment Office

ADEQ has proposed to eliminate the existing site-specific nitrate standard of 10 mg/L for the San Pedro River from Curtiss to Benson (Section R18-11-109). The justification cited is that this stretch of the San Pedro is not designated as a domestic water source (DWS). ADEQ's proposed Full Body Contact standard for nitrate of 3,733 mg/L, orders of magnitude higher than 10 mg/L, would apply in the alternative.

The proposed rule should describe available information supporting that the San Pedro River from Curtiss to Benson is not being used as a DWS. Also, ADEQ should assess whether any downstream water bodies potentially have a DWS use not identified which could be adversely impacted by a higher nitrate allowance in the San Pedro River segment in question.

Response: The Department repealed the site-specific criterion at A.A.C. R18-11-109(F)(10) for total nitrate as N that applies to the San Pedro River from Curtiss to Benson. This site-specific criterion is expressed as a single sample maximum concentration of 10 mg/L, which is the same as the drinking water MCL. The numeric criterion has been adopted for nitrate to maintain and protect water quality for the domestic water source designated use.

This segment of the San Pedro River carries designated uses of Aquatic & Wildlife, Fish Consumption, Full Body Contact, Agricultural Livestock Watering and Agricultural Irrigation. It is not and never has been designated for Domestic Water Source, which would have a nitrate standard of 10 mg/L.

The Department researched the origin of the current site-specific criterion of 10 mg/L for the cited reach of the San Pedro River. The Department found that the source of the site-specific criterion appears to be a report prepared by the Water Assessment Section of the Arizona Department of Health Services titled *San Pedro and Santa Cruz Rivers: Nutrient Standards Review* (September, 1985). The purpose of this report was to summarize water quality data for the San Pedro River and Santa Cruz River to evaluate the need for nitrogen and phosphorus standards to protect beneficial uses and to determine whether federally-promulgated nutrient standards should be repealed and replaced by state-adopted standards.

The report stated, in relevant part, that nitrogen additions in the San Pedro River were occurring in the St. David area as a result of the inflow of nitrate-contaminated groundwater from the Apache Nitrogen site. The final recommendation of the report was to promulgate a nitrate standard of 10 mg/L for the San Pedro River, from one-mile upstream of the U.S. 80 bridge near St. David to Benson, investigate the source of the nitrate contamination, and implement a corrective action program.

The Department has concluded that the site-specific criterion of 10 mg/L for nitrate for the San Pedro River from Curtiss to Benson should be repealed. The 1985 criterion appears to be based on drinking water protection but the identified reach of the San Pedro River was not used as a domestic water source in 1985 and this reach of the river is not used as a drinking water source today. Moreover, if the intention in 1985 was to protect the full body contact recreation designated use, the site-specific criterion of 10 mg/L is overprotective. The Department's current water quality criteria for nitrate to maintain and protect water quality for the full body contact recreation designated use is 2,240 mg/L, over 200 times the 1985 site-specific criterion. The current criterion for nitrate for the full body contact designated use is derived using an incidental water ingestion exposure assumption. Finally, the Department has adopted an aquifer water quality standard of 10 mg/L for nitrate to maintain and protect ground water for drinking water purposes (See R18-11-406(B)). An active corrective action plan is in place at Apache Nitrogen Products and is addressing the source of the high nitrates.

In October 2005, the Department placed a public notice in the newspapers serving Benson and Tombstone, seeking public comment on the proposal to repeal the site-specific nitrate (NO_3) standard that currently applies to the San Pedro River from Curtiss to Benson. The notice indicated that the Department was seeking information on whether the public is obtaining drinking water from groundwater wells that are hydrologically connected to the shallow aquifer and whether local wells have been impacted by nitrates in this area. No comments were received. Based on the available hydrologic data for the area, the Department staff determined there is no hydrologic connection between the public water system wells in the St. David area and the San Pedro River. Since the river is not designated for domestic water source uses and there appears to be no hydrologic connection to the river from area wells, removal of the site-specific nitrate standard is justified. The existing full body contact standard is protective of humans that may recreate in the water in this area.

R18-11-112. OUTSTANDING ARIZONA WATERS

Comment #88

Claire L. Zucker, Pima Association of Governments (PAG)

Some of the criteria listed as the basis for the Director's designation of an OAW are new as of this rule. The rule should state that these criteria are the basis for all new designations made by the Director and that they will not be retroactively applied to any of the OAWs listed in R18-11-112(G) and Appendix B.

Response: The Department disagrees that clarification is needed; there is nothing in the rule that suggests OAWs are to be re-examined after designation. New criteria would affect future designations.

Comment #89

Sandy Bahr, Sierra Club Grand Canyon Chapter

We also support adding the clarification that an intermittent water can be considered for Outstanding Arizona Water designation. Intermittent waters in Arizona provide significant and important wildlife habitat.

Response: The Department appreciates the comment.

R18-11-112(A)

Comment #90

Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Furthermore, the proposed language in R18-11-112(D)(1), extends the potential scope of the OAW designation to intermittent waters. ADEQ provides no justification for this extension in the rules. Such a drastic extension of protection intended for unique, ecologically valuable surface waters to features that may only contain water on an infrequent basis unnecessarily broadens the scope of this protection. Because of the potentially significant restrictions on land use activities resulting from OAW designations, this designation is best preserved for perennial waters which support critical habitats and provide recreation, instead of diluting scarce state resources by extending OAW protection to anywhere in the state that water may be present. ADEQ should revise the proposed definition of OAW and the OAW regulations at R18-11-112 to clarify that the OAW designation is limited to free-flowing perennial waters with good water quality that exhibit the characteristics specified in R18-11-112(D)(4).

Sydney Hay, Arizona Mining Association

ADEQ has proposed extending potential OAW status to intermittent waters, not just perennial waters. ADEQ has provided no explanation or rationale whatsoever for this change, and in fact does not even note the change in the preamble discussion of the rules. Given that the Department in the last triennial review adopted the requirement that OAWs must be perennial waters and emphasized repeatedly that intermittent waters were not eligible for listing, this unexplained change in course is puzzling.

The lack of explanation makes it very difficult to comment on this aspect of the proposal. Nevertheless, given the broad and vague definition of "intermittent" waters found in the rules (those flowing continuously at certain times of the year), and the fact that intermittent waters, unlike ephemeral and effluent-dependent waters, are not specifically identified in Appendix B, the AMA is concerned that this proposal potentially dramatically expands the universe of OAWs in Arizona. Rather than protecting only the truly unique and rare waters in the state, this proposal moves toward allowing OAW status to be conferred anywhere water is sometimes present, even if infrequently. This is not, and never has been, the intent of the unique water (now OAW) program.

Response: The Department is not drastically extending the scope of eligibility for Outstanding Arizona Water classification in this rulemaking. The Department is correcting a fairly recent limitation on the eligibility of surface waters for OAW classification and restoring the universe of surface waters eligible for OAW classification to pre-2002 conditions. The limited eligibility for unique water classification to perennial waters was established in 2002. Prior to 2002, there were no eligibility requirements for unique water classification based on flow regime and no limitation only to perennial waters. A person could nominate any surface water for unique water classification and the Director could classify any surface water as a unique water provided the Director made the requisite findings that the surface water met the criteria for unique water classification prescribed in R18-11-112.

The Department has concluded that there should be no prior restrictions on the eligibility of a surface water for consideration as a Outstanding Arizona Water based on flow regime. All surface waters should be eligible for nomination for Outstanding Arizona Water classification and a nomination for OAW classification should be considered on its merits. The Department is persuaded that prior restrictions of OAW eligibility based on flow may restrict consideration of intermittent waters that may qualify as OAWs because they are of exceptional recreational or ecological significance, essential to the maintenance and propagation of a threatened or endangered species, or provide critical habitat for a T&E species.

R18-11-112(D)

Comment #91

Kim S Wilson

The proposed changes to the surface water standards are needed to identify, nominate, and regulate OAWs in ways that are critical for maintaining their ecological resource values. The inclusion of intermittent waters as OAWs is especially important because the significant role intermittent waters play in providing wildlife habitat and watershed resources is often overlooked. The water quality of intermittent waters needs to be maintained in consistency with federal and state antidegradation policies, especially as the water resources of Arizona come under ever increasing pressure due to development and climate change. Some will argue against the inclusion of intermittent waters as OAWs by indicating that intermittent waters lack value. However, a rational society would not categorically exclude these important water sources from OAW protection without consideration of their unique roles in local ecosystems and their intrinsic value given Arizona's ever-shrinking inventory of intermittent waters.

Response: The Department appreciates the comment.

Comment #92

Claire L. Zucker, Pima Association of Governments (PAG)

PAG, and its jurisdictions, strongly support the addition of intermittent waters to the criteria, allowing intermittent waters to be protected as long as other OAW classification requirements are met. In our region, perennial and intermittent stream reaches are often intermixed. OAW water quality protections are needed on the intermittent reaches because both intermittent and perennial reaches support critical habitats and provide recreation for Arizona's citizenry.

Response: The Department appreciates the comment.

R18-11-113G(G)(21)

Comment #93

Sydney Hay, Arizona Mining Association

Davidson Canyon is subdivided into four reaches in Appendix B. It appears that the lower three reaches are intended for designation as an OAW (although there is some uncertainty over the scope of the proposed designation, as noted below). However, it has not been adequately demonstrated that these segments qualify for listing even under the revised criteria set forth in the proposed rule.

The proposed listing of Davidson Canyon is confusing. As noted above, Davidson Canyon is subdivided into four reaches in Appendix B. The first reach is defined as "headwaters to unnamed spring at 31°59'00"/110°38'46." However, the proposed listing in A.A.C. R18-11-112(G)(22) reads as follows: "Davidson Canyon, from its headwaters at the unnamed spring at 31°59'00"/110°38'46" to its confluence with Cienega Creek." The specified latitude and longitude mark the end of the first (headwater) segment, not its commencement. The nominating petition sought OAW designation only for the lower three reaches and not the upper (headwater) reach. We presume ADEQ intended to propose the same thing. If any OAW listing is finalized for Davidson Canyon, which the AMA does not believe is appropriate for the reasons outlined below, ADEQ needs to be more clear in identifying the delineated segment.

Response: The commenter is correct that Davidson Canyon is divided into four separate reaches in Appendix B of the surface water quality standards rules and that the lower three reaches from the unnamed spring at 31°59' 00" / 110° 38' 46" to the confluence of Davidson Canyon and Cienega Creek are intended for Outstanding Arizona Water (OAW) classification. The Department agrees that the Department may have inadvertently created confusion over which reaches of Davidson Canyon were proposed for OAW classification because the Department incorrectly included the phrase, "from its headwaters" in the description of the proposed listing at R18-11-112(G)(21). The ephemeral reach of Davidson Canyon from its headwaters to the unnamed spring at 31°59' 00"/ 110° 38' 46" is not included in the proposed OAW classification and the phrase "from its headwaters" has been removed.

Comment #94

Sydney Hay, Arizona Mining Association

The second (uppermost) segment proposed for OAW designation (from the unnamed spring at 31°59'00"/110°38'46" to confluence with unnamed tributary at 31°59'32.5"/110°38'43.5") may not possess the requisite "good water quality" required under proposed A.A.C. R18-11-112(D)(3). Designated uses for that reach are A&W (warm water), fish consumption, full body contact and agricultural livestock watering.

Data is insufficient to demonstrate with any certainty that the uppermost stretch of Davidson Canyon proposed for OAW classification possesses the "good water quality" necessary for such designation. The lowermost reach proposed for OAW designation (from the unnamed spring at 32°00'54"/110°38'54" to Cienega Creek) likewise lacks sufficient data to accurately assess water quality. Although none of the data provided in support of the nomination does demonstrate the existence of water quality problems, it is insufficient to allow an evaluation of overall existing water quality.

Response: The Department disagrees that Davidson Canyon lacks the requisite good water quality required by R18-11-112(D)(3) for an Outstanding Arizona Water classification. Under R18-11-112(D)(3), the Director may classify a surface water as an Outstanding Arizona Water if the surface water has water quality that meets or is better than applicable water quality standards. The Pima Association of Governments provided sufficient water quality data to the Department from samples collected in Davidson Canyon from 2002 to 2005 for the Department to find that Davidson Canyon possesses good water quality. None of the available water quality data indicates the existence of any water quality problems or exceedances of applicable water quality standards.

Comment #95

Sydney Hay, Arizona Mining Association

The middle reach of Davidson Canyon proposed for OAW designation (the third of four delineated in Appendix B) extends from the confluence with the unnamed tributary at 31°59'32.5"/110°38'43.5" to the unnamed spring at 32°00'54"/110°38'54." No water quality results appear to have been provided for this reach of the Creek. However, the reach is listed in Appendix B of both the current and proposed rules as ephemeral. As an ephemeral reach, it cannot qualify for OAW designation under the current or proposed rules. It therefore should be removed from the proposal.

Response: The Department agrees that the identified middle reach of Davidson Canyon is listed in Appendix B of the surface water quality rules as an ephemeral water. However, the existence of this ephemeral reach does not disqualify Davidson Canyon from OAW classification. Davidson Canyon from the unnamed spring at 31°59' 00" / 110° 38' 46" to the confluence of Davidson Canyon and Cienega Creek is more correctly described as a spatially intermittent stream with reaches of the stream above and below the ephemeral middle reach that have perennial and intermittent stream flow. The segment of Davidson Canyon nominated for OAW classification is 3.2 miles in length with approximately 0.75 miles of perennial stream flow and 1.25 miles of intermittent stream flow. The nomination document for Davidson Canyon provides sufficient information for the Department to find that the nominated segment of Davidson Canyon, considered as a whole, is an intermittent stream that was eligible for OAW classification under the proposed rule at R18-11-112(D)(1). The Department has previously classified surface waters as unique waters (or OAWs) that have perennial, intermittent, and ephemeral reaches. It should be noted that Davidson Canyon is tributary to Cienega Creek which the Department has already classified as an OAW and it has a similar hydrology to Cienega Creek. The existence of ephemeral reaches in Cienega Creek did not disqualify Cienega Creek from being classified as a unique water and does not disqualify Davidson Canyon.

Comment #96

Sydney Hay, Arizona Mining Association

The listing criteria for OAW designation make clear that it is the attributes of the surface water that should determine whether listing is appropriate. As noted above, the water quality data regarding Davidson Canyon is not conclusive. Moreover, the preamble (as well as the nomination and supporting letters) focuses heavily on preservation of the area as a local corridor for wildlife migration, particularly as a means for wildlife to cross I-10. The AMA does not question this characterization, but believes it is irrelevant with respect to the question of classifying Davidson Canyon as an OAW. The areas adjacent to the surface water presumably provide that migration corridor today, even without OAW status, and there is no suggestion that the wildlife corridor functions of these areas would be diminished by *any* change in water quality. It is not clear why Tier II antidegradation protection would be insufficient to protect the functioning of the existing migration corridor. In short, classification of Davidson Canyon as an OAW is not essential to one of the primary stated purported benefits of the designation.

Similarly, the recreation benefits cited in the nominating petition are hiking, biking and birdwatching in the vicinity of the surface water. These are benefits of the surrounding land, not the surface water itself – no mention is made of boating, swimming, fishing or other water-based recreation. It is therefore unclear why these recreational uses require imposition of Tier 3 antidegradation protection for the nearby surface water, or why Tier 2 protection would not be sufficient to allow those uses to continue.

The preamble also states that the stream provides habitat for "threatened and endangered species or species of concern identified by the U.S. Fish and Wildlife Service, including the lowland leopard frog and the long fin dace." These species are not listed as threatened or endangered, nor are they candidates for listing. The phrase "species of concern" does not appear to have any legal significance or definition. The two species identified are priority vulnerable species under the Sonoran Desert Conservation Plan, but that County-specific plan should not alone be sufficient to elevate a water to status as an outstanding *Arizona* resource water. *(One of the stated goals of the Sonoran Desert Conservation Plan is to "maintain or improve the status of unlisted species whose existence in Pima County is vulnerable" (italics added). This highlights the County-specific nature of the Plan.)*

For all the foregoing reasons, the AMA questions whether Davidson Canyon meets the criteria for listing set forth in A.A.C. R18-11-112(D).

Response: The Department agrees that it is the attributes of a surface water that determine whether a surface water should be classified as an OAW and has concluded that Davidson Canyon possesses those attributes and meets the criteria for OAW classification in R18-11-112(D). The nominated segment of Davidson Canyon is a spatially intermittent stream with perennially flowing reaches, is in a free-flowing condition, has good water quality that meets applicable water quality standards and it is of exceptional ecological significance.

The U.S. Fish & Wildlife Service (USFWS), the lead federal agency charged with implementation of the Endangered Species Act, wrote a letter of support for the OAW classification of Davidson Canyon. In their letter, the USFWS states that Davidson Canyon provides habitat for listed species. Davidson Canyon is an outstanding example of a lowland desert stream with perennial water that provides habitat for a number of listed and vulnerable species of concern and that its importance as a wildlife migration corridor qualifies it as an OAW as a surface water of exceptional ecological significance under R18-11-112(D)(4)(a). The designation as an OAW is not based on R18-11-112(D)(4)(b), which requires endangered or threatened species.

Comment #97

Sydney Hay, Arizona Mining Association

More generally, the AMA is concerned that the proposed OAW designation may be driven more by a desire to limit land use in the vicinity (even if not directly adjacent to the reaches proposed for OAW designation) than by anything else.

OAW designations unquestionably have a limiting effect on land use in the area of the designation (because of Tier 3 antidegradation protections, limits on use of some general permits, etc.), and such designations should be judiciously made and limited to situations where the truly unique characteristics of a surface water require it.

Land use decisions are best made at the local level, not indirectly via state rulemaking. In fact, in this case, such decisions *are* being made at the local level. Pima County already controls much land around the reaches proposed for designation, and is purchasing private lands and trust land grazing leases in the area in order to augment the Cienega Valley Reserve system. Thus, the nomination of the Creek as an OAW is unnecessary to prevent the "fragmentation" of the area and its loss of function as a wildlife corridor.

Moreover, if the designation were to be used in an attempt to block a mining operation from ever opening, as is clearly the intent of at least some of the proponents of the designation, then the costs imposed by the designation are potentially enormous. In short, if ADEQ proceeds with the proposed designation, it must make a good faith effort to assess the probable costs of the designation in light of potential limits on activity in the watershed, as required by A.R.S. § 41-1052(C). See also 8 A.A.R. at 1303 (identifying as a factor that ADEQ can use in exercising its discretion concerning whether to designate a qualifying water as unique the social and economic impact of Tier 3 antidegradation protection, such as: limits on existing or new point sources, restrictions on land use in the watershed (including possible limits on mining), stricter § 401 certification requirements, and impact on private property rights, including the potential for regulatory takings).

Response: The nomination of Davidson Canyon was prepared by the Pima Association of Governments Watershed Planning group (PAG), which prepared the water quality element of the Pima County's Sonoran Desert Conservation Plan. As early as 2002, PAG had recommended that Pima County pursue OAW classification for priority streams in Pima County such as Davidson Canyon. The Department supports Pima County's efforts to conserve and protect Arizona's disappearing desert streams and riparian habitats at the watershed scale.

The nomination of Davidson Canyon comes at the request of Pima County, the local jurisdiction responsible for land use decisions and water quality management planning. The Department notes that the Davidson Canyon nomination is supported by the unanimous vote of the Regional Council of the Pima Association of Governments, including the City of Tucson. The vast majority of public comments that the Department received are in support of the proposed Davidson Canyon nomination came from local residents, non-profit organizations, and academia. In fact, the Davidson Canyon nomination received an unprecedented level of support from local government and others.

The Department agrees that an OAW classification may affect land uses in the Davidson Canyon watershed, particularly any land uses that may degrade existing water quality in Davidson Canyon. As the commenter correctly points out, Tier 3 antidegradation protection prohibits the long-term degradation of existing water quality in an Outstanding Arizona Water. The proposed antidegradation criteria rule would prohibit new or expanded point source discharges directly to the nominated reaches of Davidson Canyon. Discharges to tributaries or upstream of the reaches of Davidson Canyon that are classified as an OAW would be reviewed to ensure that existing water quality in Davidson Canyon is not degraded. Refer to the EIS for the cost/benefit analysis of this rule change.

Comment #98

Sandy Bahr, Sierra Club Grand Canyon Chapter

Under subsection G, Davidson Canyon should be number 21 not number 22 as listed in the draft rule.

Claire L. Zucker, Pima Association of Governments (PAG)

Within the Santa Cruz watershed, the rules list four reaches of Davidson Canyon. For clarity, please add the qualifier (OAW) to the three reaches of Davidson Canyon that will be designated as Outstanding Arizona Waters as a result of this rule.

The description of the OAW section of Davidson Canyon sited in 22 does not match the nominated reach, which extends from the unnamed spring at 31°59'00"/110°38'46" to the confluence of Davidson Canyon and Cienega Creek. Removal of the word "headwaters" from the cited reach would fix this discrepancy.

Response: The Department thanks the commenters for their careful review. The qualifier (OAW) has been added to the appropriate segments in Appendix B and R18-11-112(G)(21) has been revised as follows:

21. Davidson Canyon, from the unnamed spring at 31°59'00"/110°38'46" to its confluence with Cienega Creek;

R18-11-112(G)(21 and (22))

Davidson Canyon and Fossil Creek

NOTE: The Department received many comments in support of the Davidson Canyon and Fossil Creek designations, and wishes to thank them for their involvement in the rulemaking process. Here are a few of the comments:

Sandy Bahr, Sierra Club Grand Canyon Chapter

The Sierra Club strongly supports designation of both Davidson Canyon and Fossil Creek as Outstanding Arizona Waters.

Davidson Canyon, in Pima County southeast of Tucson, is a main tributary of Cienega Creek, which currently is designated as a Unique or Outstanding Arizona Water. Davidson Canyon should also be designated as an Arizona Outstanding Water in order to protect its unique values and surface water quality. The canyon contains spring-fed perennial water and cottonwood-willow riparian habitat that provides homes and sustenance to numerous species of wildlife, endangered species, and many migratory birds.

The fact that it connects to Cienega Creek, another rare perennial stream, makes it even more important that Davidson Canyon be protected with an Outstanding Arizona Waters designation. Davidson Canyon has excellent water quality, and existing data show that it would meet or exceed surface water quality standards required to be classified as an "Outstanding Arizona Water."

Under subsection G, 22, Fossil Creek is proposed for designation as an Outstanding Arizona Water. We strongly support this designation. Fossil Creek clearly meets both of the conditions for Outstanding Arizona Water designation, especially from an ecological perspective. It provides habitat for a diversity of plants and wildlife and, with full flows restored, presents a wonderful opportunity for restoration of native fishes. Details on how it is of exceptional ecological significance are outlined below. In addition to meeting this important criterion, the creek is perennial, is in a free-flowing condition, and has excellent water quality.

It flows through two congressionally designated wilderness areas — Fossil Springs Wilderness and the Mazatzal Wilderness — and it flows almost entirely within federal public lands with the exception of several small parcels of private land that are just south of the current location of the Irving Power Plant.

Fossil Creek is one of very few warm-water perennial streams that are home to an assemblage of our native fishes. The water quality in Fossil Creek provides habitat and is critical to the maintenance and propagation of these species. Additionally, according to Northern Arizona University, the Fossil Creek watershed is home to more than 175 species of mammals, birds, reptiles, amphibians, and invertebrates. The creek itself supports 147 macroinvertebrate species.

Based on the unique characteristics of this warm-water perennial creek, the opportunities for native fish recovery it offers, the diverse macroinvertebrate community that inhabits it, and the travertine-forming character of the spring water in the creek, we strongly urge designation of Fossil Creek as a unique water and, under the proposed rule, an Outstanding Arizona Water.

David Kennedy

I am writing to ask that ADEQ support "Outstanding Arizona Water" designation for both Fossil Creek and Davidson Canyon and also to oppose the Site Specific Standard for Dissolved Copper in Pinto Creek.

Based on the unique characteristics of this warm water perennial creek, the opportunities for native fish recovery it offers, the diverse macroinvertebrate community that inhabit it, and the travertine-forming character of the spring water in the creek, Fossil Creek should be designated as an Outstanding Arizona Water. The Creek clearly meets the criteria required by the rule.

Fossil Creek is one of very few warmwater perennial streams that are home to an assemblage of our native fishes. These fish include the Sonora sucker, desert sucker, headwater chub, roundtail chub, speckled dace, and the longfin dace. Loach minnow and spikedace, both threatened species in Arizona, were recently reintroduced to Fossil Creek.

In regards to Davidson Canyon, it contains spring-fed perennial water and cottonwood-willow riparian habitat that provides homes and sustenance to numerous species of wildlife, including Gila topminnow, Gila chub, Mexican gartersnake, lowland leopard frog, lesser long-nosed bat as well as many migratory birds. It connects to Cienega Creek, another rare perennial stream, makes it even more important that Davidson Canyon be protected with an Outstanding Arizona Waters designation. Davidson Canyon has excellent water quality and existing data show that it would meet or exceed surface water quality standards required to be classified as an "Outstanding Arizona Water."

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

Davidson Canyon Designation as an Outstanding Arizona Water R18-11-112(22)

Pima County in partnership with the Pima Association of Governments nominated segments of Davidson Canyon as an Outstanding Arizona Water (Attachment #13). Davidson Canyon is a rare perennial low elevation desert stream with native fish and frogs, unique riparian habitat, and spectacular geology. It contributes a significant portion of the flow in Cienega Creek already a Unique Water of the state. We continue to strongly support ADEQ's proposal to designate Davidson Canyon as an Outstanding Arizona Water in this rulemaking.

Timothy J. Flood, Friends of Arizona Rivers

The Friends support the inclusion of the waters of Davidson Canyon as an Outstanding Arizona Water (OAW; termed a Unique Water under the rules being amended.) We acknowledge the importance of the Canyon's sensitive animal species and their dependence upon high quality riparian habitat that, in turn, depends upon high water quality. Designation as OAW will serve to promote the protection of these species.

Barbara Raley

Davidson Canyon is a rare perennial, low-elevation desert stream with native fish, frogs, unique riparian habitat and spectacular geology. We have personally kept a log of the wildlife, birds and endangered species seen on our own 5 acres, including bobcat, mountain lions, coyote, javalina, skunks, several species of deer, as well as dozens of identified birds, hundreds of bats, Red Tailed Hawks, Road runners, and reptiles such as fat healthy Gila Monsters who regularly burrow into outcroppings on our property, King, Gopher and Ring-tailed Diamondback rattlers, with an occasional Blue Racer or Coral snake.

Carol Mangold

I strongly support the Outstanding Water designation for Davidson Canyon. Both the Sky Island Alliance and the AZ Dept. of Transportation have documented that Davidson Canyon is an important wildlife corridor, one of the few places where wildlife can safely cross the interstate. Floods coming down this canyon provide sediment, nutrients and seed sources for riparian areas downstream. This canyon has outstanding scenic value.

John L. Leonard

Davidson Canyon is a valuable resource for both human and non-human creatures. It contributes a significant amount of water to Cienega Wash. It provides both water and a passage under I-!0 to the benefit of wildlife. There are significant archaeological remnants near the confluence of Davidson and Cienega Creek. And it's a nice place for humans to go hiking, after they've come up Cienega Creek. Water in an arid land is a precious resource, and I urge you to protect Davidson Canyon and its water in every way possible.

Roger Tanner

This area is also an important tourist area for birders, hiking, camping, and other desert recreational uses. I think it is important to maintain this area in a good state for future generations to enjoy. I moved out here for the dark skies for my astronomy hobby and the clean air and water. Giving Davidson Canyon an Outstanding Water designation will help protect all this.

Response: The Department appreciates the comments. Other similar comments on Davidson Canyon and Fossil Creek, which have not been printed in this final rulemaking document, may be viewed at the Arizona Department of Environmental Quality, 1110 West Washington Street, 5415A-1, Phoenix, Arizona 85007.

R18-11-112(H)

Comment #99

Sandy Bahr, Sierra Club Grand Canyon Chapter

Regarding the delayed effective date for the Fossil Creek designation, it is our understanding that this is being included to address concerns raised by APS regarding the designation's implication affecting the company's decommissioning activities, including the removal of the dam. While we think the designation allows for these activities because they will not result in any permanent or long-term degradation in water quality, we do not object to the delayed enactment.

Response: The commenter correctly points out that the OAW classification for Fossil Creek has a delayed effective date of June 10, 2010 to allow time for APS to complete decommissioning and restoration activities in the Fossil Creek watershed that may have been hindered or delayed by the implementation of Tier 3 antidegradation protections upon the effective date of the rule.

R18-11-113. EFFLUENT-DEPENDENT WATERS

R-18-11-113

Comment #100

Claire L. Zucker, Pima Association of Governments (PAG)

R18-11-113(A) states that the Director shall classify a surface water as an effluent-dependent water by rule. If chronic discharge of wastewater is occurring along an ephemeral stream reach, requiring protection of our state's water quality, the Director could choose to designate the reach as EDW through the rule process instead of relying on the permit writer to determine when to apply A&W edw standards.

Response: The commenter is correct, however, the current rule allows both Director's designation and interim use of EDW standards in permits until a reach can be officially designated. If the only option were through Director's designation, the agency could not issue a permit until the surface water was appropriately classified by rule. This could delay permit issuance for years. This was the original reason for directing that EDW standards be used by the permit writer in the existing provision of R18-11-113(E) to allow permitting to proceed using appropriately protective standards until formal designation is made through the rulemaking process.

Riparian Restoration Projects

Comment #101

Claire L. Zucker, Pima Association of Governments (PAG)

We recommend that ADEQ remain flexible about applying A&Wedw standards to ephemeral stream reaches so that riparian enhancement projects can be encouraged. In addition, some human created ecosystem projects are constructed for riparian habitat restoration and do not include an aquatic element even though they do utilize discharges of treated wastewater. According to the rule, any discharge of effluent would trigger A&W edw water quality standards to be applied even if no surface waters were created, such as for some restoration projects. PAG supports the creation of riparian restoration projects in our region, and is concerned that automatic application of A&Wedw standards to these projects will discourage these projects from being constructed, even though they offer a net ecological benefit to our region.

Jim F. DuBois, City of Tucson – Department of Transportation

The City of Tucson would like to use reclaimed water for riparian enhancement projects designed to minimize discharge and maximize use of effluent to encourage riparian vegetation. Our past experience seeking approval for this activity has shown that ADEQ is reluctant to allow ephemeral standards to prevail in these circumstances. We remain skeptical that the provisions added in R18-11-113(D) and (E) will significantly relax restrictions on reclaimed water use in ephemeral channels. We would prefer more explicit provisions to create a "safe harbor" in standards and permitting requirements for this type of project.

For all of these reasons, ADEQ should repeal or modify R18-11-113(E) to add flexibility for the above issues.

Response: While the Department supports riparian restoration projects in concept, it is the attainment of standards and protection of aquatic life, wildlife, recreation, and other uses that are the cornerstones and requirements of the Clean Water Act. The current rule is clear about the applicability of the A&Wedw standards to regulate point source discharges from wastewater treatment plants to ephemeral waters under R18-11-113(E). The current R18-11-113(E) appropriately mandates the use of A&Wedw standards to regulate these discharges (i.e., "…the NPDES permit issuing authority shall use the water quality standards that apply to an effluent-dependent water to derive discharge limitations for a point source discharge from a wastewater treatment plant to an ephemeral water that changes that ephemeral water into an effluent-dependent water."). The Department agrees there is regulatory flexibility to apply "acute-only" A&Wedw standards under certain conditions (such as for sporadic or infrequent point source discharges of treated wastewater to an ephemeral water) and has included the new provisions in subsections (E) and (F).

Comment #102

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

In general, proposed rule R18-11-113 does not provide a sufficient definition of what features of an "effluent-dependent water" justify stricter water quality standards than would otherwise apply to an ephemeral water. Rule R18-11-113(C), (D), and (E) should clarify that "effluent-dependent waters" are only those tributary waters that, due to the addition of a sufficient volume and frequency of effluent, are no longer ephemeral waters at a location where there is a significant nexus to waters of the United States pursuant to the *Rapanos* decision.

Response: The Department disagrees that it must determine that there is a significant nexus to another water of the United States in order to regulate point source discharges of effluent to ephemeral waters under R18-11-113. The Department considers tributary ephemeral waters to be a category of surface water as that term is defined in A.A.C. R18-11-101(41) and a water of the United States. See Response #4 regarding *Rapanos*.

The proposed rule clearly states at R18-11-113(D) that the Department shall use the water quality standards that apply to effluent-dependent waters to derive AZPDES permit limits for a point source discharge of wastewater to an ephemeral water. This language has remained virtually unchanged since the inception of the rule. The application of the water quality standards that apply to effluent-dependent waters is not dependent upon a minimum volume or frequency of effluent discharge. The ephemeral water quality standards are not developed to protect aquatic life that live and propagate in effluent-dependent water systems and are inappropriate to protect effluent-dependent water systems. See Responses #19, #20, and #106.

Comment #103

Sydney Hay, Arizona Mining Association

ADEQ has stated on numerous occasions in stakeholder meetings that the provisions of proposed A.A.C. R18-11-113(D)-(E) are not intended to apply to storm water discharges (i.e., that storm water is not wastewater), but that intent is not clearly expressed in the proposed rule language. Any final EDW rule should make clear in the text of the rule itself (not merely the preamble) that its provisions do not apply to discharges of storm water or discharges of non-storm water that are authorized by an applicable storm water permit, such as the construction or multi-sector general industrial permits. The AMA also supports the Coalition comment that these provisions should not apply to discharges authorized under ADEQ's de minimus general permit.

Response: The Department agrees. See Response #16.

Comment #104

Robert S. Lynch, Irrigation & Electrical Districts Association of Arizona

In R18-11-113, the reference to a point source discharge has been changed from "a wastewater treatment plant" to "a point source discharge of wastewater." This change broadens the applicability of the rule and will include any point discharges from industrial facilities, i.e. power plants. These point source discharges will now be evaluated under the surface water quality standards. When asked whether the economic impact of this change had been considered, ADEQ staff stated the Economic Impact Statement was in the preliminary stages.

Response: Discharges from industrial facilities have always been evaluated under the surface water quality standards program but due to the restriction in the current R18-11-113(E) language, there was an inequity in how they were treated versus municipal dischargers. The final EIS includes consideration of this rule change. See Response #17.

R18-11-113(D)

Comment #105

Sandy Bahr, Sierra Club Grand Canyon Chapter

This Section clarifies that an Effluent-Dependent Water must have a point source discharge of wastewater; otherwise it is an ephemeral water. This change allows for inclusion of the industrial process waters including cooling water discharge from power plants.

Classification of an Effluent-Dependent Water should include an opportunity for public comment and review. The conversion of ephemeral waters to effluent-dependent waters could have significant impact on certain species of wildlife, including desert frogs that only surface and breed in the presence of water each year. Furthermore, these waters feed into larger water bodies and ultimately affect perennial streams. We are concerned about the "flexibility" proposed in the rule for applying only acute standards for discharge for Aquatic and Wildlife (edw) and for not applying the chronic standards. How will the need to apply this be determined? What constitutes "sporadic, infrequent, or emergency?"

Response: The administrative rulemaking process provides an opportunity for public participation, including an opportunity to review and comment on each surface water that the Department proposes to classify as an effluent-dependent water. The Department proposed to classify 29 surface waters as EDWs in this rulemaking. In addition, the AZPDES permit process provides the public opportunity to review and comment on the Department's permitting decision including when the permit includes effluent-dependent water designation.

The Department believes it is reasonable to provide regulatory flexibility to use acute A&W(edw) standards only to derive water quality-based effluent limits in AZPDES permits for point source discharges that are "sporadic, infrequent, or emergency" discharges. In general, the Department would use this regulatory flexibility in AZPDES permits where there is not a reasonable likelihood that organisms in the receiving ephemeral water or EDW would have chronic or long-term exposures to pollutants in the discharge. The Department will evaluate AZPDES-permitted point source discharges to ephemeral waters on a case-by-case basis to make this determination. The Department will consider the amount, frequency, and duration of the point source discharge; the length of time that water remains in the receiving ephemeral water or EDW; and the distance to the nearest downstream surface water with chronic A&W standards. This determination will be reflected in draft AZPDES permits and subject to public notice and comment.

The terms sporadic and infrequent describe the types of point source discharges that might be regulated under acute-only A&Wedw standards and have the conventional meanings. Sporadic means occurring at irregular intervals or isolated instances and infrequent means not occurring often or not occurring at close intervals. The Department has not adopted criteria that specifically define the conditions under which discharge limits, based on acute-only A&Wedw standards, adequately protect the animals, plants, and other organisms that inhabit an ephemeral water that receives an infrequent or sporadic discharge where the water may remain for a short period of time before it dries up and returns to its status as a normally dry channel. This will need to be a site-specific evaluation as it is dependent on many factors.

R18-11-113(D)

Comment #106

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ has failed to properly assess the scientific basis for identifying and properly regulating effluent-dependent waters.

Pima County concurs with other stakeholders that resolution of this issue can be achieved with a new definition of effluent-dependent waters. Pima County proposes the following definition: "Effluent-dependent water" means a surface water that consists of discharges of treated wastewater that the Director determines create a significant aquatic ecosystem in terms of size and location that would otherwise not exist due to flows from precipitation events alone. An effluent-dependent water is a surface water that, without the discharge of treated wastewater creating a significant aquatic ecosystem that would otherwise not exist due to flows from precipitation events alone, would be an ephemeral water."

Pima County objects to the proposed changes to A.A.C R18-11-101(21) and A.A.C. R18-11-113(E). Due to lack of scientific clarity as to the effluent discharge circumstances necessary to change an ephemeral water into an aquatic habitat called effluent-dependent water and under what circumstances acute or chronic standards should be applied, we believe that ADEQ must, until appropriate rule language has been adopted, perform site specific ecological and hydrological investigations on a site specific basis for each permitted discharge, to make a correct determination if a water should be listed in rule as an EDW or not, and what standards should apply.

Response: The Department disagrees with any proposed definition of effluent-dependent water that requires the creation of a significant aquatic ecosystem for the reasons outlined in Responses #19 and 20.

The Department disagrees that the Department should develop criteria for effluent-dependent waters that identify "when a substantial aquatic ecosystem has been established" that requires the protection of A&Wedw standards. The Department opposes this approach because it requires a subjective determination of how "substantial" an aquatic ecosystem that is created by the discharge of treated wastewater is before the Department could designate a surface water as an EDW. The term "substantial" is undefined and there are no recommended criteria for how the Department should determine whether an aquatic ecosystem is substantial or insubstantial. In the absence of clearly defined and objective tests, that determination becomes little more than a subjective value judgment. Development of the guidelines proposed in this rulemaking for situations where water quality may be protected by aquatic and wildlife acute standards only, was based on principles mutually agreed to in the stakeholder meetings. See R18-11-113(E).

Comment #107

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Also, in its proposed R18-11-113(D), ADEQ provides that it "shall use the water quality standards that apply to an effluent-dependent water to derive water quality based effluent limits for a point source discharge of wastewater to an ephemeral water." ADEQ provides no justification for requiring the application of EDW criteria to point source discharges of all wastewater. Such an approach allows ADEQ to apply EDW criteria in the permitting context to stream segments that have not yet been designated as EDW through the required rulemaking process. ADEQ should delete the language in R18-11-113(D). At the very least, ADEQ should replace the term "shall" in R18-11-113(D) to "may" to allow for some discretion in determining the appropriate criteria to apply to permitted wastewater discharges to waters that may or may not be classified as EDW. Additionally, ADEQ should insert the phrase, "Notwithstanding the language in R18-11-113(D)" to preface R18-11-113(E).

Additionally, the Coalition appreciates ADEQ's understanding that chronic criteria should not apply to sporadic, infrequent, or emergency discharges, as established in R18-11-113(E). However, in order to ensure proper interpretation of that Section, the Coalition recommends that ADEQ insert the following language before the first sentence in the proposed Section (E): "The Director shall not use aquatic and wildlife (edw) chronic standards to derive water quality based effluent limits for a sporadic, infrequence, or emergency point source discharge to an ephemeral water or to an effluent-dependent water." Additionally, ADEQ should remove the language in R18-11-113(E)(3), which provides that ADEQ will consider distance to a downstream water with aquatic and wildlife chronic standards in assessing whether to apply aquatic and wildlife acute standards to an EDW.

Response: Regarding the suggestion to modify R18-11-113(D) to say EDW standards may be used to develop permit limit, the Department disagrees. Very little change has been proposed to this Section. The changes made have been for clarification purposes only. What is new to this Section is subsection (E), which was developed after numerous stakeholder meetings to provide some clarification on when acute only standards might be appropriate for a discharge that is sporadic, infrequent, or of rare occurrence. The Department does not consider the proposed language for R18-11-113(E), regarding the prohibition of using chronic standards, to be protective of water quality. The Director needs to determine what is protective of water quality based on the four factors listed in subsection (E) only if the discharge is sporadic, infrequent, or a rare occurrence will acute-only standards be justified; otherwise chronic is required.

The Department believes that the consideration of the impact of a discharge on downstream surface waters with chronic water quality standards is both reasonable and necessary if and when a discharge might reach a downstream water that carries a higher level of protection. Permittees have the ability to create flexibility within their water quality management programs by developing multiple outlets for disposal including reuse, recharge or more than one surface water discharge location.

Comment #108

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ is proposing in this rulemaking under Appendix B to change the designated use of the Black Wash downstream of the Pima County Avra Valley WRF from an ephemeral to EDW use. The preamble to these rules only provides a very brief statement that ADEQ used permit application, fact sheet, and discharge monitoring reports to help make their decision. There is no mention of any site specific field investigations performed by ADEQ or any other investigations that would have allowed ADEQ to determine that the Black Wash has been "changed" into an EDW. Pima County records show that the Avra Valley facility has not discharged to the Black Wash since November 2006. The Avra Valley facility has sufficient percolation basin capacity operated under a valid aquifer protection permit, to recharge all discharged effluent. Pima County has obtained a AZPDES permit for this facility for use on an emergency discharge basis only.

Response: The Avra Valley WWTP is authorized to discharge by an individual AZPDES permit that currently authorizes the discharge of 1.2 million gallons per day of treated effluent, with no limitation, to spray fields established in Black Wash. While Pima County Regional Wastewater Reclamation Department may direct discharges to other methods of disposal, there is nothing in the AZPDES permit restricting the discharge of the full 1.2 mgd every day of the year to Black Wash thereby creating and maintaining an effluent-dependent ecosystem. However, the Avra Valley WWTP as described by the commenter, may be the type of facility that could benefit from the flexibility proposed under R18-11-113(E).

Comment #109

Claire L. Zucker, Pima Association of Governments (PAG)

Section E. of R18-11-113 indicates that A&W edw standards will be applied to ephemeral streams that receive any point source discharge of wastewater. The rule does not specify how much effluent, or for how long effluent need be discharged before an EDW is created. Therefore, intermittent or sporadic point source discharges to ephemeral streams from a wastewater plant will trigger A&W edw water standards. Many of Arizona's wastewater plants are currently constructed to fully re-use or recharge their treated effluent, with discharge to streams being held as a remote back up plan. However, this rule indicates that the rare discharge of effluent to the ephemeral streams would change the water from ephemeral to edw, even though for the vast majority of the time the waters remain ephemeral and no effluent-dependent ecosystem has developed. Jurisdictions would then have to meet edw standards on that stream reach, but it is unclear from the rule for how long these standards must be met or for what extent along the stream the standards apply. Meeting these standards would place a significant financial burden on our jurisdictions.

Robert A. Hollander, City of Phoenix

With the elimination of the phrase "…that changes that ephemeral water into an effluent-dependent water" the standard codifies only one interpretation of an effluent-dependent water based on hydrology alone. Another interpretation is based on a discharge to an ephemeral water creating an aquatic community that is "dependent" on the discharge. This issue is discussed in more detail in an E mail from Byron McMillan to Steven Pawlowski dated October 4, 2007, which is incorporated in these comments by reference. We request that ADEQ retain the current phrase. I have attached the referenced E mail for your convenience.

Response: The commenters are correct that under the current permitting process any discharge from a WWTP is permitted to meet EDW standards under the existing provisions of R18-11-113(E). Standards that apply in this instance must be met at the point of discharge to the wash. Discharge of effluent under ephemeral standards is not protective of aquatic life, so if a facility maintains an AZPDES permit as a contingency, it must meet the EDW standards when discharge is necessary. The changes made in R18-11-113(E) provides flexibility for discharges that are short term, intermittent, or sporadic.

The commenter is correct that the definition of effluent-dependent water is based on hydrology alone. All the stream definitions — that is, ephemeral, intermittent, perennial, and effluent-dependent are based on stream hydrology. The Department believes it is common knowledge and confirmed by research and experience that a wastewater discharge of virtually any quantity and consistency will be used by aquatic organisms, unless such discharge is toxic. See: "An Exploration of Nutrient and Community Variables in Effluent Dependent Streams in Arizona," Arizona Department of Environmental Quality, OFR 05-09. The Department considers a hydrological definition to be the most appropriate approach at this time. (Note: The October 4, 2007 e-mail is reproduced in comment #110).

Comment #110

Byron McMillan, Pima County Wastewater Management

On behalf of the jurisdictions listed in the comments below, please find attached suggested changes to ADEQ proposed rule language at R18-11-113(D). The cities of Mesa, Peoria, Phoenix, Scottsdale, Surprise and Tempe, Pima County, Arizona American Water, and the Superstition Mountain Community Facilities District appreciate the time you and your staff took on September 21, 2007, to meet with us regarding A.A.C. R18-11-113.E and the impact ADEQ's implementation of this rule has had on AZPDES permittees.

During our meeting, ADEQ agreed to review a written proposal modifying part of R18-11-113 to accommodate the various discharge scenarios we discussed. The attached file contains the suggested modifications to the rule. Included is a matrix showing when to apply EDW standards on the basis of discharge duration. We believe this proposed rule language provides needed flexibility for applying conservative and yet reasonable surface water quality standards on these Arizona waters. The proposed rule language also provides bright line standards which will aid both ADEQ permitting staff in implementing the rule and assist the regulated community to comply with these rules.

We continue to believe that applying EDW standards before an effluent-dependent ecosystem has been established is inappropriate and scientifically indefensible. While there is some challenge in determining what constitutes a self sustaining ecosystem, it is not beyond the ability of ADEQ and the regulated community to define that boundary as we go forward. We believe that our suggested rule language including the discharge durations and drying periods are reasonable based on seasonality and the minimum length of time one might reasonably expect an effluent dependent ecosystem to begin developing within a normally dry wash. ADEQ expressed concern that a discharge duration of 30 days would be unacceptably long to EPA for applying acute only standards. If EPA has information to show that an aquatic ecosystem can develop in a time period shorter than 30 days after the addition of effluent to an ephemeral stream, we believe they should share that information with ADEQ and us. At this point, we are unaware that EPA has any such information. Prior to ADEQ primacy, permits issued by EPA for discharges to ephemeral streams were written using ephemeral water quality standards. EPA cautioned permittees that in the future, EDW standards may apply if the stream becomes effluent-dependent. This is a clear indication that EPA at that time, had no information on when to expect an EDW to develop. We believe the scientific body of information in this regard has not changed substantially in recent years. Since EPA did not intend for EDW standards to apply to discharges to ephemeral waters until an effluent-dependent ecosystem had developed, we believe ADEQ would find support from EPA on this issue.

We believe that ADEQ understands that adding water to a dry streambed does not instantly result in the emergence of aquatic life, and most certainly does not create an ecosystem dependent on effluent. ADEQ is reluctant to discuss an ecosystem approach as it appears to be too complicated. One simple ecosystem-based solution to the problem is to apply EDW standards when an indicator organism appears in the stream. The indicator organism could be a fish species or another species whose entire life-cycle is aquatic and has a life-span of at least one-year. The use of indicator organisms has precedence in permitting as they are used in whole-effluent toxicity testing and pathogen testing.

This may be an approach that ADEQ and the regulated community can consider and pursue in the future. Because ADEQ is reaching the end of the Triennial Review rulemaking process and needs to move forward we suggest that our proposed rule language is an acceptable interim step that will provide needed flexibility for addressing issues such as WETT, riparian habitat restoration project permitting, and discharge seasonality issues where the current rules do not provide flexibility. The proposed matrix serves as an attempt to use best professional judgment to provide the bright lines needed for making permitting decisions. We believe it to be an acceptable approach in lieu of a more scientific approach that apparently is beyond the scope of this current triennial review. As additional data is collected and more research is conducted, the matrix can be modified to make it more representative of the best available science. At some point in the future, the matrix may actually become obsolete but for the moment, it is in our judgment a reasonable starting point.

We just became aware of new information that we believe ADEQ ought to consider. ADEQ has expressed concern about how EPA will respond to Arizona's SWQS. EPA approved the ephemeral stream standards in Mississippi's Water Quality Criteria for Intrastate, Interstate and Coastal Waters. We are keenly aware that Arizona's ephemeral waters definition is the primary reason for applying EDW standards to discharges to ephemeral waters. We strongly encourage ADEQ to consider Mississippi's description/definition of ephemeral streams as it is an accurate description of waters in Arizona and it has been approved by EPA. We also note that the standards require domestic wastewater discharges to meet chronic toxicity limits only in downstream perennial waters. Acute standards are applicable.

EPHEMERAL STREAM

Waters in this classification do not support a fisheries resource and are not usable for human consumption or aquatic life. ***Ephemeral streams normally are natural watercourses, including natural watercourses that have been modified by channelization or manmade drainage ditches, that without the influent of point source discharges flow only in direct response to precipitation or irrigation return-water discharge in the immediate vicinity and whose channels are normally above the groundwater table.*** *These streams may contain a transient population of aquatic life during the portion of the year when there is suitable habitat for fish survival. Normally, aquatic habitat in these streams is not adequate to support a reproductive cycle for fish and other aquatic life. Wetlands are excluded from this classification.*

Waters in this classification shall be protective of wildlife and humans that may come in contact with the waters. Waters contained in ephemeral streams shall also allow maintenance of the standards applicable to all downstream waters.

A. Provisions 1,2,3 and 5 of Section II (Minimum Conditions Applicable to All Waters) are applicable except as they relate to fish and other aquatic life. All aspects of provisions 4 and 10 of Section II concerning toxicity will apply to ephemeral streams, except for domestic or compatible domestic wastewater discharges which will be required to meet toxicity requirements in downstream waters not classified as ephemeral. Alternative methods may be utilized to determine the potential toxic effect of ammonia. Acutely toxic conditions are prohibited under any circumstances in waters in this classification.

B. Dissolved Oxygen: The dissolved oxygen shall be maintained at an appropriate level to avoid nuisance conditions.

C. Bacteria: The Permit Board may assign bacterial criteria where the probability of a public health hazard or other circumstances so warrant.

D. Definitions:

1. *Fisheries resources is defined as any waterbody which has a viable gamefish population as documented by the Mississippi Department of Wildlife Conservation or has sufficient flow or physical characteristics to support the fishing use during times other than periods of flow after precipitation events or irrigation return water discharge.*
2. *"Not usable for human consumption or aquatic life" means that sufficient flow or physical characteristics are not available to support these uses.*
3. *"Flow only in response to precipitation or irrigation return water" means that without the influence of point source discharges the stream will be dry unless there has been recent rainfall or a discharge of irrigation return water.*
4. *"Protective of wildlife and humans that may come in contact with the waters" means that toxic pollutants shall not be discharged in concentrations that will endanger wildlife or humans.*
5. *"Nuisance conditions" means objectionable odors or aesthetic conditions that may generate complaints from the public.*

Recommendations for assignment of the Ephemeral Stream classification shall be made to the Commission on Environmental Quality by the Permit Board after appropriate demonstration of physical and hydrological data. The Ephemeral Stream classification shall not be assigned where environmental circumstances are such that a nuisance or hazardous condition would result or public health is likely to be threatened. Alternate discharge points shall be investigated before the Ephemeral Stream classification is considered.

Attachment to October 4, 2007 e-mail from Byron McMillan, Pima County Wastewater Management

Proposed Changes to ADEQ Draft R18-11-113(D)

The Director or the NPDES permitting authority, upon determining that water quality based effluent limitations are necessary in a permit, may use any of the water quality standards that apply to an effluent-dependent water to derive appropriate water quality based effluent limits for a point source discharge of wastewater to an ephemeral water. The Director or the NPDES permitting authority may use any acute and chronic aquatic and wildlife (effluent-dependent water) standards to derive appropriate water quality based effluent limits in an AZPDES or NPDES permit authorizing any of the following:

1. *A continuous discharge of wastewater to an ephemeral water.*
2. *An intermittent discharge of wastewater to an ephemeral water on 30 or more consecutive days from April through September, or 90 or more consecutive days from October through March.*
3. *A discharge to an impoundment located within a surface water, other than an impoundment listed in R18-11-102(B), or an impoundment allowed for storage of reclaimed water by rule adopted under A.R.S. § 49-203(A)(6).*

4a. *An intermittent discharge of wastewater to an ephemeral water for less than 30 consecutive days from April through September, with a period of time between discharge events less than those specified in the table below:*

#Days Consecutive Discharge	*#Days Between Discharge*
1-5 days	*1 day*

6-10 days	*2 days*
11-15 days	*3 days*
16-20 days	*4 days*
21-25 days	*5 days*
26-30 days	*7 days*

4b. An intermittent discharge of wastewater to an ephemeral water for less than 90 consecutive days from October through March, with a period of time between discharge events less than those specified in the table below:

#Days Consecutive Discharge	*#Days Between Discharge*
1-5 days	*1 day*
6-10 days	*2 days*
11-20 days	*5 days*
21-30 days	*8 days*
31-40 days	*9 days*
41-90 days	*10 days*

5. A discharge, during dry weather periods, that may reach a downstream surface water that is designated as A&Wc or A&Ww in Appendix B or the downstream surface water meets any of the conditions specified in (D)(1) through (4).

Robert A. Hollander, City of Phoenix

The Water Services Department appreciates ADEQ working with the regulated community on addressing their concerns with how the Surface Water Quality Standards (SWQS) will be applied to facilities that have sporadic, infrequent or emergency discharges to ephemeral or effluent-dependent waters (EDWs). The proposed language articulates an understanding and acknowledgement that such situations are unique and require a different approach than do continuous discharges. However, the proposal does not discuss specifically how R18-11-113.E.1 through 4 will be implemented. ADEQ has articulated that their approach to addressing the intermittent discharges to ephemeral waters and EDWs was to provide permit flexibility. While the proposed language would provide flexibility, it creates a great deal of uncertainty for permittees who must plan ahead and secure funding for potential capital improvements to meet future permit limits. Increased funding for capital improvements and operational changes would increase rates paid by customers and require City Council approval.

Response: The Department appreciates the commenters' support. The issues of creating an aquatic ecosystem (see Responses #19, #20 and #106) and regulatory flexibility (see Responses #105 and #111) have been addressed in other responses. The Department agrees with stakeholders that there should be regulatory flexibility in R18-11-113(E) to authorize the Department to use acute A&Wedw standards as a basis for deriving water quality-based effluent limits in AZPDES permits for sporadic and infrequent point source discharges.

This rule includes some general factors that the Director will consider in making a decision as to whether acute-only A&Wedw standards would be used to derive discharge limits in AZPDES permits or whether acute and chronic A&Wedw standards are necessary. These general factors include the amount, frequency, and duration of discharges; the length of time water is present in the receiving ephemeral water; the distance to nearest downstream surface water with chronic A&W standards, and the likelihood that organisms in the receiving ephemeral water will have long-term or chronic exposures to pollutants in the discharge. The proposal in the October 4, 2007 attachment is a revision of an early work session product. The Department appreciates the stakeholder's efforts but does not consider the bright-line durations offered as scientifically defensible. There are various case-specific and location-specific factors that will need to be considered in determining the appropriate standards to be used. The Department acknowledges that these guidelines in R18-11-113(E) do not provide absolute regulatory certainty but they do provide a general framework for evaluating sporadic and infrequent discharges to ephemeral waters on a case-by-case basis in the context of an AZPDES permit application. The Department's surface water permits unit will work with individual permit applicants on appropriate limits for specific discharges.

As to the consideration of Mississippi's water quality standards language for ephemeral systems, each state has a different way of defining and implementing its water quality standards programs. The Department will review the Mississippi proposal but note that the Mississippi approach to water resources may not be applicable in the second most arid state in the United States. Without a total contextual understanding of its program, rules and implementation, it is difficult to make an assessment of their utility and transferability to Arizona's surface water management program.

The Department notes that the last sentence in the Mississippi standard: "Alternate discharge points shall be investigated before the Ephemeral Stream classification is considered." In Arizona, 102 of AZPDES dischargers are permitted to discharge to ephemeral streams for a total flow in excess of 650 mgd. These numbers and volumes of wastewater demand care and caution to ensure that Arizona's limited water resources are protected for aquatic life and beneficial uses. At this time, the Department considers the changes to R18-11-113 to be important steps forward in dealing with effluent management and environmental protection. The Department will continue to work with the commenters and others to refine the EDW standard in future rulemakings, as appropriate.

R18-11-113(E)

Comment #111

J. Adrianne Settimo

A&W(edw) standards should never be considered unnecessary. Such stringent standards are in place to protect public health. The proposed language providing "regulatory flexibility," in granting AZPDES permits with less stringent regulations, on a "case-by-case basis" negates the purpose of having rules. AZPDES permits are stringent because they need to be, keeping standards the same for all creates a level playing field, and sets a minimum standard. This standard should not be compromised with the case-by-case approach in the proposed rule.

Response: The Department created the A&Wedw subcategory in an attempt to meet a need for more tailored and appropriate water quality standards to protect aquatic life in the ecosystems that are created by the discharge of effluent to ephemeral waters. The A&Wedw standards are not designed to protect public health, as the commenter suggests. Body contact standards protect human health. A&Wedw standards are established to maintain and protect water quality for aquatic life and wildlife that live or have contact with effluent waters. The A&Wedw standards are expressed in two ways. There are acute A&Wedw standards to protect organisms from short-term exposures to pollutants in the effluent and chronic A&Wedw standards that are intended to protect organisms in EDWs from long-term exposures to pollutants.

The Department adopted R18-11-113(E) to provide regulatory flexibility to apply acute A&Wedw standards only under certain conditions. The Department recognizes that there may be situations where a facility discharges effluent to a dry watercourse so infrequently or so sporadically that there is little likelihood that organisms in the receiving water would have long-term exposures to pollutants in the discharge. These situations are fact-sensitive and must be evaluated on a case-by-case basis, but they would typically involve small amounts of discharge of short duration that have relatively infrequent recurrence intervals. See Responses #105 & #110.

R18-11-114. MIXING ZONES

Comment #112

Sandy Bahr, Sierra Club Grand Canyon Chapter

We support tightening up the provisions here including the addition of subsection (H), which prohibits mixing zones that are so large that they can kill drifting organisms. As indicated in previous comments, we have significant concerns about mixing zones overall as they rely on pollution dilution rather than pollution prevention.

Response: The Clean Water Act allows for the use of mixing zones as long as acute toxicity to drifting organisms is prevented and the integrity of the surface water as a whole is not impaired. According to 40 CFR 131.13, states may, at their discretion, adopt certain policies in their water quality standards rules that affect the application and implementation of the standards, such as a mixing zone. Mixing zones have been applied in the water quality standards program since its inception and EPA has approved state-adopted mixing zone policies provided the mixing zone policy ensures that: 1) mixing zones do not impair the integrity of the water body as a whole, 2) there is no lethality to organisms passing through the mixing zone, and 3) there are no significant health risks considering likely pathways of exposure. The Department adopted a limited mixing zone rule whose provisions are consistent with available EPA guidance on mixing zones provided in *the Water Quality Standards Handbook, Second Edition* and EPA's *Technical Support Document for Water Quality-Based Toxics Control*.

The commenter is correct that mixing zones rely on dilution. A mixing zone is defined as a limited area or volume of water where initial dilution of a discharge takes place and where numeric water quality standards can be exceeded. The Department does not allow mixing zones where there is no water for dilution and appropriately conditions mixing zones where they are allowed.

R18-11-115. SITE-SPECIFIC STANDARDS

Flexibility

Comment #113

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ has proposed procedures to conduct studies for developing site-specific standards. Pima County fully supports the recommended procedures as relevant and appropriate for use in Arizona. However, Pima County believes that ADEQ has unnecessarily limited the amount and types of procedures that could be legitimately used for conducting studies. For example, EPA has recently approved in a federal register notice the use of the Biotic Ligand Model for calculating Aquatic Life Ambient Freshwater Quality Criteria for Copper. This method was also specifically evaluated for its valid use in Arizona as part of the Arid West Water Quality Research Project. This study found that because of Arid West water hardness issues, the BLM was actually more accurate than the generally used Water Effects Ratio procedure.

Robert A. Hollander, City of Phoenix

The Water Services Department requests that this rule should include language that allows the use of other scientifically valid procedures for performing site-specific studies including metals translator studies and procedures developed under the Arid West Water Quality Research Project.

The Arid West Water Quality Research Project conducted a number of studies to address water quality criteria and standards development in effluent-dependent and ephemeral waters characteristic of the arid west. This included an evaluation of the reliability of the Biotic Ligand Model predictions for copper toxicity in waters characteristic of the arid west. EPA and ADEQ staff participated on the Regulatory Working Group of the Research Project.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The Coalition appreciates ADEQ's proposal to adopt regulations allowing for the adoption of site-specific SWQS under proposed R18-11-115. Such flexibility in establishing a nuanced approach to surface water quality is essential in Arizona, where the natural background of many surface waters is impacted by the state's highly mineralized geology or affected by other natural conditions, such as conditions inherent to Arizona's semi-arid climate. However, the Coalition does not believe that ADEQ has provided adequate flexibility in its proposed site-specific standard regulations. ADEQ unnecessarily limits the procedures regulated parties may use in conducting a study to support the development of site-specific standards. ADEQ should revise its proposed R18-11-115 to allow more flexibility in using additional methods and approaches to setting site-specific standards. The Coalition also recommends that ADEQ include the use of EPA's approved Biotic Ligand Model as a way to determine certain site specific standards.

To increase flexibility in implementing site-specific standards for the reasons discussed above, the Coalition requests that ADEQ add the following language:

1. As R18-11-115(B)(5) – "The results of a use attainability analysis demonstrate that all designated uses of the water body are being attained, but the numerical or narrative water quality standard for one or more water quality parameters are not being attained; and
2. As R18-11-115(C)(5) – "And other scientifically sound methods. A person seeking to develop a site-specific standard based on other scientifically sound methods shall provide a study outline to the Director and obtain approval for the study before conducting the study.

Response: The Department appreciates the Surface Water Quality Standards Coalition's support for the adoption of R18-11-115, Site-Specific Standards. The Department has, for the first time in rule, prescribed approved procedures for establishing site-specific water quality standards to protect aquatic life in Arizona surface waters. As with all surface water quality standards, site-specific standards are subject to EPA review and approval.

Federal and state laws and regulations do not prescribe methods for developing site-specific standards. However, EPA has published detailed guidance describing several methods that EPA considers acceptable for the development of site-specific water quality criteria. EPA states in guidance that it will approve site-specific criteria that have been developed using appropriate procedures. For the first state rule addressing site-specific standards development, the Department decided to list only those procedures for developing site-specific standards that EPA has previously indicated are scientifically defensible. The Department included the Recalculation Procedure and the Water-Effects Ratio procedures in R18-11-115 because detailed EPA guidance on how to use the two procedures to derive site-specific criteria is available. The Department did not specifically include the Resident Species Procedure in the adopted rule because it is a combination of the two other procedures and EPA has not published separate guidance that specifically describes how to use the method. The Department included the "Streamlined Water Effects Ratio Procedure for Discharges of Copper" on the strength of the availability of detailed EPA guidance describing the method and because it is a variant of the WER Procedure which EPA has previously indicated is scientifically defensible. The Department included a method for developing site-specific standards based on natural background conditions in R18-11-115. EPA has indicated that this is an acceptable method for developing site-specific criteria (See EPA policy memorandum by Tudor T. Davies entitled "Establishing Site-Specific Aquatic Life Criteria Equal to Natural Background (November 5, 1997) and EPA Region 10, Office of Water and Watersheds, *EPA Region 10 Natural Conditions Workgroup Report on Principles to Consider When Reviewing and Using Natural Conditions Provisions* (January, 2005)).

The Department reviewed the recommended site-specific standards language provided by the Coalition in Attachment B of their comment letter. Most of the conditions that the Coalition recommends the Department use as grounds for site-specific standards development are already in R18-11-115. These four grounds, proposed by the Department, correspond to the Coalition's recommended grounds for site-specific standards development at R18-11-115 (C)(2), (C)(3), (C)(4) and (C)(7) in Attachment B.

However, the Department does not support the adoption of the additional recommended rule language in Attachment B for several reasons:

1. The Coalition proposed a new subsection at R18-11-115(B)(5) that would allow for site-specific standards to be developed where a UAA finds all uses are being met but the surface water cannot meet numeric or narrative standards. This is counter to the foundation of the water quality standards program, which is that surface waters are protected for all designated uses by means of standards that are protective. The Department considers the other site-specific standards methods, including natural background, to be appropriate and defensible in dealing with the situation outlined. Often a total maximum daily load study will uncover unknown

sources of pollutants that are adding to a waterbody impairment. These types of water quality management programs must be used to determine the necessity of a site-specific standard.

2. The Coalition recommends two grounds for the development of site-specific standards for human health standards at R18-11-115(C)(5) and (C)(6).
   - The Department does not support the concept of site-specific standards when protection of human health is the goal.
   - The Department does not find there is a currently scientifically sound rationale for distinguishing human populations and human health protections on a site-specific basis.
3. The Coalition recommends that ADEQ allow the development of site-specific standard based on the concept of net ecological benefit at R18-11-115(C)(8).
   - ADEQ disagrees that this ground should be included in R18-11-115. The Department has adopted a separate rule authorizing modifications to water quality standards based on the net ecological benefit (NEB) concept. It is more appropriate to address revisions to standards based on the NEB concept in R18-11-106.
4. The Coalition recommended that the Department be able to establish a site-specific standard if "[t]he Director determines that the default standards are not appropriate due to unique, physical, hydrological, or chemical conditions," and on "[o]ther factors or combinations of factors that upon review of the Director may warrant modifications to the default standards."
   - These two recommended grounds for site-specific standards development are non-specific, vague, and scientifically indefensible. They do not provide sufficient specificity or objective criteria that the Director can use to determine that a site-specific standard should be established.
5. The Coalition recommended that the site-specific standards rule list two additional procedures for developing site-specific standards, which are the Resident Species Procedure and an open-ended provision in R18-11-115 that would state that acceptable procedures for site-specific standards development include: "Other scientifically defensible methods such as establishing site-specific standards equal to natural background as described in EPA guidance documents, relevant aquatic field studies, laboratory tests, biological translators, toxicity testing, bioassay, bioassessment, quantitative fate and transport analyses, human health and ecological risk analyses, or available scientific literature."
   - The Department did not include the Resident Species Procedure because it is included as a combination of the Recalculation and Water Effects Ratio procedures. The Department does not support the inclusion of an open-ended provision that would authorize the use of "other scientifically defensible methods" for site-specific standards development. The Department has a relatively small water quality standards program staff and is concerned about its capacity to peer review and complete technical evaluations of alternative methods for site-specific standards development that have not been considered by EPA scientists. There are no recommended evaluation criteria for determining whether an alternative method is "scientifically or technically defensible."
   - The Department will consider the inclusion of the Biotic Ligand Model as an acceptable procedure for the development of site-specific standards as EPA has recently published detailed guidance on its use. However, the Department will defer consideration of this procedure to the next rulemaking of the surface water quality standards.

Comment #114

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

It is unclear in the proposed rule how the language in R18-11-115 relates to the language in proposed R18-11-113(B), which allows ADEQ to adopt by rule site-specific SWQS for EDWs. ADEQ should delete the language in R18-11-113(B) to clarify that Section 115 applies equally to EDWs. Alternatively, ADEQ should revise R18-11-113(B) to state that ADEQ will adopt site-specific EDW standards only in accordance with the provisions of R18-11-115. ADEQ should clarify that the provisions in R18-11-115 apply to all categories of surface waters.

Response: Similar to the changes made in R18-11-112, the Department will clarify R18-11-113(B) by including a reference to the new site-specific standard section of the rule. The rule has been revised as follows:

B. *The Director may adopt,~~by rule,~~ under R18-11-115, a site-specific w~~ater quality standards~~ standard for an effluent dependent water.*

Natural Background

Comment #115

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

Under proposed R18-11-115(C)(4)(c), ADEQ provides that "natural background" for purposes of establishing site-specific standards, means the concentration of a pollutant in a surface water due "only to non-anthropogenic sources." This definition is unnecessarily narrow. Anthropogenic sources may contribute only nominally or indirectly to pollutant loading in water that would otherwise have a high natural background for a constituent. As such, the Coalition recommends that ADEQ revise this Section so that "natural background," for purposes of establishing site-specific SWQS, means the concentration of a pollutant in a surface water due *principally* to non-anthropogenic sources."

Furthermore, with respect to the definition of "natural background," the narrative nutrient standard draft guidance document states that site-specific standards are likely to be necessary for EDW lakes. However, it is unlikely that non-anthropogenic background could be defined for an EDW lake in an ephemeral watercourse. The Coalition therefore requests that ADEQ clarify how it intends to establish site-specific standards for EDW lakes and urban lakes where a long history of anthropogenic source impacts, unrelated to the lake but related to its urban setting, may predominate.

Jim F. DuBois, City of Tucson – Department of Transportation

Fred H. Gray, City of Tucson – Parks and Recreation Department

ADEQ provides that "natural background" for purposes of establishing site-specific standards, means the concentration of a pollutant in a surface water due "only to non-anthropogenic sources." This definition is unnecessarily narrow. The narrative nutrient implementation guidance states that site-specific standards are likely to be necessary for EDW lakes. EDW lakes are usually urban lakes, and it is unlikely that non-anthropogenic background could be defined for such a water body. ADEQ should clarify how to set site-specific standards for EDW lakes and urban lakes where a long history of anthropogenic source impacts, unrelated to the lake but related to its urban setting, may predominate.

Response: The proposed natural background provision at R18-11-115(C)(4) is based upon EPA's policy "Establishing Site-Specific Aquatic Life Criteria Equal to Natural Background," November 5, 1997. The policy authorizes the establishment of site-specific numeric aquatic life water quality criteria by setting the criteria value equal to natural background. The policy specifically defines "natural background" as the background concentration due only to non-anthropogenic sources; i.e., non-manmade sources. In establishing natural background as a ground for the development of site-specific standards, the EPA policy states that the Department should, at a minimum, include in its water quality standards rules: 1) a definition of natural background consistent with the one in the EPA policy stated above, 2) a provision that site-specific criteria may be set equal to natural background, and 3) a procedure for determining natural background. The Department included these three elements in its natural background provision in R18-11-115.

While the Department agrees that the natural background provisions of R18-11-115 could not be used to establish site-specific criteria for a man-made EDW lake, the other site-specific standards development methods, such as the recalculation procedure or the water effects ratio procedure can be used to develop site-specific standards for an EDW lake. The Department will continue to study available methodologies for site-specific standards for EDW lakes.

R18-11-117. CANALS AND MUNICIPAL PARK LAKES

Comment #116

David E. McNeil, City of Tempe

Tempe requests that the existing term "municipal park lake" in this Section and in Appendix B be changed to the term "urban lake." The use of both of these terms within the water quality standards is duplicative and creates confusion regarding the applicability of A.A.C. R18-11-117 to urban lakes, which is clearly necessary. In addition, Tempe objects to the proposed elimination of the last sentence in this Section. Removal of clarifying language regarding the effect of this Section is not a "minor editorial change" as described in the preamble, and could change the applicability of the rule.

Robert S. Lynch, Irrigation & Electrical Districts Association of Arizona

R18-11-117, which addresses the maintenance of canals and municipal lakes, removes language that allows an increase in turbidity during physical or mechanical maintenance of the canal or municipal lake. Maintenance of these waters is necessary to maintain public health, safety and welfare. An owner should not be penalized under the degradation rules for regular maintenance and startup, i.e. re-filling or cleaning a canal or municipal lake.

Response: The Department agrees "urban" is a more inclusive term and has modified the definition and title of this Section accordingly. The Department agrees to retain the last sentence as it is in the existing rule and in R18-11-118. The Department had originally proposed removing it because there is no longer a turbidity standard but agrees, based on the comments received, that it does provide clarification that suspended sediment that is directly attributable to maintenance activities would not be a violation of standards.

R18-11-117. Canals and ~~Municipal Park~~ Urban Lakes

A. *Nothing in the Article* ~~shall be construed to prevent~~ prevents *the routine physical or mechanical maintenance of canals, drains and the* ~~municipal par~~*k* urban *lakes identified in Appendix B. Physical or mechanical maintenance includes dewatering, lining, dredging, and the physical, biological, or chemical control of weeds and algae. Increase in turbidity that result from physical or mechanical maintenance activities are permitted in canals, drains and the* ~~municipal park~~ urban *lakes identified in Appendix B.*

R18-11-118. DAMS AND FLOOD CONTROL STRUCTURES

Based on the Comment #116 above, the Department has retained the following information in subsection (A) because it provides clarification that suspended sediment that is directly attributable to maintenance activities would not be a violation of standards.

A. Increases in turbidity that result from the routine physical or mechanical maintenance of a dam or flood control structure are not violations of this Article.

R18-11-121. SCHEDULES OF COMPLIANCE

Comment #117

Robert A. Hollander, City of Phoenix

The Water Services Department recommends that ADEQ revise the three year minimum for compliance schedules, and allow for schedules of 10 years, with provisions for longer periods when necessary. This approach is consistent with the May 2007 EPA memo prepared for Region 9 in considering California's proposed compliance schedule policy. On April 15, 2008, the California State Water Resources Control Board adopted a new compliance schedule policy. In keeping with this approach, the standards should include the provisions:

- Any compliance schedule must require compliance as soon as possible, taking into account the amount of time reasonably required for the discharger to implement actions, such as designing and constructing facilities or implementing new or significantly expanded programs and securing financing, if necessary, to comply with a more stringent, permit limitation specified to implement a new, revised, or newly interpreted water quality objective or criterion in a water quality standard.
- The duration of the compliance schedule may not exceed 10 years from the date of adoption, revision, or new interpretation of the applicable water quality objective or criterion in a water quality standard.

A compliance schedule that exceeds 10 years in a permit can be adopted if it implements or is consistent with the waste load allocations specified in a TMDL.

Response: The Department appreciates the comment. The Department cannot make a substantive rule change at this point in the process, but it appears that there is merit to exploring this issue and addressing it in a subsequent rulemaking.

R18-11-121(D)

Comment #118

David E. McNeil, City of Tempe

Schedules of compliance for AZPDES stormwater permits should be limited to the implementation of best management practices to the maximum extent practicable MEP.

Response: R18-11-121(D) does determine whether or not standards apply. This rule is not a new provision and simply allows the Director the discretion to include a compliance schedule in a stormwater permit.

R18-11-123. DISCHARGE PROHIBITIONS

The Department has withdrawn two of the four proposed discharge prohibitions to the Ak-Chin Indian Reservation for the following reasons: (1) The Department received significant comments on the lack of sufficient cost analysis on the impact of the prohibitions to upstream discharges; and (2) The Department did not have the information about how the prohibitions would impact certain discharges and had no figures to support the impacts. The Department will not issue permits for discharges onto Ak-Chin lands and will require permittees to work with the Ak-Chin Community on their discharges until such time as the Department can move forward with the prohibitions in a subsequent rulemaking.

A. *The discharge of ~~treated~~ wastewater to ~~Sabino Creek is~~ the following surface waters is prohibited~~.~~:*
1. *Sabino Canyon Creek;*
2. *Vekol Wash, upstream of the Ak-Chin Indian Reservation; and*
3. *Smith Wash, upstream of the Ak-Chin Indian Reservation.*
4. ~~*Santa Rosa Wash, from its confluence with Greene Wash to the Ak-Chin Indian Reservation; and*~~
5. ~~*Santa Cruz Wash, from its confluence with the North Branch of the Santa Cruz Wash to the Ak Chin Indian Reservation.*~~

R18-11-123(A)(2)-(5)

Comment #119

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ has improperly proposed a strict discharge prohibition to the Santa Cruz Wash, Santa Rosa Wash, Vekol Wash, and the Smith Wash.

ADEQ is proposing to add a strict discharge prohibition to the above washes, but ADEQ has failed to provide any prior notice of this action to affected stakeholders during the almost four-year period since the proposed rules were first noticed. ADEQ also provides no informative discussion in the rule or preamble as to why this prohibition is necessary or beneficial to Arizona citizens.

Pima County has obtained all necessary discharge permits for discharging treated effluent into the Santa Cruz River which is tributary to some or all of the designated washes and this discharge has continuously occurred for over 40 years. Discharged effluent consistently meets permit requirements for the designated use of the river.

The ADEQ proposed discharge limitation is intended to prevent a discharge of wastewater to the Ak-Chin Indian Reservation even though discharged wastewater meets all required permit limitations. Pima County is unaware of any legal right by the Ak-Chin to require that ADEQ incorporate this prohibition into these rules. Pima County asks that ADEQ remove the requirements of A.A.C. R18-11-123(A) from this proposed rule.

ADEQ must also revise its EIS to incorporate a discussion of the potential impacts on Pima County citizens and a discussion of what steps ADEQ could take to minimize any impact on Pima County small businesses.

Response: Modifications to this Section have been out for public review since early 2007. The intent of the discharge prohibitions was to protect surface waters on the Ak Chin Reservation that carry additional, more protective designated uses. The Ak Chin Indian Community has adopted tribal water quality standards that have additional narrative and numeric criteria for its waterbodies. In addition, one of the surface waters, Vekol Wash, is recognized as a unique water under the Ak Chin water quality standards. The Ak Chin Indian Community opposes the flow of effluent onto its sovereign reservation land.

This rule is adopted to prevent discharge from reaching the washes on the reservation, except those flows carried incidentally during precipitation events. In the case of these specific provisions, the best and 'existing' uses of these washes is considered by the Ak Chin Community to be ephemeral, and as such would be adversely affected by discharges. Under the Clean Water Act, Arizona has the authority to designate uses. Accordingly, the discharge prohibitions establish the use as ephemeral.

As a sovereign nation, the Department respects and acknowledges the Community's efforts to protect its surface waters for its established uses. The Department has committed to honoring the cultural sensitivities and water quality standards of tribes that may be affected by discharges when possible, whether or not those standards are 'officially' recognized by EPA – just as the Department would expect another governing state would honor Arizona's position on discharges impacting Arizona lands.

While the Department does not believe these prohibitions will have any near-term impacts on Pima County's discharges that are over 50 miles south of the reservation, the Department recognizes that there are a small number of upstream permitted dischargers that may be impacted by a prohibition to discharge to the listed reach of Santa Cruz Wash and the Santa Rosa Wash. Therefore, the Department is withdrawing the prohibitions on both the Santa Cruz and the Santa Rosa Washes at this time and will work with permittees and the Tribe to resolve the issues. The Department is not aware of any discharges affecting Vekol and Smith washes. All dischargers seeking discharges in or near these streams that may flow onto the Ak Chin Reservation should promptly engage the Ak Chin Community in discussions. The Department expects that existing dischargers will maximize disposal options to manage effluent flows to prevent them from reaching Reservation lands.

Comment #120

Claire L. Zucker, Pima Association of Governments (PAG)

This Section of the rule indicates that there is a prohibition of discharge to the Santa Cruz Wash from its confluence with the North Branch of the Santa Cruz Wash to the Ak Chin Indian Reservation. Although Pima County does not discharge to this segment of the Santa Cruz Wash it is unclear whether this prohibition would apply to any discharge that reaches the Ak Chin Reservation by flowing through the Santa Cruz Wash. While Pima County's discharge does not generally reach the Ak Chin Indian Reservation, it is possible for their effluent to flow that far when infiltration along the river is decreased or when stormflows flood the river. We are concerned that Pima County was not given prior notice or allowed input before the proposed rule was issued. If Pima County is required to contain the effluent, they would be forced to build expensive facilities for no added benefit to water quality of the state, but at great expense to the tax payers.

The change in this Section from referring to "treated wastewater" as simply "wastewater" means that virtually any discharge to the Santa Cruz River system could be held accountable whenever any flow reaches the Ak Chin reservation. Since the term "wastewater" is left undefined, the rule does not make it clear whether or not stormwater, which may contain industrial discharges, would be included in this prohibition.

Response: See Response #16 regarding stormwater flows not being considered wastewater. These discharge prohibitions were originally proposed in early 2007 to apply to any wastewater discharge that would enter or extend to these reaches during dry weather because such discharges would be inconsistent with the existing ephemeral and cultural uses of these washes. This prohibition was not intended to extend to flows resulting from precipitation events, whether or not that flow contains other permitted discharges. See Response #119.

Comment #121

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

ADEQ inappropriately proposes certain discharge prohibitions under R18-11-123 intended to prevent discharges from reaching the Ak Chin Indian Reservation, as well as prohibiting certain discharges to Lake Powell. Discharge prohibitions do not belong in SWQS regulations, which are intended to provide the basis of water quality assessments and permitting depending on designated uses. The Coalition requests that ADEQ remove these discharge prohibitions from this rule proposal.

Response: The Department disagrees that discharge prohibitions do not belong in standards. Discharge prohibitions directly relate to water quality within a waterbody, antidegradation provisions of the Clean Water Act, and the ability to develop and issue protective permits. Arizona surface water quality standards have included discharge prohibitions since 1981. See Responses #119 and #120.

Comment #122

Sydney Hay, Arizona Mining Association

The proposed rule includes a complete prohibition on discharges of wastewater to four washes upgradient of the Ak-Chin Indian Reservation. The preamble provides no explanation whatsoever of the basis for this complete ban on discharges to these ephemeral washes, although it can be inferred that it is in response to the wishes of the Tribe.

There are several issues with this proposal. First, as noted above, it is unclear what is meant by "wastewater," so the precise scope of the proposal is difficult to discern, especially given ADEQ's complete lack of explanation for the proposal.

Second, and of greater concern, the legal basis for these proposed prohibitions is unclear, and ADEQ provides no explanation in the preamble.Third, ADEQ has made no attempt to quantify the economic costs of these discharge prohibitions. Presumably, planned wastewater treatment plants in the vicinity would be prohibited from any discharge whatsoever into the washes, and would have to find an alternate method of effluent handling. It is unclear how existing discharges, if any, would be affected.

The proposed discharge prohibitions should be removed from the final rules.

Response: Under the Clean Water Act, the Department has authority to designate uses. Accordingly, the discharge prohibitions establish the use as ephemeral in these segments. As a sovereign nation, the Department respects and acknowledges the Community's efforts to protect its surface waters for its established uses. See Response #119.

Comment #123

Daniel Hartley, Tohono O'odham Nation

The proposed rule "R18-11-123. Discharge Prohibitions" involves the Tohono O'odham Nation (Nation) by virtue of the fact that the Nation is upstream of the reach of Santa Rosa Wash where discharge of wastewater is prohibited in this proposal. The stream channels involved are connected as follows. Almost all flow in the Santa Cruz River is diverted into the former Greene Canal shortly after it crosses from Pima to Pinal County. The Greene Canal joins Greene Wash, which flows through the northern part of the Tohono O'odham Nation and continues on to its confluence with Santa Rosa Wash, which enters the Ak Chin Reservation about 12 miles downstream of where it leaves the Tohono O'odham Nation. Wastewater discharged into the Santa Cruz River in Tucson under an AZPDES permit occasionally reaches the Tohono O'odham Nation when evaporation and channel infiltration are reduced. We have measured a flow rate of 2 cfs on the Nation. In order for that wastewater to reach Santa Rosa Wash and the Ak Chin Reservation before it dries up, there has to be a large increase in flow volume from storm runoff. This large volume of storm runoff dilutes the wastewater so that its chemistry is not noticeable in the combined streamflow, so there is no effect on far downstream reaches from the wastewater component. If the intent of the rule is to prevent wastewater flows from affecting the Ak Chin Reservation, then the rule should be re-written to prohibit wastewater from entering those washes *without any added stormflow volume.*

Response: The Department appreciates the information on impacts of the Pima County flows to the Tohono O'odham Nation. The commenter is correct that the intent of the proposed language was to prevent discharges from reaching the washes on the reservation, except those flows carried incidentally during precipitation events. See Response #119.

Comment #124

Sandy Bahr, Sierra Club Grand Canyon Chapter

We support prohibition of discharges into Vekol Wash, Smith Wash, Santa Rosa Wash, and Santa Cruz Wash in order to limit wastewater flowing on to the Ak Chin Indian Reservation.

Response: The Department appreciates the comment.

Comment #125

Louis J. Manuel Jr., Vice-Chairman, Ak-Chin Indian Community

The Ak-Chin Indian Community (Community) fully supports the proposed revision to the state of Arizona's Surface Water Quality Standards. The supported revision is within *R18-11-123 Discharge Prohibitions* whereby the addition of four new discharge prohibitions that prevent point source discharges of wastewater to ephemeral waters that may flow onto the Ak-Chin Indian Reservation. These ephemeral waters are Vekol Wash, Smith Wash, Santa Rosa Wash and Santa Cruz Wash, which do transect the Reservation.

The Community had and will continue to protect and preserve its cultural, natural and environmental resources such as the washes: Vekol, Smith, Santa Rosa and Santa Cruz. Our Elders and membership have the deepest respect for these washes because they not only carry a life sustaining element (water) but other natural abundances that maintain our O'odham Him-Dak ("Way of Life").

The Community greatly appreciates the Arizona Department of Environmental Quality's understanding of the significance of these washes.

Response: The Department appreciates the comment.See Response #119 indicating that the Department is not moving forward at this time with the discharge prohibition on either the Santa Cruz or the Santa Rosa Washes. The Department expects currently permitted dischargers to work with the Community to ensure its interests and water quality standards are met.

APPENDIX A. NUMERIC WATER QUALITY STANDARDS

Comment #126

Sandy Bahr, Sierra Club Grand Canyon Chapter

We support the adoption of more protective standards in several areas, including for arsenic, 2,3,7,8-Tetrachlorodibenzo-p-dioxin, and uranium. These standards will better protect the public's health and will continue the improvement of surface water quality in Arizona. There are a couple of areas in which there is significant increase in the standard, however. For example, for Chlorine (total residual) the standard increased from 700 µg/L to 4,000 µg/L for Domestic Water Use and for Full and Partial Body Contact. Additionally, total residual chlorine standards for Aquatic and Wildlife designation increased from 11 µg/L to 19 µg/L acute and from 5 µg/L to 11 µg/L chronic. It is our understanding these increased standards were adopted by EPA, but we question if they are protective and whether or not they have been adequately reviewed.

Response: The proposed chlorine standards for the domestic water source, partial and full body contact uses have been increased to match the maximum residual disinfectant level (MRDL) for total residual chlorine. Since 1992, it has been Department policy that where an maximum contaminant level (MCL) or MRDL for drinking water exists and is greater than the calculated domestic water source or full and partial body contact standards for that pollutant, the MCL or MRDL is substituted as the standard for that use. As the domestic water source use pertains to natural waters that will be treated to produce potable water, this protects that use and minimizes the cost of treatment. For the full and partial body contact uses, the assumed water consumption rate of 15 mL/day is far below the assumed consumption rate of 2 liters per day used in the calculation of the DWS use. As the assumed consumption rate is so much lower, it is implicit that a standard calculated for a higher consumption rate would protect human health.

The change to the A&W standards for total residual chlorine is to correct a long-standing inconsistency between state and federal criteria. The current federal criteria are 11 µg/L for acute and 19 µg/L for chronic exposures. The Department has researched the history of the state's lower numbers and cannot find a scientifically defensible reason for keeping them artificially low. While the proposal to increase the state standards to match the federal criteria doubles or nearly doubles the standards (from 5 to 11 for acute and from 11 to 19 for chronic), these are negligible increases in terms of aquatic toxicity and laboratory analysis.

Comment #127

Sandy Bahr, Sierra Club Grand Canyon Chapter

We support the changes in the fish consumption criteria which afford greater protection for public health, including the change in consumption rate and the assumption that those who are consuming fish are also being exposed to these pollutants via other sources. We also support implementation of a Methylmercury Fish Tissue Criterion as consumption of fish is a major pathway for human exposure to methylmercury. With it come serious public health issues including developmental impairments for children. Methylmercury is a developmental neurotoxicant. The developing fetuses of women who consume fish during pregnancy are most at risk and impacts include lifelong injury to the developing brain.

We support the addition of numeric water quality standards for chloropyrifos, guthion, hydrogen sulfide, iron, malathion, mirex, paraquat, parathion, permethrin, and tributyltin. It is clear from the many assessments done on our nation's waters that herbicides and pesticides are increasingly showing up in both rural and urban waters.

We strongly support inclusion of these new numeric water quality criteria for total ammonia in the state's effluent-dependent waters.

Because many of the criteria in this appendix are established and based on the average weight of a human male, they fail to address the impacts on children and, in some instances, women. For example, there is increasing evidence connecting numerous pesticides and other chemicals that affect estrogen production to breast cancer in women. We think the Department should use the precautionary principle wherever possible and use the most protective standards available.

Response: The Department appreciates the commenter's support on the changes. To address much of the uncertainty inherent in risk analysis, the Department relies on the safety factors already designed into the standards derivation process. In the derivation of EPA risk values, such as the reference dose (RfD) and the oral cancer slope factor

(OCSF) used in the calculation of water quality standards, there are many safety factors built into the equation to account for the uncertainty of toxic effects. These safety factors can affect a manifold decrease in the allowable risk for a pollutant. If there is a significant source pathway for a pollutant that involves excess consumption by children, that issue can also be addressed in the relative source contribution calculation. Also, for pollutants with developmental toxicity endpoints (e.g. methylmercury), these issues can be addressed through the studies chosen for the derivation of the underlying RfD or OCSF. These safety factors combined offer adequate protection for the greater population as a whole.

Ammonia

Comment #128

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

The new acute criteria for total ammonia and the chronic criteria for total ammonia proposed at tables 25 and 26 respectively, are unreasonably low. The commenter believes in order for a biological plant to consistently meet nitrogen limits and these new ammonia limits will require significant capital improvements.

Standards used in the aquifer protection permit program provide flexibility to address the treatment process limitations by setting limits only for total nitrogen (regardless of the composition), and application of a five-month rolling geometric mean. There are no such protections in the proposed rule, and the likely result will be numerous violations by biological treatment plants.

Further, in SMCFD's service area, nitrates in groundwater are a significant human health concern because of numerous septic tank systems and it is desirable in this area especially to favor treatment of nitrates over ammonia. The proposed standards do not provide flexibility to address this concern.

SMCFD is concerned with the amount of time and significant capital resources needed to make plant upgrades from funding through permitting to construction.Because this is the first time numeric criteria for ammonia are being applied to effluent-dependent waters, ADEQ should propose a reasonable schedule for the effective date of these limitations that recognizes that it may take up to three years for publicly-owned treatment plants to fund, design, and build new infrastructure.

Response: The aquifer protection program serves to protect groundwater, where the AZPDES program is to protect surface water in a manner consistent with the Clean Water Act. The two programs have very different goals and standards to meet and a permittee with both permits must meet both. The new ammonia standard is being adopted because discharges of ammonia are toxic to aquatic life and not just to fish. Ammonia is the source of toxicity in a number of domestic wastewater discharges. In calculating the ammonia standards using the established EPA method, the Cypriniform (or carp-like) golden shiner, an abundant fish in Arizona's waters and one that can be logically found in EDWs, is the second most sensitive fish in the entire ammonia calculation. Centrarchids (bass and sunfish), also prevalent in the state's warm water streams and EDWs, are highly sensitive.

Nitrate in groundwater is a significant concern although it is important that neither the groundwater standard for total nitrogen nor the surface water standard for ammonia be violated. Nutrient removal technologies presently exist that can address both issues. The Department recognizes that changes in standards may require changes in treatment or in disposal options. However, there are already tools in the water quality standards that allow for phase in of standards. When any new water quality standard is implemented, there is an opportunity in a permit for a compliance schedule under R18-11-121. There is also the possibility for a variance if a discharger can qualify under R18-11-122, which must be approved by EPA. The surface water permits program will work with individual permittees on case-by-case appropriate approaches for their facilities.

Comment #129

Robert A. Hollander, City of Phoenix

The City of Phoenix uses chloramines for disinfection. It provides stable, longer-lasting residual. The new standard puts Phoenix at risk of exceeding future water quality based permit limits for total ammonia. To disinfect using free chlorines puts Phoenix at greater risk of running at a residual, because even in good quality effluent, chlorine demand is high even in advanced secondary treatment, and could potentially exceed pathogen limits. The City requests that ADEQ consider this in the total ammonia standard and the cost impact of imposing the standard on operations of wastewater treatment plants.

Response: The new ammonia standard is being adopted because discharges of ammonia are toxic to aquatic life. The Department understands the delicate balance WWTPs have to maintain in dealing with disinfection, however, this does not justify not meeting appropriate ammonia standards and the standard is achievable. See the EIS for the cost-benefit analysis of the new ammonia standard.

Comment #130

Steven L. Spangle, Field Supervisor, U.S. Fish And Wildlife Service

We support the proposed acute and chronic A&Wedw standard for ammonia and provide the following information. Threatened and endangered species, or their former or potentially suitable habitat, exist downstream of wastewater treatment plants in Arizona. For example, the Gila topminnow formerly inhabited the Santa Cruz River downstream of the Nogales International Wastewater Treatment Plant (NIWTP). Although the Gila topminnow has a wide tolerance to temperature and dissolved oxygen fluctuations, it is unable to withstand elevated ammonia concentrations, which have exceeded EPA's recommended chronic criteria for ammonia downstream of Nogales (Boyle and Fraleigh 2003). However, the lack of an A&Wedw standard for ammonia, such as the Santa Cruz below the NIWTP, has negatively affected the ability of the Gila topminnow to maintain its population and recolonize this area (King et al. 1999). The last recorded observation of Gila topminnow in the Santa Cruz River downstream of the NIWTP was in 2003 at Tubac, which is approximately 10 miles downstream. USFWS feels the proposed acute and chronic A&Wedw standard for ammonia is protective of the endangered Gila topminnow.

Response: The Department appreciates the comment.

Arsenic

Comment #131

Jennifer Hetherington, City of Mesa

The City of Mesa respectfully submits that the existing standard of 50 ug/L should be retained in the rule. In the past seven years, there have been only two violations due to exceedence of the arsenic drinking water standard (other violations related to arsenic can be attributed to missed routine sampling events) in the SDWIS database. These results indicate that arsenic in treated surface water is not an issue in Arizona. Even when issues do arise, well water in Arizona is the primary source of treated water that can exceed the drinking water standard of 10 ug/L for arsenic, not surface water. There is no need to reduce the arsenic standard for domestic water sources to protect the treated drinking water, because treatments plants in Arizona are already meeting the current standard of 10 ug/L.

To the extent that arsenic is an issue, proposed R18-11-107.01 regarding antidegradation implementation procedures might be the more appropriate vehicle to regulate discharges to affected waters. Surface water treatment plants are able to treat water down to less that 10 ug/L arsenic. Since high-level arsenic is not prevalent in surface water, then domestic water source limits need not match the drinking water standard – treatment will address any arsenic issues. However, there are drinking water plants that may have to discharge partially treated water to a domestic water source, in the event of high turbidity. The City of Phoenix Val Vista Treatment plant co-owned by the City of Mesa is one such plant. When turbidity is high, arsenic may also be present. Thus while such discharges may meet the 50 ug/L standard, it will be very difficult to meet the proposed standard. This will result in a "Catch 22" situation for the treatment plant. The reason for this type of discharge in the first place is the non-compliance with drinking water standards, yet the discharge will still be required to meet the same standard as if it were treated drinking water. This will cause financial hardship, as well as design difficulties that are not necessary, because the domestic water would still ultimately be treated before it is ever used as drinking water, and as stated previously, these treatment plants are highly successful in removing arsenic.

In conclusion, the Rules should retain the current arsenic domestic water source limit of 50 ug/L. The violations documented in drinking water discharges from surface water treatment plants do not indicate that arsenic levels in domestic water sources are an issue.

Response: The Department disagrees that the outdated MCL should be retained. EPA revised the MCL for arsenic to 10 μg/L and the Department adopts the new MCL to protect surface water quality for the Domestic Water Source (DWS) designated use. The adoption of MCLs to protect surface water quality for the DWS is consistent with the way that the Department has adopted standards since 1992. If the Department applied the default methodology it uses to derive water quality criteria for the DWS designated use for parameters where an MCL is unavailable, the resulting criterion for arsenic would have been less than 10 μg/L. The fact that few surface waters are currently listed for arsenic impairment does not equate to there being no issue with arsenic in Arizona surface waters. There are over 95,000 stream miles throughout the state and the Department cannot assess every one of them for each assessment. There are surface waters in Arizona that have naturally occurring levels of arsenic higher than the current and proposed standard. The canals to which the Val Vista water treatment plant discharges carries the DWS designated use. Downstream users of the canal water are entitled to the same water quality as the upstream users. The standards provide for mixing zones, which the Val Vista AZPDES permit currently has for several pollutants, including arsenic. A mixing zone allows a permitted discharge to exceed an acute water quality standard at the end of pipe provided it is not exceeded at the edge of the mixing zone. A mixing zone is a prescribed area or volume contiguous to a discharge where initial dilution of the discharge takes place within the receiving water.

Comment #132

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

MCLs are set by the EPA in order to regulate drinking water systems under the Safe Drinking Water Act ("SDWA"), whereas SWQS are designed to preserve and protect water quality for certain designated uses. MCLs apply to public water systems, which provide water to the public for "human consumption" and are applied after treatment. In contrast, SWQS apply to natural, pretreated water. The SWQS cut across many programs not considered by EPA when revising the drinking water MCLs, including the AZPDES and TMDL programs. The assumptions used to set MCLs for drinking water systems do not always translate into reasonable standards for pretreated surface water, because those standards take treatment into account. Additionally, MCLs are set on a national basis using national data on contaminant background levels and treatment costs, which may not be representative of Arizona's hydrogeological conditions. Additionally, MCLs may be based on outdated or refuted science. The Coalition therefore requests that ADEQ justify its adoption of the federal MCLs as untreated SWQS.

Response: It has been long-standing Department policy to adopt MCLs, where available, to protect surface water quality for the Domestic Water Source (DWS) designated use. The use of the MCL to protect water quality for the DWS designated use in surface water is consistent with the protection of drinking water under the Safe Drinking Water Act. The Department believes that the level of protection for surface waters that are used as sources of drinking water should be equivalent to that required of public water systems that provide drinking water. The numeric water quality criteria for the DWS designated use are intended to be quantitative concentrations of levels of pollutants in water that, if not exceeded, will generally ensure adequate water quality for the specified designated use. MCLs represent concentrations of pollutants in finished drinking water that EPA considers safe for human consumption and other potable uses. The Department has made the common sense determination that where surface water quality does not exceed the MCL, then it generally ensures adequate water quality for the DWS designated use. In consideration of the Department's goal of pollution prevention, ambient surface waters with the DWS designated use should not be contaminated to a level where the burden of achieving the MCL in drinking water is shifted away from those responsible for pollutant discharges to public water systems who must bear the costs of providing treatment for drinking water.

As for the scientific validity of the arsenic standard at 10 µg/L, the criteria was adopted by EPA in January, 2001 and was to be enforceable in January, 2006. In March of 2001, EPA requested that the National Academy of Sciences convene a panel of experts to review EPA's interpretation and application of arsenic research. In October 2001, EPA announced that the findings of the NAS were that "the 10 ppb (standard) protects the public health based on the best available science and ensures that the cost of the standard is achievable."

Bromoform

Comment #133

Janet Hashimoto, Chief; EPA Monitoring & Assessment Office

In applying ADEQ's methodology for calculating the numeric criteria for Full Body Contact for carcinogens, we derived a value of 0.00059 µg/L for bromoform relative to ADEQ's proposed criterion of 18,667 µg/L. Please clarify the calculation used to derive the bromoform criterions.

Response: An error was made in the calculation of the full body contact standard for bromoform. The non-carcinogenic endpoint was used (RfD) rather than the oral cancer slope factor. The Department is withdrawing this proposed standard revision and will initiate a separate rulemaking to adopt the correct standard.

Cadmium and Barium

Comment #134

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The Coalition requests that ADEQ update its cadmium and barium standards to reflect current toxicity factors recommended by EPA and that ADEQ review its proposed standards to ensure that these are based on the most current toxicological information.

Michael Garry, Exponent, on behalf of the Pinal Creek Group

In our review of previous drafts of the numerical standards, we identified the use of incorrect RfDs for cadmium and barium. In both cases the errors have been carried through to the 2008 draft.

Response: The Department is withdrawing the proposed standard revisions for both cadmium and barium and will initiate a separate rulemaking to adopt the corrected standards.

Chlorine

Comment #135

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

The proposed standard of 19 micrograms per liter for acute total residual chlorine ("TRC") and 11 micrograms per liter (parts per billion) for chronic TRC, although they have been loosened somewhat, are still unreasonable. There is no test method currently available that can reliably measure TRC at the proposed levels. The TRC test is highly sensitive to interferences from many different types of chemicals in the water and the TRC PQL for every plant will vary throughout the year and from plant to plant.

Response: The Department is aware of current analytical limitations and issues related to chlorine monitoring. However, water quality standards are based on studies concerning affects to life at certain concentrations and the proposal to raise chlorine limits is in response to new scientific information, specifically EPA's revised chlorine criteria.

While interference and quantification issues can be problematic for the A&W chlorine standard, those issues are more precisely addressed in the provisions of the discharger's permit. Surface water quality standards are designed to protect human health and aquatic and wildlife. Chlorine is a disinfectant added to waste streams to kill microorganisms and it can kill aquatic life in surface waters. AZPDES permits have specific language for how a permittee is to report data when analytical methods cannot detect contaminants below the standard or discharge limitation in the permit. Assuming the permittee is following the permit language, there is no violation of the permit if the samples are collected appropriately, analyzed using proper laboratory methods, and reported to the Department on time.

Comment #136

David E. McNeil, City of Tempe

Tempe is concerned with a proposed revision of the Full Body Contact (FBC) and Partial Body Contact (PBC) standards for chlorine to 4,000 ppb based on the Safe Drinking Water Act maximum residual disinfectant level (MRDL) for two reasons:

1. The MRDL is based on *ingestion* resulting in irritation to the eyes and ears, not skin exposure resulting in "eye and skin irritation" as explained in the rule proposal. Four thousand ppb of chlorine should not result in skin irritation.
2. Safe Drinking Water Act compliance with the MRDL is calculated as a running annual average of monthly averages of all samples. For a drinking water system the size of Tempe's, compliance is calculated by averaging 120 monthly samples each month and then averaging all of the last 12 monthly averages.

Response:. The commenter is correct, the full body contact (FBC) and partial body contact through ingestion (PBC) standards were set at the maximum residual disinfectant level (MRDL) due to irritation of eyes and ears not skin exposure.

The Department's long standing policy has been to use the MCL or MRDL if the calculated DWS or recreational contact standard is more restrictive. The calculated standard for residual chlorine for the full body contact (FBC) use would be 467 µg/L using the RfD for the ingestion of water which is 10 times more restrictive than the MRDL of 4000 µg/L.

Full body contact and partial body contact are "terms of art" and necessarily use consumption in calculating the standards. Full body contact standards are used to protect the use where an activity such as swimming can occur and water is ingested. Partial body contact standards protect the use where activities such as wading and boating can occur. The latter standard may entail ingestion because a small child could either become completely submerged or transfer water to their mouth on their hands. It is important that ingestion endpoints be addressed for both of these uses. Additionally, any waterbody with a contact standard will also have an aquatic and wildlife (A&W) standard, which is considerably more stringent than the human health/recreational standards referenced above.

Chloroform

Comment #137

Janet Hashimoto, Chief; EPA Monitoring & Assessment Office

ADEQ has proposed less stringent chloroform criteria for Fish Consumption and Full Body Contact beneficial uses, considering chloroform to be non-carcinogenic. However, EPA has not determined that chloroform is a non-carcinogen. We are currently in the process of updating the scientific assessment for chloroform. We recommend that ADEQ retain its existing chloroform criteria until EPA makes a final determination as to whether it is non-carcinogenic.

Response: Arizona has a standing policy of using the oral cancer slope factor (OCSF), if available, to calculate the standards for the full body contact use. If the OCSF is not available, the reference dose (RfD) is used. As of July 7, 2008, no OCSF was available in the EPA Integrated Risk Information System (IRIS) database but it did state: "A dose of 0.01 mg/kg/day (equal to the RfD) can be considered protective against cancer risk." The Department used the RFD in calculating the new criteria.

Iron

Comment #138

Benjamin R. Parkhurst, HAF, Inc., on behalf of the Pinal Creek Group

The proposed chronic A&W standard for iron for cold water, warm water, and effluent-dependent water (1000 µg/L) should be changed to 1000 µg/L dissolved iron. This proposed standard is based on the iron criterion in U.S. EPA's (1976) "Red Book." Like all inorganic metals, only the dissolved fraction of iron is considered to be significantly toxic to aquatic life (U.S. EPA 1992).

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The Coalition requests that ADEQ revise its proposed numeric SWQS for iron for aquatic and wildlife uses and EDWs to apply only to dissolved iron. Only dissolved iron is considered to have significant toxic effects to aquatic life.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

Pima county supports comments made by Dr. Ben Parkhurst concerning the A&W chronic standards for iron, in Appendix A Numeric Water Quality Standards.

Response: Due to a typographical error the 'D' designation to indicate dissolved iron was omitted in Appendix B and has been corrected.

Mercury

Comment #139

Benjamin R. Parkhurst, HAF, Inc., on behalf of the Pinal Creek Group

It is requested that the chronic Aquatic and Wildlife (A&W) standard for mercury for cold water, warm water, and effluent-dependent water (0.01 µg/L dissolved mercury) be withdrawn and that it be replaced by the U.S. EPA's (2004a) chronic, freshwater, National Recommended Water Quality Criterion (0.77 µg/L dissolved mercury).

ADEQ's chronic A&W standard for mercury (0.01 µg/L) was taken from U.S. EPA's (1985) *Ambient Water Quality Criteria for Mercury 1984*. ADEQ's A&W standard for Hg is a human health-based standard. The FC standard provides greater protection to aquatic life and human health than the chronic A&W standard.

ADEQ's FC and chronic A&W standards are redundant, because they are both based on protection of human health from mercury bioaccumulation in fish. The chronic A&W standard should be 0.77 µg/L dissolved mercury (II), which is U.S. EPA's (2004a) recommended chronic criterion. If ADEQ prefers to retain its current A&W standard, 0.01 µg/L dissolved aqueous mercury, the standard should be based on measurement of dissolved methylmercury in water, not total or inorganic mercury. ADEQ's proposed FC standard, 0.3 mg/kg methylmercury, should be protective of most piscivorous wildlife; therefore, a separate standard to protect piscivorous wildlife is unnecessary.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

Pima county supports comments made by Dr. Ben Parkhurst concerning the A&W chronic standards for mercury in Appendix A Numeric Water Quality Standards.

Robert A. Hollander, City of Phoenix

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

We recommend that ADEQ replace its proposed chronic aquatic and wildlife and EDW standard for mercury with EPA's chronic, freshwater, recommended water quality criterion of 0.77 µg/L dissolved mercury. ADEQ's proposed mercury standard for these designated uses is based on data of human consumption. However, concerns related to human consumption are already addressed through the fish consumption designated use. Basing the aquatic and wildlife and EDW standards on those same assumptions is unnecessarily redundant and is not directed specifically at the purpose of those designated uses – to protect wildlife.

Response: The Department disagrees. In an arid climate where water is relatively scarce, it is important to have aquatic and wildlife (A&W) standards that are protective of the wildlife that feed in and on all of the state's surface waters. While the community that inhabits the water column of an effluent-dependent water (EDW) may differ slightly from that found in A&Ww and A&Wc streams, the terrestrial and avian wildlife that use these streams are very similar. EDW ecosystems can be an integral part of the home range of bald eagles, black crown night herons, great blue herons, cattle egrets, osprey, and other wildlife that prey on fish and other aquatic organisms. Because these streams are often extremely predictable; having consistent flows and temperatures even during droughts and winter freezes, these ecosystems may be even more attractive for wildlife than the surrounding landscape.

The current A&Wedw chronic criterion for dissolved mercury is 0.2 µg/L and was originally adopted in 1992. Documentation on the derivation of the A&Wedw chronic criterion for mercury indicates that the chronic criterion was originally proposed at 1.1 µg/L, not 0.2 µg/L using EPA's Guidelines Methodology and recalculation procedures. (See *Rationale for the Development of Toxic Pollutant Criteria to Protect Aquatic and Wildlife Designated Uses,* January 10, 1992.) This derivation method only considered endpoints that were directly toxic to aquatic life and did not adequately protect against bioaccumulation in wildlife. However, in an addendum to the Concise Explanatory Statement for the 1992 rulemaking, the Department addressed the propensity for mercury to bioaccumulate by employing an available final residue equation based on the FDA action level for mercury in edible fish. Using this method, a recalculated A&Wedw standard of 0.2 µg/L was derived.

The Department has reevaluated the technical basis for the re-calculation of the A&Wedw standard. The Department questions the use of FDA action level as a surrogate to protect wildlife in the equation used to calculate the criterion. The FDA action level is designed only to protect consumers of commercially caught and sold fish from symptoms of mercury poisoning such as paresthesia (a sensation of tingling, pricking, or numbness of a person's skin) and not the more sensitive developmental endpoint in children. The Department questions the bioconcentration factor of 4994 L/kg that was used in the equation to calculate the 0.2 µg/L criterion. Methylmercury is an extremely bioaccumulable fraction of the total mercury addressed in the surface water quality standard. Methylmercury bioaccumulation potentials as high as 20,000,000 L/kg have been measured in the field in piscivorous fish.

In April 1994, the EPA disapproved all of Arizona's water quality criteria for dissolved mercury to protect aquatic life, including the A&W(edw) chronic criterion of 0.2 µg/L (See discussion in *Federal Register*, Volume 61, No. 19, p. 2769). EPA's disapproval of the mercury criteria was based on the results of the U.S. Fish & Wildlife Service (USFWS) consultation under § 7 of the Endangered Species Act on the adoption of the 1992 standards. The USFWS determined that Arizona's mercury criteria for the protection of aquatic and wildlife uses were developed without adequate consideration of the bioaccumulative effects of mercury on predatory wildlife. The USFWS identified the adoption of mercury criteria protective of threatened and endangered wildlife as a "reasonable and prudent alternative" to avoid jeopardizing endangered and threatened wildlife species in Arizona. However, there was inadequate information regarding mercury's impact on predatory fish and birds in Arizona for EPA or the state to develop scientifically defensible water quality criteria to protect wildlife.

Like the current Arizona WQS, the present EPA mercury criterion (0.77 µg/L found at 62 FR 42160) is also based on a human health endpoint. This endpoint, the oral reference dose for methylmercury, is employed to calculate EPA's recommended 304(a) criterion, which is published with an important caveat:

"This recommended water quality criterion was derived from data for inorganic mercury (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. In addition, even though inorganic mercury is converted to methylmercury and methylmercury bioaccumulates to a great extent, this criterion does not account for uptake via the food chain because sufficient data were not available when the criterion was derived."

Methylmercury is an extremely bioaccumulable fraction of the total mercury addressed in the surface water quality standard. The bioconcentration factor used to calculate the proposed A&Wedw standard is 81,700 and the BCF used to calculate the present federal criterion is only 5500. Bioconcentration factors are the laboratory-measured difference between the concentration of a substance in water and the concentration on fish tissue and do not consider food chain effects. The Department believes that the 81,700 BCF better addresses the probability of food chain bioaccumulation in wildlife. No change has been made to the rule.

Comment #140

Janet Hashimoto, Chief; EPA Monitoring & Assessment Office

ADEQ proposes to eliminate the existing 0.6 µg/L FC standard in lieu of the newly proposed 0.3 mg/kg methylmercury fish tissue standard. While we strongly support ADEQ's adoption of the 0.3 mg/kg standards, fish tissue samples may: a) not be collected in all Arizona water bodies that contain fish and which are otherwise monitored for total mercury in the water column, and/or b) not always be collected to an extent sufficient for assessment purposes under section 303(d) of the Clean Water Act.

We cannot assume that the chronic criterion for aquatic life can fully substitute for the 0.6 µg/L FC standard to ensure the current level of protection is maintained in cases where future data collection is insufficient to apply the proposed 0.3 mg/kg fish tissue standard.

Response: The Department disagrees with the suggestion that it retain the FC standard for mercury in addition to the new fish tissue standard for methylmercury. While implementation of the 0.3 mg/kg tissue standard for methylmercury does not entail collecting samples from all waterbodies previously covered by the fish consumption water column standard for mercury, Arizona has a robust REMAP sampling program that will sample fish tissue from representative waterbodies throughout the state. Also, the State Fish Consumption Advisory Program samples targeted waterbodies where angling and the consumption of fish are most likely to occur.

Because all waterbodies carrying the FC designated use also have A&W standards, the Department doesn't believe that the removal of the water column number for the FC designated use is problematic. The A&W chronic standard of 0.01 µg/L is more protective than the 0.6 µg/L fish consumption water column standard that is being repealed in this rulemaking. Employed together, the tissue standard for methylmercury and the chronic aquatic and wildlife water column standard for mercury will afford increased protection for human health over the standards in place.

Methylmercury 0.3 mg/kg

Comment #141

Robert A. Hollander, City of Phoenix

The standards are not clear on how this criterion will be implemented. We believe that the lack of specific provisions for applying the fish tissue criterion for permits, listings, and TMDLs will prove to be problematic for wastewater management utilities and for ADEQ because there are number of options that can be utilized to apply the fish tissue criterion to permits, listings and TMDLs, and the specific approach utilized could pose significant compliance issues for wastewater agencies. We recommend that ADEQ use the approach adopted by the state of Idaho which directly uses fish tissue rather than converting the methylmercury criterion into water column standards. Information on the Idaho program has been previously provided to ADEQ and is consistent with EPA's Draft Methylmercury Guidance.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The Coalition appreciates ADEQ's clarification in the preamble of the proposed rule that the proposed fish tissue criteria for bioaccumulative pollutants in waters with fish consumption designated uses apply in lieu of, and not in addition to, the previous water column criteria for bioaccumulative pollutants. The Coalition agrees in principal with the fish tissue criteria approach. However, the Coalition requests that ADEQ clarify, either in the rule or in the preamble, how the new fish tissue criteria will be translated to apply to water column testing in AZPDES permits. Additionally, the Coalition requests that ADEQ describe the method it proposes to use to calculate fish tissue criteria. The Coalition recommends that ADEQ develop an implementation plan on applying the fish tissue criteria in coordination with appropriate stakeholders.

Response: The Department adopts surface water quality standards in 18 A.A.C 11, Article 1 but discussions of how those new or revised water quality standards will be implemented through other Department water quality management programs are better held during rulemakings on Impaired Waters Identification or AZPDES permitting. The Department is developing an implementation guidance document that will be adopted as policy and will be made available for public comment, for implementing the new methylmercury fish tissue standard in the AZPDES permit program, water quality assessment and impaired waters identification, and the fish consumption advisory program. However, the adoption of the methylmercury fish tissue standard is the first step in the policy development process. There is currently no intention to translate the fish tissue criterion into water quality-based effluent limits in permits. Once the guidance is finished, it may result in additional rulemaking to incorporate necessary provisions in standards and other rules.

Comment #142

Steven L. Spangle, Field Supervisor, U.S. Fish And Wildlife Service

A&Wedw – acute and chronic mercury

Arizona Department of Water Quality has proposed to change the mercury standard for A&Wedw acute from 2.6 µg/L to 2.4 µg/L and the mercury standard for A&Wedw chronic from 0.2 µg/L to 0.01 µg/L. Compared to the EPA's National Recommended Water Quality Criteria (2006) for acute mercury (1.4 µg/L), Arizona's number is higher. Please clarify the rationale behind this difference.

For the A&Wedw chronic mercury standard, the FWS supports ADEQ's decision to lower the standard, but thinks an even lower chronic standard (for all A&W designated uses) would better protect piscivorous wildlife. For the proposed change to the A&Wedw chronic mercury standard, ADEQ recognized the potential for mercury to bioaccumulate from water to aquatic life was greater than originally thought.

Using a BCF of 100,000 L/kg and the proposed A&Wedw standard of 0.01 µg/L, which is also the current standard for A&Wc and A&Ww, we calculated a fish tissue concentration of 1 mg/kg wet weight. Methylmercury concentrations from 0.2-0.3 mg/kg wet weight in fish appear to be protective of bald eagles in most cases (Lusk et al. 2005, USFWS 2003). Since 1 mg/kg is greater than 0.3 mg/kg, the proposed chronic A&W standard is not protective of piscivorous wildlife.

Mercury bioconcentration factors as high as 1,958,000 L/kg have been documented in piscivorous wildlife (Evers et al. 2004). Given that bioconcentration factors from water to piscivorous wildlife have been documented as high as 1 or 2 million, we recommend that EPA and ADEQ re-evaluate the adequacy of the chronic mercury A&W standard in the water column.

A&W – tissue-based methylmercury

The FWS supports ADEQ's proposal to revise the Fish Consumption (FC) standard for methylmercury. The former FC standard was based on total mercury in the water column, but ADEQ proposes to adopt a tissue-based standard for methylmercury. While this standard is designed to protect human health, Lusk et al. (2005) and USFWS (2003) evaluated its effectiveness to protect piscivorous wildlife. They found that 0.3 mg/kg wet weight in fish tissue is generally protective of piscivorous wildlife. We recommend ADEQ expand the tissue-based standard for methylmercury from human health to include aquatic and wildlife designated uses. This is especially important considering the inadequacy of the chronic mercury A&W standard to protect wildlife.

Response: In the history of its surface water sampling program, the Department has rarely found mercury in water column sampling. The concern is for bioaccumulation in aquatic organisms that are then consumed by the public or by wildlife. The 0.01 µg/L aquatic and wildlife standard is a compromise standard developed by the state, EPA, and the USFWS to address the acknowledged inadequacies of the federal criterion without adopting a standard requiring extremely expensive sample collection and analysis. A standard calculated using the Great Lakes Water Quality Initiative methodology (0.0008 µg/L) would only be 0.0003 µg/L above our method reporting limit and very possibly reasonably within the margin of error for that method.

The adopted tissue standard of 0.3 mg/Kg methylmercury is, as the commenter pointed out, considered to be "generally protective of piscivorous wildlife." The combination of the expanded scope of the current chronic water column standard for mercury coupled with the proposed tissue standard protects piscivorous wildlife.

Selenium

Comment #143

Benjamin R. Parkhurst, HAF, Inc., on behalf of the Pinal Creek Group

The chronic A&W standard for selenium should be changed from 2 µg/L to 5 µg/L. In its March 2005 proposed revisions to its water quality standards, ADEQ proposed to increase the chronic A&W standard for selenium from 2 µg/L to 5 µg/L so that the standard would be consistent with U.S. EPA's (2004a) criterion which is 5 µg/L. In not including this proposed revision to its water quality standards, ADEQ cited an August 18, 2005 letter from Thomas Gatz, USFWS, to Linda Taunt, ADEQ, which opposed the revision. The key points from this letter are as follows:

1. A 2 µg/L chronic selenium standard will lead to many waters being listed as impaired when, in reality; many will not be experiencing significant toxic effects to biota from selenium. TMDLs will be required for these waters.
2. Further studies and analyses will be needed, including measurements of selenium in water, sediment, macroinvertebrates, fish eggs, and aquatic bird eggs, to determine if the waters are truly impaired.
3. The real risk from selenium is bioaccumulation, which is best determined by measurements of the concentration of selenomethionine, not total selenium, in water, and/or direct measurements of selenium in biota.

To preclude the listing of many unimpaired waters with total selenium concentrations between 2 µg/L and 5 µg/L as impaired leading to unnecessary and wasteful TMDLs, it is requested that ADEQ increase the chronic A&W standard for selenium from 2 µg/L to 5 µg/L. In addition, it is recommended that ADEQ undertake monitoring of selenium concentrations in biota to determine if any waters in the state are impaired from selenium bioaccumulation.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

Pima county supports comments made by Dr. Ben Parkhurst concerning the A&W chronic standards for selenium in Appendix A Numeric Water Quality Standards.

Sydney Hay, Arizona Mining Association

The AMA supports the removal of acute water quality criteria for selenium for aquatic and wildlife uses for the reasons outlined in the proposal.

The AMA supports the comments of HAF Inc., on behalf of the Pinal Creek Group, requesting that ADEQ conform the chronic selenium standard of 2 µg/L to EPA's § 304(a) criteria recommendation of 5 µg/L, possibly in conjunction with monitoring of fish tissue to determine if sediment is actually bioaccumulating in biota in those waters where the 5 µg/L criterion is being exceeded in the water column.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The Coalition requests that ADEQ revise its aquatic and wildlife selenium standard from 2 µg/L to 5 µg/L, to be consistent with EPA's selenium criterion continuous concentration established in 2004. This standard would thus be more consistent with EPA's recommendations, and would account for high selenium concentrations in many Arizona waters due to natural background or to out-of-state irrigation-related effects from the upper Colorado River Basin.

Robert A. Hollander, City of Phoenix

The Water Services Department understands that ADEQ is retaining the 2 µg/L selenium water quality standard because of a request in the August, 2005 FWS letter and is concerned that the recommendations found in the letter are inconsistent with the comments submitted by Everett Wilson, Chief of the FWS Division of Environmental Quality located in Washington, D.C. FWS Headquarters office to EPA on May 19, 2005 (May letter) in regard to EPA's *Draft Selenium Water Quality Criteria Document*. While the August letter adamantly calls for a 2 µg/L water quality standard, the May letter recommends a "safety-net water criterion of 2 µg/L and recommends that "only when the water column criterion and the fish tissue criterion are both exceeded, or the fish tissue criterion alone, would a full site-specific analysis including development of intermedia translation factors be necessary."

Naturally occurring selenium in Arizona streams frequently is passed through drinking water treatment plants and on to wastewater treatment plants. Additionally, selenium is a common dietary supplement and is found in products such as dandruff shampoos. Wastewater treatment facilities are not designed to remove low levels of selenium, thus, increasing the likelihood of selenium exceedances due to pass-through. The Water Services Department believes that it should not be held liable for selenium that is attributable to natural sources. According to the FWS August letter, most of Arizona's high selenium concentrations are produced outside of Arizona and outside of ADEQ's jurisdiction. This provides additional impetus to develop a better alternative to regulating discharges of selenium from wastewater treatment plants.

The Water Services Department asks ADEQ to consider either altering the Natural Background rule to apply in this situation, placing the selenium standard in "reserve," or using an alternative method for determining compliance. The Water Services Department believes that using fish tissue and a subsequent investigation of sources when an exceedance is found (the method recommended in the FWS May letter) would provide an acceptable interim means of regulating selenium, especially since the environmental concern is for selenium concentrations in fish tissue.

Response: The Department appreciates the issues of selenium in Arizona's source waters and the impact of dischargers; however, the Department is not electing to revise the current criteria. Although the U.S. Environmental Protection Agency (EPA) has published a nationwide § 304(a) criteria recommendation of 5 µg/L to protect aquatic and wildlife from chronic effects of selenium, the U.S. Fish & Wildlife Service (USFWS) recommended using a standard of 2 µg/L. After reviewing nearly every major experimental and field study conducted over the past 15 years, the USFWS did not support the use of a 5 µg/L chronic standard for selenium because it is not scientifically valid or fully protective of fish and wildlife resources. In aggregate, the weight of scientific evidence supporting a chronic criterion of ≤ 2 µg/L is now overwhelming. As early as 1991, the evidence available in the scientific literature was sufficient for Canada to issue a national water quality guideline stipulating that the concentration of total selenium should not exceed 1 µg/L (Environment Canada 1991). Based on data collected by the U.S. Department of Interior's National Irrigation Water Quality Program (NIWQP) from 26 study areas in 14 western states, a 5 µg/L chronic criterion for selenium is only 50-70 percent protective (Adams et.al 1998), as opposed to the 95 percent level of protection that EPA's national water quality criteria are intended to achieve (Stephan et. al. 1984). The NIWQP data suggest that on a dissolved basis a criterion of 1 µg/L would be required to be 95 percent protective, which is equivalent to a 2 µg/L criterion on a total recoverable basis (Peterson and Nebeker 1992).

The USFWS provided a variety of conceptual bases for deriving a generally applicable chronic water quality criterion for selenium that is protective of fish and wildlife with results ranging from 1-4 µg/L. The available body of scientific evidence (the majority of which has been produced subsequent to EPA's 1987 criterion derivation for selenium) consistently supports an aquatic life criterion of 2 µg/L for the protection of sensitive taxa of fish and wildlife. Even a criterion of 2 µg/L; however, can fail to be protective in specific cases where water column contamination with selenium fails to accurately reflect food chain contamination. There is a strong need for developing a method to link criteria directly to food chain contamination. In the absence of site-specific and species-specific data regarding the sensitivity of particular species and or populations, a general criterion of 2 µg/L is required to assure adequate protection of threatened and endangered species of fish and wildlife. This is especially warranted considering the steep response curves for selenium and well demonstrated potential for selenium facilitated pathogen susceptibility that can rapidly destroy entire populations of fish and wildlife via epizootic events.

Sulfide

Comment #144

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ proposes to create a new numeric water quality standard for hydrogen sulfide that was developed based on toxicity data for species that do not reside in the Santa Cruz River.

Response: The Department disagrees. Hydrogen sulfide is a soluble, highly poisonous compound that is appropriately regulated in effluent-dependent waters. The proposed hydrogen sulfide numeric water quality standard to protect aquatic life in effluent-dependent waters is based on EPA national § 304(a) criteria recommendations for hydrogen sulfide to protect aquatic life in fresh water. The proposed criterion is based on "Red Book" criteria values originally recommended by EPA in 1976. EPA has not withdrawn the hydrogen sulfide criteria from its current National Recommended Water Quality Criteria, U.S. Environmental Protection Agency, Office of Water (2006).

Standards are not developed based on specific species that reside in a particular waterbody, but rather are measured on representative species that would prove protective of most aquatic species. In the case of the Santa Cruz, the argument is particularly inappropriate as the river does not have a healthy aquatic diversity. Some of this may be due to substrate and physical issues, but also is likely due to the fact that the current discharges are toxic due to high ammonia.

Full/Partial Body Contact

Comment # 145

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

EPA adopts a federal methodology for deriving criteria for full body contact designated use based on an incidental ingestion rate of 10 ml/day. ADEQ however adopts a different and more stringent assumption of 15 ml/day and justifies this more stringent standard by arguing that people swim more in Arizona, but provides no evidence for that statement. The Coalition recommends that ADEQ adopt the same methodology for deriving criteria for full body contact designated use as used by EPA.

Additionally, ADEQ adopts the exact same incidental ingestion rate assumptions for deriving criteria for partial body contact designated uses as for full body contact. Clearly, the incidental ingestion rate for partial body contact is lower than that of full body, seeing as how one is partial and the other full.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

EPA has adopted full body contact designated use standards based on an incidental water ingestion rate of 10 ml/day as specified in the preamble to this rulemaking. Contrary to the EPA methodology, ADEQ has used more stringent criteria assuming a water ingestion of 15 ml/day. ADEQ has not provided a substantial scientific rationale for taking this more conservative approach. Therefore, Pima County asks that ADEQ revise its standards for this rulemaking to comport with the EPA methodology and standards.

Similarly, ADEQ has used full body contact ingestion rates to derive the proposed standards for partial body contact in these proposed rules. ADEQ provides no meaningful scientific discussion to justify this overly protective action. Partial body contact standards were developed to account for activities such as wading that result in a significant decrease in the potential amount of water ingested during the activity as compared with full body contact activities such as swimming. ADEQ should adopt the same assumptions for partial body contact incidental ingestion rate as those relied upon by EPA.

Michael Garry, on behalf of the Pinal Creek Group

We note that the numerical standards for full-body contact (FBC) with surface water were modified in the 2007 draft to incorporate a water ingestion rate of 15 mL/day, consistent with our 2005 comments, and that this modification has been retained in the 2008 draft. However, the numerical standards for partial-body contact (PBC) continue to assume a level of exposure equal to FBC. The PBC water quality standards should reflect the lower potential for exposure relative to FBC standards. Thus, we again request that ADEQ consider reducing the ingestion rate under PBC to reflect lower exposure potential relative to a FBC water body.

Response: The Department believes the adopted revisions to the water ingestion exposure assumptions used to calculate the numeric criteria represent more realistic and reasonable water ingestion assumptions than those used to calculate the existing criteria. The existing numeric criteria for the FBC and PBC designated uses were calculated using 50 ml/day as the exposure assumption. In this rulemaking, a more realistic exposure of 15 ml/day is used to represent the incidental water ingestion associated with full body contact or partial body recreation. *See* "Methodologies for Deriving Criteria for the Full Body Contact Designated Use" in the Preamble Section by Section Discussion in Appendix A, Numeric Water Quality Criteria. While EPA has used an incidental ingestion rate of 10 ml/day, states are at liberty to use and justify alternative rates, however, EPA does not make any national § 304(a) recommendations for water quality criteria based on incidental ingestion of water from *recreation*. The Department stands by its reasons stated in the Preamble for using an incidental ingestion rate of 15 ml/day for recreational activities in Arizona. As there is not a separate methodology for calculating the PBC criteria, the Department used the FBC methodology for *non-carcinogens* recognizing that the limited exposure envisioned under partial body contact would not give rise to excess cancer risk. The Department disagrees that a lower ingestion rate is called for. While adults may have limited exposure to water in partial body contact scenarios, infants and small children, the most sensitive populations, have an equally high potential for exposure in both full and partial body contact contexts (e.g., hand to mouth).

Comment #146

Michael Garry, Exponent, on behalf of the Pinal Creek Group

ADEQ applies a fish consumption rate of 17.5 g/day in deriving fish consumption criteria. However, as noted on page 4-24 of EPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (2000), a consumption rate of 17.5 g/day "…represents the 90th percentile of the 1994-96 CSFII data." We recommend ADEQ modify the text on page 970 of the proposed standards to clarify that 17.5 g/day represents a high-end national fish consumption rate. This will underscore the protectiveness of the fish consumption criteria, even for individuals who are high-end fish consumers.

We note that in the 2008 draft standards, ADEQ provided all input values (including bioconcentration factors, RSCs, and RfDs) used to calculate the numerical standards for those chemicals for which the criteria changed relative to previous standards. This is an excellent way to provide transparency in the calculations, avoid confusion in how specific criteria were derived, and allow for meaningful input from reviewers. We recommend ADEQ include an additional table providing the bioconcentration factors, RSCs, and RfDs used to derive the numerical criteria, along with references for the source of those assumptions. Along this same line, we recommend that the equations used to derive the standards explicitly include the necessary unit conversion factors.

Response: The Department appreciates the comment on "high end" national fish assumption and will clarify that in the Preamble. The Department agrees that a tabular presentation of all the input values, equations and units would be useful for the public to follow in setting standards and will consider preparing such a document for use in the future.

Relative Source Contribution (RSC)

Comment #147

Janet Hashimoto, Chief; EPA Monitoring & Assessment Office

In calculating several of the proposed numeric criteria, ADEQ assumed a less stringent Relative Source Contribution (RSC) than EPA's recommended default RSC of 20%. RSC relates to the percentage of total exposure to a pollutant from water versus other sources, such as diet (e.g., a 20% RSC conservatively assumes that 80% of total exposure comes from other sources). In the proposed rule, ADEQ assumes a RSC of 40% or 50% for barium, boron, 1,1 dichloroethylene, nitrate, nitrite, and toluene with respect to one or more of the following beneficial uses: Full Body Contact, Partial Body Contact, Fish Consumption, and/or Domestic Water Source.

RSC strongly influences the resulting proposed standard. A less conservative RSC assumption is acceptable if it can be demonstrated that other sources and routes of exposure are not anticipated for the pollutant in question, based on information about its known/anticipated uses and chemical/physical properties. However, ADEQ's proposed rule does not contain justification for assuming a 40% to 50% RSC for the six numeric criteria noted. We recommend that ADEQ either provide justification for these values or use the default RSC of 20%.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

The Coalition requested that ADEQ adopt language allowing for chemical-specific evaluations of relative source contribution ("RSC") rather than rely solely on the default RSC of 20%. ADEQ has adopted alternative RSCs for certain contaminants (such as for barium), demonstrating that chemical-specific evaluations are clearly called for in certain circumstances. The Coalition recommends that ADEQ provide for greater flexibility in relying on chemical-specific evaluations of RSC, and in particular allow for reliance on the subtraction approach described in EPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (2000).

Michael Garry, Exponent, on behalf of the Pinal Creek Group

Our 2005 comments commented on the use of a default relative source contribution (RSC) term of 0.2 rather than the use of chemical-specific information when available. We note that ADEQ has incorporated alternative RSC terms for a few chemicals in their 2008 draft standards (e.g., RSC of 0.5 for barium). The regulations should have flexibility to allow for a chemical-specific evaluation of the science if the standard is exceeded or if new information becomes available. For example, as we noted in our comments, EPA's draft reference dose (RfD) for cadmium is intended to be protective of exposures in excess of diet, a major source of cadmium exposure. Therefore, in the future, a RSC term for cadmium is unnecessary when calculating health risks associated with water exposures. We recommend that specific language be incorporated into the standards allowing for a chemical-specific evaluation of RSCs and the mechanism for doing so, including the ability to use the subtraction approach described in EPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (2000) and discussed in our December 15, 2005, technical memorandum.

Response: The Department currently provides for chemical-specific evaluations of relative source contribution within the water quality standard derivation process. However, it is important that any such recalculation of the relative source contribution be done on the strength of adequate reviewed and published scientific data. At present there are nine proposed standards where an RSC other than the default 20 percent is used. In each case these were adjusted on the strength of EPA's published RSC values.

The recalculation of an RSC value is a resource and data intensive project with an uncertain outcome. As an example, the recalculation of the RSC for cadmium illustrates the complexity of developing reliable chemical-specific RSC values. Cadmium is a heavy-metal used in a number of industrial processes, and has been associated with both occupational and non-occupational exposures. Environmental levels of cadmium have been increasing from smelting, cement production, and combustion of fossil fuels. The major route of exposure for the non-smoking general population is via food and tobacco is an important source of cadmium uptake in smokers. Drinking water does not appear to be a significant source of cadmium exposure. Cadmium is classified as a B1 or probable human carcinogen and the lone reason an RfD (and for that matter the RSC) is used to calculate the human health water quality standard is that an oral cancer slope factor has yet to be published by the EPA. The bioconcentration factor for cadmium ranges as high as 44,000 in laboratory studies. These factors would make it very complex to calculate a reliable RSC for cadmium using the subtraction method. Since water is considered an insignificant source of cadmium, the RSC from that source would necessarily be small.

Boron and 1,1 Dichloroethylene both are calculated using the 20 percent default RSC, as preferred by EPA. Use of the RSC was deemed not applicable for both nitrate and nitrite due to the assumptions used in the calculation of the RfD. Infants are the sensitive subpopulation being protected when analyzing risk from nitrates and nitrites. The main exposure pathways for infants are through drinking water. Long-term full-body contact is not an assumed use for this population group. A relative source contribution of 40 percent was determined for toluene because volatile chemicals are much less likely to be found in food and soil. Also, ambient air concentrations for toluene are decreasing steadily with the half-life of toluene in the atmosphere ranging from three hours to slightly greater than one day.

The following is a table of relative source contribution factors greater than 20 percent used in the calculation of Arizona's water quality standards.

PARAMETER	RfD	OCSF	RSC	DWS	FBC	PBC	FC	Citations
Antimony	4.00E-04	NA	0.4	6	747	747	640	3,4,5,6
Barium	7.00E-02	NA	0.5	2,000	98,000	98,000		2,3,5,6
Carbon tetrachloride	7.00E-04	1.30E-01	0.4	5	11	1307	2	6
Fluoride	6.00E-02	D	0.5	4,000	140,000	140,000		2,3,6
Hexachlorocyclopentadiene	6.00E-03	NA	0.4	50	11,200	1,200	74	6
Nickel	2.00E-02	NA	0.3	210	28,000	28,000	511	1,6
Nitrate	1.60E+00	NA	1.0	10,000	3,733,333	3,733,333		2,6
Nitrite	1.00E-01	NA	1.0	1,000	233,333	233,333		1,2,6
Tetrachloroethane 1,1,2,2	NA	2.00E-01	0.5	0.2	7	93,333	4	6
Toluene	2.00E-01	D	0.4	1,000	373,333	373,333	29,907	6,7

Citations
1 Drinking Water Criteria Document on Nitrate/Nitrite, U.S.EPA (1990)
2 Guidelines for Canadian Drinking Water Quality, Health Canada (2003).
3 Guidelines for Drinking Water Quality, WHO (2003)
4 Human Health Criteria Calculation Matrix, EPA-822-R-02-012
5 Minnesota Health Risk Limits for Groundwater Rule (1994)
6 Risk Assessment for Chemicals in Drinking Water: Estimation of Relative Source Contribution, R.A. Howd, J.P. Brown, OEHHA, California Environmental Protection Agency
7 Public Health Goal for Toluene In Drinking Water, OEHHA, 1999

APPENDIX B. SURFACE WATER AND DESIGNATED USES

Full/Partial Body Contact

Comment #148

Claire L. Zucker, Pima Association of Governments (PAG)

ADEQ plans to apply Partial Body Contact (PBC) standards to urban lakes to protect recreational uses of boating and wading. For several compounds, the proposed PBC standards are more stringent than A&W w standards and A&W eph standards. PBC standards need to be set using technically sound rationale because they will become significant benchmarks for urban lakes and for urban stormwater. According to our PAG jurisdictional members, ADEQ has established the standards for PBC recreational use by assuming the same exposure pathway as for Full Body Contact, which are used for swimming use and are based on an assumed amount of ingestion. However, ingestion criteria are inappropriate for Partial Body Contact exposure, which involves dermal exposure only. This approach is inconsistent and should not be implemented in rule until the standards for dermal exposure are established, technically sound and defensible.

It is unclear from the rule whether ADEQ feels it is appropriate to apply PBC standards to stormwater, and if so, how and where the standards should be assessed. ADEQ has stated in MS4 stakeholder groups that they must apply the standards, in whatever manner they are stated in the Surface Water Quality Standards rule. In the rule, PBC defined as appropriate for surface waters being used for recreational purposes, but recreational use of stormwater is discouraged by MS4s and is not common at, or near, MS4 outfalls. ADEQ should clarify whether PBC standards are appropriate for wet weather flows in Arizona.

Fred H. Gray, City of Tucson, Parks and Recreation Department

ADEQ expects PBC levels to be used at urban lakes to protect recreational uses of boating and wading. PBC standards are more stringent than A&W standards for about 46 compounds, some of which have no standard for A&W protection. Because the PBC standards become significant benchmarks for urban lakes, we need to assure that PBC standards have been set using technically sound rationale. ADEQ has established the standards for PBC recreational use by assuming the same exposure pathway as for Full Body Contact. Full Body Contact standards are for swimming use and are based on an assumed amount of ingestion.

This approach is inconsistent with the rule definition of the term "Partial Body Contact," which states that in this type of exposure "ingestion of the water is not likely."

Jim F. DuBois, City of Tucson – Department of Transportation

ADEQ expects PBC levels to be used in the context of municipal stormwater permits. The City of Tucson and our Phase I stakeholder group questioned the appropriateness of PBC standards for stormwater during our permit discussions this past year with ADEQ. We believe that stormwater should not be held to PBC because the PBC criterion assumes recreational uses as the exposure pathway, and stormwater flows are not typically subject to recreational use. MS4s discourage boating and wading in stormwater flows.

Municipalities are concerned about the PBC standards because they become significant benchmarks for MS4s permits and because ADEQ expects PBC levels to apply at urban lakes to protect recreational uses of boating and wading. ADEQ should ensure that PBC standards have been set using technically sound rationale. ADEQ has established the standards for PBC recreational use by assuming the same exposure pathway as for Full Body Contact. FBC standards are for swimming use and are based on an assumed amount of ingestion.

ADEQ should delete PBC standards from the rule until appropriate data can be developed for dermal exposure. Alternatively, ADEQ should identify a lower ingestion level and lesser frequency of exposure for boating and wading activities.

Response: While ingestion is not likely for the partial body contact (PBC) use, it is an important pathway when considering that young children, having a much lower body weight, higher metabolism, and who may be undergoing sensitive developmental stages, may come in contact with these waters. Smaller children could become completely submerged or transfer water to their mouths on their hands. Infants and toddlers often may not have yet developed the defensive reactions that would prevent the ingestion of large amounts of water in the event of an accident. The Department addresses the episodic and hopefully rare nature of these events by not applying the cancer endpoint to the PDB use where long-term frequent exposure is minimized. Currently, all waters of the United States in Arizona, except listed canals, have a body contact standard. This is keeping with the fishable/swimmable goals of the Clean Water Act and the Department's mission to protect human health.

The standards that apply to stormwater are those applicable to the water receiving the stormwater discharge. PBC standards apply to stormwater discharging to a waterbody where PBC standards apply; the FBC standards apply to stormwater discharging to a waterbody where FBC standards apply. It is understood that MS4s and others do not intend for, or encourage, recreation within stormwater. However, it is equally clear that children and others playing in stormwater is a common occurrence and documented routinely by news pictures and videos. The Department is aware of the challenges in meeting this standard during storm events particularly as it applies to *E. coli* from MS4 discharges. MS4 permits do not have discharge limitations based on the standards because of the applicable "maximum extent practicable" standard in the Clean Water Act, but achieving the standards continues to be the ultimate goal.

Fish Consumption

Comment #149

Claire L. Zucker, Pima Association of Governments (PAG

Fred H. Gray, City of Tucson, Parks and Recreation Department

Fish consumption standards are applied to urban lakes such as Kennedy and Lakeside in the Tucson region. However, these lakes are not managed for propagation of fish as envisioned by the Clean Water Act Section 303(c). Fish taken by fishers from Lakeside Lake were stocked by Arizona Fish and Game Department and were raised to catchable size elsewhere. The Bioconcentration Factor used by ADEQ to develop the Fish Consumption Standards is inappropriate for this type of managed fishery because bioconcentration from Lakeside Lake's waters is insignificant. The impact on human health from concentration of pollutants in fish tissue in the lakes would be due primarily to the waters in which the fish have been raised to catchable size.

Response: While the lakes cited are "put and take" fisheries where larger fish are stocked, it is nevertheless important that water quality be maintained according to Arizona water quality standards and Clean Water Act goals. Because channel catfish that are the main fish stocked in the cited lakes and could survive and reproduce, there is a chance that some fish, if not caught, could live long enough to bioaccumulate pollutants. The best way to prevent the bioaccumulation of toxic pollutants and to protect this recreational fishery is the preservation of the fish consumptions standards presently in place.

Since anglers catch fish for consumption at Kennedy Lake and Lakeside Lake, fish consumption is an existing use. As such, it must be listed as a designated use in Appendix B of the surface water quality standards. The Department does not have a subcategory of the fish consumption designated use nor is there scientifically defensible data to defend a subcategory for lakes that are stocked.

Boulder Creek

Comment #150

Teague J. Raica, Freeport-McMoRan Bagdad

The two Boulder Creek segments listed in Appendix B for the Bill Williams watershed both include agricultural irrigation ("Agl") as an applicable designated use. FCX is not aware of any crop irrigation on Boulder Creek especially given the location and topography associated with Boulder Creek. FCX respectfully requests that Agl be removed as a designated use from both segments of Boulder Creek.

Response: While the commenter may be correct that there is no crop irrigation in the watershed, in accordance with the CWA, the Department cannot remove a designated use without completing a use attainability analysis (UAA). The Department is willing to work with FCX-Bagdad prior to the next rulemaking to develop the evidence required in a UAA.

EDW Listing of Unnamed Wash Tributary to Cave Creek

Comment #151

Robert A. Hollander, City of Phoenix

The Water Services Department previously commented on this proposed listing in our letter to Steve Pawlowski dated December 5, 2007, which is attached and incorporated by reference. Appendix B lists the Unnamed Wash in the Middle Gila River below the City of Phoenix Cave Creek Water Reclamation Facility as an EDW. The Water Services Department does not agree that this water should be listed simply because there is a permitted discharge (i.e., City of Phoenix Cave Creek Water Reclamation Plant (CCWRP)). The last discharge from the facility occurred on March 30, 2005. As evidence that the receiving water is not an EDW, the Water Services Department attached photographs, to the referenced letter, showing the unnamed tributary both upstream and downstream from the outfall. These photographs clearly show that there is no established aquatic life despite the fact that the CCWRP has been a permitted facility since January 24, 2000. In addition, there are no riparian plant species in this segment. The bank vegetation includes cactus, creosote, saltbush and other non-riparian species. The stream bottom is dry and consists almost entirely of sand. Clearly, this wash is not dependent upon the effluent to support an aquatic ecosystem or a riparian habitat.

The Water Services Department requests ADEQ provide the data and information used to determine that this water body "consists of treated wastewater" as required by the EDW definition.

Response: The City of Phoenix states in its comment that the water body that receives sporadic discharges from the Cave Creek Water Reclamation Plant (CCWRP) is an ephemeral tributary to Cave Creek Wash. As previously outlined in Responses #108 and 109, by definition discharging of effluent to an ephemeral systems, creates an EDW which must be listed in rule by the Director. We note that the CCWRP may be the type of facility that the flexibility in permitting in R18-11-113E was developed for.

EDW Listing of Mule Gulch

Comment #152

Michael Jaworski, Freeport-McMoRan - Copper Queen Branch

The segment of Mule Gulch no longer qualifies as effluent-depedent as the Bisbee WWTP was decommissioned in early 2006 and has not discharged into Mule Gulch since the first quarter of 2006. The designated uses for this segment of Mule Gulch should be changed from aquatic and wildlife (effluent-depedent water) ("A&Wedw") and partial body contact ("PBC") to aquatic and wildlife (ephemeral) ("A&We") and PBC.

Response: While the commenter may be correct that there is no longer discharges to Mule Gulch from the WWTP, in accordance with the CWA, the Department cannot remove a designated use without completing a use attainability analysis (UAA). The Department is willing to work with Freeport-McMoRan-Copper Queen Branch prior to the next rulemaking to develop the evidence required in a UAA.

EDW Listing of Siphon Draw

Comment #153

Michele Van Quathem, Superstition Mountains Community Facilities District No. 1

ADEQ proposes to include a stretch of Siphon Draw in Appendix B to the surface water quality rules. SMCFD opposes inclusion of Siphon Draw in Appendix B as an EDW on several grounds:

1. SMCFD's Effluent is Not "Wastewater." Use of the term "wastewater" in the proposed definition of "effluent-dependent water" indicates untreated sewage is being discharged to the effluent-dependent water. SMCFD does not discharge untreated "wastewater."
2. In listing Siphon Draw as an "effluent-dependent water," ADEQ fails to consider the nature of flow in Siphon Draw and its nexus with any water of the United States.
3. SMCFD's discharge location is not in Siphon Draw. SMCFD's "outfall" is not in Siphon Draw, and the coordinates provided for the point where flows reach Siphon Draw are incorrect.

For all the reasons stated above, the Department should remove Siphon Draw from Appendix B. Siphon Draw is not a jurisdictional water, nor is there sufficient evidence to establish a significant nexus between the SMCFD discharge and any water of the United States.

Response: The Department disagrees that: 1) wastewater means 'untreated sewage' and that SMCFD's discharge is not wastewater, see Response #14; and 2) that Siphon Draw has been determined as a non-jurisdictional water, see Response #4. See Responses #19, #20 and #106 regarding the need for a sufficient volume of discharge.

As for the discharge location, the following information is quoted from the Fact Sheet for the SMFCD's AZPDES permit:

> "It should be noted that permit #AZ0023931, which was issued on April 9, 1996 and expired on May 11, 2001, was drafted to authorize discharge to Weekes Wash, eventual tributary to Queen Creek in the Middle Gila River Basin. While the discharge location has not changed, the name of the receiving water in this draft permit was changed to Siphon Draw. Weekes Wash and Siphon Draw meet just upstream of Superstition Mountain CFD No. 1's outfall where they are both impounded by the Powerline Flood Retarding Structure. The ephemeral wash that continues on past this point, and that the Superstition Mountain WWTP discharges to, is not named on the U.S.G.S. 1981 topographic map of the area (Desert Well). However, the wash is better known locally as Siphon Draw and a search for these two names on the USGS National Mapping Information web site showed that Weekes Wash ends where the two waterways meet while Siphon Draw continues on past their juncture. For this reason, the name of the receiving water was changed from Weekes Wash to Siphon Draw. Siphon Draw is an eventual tributary to Queen Creek. According to the Tributary Rule in A.A.C. outlined above, A&We and PBC standards apply to all tributaries to listed waters. Siphon Draw connects with Roosevelt Canal which joins Queen Creek about 15 miles downstream of Superstition Mountain's discharge point."

In high flow events, it is possible and even likely that flows from the SMCFD facility will reach Queen Creek; therefore the Department considers the designation of Siphon Draw to be accurate.

EDW listing of Mineral Creek

Comment #154

Scott Thomas, (Fennemore Craig, PC),

ASARCO formally submitted information in support of the removal or modification of certain designated uses currently applicable to the tunnel and lined channel at the Asarco Ray Mine. These manmade features were constructed to convey flow in Mineral Creek around mining operations. Work on the lined channel and an extension to the pre-existing tunnel segment was completed subsequent to the last triennial review which was finalized in March 2002.

Response: The information submitted appears to meet the requirements for a use attainability analysis (UAA). The Department will begin a comprehensive review of the information and, if warranted, propose the changes in a separate rulemaking.

Wagner Wash

Comment #155

Robert D Anderson (Fennemore Craig), El Dorado Holdings (EDH)

EDH noted that the Department has proposed designating Wagner Wash from the outfall of the Festival Ranch WRF (33°39'14"/112°40'18") to its confluence with the Hassayampa River as EDW, a distance of approximately 6 miles.

Festival Ranch WRF will discharge to Wagner Wash only when recharge and reuse options are not available. With this sort of sporadic discharge, and with the evapo-transpiration and percolation losses along the way, it is exceedingly unlikely that any effluent from the Festival Ranch WRF would ever reach the lower stretches of Wagner Wash.

For the foregoing reasons, EDH requests that if Wagner Wash is to be classified as an EDW, only that portion in reasonable proximity to the Festival Ranch WRF (i.e., that portion in which treated wastewater may actually flow) be so classified. The balance of Wagner Wash should remain unlisted (as it is now) or be listed as an ephemeral water.

Response: The Department has reviewed the listing and the capacity of the WWTP and agrees that the description of the EDW segment of Wagner Wash should initially be limited to 2 kilometers below the Festival Ranch WRF outfall. The entry in Appendix B has been revised to reflect this change.

Verde River

Comment #156

Wang Yu, Salt River Pima-Maricopa Indian Community

EPNR has concerns pertaining to the proposed total phosphorus and total nitrogen standards established for the Verde River and its tributaries indicated on page 1346 of the Notice of Proposed Rulemaking (Volume 14, Issue 17).

In addition to other designated uses, the approximate 2-mile portion of the Verde River located within SRPMIC has always been regarded by its members for its sacred, cultural, and ceremonial significance. It is understood that these proposed standards apply only on the non-tribal portion of the Verde River and its tributaries upstream of SRPMIC, nevertheless the proposed standards established by ADEQ for total phosphorus (0.10 mg/L) for annual mean and 1.00 mg/L for single maximum) and total nitrogen (1.00 for annual mean and 3.00 for single maximum) still appear to be a bit too high with respect to the sacred, cultural, and ceremonial significance by SRPMIC on the portion of its Verde River downstream.

Response: The Department has not made any changes to this Section. However, the Department acknowledges that it does not have jurisdiction to adopt surface water quality standards for the Verde River and its tributaries located within the tribal lands of the Salt River Pima-Maricopa Indian Community. The Department is committed to working proactively with tribal governments to ensure off-site discharges, when and where proposed, are compatible with on-reservation designated uses.

APPENDIX C. SITE-SPECIFIC STANDARDS

Site-Specific Standard for Pinto Creek

The Department received a number of comments concerning its development of the site-specific standard for copper on Pinto Creek. These comments are on file with the Department. The commenters were generally opposed to the proposed standard of 42 µg/L for a variety of reasons including: consideration of past mining activities in the area, aerial deposition of copper from current and historic mines, impacts of wildfire, and the proximity of mining roads as well as other disturbances to areas thought to the “natural” background sites. The Department has reviewed these comments in detail, including photos of disturbed areas upstream of one or more of the Department’s sampling locations, which is new information to the Department. The Department had the modeling calculations revised based on the new information, and the resulting change in the proposed standard was significant. Based on the Department’s review of the new information and the modeling results, the Department is withdrawing the site-specific standard for Pinto Creek and will re-propose the standard under a separate rulemaking. The Department will notify each person who provided a comment on the Pinto Creek site-specific standard and other affected parties of the future rulemaking.

Yuma East Wetlands

Comment #157

Sandy Bahr, Sierra Club Grand Canyon Chapter

The Sierra Club understands that the U.S. Fish and Wildlife Service support the site-specific standards for the Yuma East Wetlands but have several questions.

Will these site-specific standards adequately protect wildlife since selenium is highly toxic to wildlife and invertebrate species. The proposed rule states that the site-specific standard of 2.2 µg/L of selenium is based on the natural background levels in that section of the Colorado River. ADEQ should focus on affording the highest protection for sensitive wildlife species. Excess levels of chlorine can also be toxic and can contribute to a decrease in reproductive performance and increases in embryonic mortality. We would appreciate some further explanation of how this standard was developed.

The proposed rule states that the Director has determined that a net ecological benefit will be achieved through these site-specific standards. However, due to the toxicity of both selenium and chlorine, it is possible that the Yuma Wetlands may become a wildlife sink rather than suitable habitat and could adversely impact resident species as well as migratory birds.

Response: The site-specific standards for chlorine and selenium that apply to the Yuma East Wetlands project will protect aquatic life and wildlife, including threatened and endangered species. The 2.2 µg/L Se site specific standard is based on the greatest concentration of selenium that the City of Yuma has measured in the Yuma East Wetlands receiving water. It represents the background concentration of Se in the lower Colorado River. The less stringent TRC criteria were derived using EPA recalculation procedures. The City of Yuma used the recalculation procedures following ADEQ recommendations for the recalculation. The rulemaking modifies the water quality standard applicable to this discharge for total residual chlorine to protect aquatic life from acute and chronic toxicity. The acute criterion is 33 µg/L and the chronic criterion is 20 µg/L. These criteria are based on EPA recalculation procedures and the species list for chlorine toxicity, which is located on the EPA web site at www.epa.gov/region7/water/chlorine. The only adjustment made in the recalculation procedure was to remove the organism *Daphnia magna* from the toxicity dataset. The resulting chlorine criteria, calculated from the modified dataset, are the criteria of 33 µg/L and 20 µg/L. See Appendix C, Site Specific Standards explanation in section #5 of the Preamble.

As the commenter notes, the U.S. Fish & Wildlife Service provided a letter of support for the proposed site-specific standards for chlorine and for selenium. The USFWS specifically supported the adoption of the acute and chronic total residual chlorine standards of 33 µg/L and 20 µg/L, respectively, and the proposed standard for selenium of 2.2 µg/L for the Yuma East Wetlands. The USFWS stated that the proposed modification of the selenium from 2.0 µg/L to 2.2 µg/L represented a minimal hazard to the aquatic and wildlife resources using the wetlands. It should be noted that the proposed site-specific standard for selenium is still more stringent than EPA's nationally recommended criterion of 5 µg/L to protect freshwater aquatic life.

ECONOMIC IMPACT STATEMENT

Comment #158

Fred H. Gray, City of Tucson – Parks and Recreation Department

In its economic impact statement in the preamble to its proposed rule, ADEQ specifically identifies only private wastewater utilities, mining operations and electric utilities as persons directly affected by this rulemaking, with vague references to the real estate and agricultural industries.

ADEQ does not identify municipalities and the tax-paying public. This rulemaking proposes changes that will inevitably increase costs to many Arizona citizens and municipalities. ADEQ makes no efforts to discuss any less intrusive or less costly alternative methods of achieving the purpose of the proposed rule. ADEQ's analysis should address the increased monitoring and maintenance costs imposed by enactment of this rule on management of urban lakes by municipalities. For example, the City of Tucson spent $250,000.00 to build and operate an aeration system to treat water at Lakeside Lake to manage for nutrient impacts. In the past year and a half, the City of Tucson has been forced to spend and additional $277,000.00 pertaining to required permits, and monitoring imposed by ADEQ. The City has also been required to abandon past efforts to use reclaimed water at the lake.

Response: The example of Lakeside Lake underscores the inherent incompatibility of using reclaimed water as the sole source of water for lakes and still meet surface water standards. The City of Tucson was not required to stop using reclaimed water at Lakeside, the choice was made based on the degree of phosphorus reduction needed (and cost of doing so) that was laid out in the TMDL report. Even before a proposed chlorophyll-*a* criterion, Lakeside Lake was listed as impaired due to low DO, high pH, and a history of fish kills.

General EIS Comments

The following comments refer primarily to costs associated with the rulemaking. The comments are produced here but the reader is directed to the Economic Impact Statement (EIS) for the comprehensive review of costs associated with the rulemaking. Topic-specific responses to comments not directly related to costs are provided in this portion of the Department's response to comments.

The Department appreciates that the following comments acknowledge the difficulty of quantifying costs and benefits of environmental rulemaking, which is particularly difficult at the proposed rulemaking stage. A proposed rule is required to have only a preliminary summary, as stated in A.R.S. § 41-1001(14)(a)(v): "The economic, small business and consumer impact summary, or in the case of a proposed rule, a preliminary summary and a solicitation of input on the accuracy of the summary." The Department has considered all comments received for the economic, small business, and consumer impact statement that is submitted to the Governor's Regulatory Review Council as required under A.R.S. § 41-1024(C).

Sydney Hay, Arizona Mining Association

It is admittedly difficult to quantify costs and benefits of environmental rulemakings. However, ADEQ must make at least a good faith effort to demonstrate that the proposed benefits of the rule exceed its costs.

The AMA can readily identify at least four manners in which private businesses could face increased costs based on these proposed rules: (1) the proposal to apply EDW criteria to discharges to ephemeral washes will require many discharge to meet stringent chronic aquatic life criteria for the first time; (2) as noted above, the proposed OAW designation of Davidson Canyon has already imposed costs on at least one entity, and the designation could impose potentially far greater costs in the future based on Tier 3 antidegradation requirements; (3) also as noted above, the ban on wastewater discharges to four ephemeral washes upgradient of the Ak-Chin Indian Reservation (this presumably was adopted in light of specific concerns with one or more existing or proposed discharges, so some cost information on the effects of the ban should be obtainable by ADEQ); and (4) the general tightening of numeric water quality criteria contained in the rule and the adoption of new implementation procedures for narrative criteria, including the new biological criterion.

The foregoing is not intended to be an exclusive summary of the potential increased costs, just an identification of some of the more obvious cases of increased costs that could be imposed by the proposed rule.

David E. McNeil, City of Tempe

The summary of economic, small business and consumer impact does not accurately account for costs and benefits of the proposed rule.

1. The summary does not address the monetary costs associated with nutrient removal to meet the criteria established under the narrative nutrient standard. With drought and climate change making the increased use of reclaimed water for lakes a necessity in Arizona, the rule fails to address the costs associated with the extreme nutrient removal that ADEQ is proposing.
2. The summary confuses the economic benefits associated with the general concept of "clean water" with the economic benefits that will result directly or indirectly from the changes that are being made to water quality standards through the proposed rulemaking. Economic benefits resulting from the rule should be limited to benefits that will incur from the changes in standards and that would not otherwise be realized in the absence of the rule changes, not the benefits that incur from "clean water" in general.

Robert Hollander, City of Phoenix

The Water Services Department believes that the preamble inadequately addresses the costs of the rules to political subdivisions, specifically, regarding wastewater treatment and other facilities operated by municipalities and counties. The Preamble devotes a substantial amount of time discussing the costs of complying with the numeric water quality criteria for ammonia. But other issues were not adequately addressed including: the potential cost of compliance with the proposed methylmercury standard of 0.3 mg/kg and the impact of the Narrative Nutrient Standard Implementation Procedures.

ADEQ has not clarified how they will implement the (methylmuercury) standard and if it will be implemented in permits. Considering the very low Aquatic and Wildlife chronic standard of 0.01 µg/L proposed for dissolved mercury, the Water Services Department remains concerned that ADEQ will derive a water column-based permit limit for methylmercury based on the fish tissue criterion. This could result in extremely low permit limits with a huge cost issue for dischargers. ADEQ needs to clarify how they intend to implement the proposed methylmercury standard and/or provide an analysis of the potential costs of removing this contaminant to comply with the standard and anticipated permit limits.

D. Lee Decker (Gallagher & Kennedy), Surface Water Quality Standards Coalition

In its economic impact statement in the preamble to its proposed rule, ADEQ specifically identifies only private wastewater utilities, mining operations and electric utilities as persons directly affected by this rulemaking, with vague references to the real estate and agricultural industries. ADEQ does not identify other persons and industries impacted by this proposed rule, including those in the construction industry, municipalities, and tourist industries. ADEQ provides no cost-benefit analysis of the proposed rule and only briefly mentions that "some business, industry, and consumers may have to pay higher utility bills for sewer services" but provides no analysis comparing these costs to the benefits of the proposed rule.

The Coalition requests that ADEQ reformulate its preamble to the proposed rule to (1) address the broad spectrum of citizens, industries, municipalities and small businesses impacted by this rule; (2) provide a true cost-benefit analysis and not simply a catalog of the general benefits of clean water and a brief mention of potentially higher utility bills; (3) recognize all costs imposed on citizens, small businesses, employers and municipalities beyond simply higher utility bills; and (4) consider potential alternative methods to minimize the costs and administrative burdens of this proposed rule.

Michael Gritzuk, Pima County Regional Wastewater Reclamation Department

ADEQ, in its EIS fails to address all the required analysis required by statute. ADEQ specifically mentions only wastewater utilities, mining operations, and electric utilities as potentially impacted by this rulemaking. Others that will certainly be impacted that ADEQ fails to mention are the construction and tourism industries as well as municipalities throughout Arizona. ADEQ also fails to provide a substantial discussion of the potential impacts of this rule upon small businesses including identification of those businesses that might be negatively impacted, a discussion of anticipated administrative costs to small businesses, and analysis of any methods ADEQ might undertake to reduce the regulatory burden on small business. ADEQ also provides no meaningful analysis of the potential costs of this rulemaking to the anticipated benefits.

Pima County has commissioned an analysis of the anticipated costs to county ratepayers that will result as a consequence of this rulemaking. The cost for Pima County government to comply with just three of the numerous proposed new rule provisions is conservatively estimated at between 90 million to 100 billion dollars. ADEQ has failed to properly address the impact of these costs upon the businesses and ratepayers within Pima County and has failed to discuss what steps ADEQ could take to minimize these impacts.

Pima County requests that ADEQ carefully consider all the impacts of these rules upon Arizona citizens and to fully comply with state statutory requirements by revising and republishing its EIS for stakeholder review and comment.

12. Any other matters prescribed by statute that are applicable to the specific agency or to any specific rule or class of rules:

None

13. Incorporations by reference and their location in the rules:

R18-11-110(B)	"2005 Review, Water Quality Standards for Salinity, Colorado River System," Colorado River Basin Salinity Control Forum (October, 2005)
R18-11-112(D)(4)(b)	"Endangered and Threatened Wildlife," 50 CFR 17.11 (Revised 2005)
	"Endangered and Threatened Plants," 50 CFR 17.12 (Revised 2005)
R18-11-115(C)(1)	"The Recalculation Procedure," Appendix L, pages 90 - 98, Water Quality Standards Handbook, Second Edition, EPA 823-B-94-005b (August 1994)
R18-11-115(C)(2)	"Water-Effects Ratio for Metals," Appendix L, pages 1 - 89, Water Quality Standards Handbook, Second Edition, EPA 823-B-94-005b (August 1994)
R18-11-115(C)(3)	"Streamlined Water Effects Ratio Procedure for Discharges of Copper," EPA-822-R-01-005 (March 2001)

14. Was this rule previously made as an emergency rule?

No

15. The full text of the rules follows:

TITLE 18. ENVIRONMENTAL QUALITY

CHAPTER 11. DEPARTMENT OF ENVIRONMENTAL QUALITY WATER QUALITY STANDARDS

ARTICLE 1. WATER QUALITY STANDARDS FOR SURFACE WATERS

Section

R18-11-101. Definitions
R18-11-102. Applicability
R18-11-107. Antidegradation
R18-11-107.01. Antidegradation Criteria
R18-11-108. Narrative Water Quality Standards
R18-11-108.01. Narrative Biological Criteria for Wadeable, Perennial Streams
R18-11-108.02. Narrative Bottom Deposit Criteria for Wadeable, Perennial Streams
R18-11-108.03. Narrative Nutrient Criteria for Lakes and Reservoirs
R18-11-109. Numeric Water Quality Standards
R18-11-110. Salinity Standards for the Colorado River

R18-11-111. Analytical Methods
R18-11-112. ~~Unique~~ Outstanding Arizona Waters
R18-11-113. ~~Effluent-dependent~~ Effluent-Dependent Waters
R18-11-114. Mixing Zones
R18-11-115. ~~Repealed~~ Site-specific Standards
R18-11-116. Resource ~~management agencies~~ Management Agencies
R18-11-117. Canals and ~~Municipal~~ Urban Park Lakes
R18-11-118. Dams and Flood Control Structures
R18-11-121. Schedules of Compliance
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Table 6. Acute Water Quality Standards for Dissolved Cadmium Aquatic and Wildlife ephemeral
Table 7. Acute Water Quality Standards for ~~dissolved~~ Dissolved Chromium III Aquatic and Wildlife coldwater, warmwater, and edw
Table 8. Chronic Water Quality Standards for ~~dissolved~~ Dissolved Chromium III Aquatic and Wildlife coldwater, warmwater, and edw
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Appendix B. ~~List of~~ Surface Waters and Designated Uses

Appendix C. ~~Repealed~~ Site-specific Standards

ARTICLE 1. WATER QUALITY STANDARDS FOR SURFACE WATERS

R18-11-101. Definitions

The following terms ~~of~~ apply to this Article ~~have the following meanings~~:

1. "Acute toxicity" means toxicity involving a stimulus severe enough to induce a rapid response ~~rapidly~~. In aquatic toxicity tests, an effect observed in 96 hours or less is considered acute.
~~2. "AgI" means agricultural irrigation.~~
~~3. "AgL" means agricultural livestock watering.~~
~~4.~~2. "Agricultural irrigation (AgI)" means the use of a surface water for ~~the irrigation of crops~~ crop irrigation.
~~5.~~3. "Agricultural livestock watering (AgL)" means the use of a surface water as a ~~supply of~~ water supply for consumption by livestock.
~~6.~~4. "Annual mean" ~~means~~ is the arithmetic mean of monthly values determined over a consecutive 12-month period, provided that monthly values are determined for at least three months. ~~The~~ A monthly value is the arithmetic mean of all values determined in a calendar month.
~~7.~~5. "Aquatic and wildlife (cold water) (A&Wc)" means the use of a surface water by animals, plants, or other cold-water organisms, generally occurring at ~~elevations~~ an elevation greater than 5000 feet, for habitation, growth, or propagation.
~~8.~~6. "Aquatic and wildlife (effluent-dependent water) (A&Wedw)" means the use of an effluent-dependent water by animals, plants, or other organisms for habitation, growth, or propagation.
~~9.~~7. "Aquatic and wildlife (ephemeral) (A&We)" means the use of an ephemeral water by animals, plants, or other organisms, excluding fish, for habitation, growth, or propagation.
~~10.~~8. "Aquatic and wildlife (warm water) (A&Ww)" means the use of a surface water by animals, plants, or other warm-water organisms, generally occurring at ~~elevations~~ an elevation less than 5000 feet, for habitation, growth, or propagation.
~~11. "A&Wc" means aquatic and wildlife (cold water).~~
~~12. "A&We" means aquatic and wildlife (ephemeral).~~
~~13. "A&Wedw" means aquatic and wildlife (effluent-dependent water).~~
~~14. "A&Ww" means aquatic and wildlife (warm water).~~
9. "Arizona Pollutant Discharge Elimination System (AZPDES)" means the point source discharge permitting program established under 18 A.A.C. 9, Article 9.
10. "Assimilative capacity" means the difference between the baseline water quality concentration for a pollutant and the most stringent applicable water quality criterion for that pollutant.
~~15.~~11. "Clean Water Act" means the Federal Water Pollution Control Act [33 U.S.C. 1251 to 1387].
~~16.~~12. "Criteria" means elements of water quality standards that are expressed as pollutant concentrations, levels, or narrative statements representing a water quality that supports a designated use.
13. "Critical flow condition" means the lowest flow over seven consecutive days that has a probability of occurring once in 10 years (7 Q 10).
14. "Deep lake" means a lake or reservoir with an average depth of more than 6 meters.
~~17.~~15. "Designated use" means a use specified in Appendix B of this Article for a surface water.
~~18.~~16. "Domestic water source (DWS)" means the use of a surface water as a source of potable water ~~supply~~. ~~Coagulation, sedimentation, filtration, disinfection, or other treatments~~ Treatment of a surface water may be necessary to yield a finished water suitable for human consumption.
~~19. "DWS" means domestic water source.~~
~~20. "EDW" means effluent-dependent water.~~
~~21.~~17. "Effluent-dependent water (EDW)" means a surface water, classified under R18-11-113, that consists of a point source ~~discharges~~ discharge of ~~treated~~ wastewater ~~that is classified as an effluent-dependent water by the Director under R18-11-113.~~ An effluent-dependent water is a surface water that, without the point source discharge of ~~treated~~ wastewater, would be an ephemeral water.
~~22.~~18. "Ephemeral water" means a surface water that has a channel that is at all times above the water table~~,~~ and ~~that~~ flows only in direct response to precipitation.
~~23.~~19. "Existing use" means ~~those uses actually~~ a use attained in the waterbody on or after November 28, 1975, whether or not ~~they are~~ it is included in the water quality standards.
~~24. "FBC" means full-body contact."~~
~~25. "FC" means fish consumption.~~
~~26.~~20. "Fish consumption (FC)" means the use of a surface water by humans for harvesting aquatic organisms for consumption. Harvestable aquatic organisms include, but are not limited to, fish, clams, turtles, crayfish, and frogs.
~~27.~~21. "Full-body contact (FBC)" means the use of a surface water for swimming or other recreational activity that causes the human body to come into direct contact with the water to the point of complete submergence. The use is such that

ingestion of the water is likely and sensitive body organs, such as the eyes, ears, or nose, may be exposed to direct contact with the water.

~~28.~~22. "Geometric mean" means the nth root of the product of n items or values. The geometric mean is calculated using the following formula:

$$GM_y = \sqrt[n]{(Y_1)(Y_2)(Y_3)...(Y_n)}$$

~~29.~~23. "Hardness" means the sum of the calcium and magnesium concentrations, expressed as calcium carbonate ($CaCO_3$) in milligrams per liter.

24. "Igneous lake" means a lake located in volcanic, basaltic, or granite geology and soils.

~~30.~~25. "Intermittent ~~surface~~ water" means a stream or reach ~~of a stream~~ that flows continuously only at certain times of the year, as when it receives water from a spring or from another surface source, such as melting snow.

~~31.~~26. "Mixing zone" means ~~a prescribed~~ an area or volume of a surface water that is contiguous to a point source discharge where ~~initial~~ dilution of the discharge takes place.

~~32. "National Pollutant Discharge Elimination System means the point source discharge permit program established by § 402 of the Clean Water Act [33 U.S.C. 1342].~~

~~33. "Ninetieth percentile" means the value that may not be exceeded by more than 10% of the observations in a consecutive 12 month period. A minimum of 10 samples, each taken at least 10 days apart, are required to determine a ninetieth percentile.~~

~~34. "NNS" means no numeric standard.~~

~~35.~~27. "Oil" means petroleum in any form, including ~~but not limited to~~ crude oil, gasoline, fuel oil, diesel oil, lubricating oil, or sludge.

28. "Outstanding Arizona water (OAW)" means a surface water that is classified as an outstanding state resource water by the Director under R18-11-112.

~~36.~~29. "Partial-body contact (PBC)" means the recreational use of a surface water that may cause the human body to come into direct contact with the water, but normally not to the point of complete submergence (for example, wading or boating). The use is such that ingestion of the water is not likely and sensitive body organs, such as the eyes, ears, or nose, will not normally be exposed to direct contact with the water.

~~37. "PBC" means partial-body contact."~~

~~38.~~30. "Perennial ~~surface~~ water" means a surface water that flows continuously throughout the year.

~~39.~~31. ~~"Pollutant" means fluids, contaminants, toxic wastes, toxic pollutants, dredged spoil, solid waste, substances and chemicals, pesticides, herbicides, fertilizers and other agricultural chemicals, incinerator residue, sewage, garbage, sewage sludge, munitions, petroleum products, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and mining, industrial, municipal, and agricultural wastes or any other liquid, solid, gaseous, or hazardous substance.~~ *"Pollutant" means fluids, contaminants, toxic wastes, toxic pollutants, dredged spoil, solid waste, substances and chemicals, pesticides, herbicides, fertilizers and other agricultural chemicals, incinerator residue, sewage, garbage, sewage sludge, munitions, petroleum products, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and mining, industrial, municipal, and agricultural wastes or any other liquid, solid, gaseous, or hazardous substance.* A.R.S § 49-201(29)

~~40.~~32. "Practical quantitation limit" means the lowest level of quantitative measurement that can be reliably achieved during a routine laboratory ~~operations~~ operation.

~~41. "Recreational uses" means the full-body contact and partial-body contact designated uses.~~

33. "Reference condition" means a set of ecological measurements from a population of relatively undisturbed waterbodies within a region that establish a basis for making comparisons of biological condition among samples.

~~42.~~34. "Regional Administrator" means the Regional Administrator of Region IX of the U.S. Environmental Protection Agency.

35. "Regulated discharge" means a point-source discharge regulated under an AZPDES permit, a discharge regulated by a § 404 permit, and any discharge authorized by a federal permit or license that is subject to state water quality certification under § 401 of the Clean Water Act.

36. "Riffle habitat" means a stream segment where moderate water velocity and substrate roughness produce moderately turbulent conditions that break the surface tension of the water and may produce breaking wavelets that turn the surface water into white water.

37. "Run habitat" means a stream segment where there is moderate water velocity that does not break the surface tension of the water and does not produce breaking wavelets that turn the surface water into white water.

38. "Sedimentary lake" means a lake or reservoir in sedimentary or karst geology and soils.

39. "Shallow lake" means a lake or reservoir, excluding an urban lake, with a smaller, flatter morphology and an average depth of less than 3 meters and a maximum depth of less than 4 meters.

40. "Significant degradation" means:

a. The consumption of 20 percent or more of the available assimilative capacity for a pollutant of concern at critical flow conditions, or

b. Any consumption of assimilative capacity beyond the cumulative cap of 50 percent of assimilative capacity.

~~43.~~41. "Surface water" means a water of the United States and includes the following:

a. A water that is currently used, was used in the past, or may be susceptible to use in interstate or foreign commerce;

b. An interstate water, including an interstate wetland;

c. All other waters, such as an intrastate lake, reservoir, natural pond, river, stream (including an intermittent or ephemeral stream), creek, wash, draw, mudflat, sandflat, wetland, slough, backwater, prairie pothole, wet meadow, or playa lake, the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including any such water:

i. That is or could be used by interstate or foreign travelers for recreational or other purposes;

ii. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

iii. That is used or could be used for industrial purposes by industries in interstate or foreign commerce;

d. An impoundment of a surface water as defined by this definition;

e. A tributary of a surface water identified in subsections ~~(a)~~ (41)(a) through (d) ~~of this definition~~; and

f. A wetland adjacent to a surface water identified in subsections ~~(a)~~ (41)(a) through (e) ~~of this definition~~.

~~44.~~42. "Total nitrogen" means the sum of the concentrations of ammonia (NH_3), ammonium ion (NH_4+), nitrite (NO_2), and nitrate (NO_3), and dissolved and particulate organic nitrogen expressed as elemental nitrogen.

~~45.~~43. "Total phosphorus" means all of the phosphorus present in a sample, regardless of form, as measured by a persulfate digestion procedure.

~~46.~~44. "Toxic" means a pollutant or combination of pollutants, that after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism, either directly from the environment or indirectly by ingestion through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations in the organism or its offspring.

~~47. "Unique water" means a surface water that is classified as an outstanding state resource water by the Director under R18-11-112.~~

45. "Urban lake" means a manmade lake within an urban landscape.

~~48.~~46. "Use attainability analysis" means a structured scientific assessment of the factors affecting the attainment of a designated use including physical, chemical, biological, and economic factors.

47. "Wadeable" means a surface water can be safely crossed on foot and sampled without a boat.

48. "Wastewater" does not mean:

a. Stormwater;

b. Discharges authorized under the De Minimus General Permit;

c. Other allowable non-stormwater discharges permitted under the Construction General Permit or the Multi-sector General Permit; or

d. Stormwater discharges from a municipal storm sewer system (MS4) containing incidental amounts of non-stormwater that the MS4 is not required to prohibit.

49. "Wetland" means an area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. A wetland includes a swamp, marsh, bog, cienega, tinaja, and similar areas.

50. "Zone of passage" means a continuous water route of volume, cross-sectional area, and quality necessary to allow passage of free-swimming or drifting organisms with no acutely toxic effect produced on the organisms.

R18-11-102. Applicability

A. The water quality standards prescribed in this Article apply to surface waters.

B. The water quality standards prescribed in this Article do not apply to the following:

1. A waste treatment system, including an impoundment, pond, lagoon, or constructed wetland that is a part of the waste treatment system~~.~~;

2. A man-made surface impoundment and any associated ~~ditches~~ ditch and ~~conveyances~~ conveyance used in the extraction, beneficiation, or processing of metallic ores that is not a surface water or is located in an area that once was a surface water but is no longer a surface water because it has been and remains legally converted, including:

a. ~~a~~ A pit,

b. ~~pregnant~~ Pregnant leach solution pond,

c. ~~raffinate~~ Raffinate pond,

d. ~~tailing~~ Tailing impoundment,

e. ~~decant~~ Decant pond,

f. ~~pond~~ Pond or a sump in a mine pit associated with dewatering activity,

g. ~~pond~~ Pond holding water that has come into contact with a process or product and that is being held for recycling,

h. ~~spill~~ Spill or upset catchment pond, or

i. A pond used for onsite remediation~~, that is not a surface water or is located in an area that once was a surface water but no longer remains a surface water because it has been and remains legally converted.~~;

3. A man-made cooling pond that is neither created in a surface water nor results from the impoundment of a surface water; or
4. A surface water located on tribal lands.

R18-11-107. Antidegradation

A. The Director shall, using R18-11-107.01 and this Section, determine whether there is degradation of water quality in a surface water on a pollutant-by-pollutant basis.

B. Tier 1: The level of water quality necessary to ~~protect~~ support an existing ~~uses~~ use shall be maintained and protected. No degradation of existing water quality is permitted in a surface water where the existing water quality does not meet the applicable water quality standards.

C. Tier 2: Where existing water quality in a surface water is better than the applicable water quality standard~~,~~ the existing water quality shall be maintained and protected. The Director may allow ~~limited~~ degradation of existing water quality in the surface water, ~~provided that the Department holds a public hearing on whether degradation should be allowed under the general public hearing procedures prescribed at R18-1-401 and R18-1-402 and~~ if the Director makes all of the following findings:

1. The ~~level of~~ water quality necessary ~~to protect~~ for existing uses is fully protected~~. Water~~ and water quality ~~shall~~ is not ~~be~~ lowered to a level that does not comply with applicable water quality standards~~.~~,
2. The highest statutory and regulatory requirements for new and existing point sources are achieved~~.~~,
3. All cost-effective and reasonable best management practices for nonpoint source pollution control are implemented~~.~~, and
4. Allowing lower water quality is necessary to accommodate important economic or social development in the area where the surface water is located.

D. Tier 3: Existing water quality shall be maintained and protected in a surface water that is classified as ~~a unique water~~ an OAW under R18-11-112. ~~The Director shall not allow limited degradation~~ Degradation of ~~a unique water~~ an OAW under subsection (C) is prohibited.

E. The ~~Department~~ Director shall implement this Section in a manner consistent with § 316 of the Clean Water Act [33 U.S.C. ~~§~~ 1326] if a potential water quality impairment associated with a thermal discharge is involved.

R18-11-107.01. Antidegradation Criteria

A. Tier 1 antidegradation protection.

1. Tier 1 antidegradation protection applies to the following surface waters:
   a. A surface water listed on the 303(d) list for the pollutant that resulted in the listing,
   b, An effluent dependent water,
   c. An ephemeral water,
   d. An intermittent water, and
   e. A canal listed in Appendix B.
2. A regulated discharge shall not cause a violation of a surface water quality standard or a wasteload allocation in a total maximum daily load approved by EPA.
3. Except as provided in subsections (E) and (F), Tier 1 antidegradation review requirements are satisfied for a point-source discharge regulated under an individual AZPDES permit to an ephemeral water, effluent dependent water, intermittent water, or a canal listed in Appendix B, if water quality-based effluent limitations designed to achieve compliance with applicable surface water quality standards are established in the permit and technology-based requirements of the Clean Water Act for the point source discharge are met.

B. Tier 2 antidegradation protection.

1. Tier 2 antidegradation protection applies to a perennial water with existing water quality that is better than applicable water quality standards. A perennial water that is not listed in subsection (A)(1) nor classified as an OAW under A.A.C. R18-9-112(G) has Tier 2 antidegradation protection for all pollutants of concern.
2. A regulated discharge that meets the following criteria, at critical flow conditions, does not cause significant degradation:
   a. The regulated discharge consumes less than 20 percent of the available assimilative capacity for each pollutant of concern, and
   b. At least 50 percent of the assimilative capacity for each pollutant of concern remains available in the surface water for each pollutant of concern.
3. Antidegradation review. Any person proposing a new or expanded regulated discharge under an individual AZPDES permit that may cause significant degradation shall provide the Department with the following information:
   a. Alternative analysis.
      i. The person seeking authorization for the discharge shall prepare and submit a written analysis of alternatives to the discharge. The analysis shall provide information on all reasonable, cost-effective, less-degrading or

non-degrading discharge alternatives. Alternatives may include wastewater treatment process changes or upgrades, pollution prevention measures, source reduction, water reclamation, alternative discharge locations, groundwater recharge, land application or treatment, local pretreatment programs, improved operation and maintenance of existing systems, seasonal or controlled discharge to avoid critical flow conditions, and zero discharge;

ii. The alternatives analysis shall include cost information on base pollution control measures associated with the regulated discharge and cost information for each alternative;

iii. The person shall implement the alternative that is cost-effective and reasonable, results in the least degradation, and is approved by the Director. An alternative is cost-effective and reasonable if treatment costs associated with the alternative are less than a 10 percent increase above the cost of base pollution control measures;

iv. For purposes of this subsection, "base pollution control measures" are water pollution control measures required to meet technology-based requirements of the Clean Water Act and water quality-based effluent limits designed to achieve compliance with applicable water quality standards;

b. Social and economic justification. The person shall demonstrate to the Director that significant degradation is necessary to accommodate important economic or social development in the local area. The person seeking authorization for the discharge shall prepare a written social and economic justification that includes a description of the following:

i. The geographic area where significant degradation of existing water quality will occur;

ii. The current baseline social and economic conditions in the local area;

iii. The net positive social and economic effects of development associated with the regulated discharge and allowing significant degradation;

iv. The negative social, environmental, and economic effects of allowing significant degradation of existing water quality; and

v. Alternatives to the regulated discharge that do not significantly degrade water quality yet may yield comparable social and economic benefits;

c. Baseline characterization. A person seeking authorization to discharge under an individual AZPDES permit to a perennial water shall provide baseline water quality data on pollutants of concern where no data exist or there are insufficient data to characterize baseline water quality and to determine available assimilative capacity. A discharger shall characterize baseline water quality at a location upstream of the proposed discharge location; and

4. For purposes of this Section, the term "pollutant of concern" means a pollutant with either a numeric or narrative water quality standard.

5. Public participation. The Director shall provide public notice and an opportunity to comment on an antidegradation review under subsection (B)(3) and shall provide an opportunity for a public hearing under A.A.C. R18-9-A908(B).

C. Tier 3 antidegradation protection.

1. Tier 3 antidegradation protection applies only to an OAW listed in R18-11-112(G).
2. A new or expanded point-source discharge directly to an OAW is prohibited.
3. A person seeking authorization for a regulated discharge to a tributary to, or upstream of, an OAW shall demonstrate in a permit application or in other documentation submitted to the Department that the regulated discharge will not degrade existing water quality in the downstream OAW.
4. A discharge regulated under a § 404 permit that may affect existing water quality of an OAW requires an individual § 401 water quality certification to ensure that existing water quality is maintained and protected and any water quality impacts are temporary. Temporary water quality impacts are those impacts that occur for a period of six months or less.

D. Antidegradation review of a § 404 permit. The Director shall conduct the antidegradation review of any discharge authorized under a nationwide or regional § 404 permit as part of the § 401 water quality certification prior to issuance of the nationwide or regional permit. The Director shall conduct the antidegradation review of an individual § 404 permit if the discharge may degrade existing water quality in an OAW or a water listed on the 303(d) List of impaired waters. For regulated discharges that may degrade water quality in an OAW or a water that is on the 303(d) List of impaired waters, the Director shall conduct the antidegradation review as part of the § 401 water quality certification process.

E. Antidegradation review of an AZPDES stormwater permit. An individual stormwater permit for a municipal separate storm sewer system (MS4) meets antidegradation requirements if the permittee complies with the permit, including developing a stormwater management plan containing controls that reduce the level of pollutants in stormwater discharges to the maximum extent practicable.

F. Antidegradation review of a general permit. The Director shall conduct the antidegradation review of a regulated discharge authorized by a general permit at the time the general permit is issued or renewed. A person seeking authorization to discharge under a general permit is not required to undergo an individual antidegradation review at the time the Notice of Intent is submitted unless the discharge may degrade existing water quality in an OAW or a water listed on the 303(d) List of impaired waters.

R18-11-108. Narrative Water Quality Standards

A. A surface water shall ~~be free from~~ not contain pollutants in amounts or combinations that:
1. Settle to form bottom deposits that inhibit or prohibit the habitation, growth, or propagation of aquatic life;
2. Cause objectionable odor in the area in which the surface water is located;
3. Cause off-taste or odor in drinking water;
4. Cause off-flavor in aquatic organisms;
5. Are toxic to humans, animals, plants, or other organisms;
6. Cause the growth of algae or aquatic plants that inhibit or prohibit the habitation, growth, or propagation of other aquatic life or that impair recreational uses;
7. Cause or contribute to a violation of an aquifer water quality standard prescribed in R18-11-405 or R18-11-406; or
8. Change the color of the surface water from natural background levels of color.

B. A surface water shall ~~be free from~~ not contain oil, grease, ~~and~~ or any other ~~pollutants~~ pollutant that ~~float~~ floats as debris, foam, or scum; or that ~~cause~~ causes a film or iridescent appearance on the surface of the water; or that ~~cause~~ causes a deposit on a shoreline, bank, or aquatic vegetation. The discharge of lubricating oil or gasoline associated with the normal operation of a recreational watercraft is not a violation of this narrative standard.

C. ~~A discharge of suspended solids to a surface water shall not be~~ A surface water shall not contain a discharge of suspended solids in quantities or concentrations that ~~either~~ interfere with the treatment processes at the nearest downstream potable water treatment plant or substantially increase the cost of handling solids produced at the nearest downstream potable water treatment plant.

D. A surface water shall not contain solid waste such as refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, appliances, or tires.

E. A wadeable, perennial stream shall support and maintain a community of organisms having a taxa richness, species composition, tolerance, and functional organization comparable to that of a stream with reference conditions in Arizona.

R18-11-108.01. Narrative Biological Criteria for Wadeable, Perennial Streams

A. The narrative biological criteria in this Section apply to a wadeable, perennial stream with either an aquatic and wildlife (cold water) or an aquatic and wildlife (warm water) designated use.

B. The biological standard in R18-11-108(E) is met when a bioassessment result, as measured by the Arizona Index of Biological Integrity (IBI), for cold or warm water is:
1. Greater than or equal to the 25th percentile of reference condition, or
2. Greater than the 10th percentile of reference condition and less than the 25th percentile of reference condition and a verification bioassessment result is greater than or equal to the 25th percentile of reference condition.

C. Arizona Index of Biological Integrity (IBI) scores.

Bioassessment Result	Index of Biological Integrity Scores	
	A&Wc	A&Ww
Greater than or equal to the 25th percentile of reference condition	≥52	≥50
Greater than the 10th and less than the 25th percentile of reference condition	46 - 51	40 - 49

R18-11-108.02. Narrative Bottom Deposit Criteria for Wadeable, Perennial Streams

A. The narrative bottom deposit criteria in this Section apply to wadeable, perennial streams with an aquatic and wildlife (cold water) or an aquatic and wildlife (warm water) designated use.

B. The narrative water quality standard for bottom deposits at R18-11-108(A)(1) is met when:
1. The percentage of fine sediments in the riffle habitats of a wadeable, perennial stream with an A&Wc designated use, as determined by a riffle pebble count, is less than or equal to 30 percent.
2. The percentage of fine sediments in all stream habitats of a wadeable, perennial stream with an A&Ww designated use, as determined by a reach level pebble count, is equal to or less than 50 percent.

R18-11-108.03. Narrative Nutrient Criteria for Lakes and Reservoirs

A. The narrative nutrient criteria in this Section apply to those lakes and reservoirs categorized in Appendix B.

B. The narrative water quality standard for nutrients at R18-11-108(A)(6) is met when, based on a minimum of two lake sample events conducted during the peak season based on lake productivity, the results show an average chlorophyll-*a* value below the applicable threshold for designated use and lake and reservoir category in subsection (D).
1. The mean chlorophyll-*a* concentration is less than the lower value in the target range chlorophyll-*a* for the lake and reservoir category; or
2. The mean chlorophyll-*a* concentration is within the target range for the lake and reservoir category and:
   a. The mean blue green algae count is at or below 20,000 per milliliter, and
   b. The blue green algae count is less than 50 percent of the total algae count, and
   c. There is no evidence of nutrient-related impairments such as:
      i. An exceedance of dissolved oxygen or pH standards;
      ii. A fish kill coincident with a dissolved oxygen or pH exceedance;

iii. A fish kill or other aquatic organism mortality coincident with algal toxicity;
iv. Secchi depth is less than the lower value prescribed for the lake and reservoir category;
v. A nuisance algal bloom is present in the limnetic portion of the lake or reservoir; or
vi. The concentration of total phosphorous, total nitrogen, or total Kjehldal nitrogen (TKN) is greater than the upper value in the range prescribed for the lake and reservoir category; or

3. For a shallow lake. In addition to meeting the mean chlorophyll-*a* concentrations in subsections (B)(1) or (2), submerged aquatic vegetation covers 50 percent or less of the lake bottom and there is less than a 5 mg/L swing in diel-dissolved oxygen concentration measured within the photic zone.

C. The following threshold ranges apply during the peak season for lake productivity:
1. Warm water lakes peak season, April – October;
2. Cold water lakes peak season, May – September.

D. The following table lists the numeric targets for lakes and reservoirs.

NUMERIC TARGETS FOR LAKES AND RESERVOIRS

Designated Use	Lake Category	Chl-*a* (µg/L)	Secchi Depth (m)	Total Phosphorus (µg/L)	Total Nitrogen (mg/L)	Total Kjehldal Nitrogen (TKN) (mg/L)	Blue-Green Algae (per ml)	Blue-Green Algae (% of total count)	Dissolved Oxygen (mg/L)	pH (SU)
FBC and PBC	Deep	10-15	1.5-2.5	70-90	1.2-1.4	1.0-1.1	20,000			6.5-9.0
	Shallow	10-15	1.5-2.0	70-90	1.2-1.4	1.0-1.1				
	Igneous	20-30	0.5-1.0	100-125	1.5-1.7	1.2-1.4				
	Sedimentary	20-30	1.5-2.0	100-125	1.5-1.7	1.2-1.4				
	Urban	20-30	0.5-1.0	100-125	1.5-1.7	1.2-1.4				
A&Wc	All	5-15	1.5-2.0	50-90	1.0-1.4	0.7-1.1		<50	7 (top m)	6.5-9.0
A&Ww	All (except urban lakes)	25-40	0.8-1.0	115-140	1.6-1.8	1.3-1.6			6 (top m)	
	Urban	30-50	0.7-1.0	125-160	1.7-1.9	1.4-1.7			6 (top m)	
A&Wedw	All	30-50	0.7-1.0	125-160	1.7-1.9	1.4-1.7				6.5-9.0
DWS	All	10-20	0.5-1.5	70-100	1.2-1.5	1.0-1.2	20,000			5.0-9.0

R18-11-109. Numeric Water Quality Standards

A. *E. coli* bacteria. The following water quality standards for ~~Escherichia coli (E. coli),~~ *Escherichia coli (E. coli)* are expressed in colony forming units per 100 milliliters of water (cfu / 100 ml)~~,~~ or as a Most Probable Number (MPN): ~~shall not be exceeded~~

~~E. coli~~ ***E. coli***	**FBC**	**PBC**
Geometric mean (~~four-sample~~ minimum of four samples in 30 days)	126	126
Single sample maximum	235	~~576~~ 575

B. pH. The following water quality standards for pH~~,~~ are expressed in standard units~~, shall not be violated~~:

pH	**DWS**	**FBC, PBC, A&W** [1]	**AgI**	**AgL**
Maximum	9.0	9.0	9.0	9.0
Minimum	5.0	6.5	4.5	6.5
~~Maximum change due to discharge~~	~~NNS~~	~~0.5~~	~~NNS~~	~~NNS~~

C. The ~~following~~ maximum allowable increase in ambient water temperature, ~~expressed in degrees Celsius, shall not be exceeded~~ due to a thermal discharge is as follows:

~~**Temperature**~~	~~**A&Ww, A&Wedw**~~	~~**A&Wc**~~
~~Maximum increase due to a thermal discharge~~ [2,3]	~~3.0~~	~~1.0~~

A&Ww	**A&Wedw**	**A&Wc**
3.0° C	3.0° C	1.0° C

D. Suspended sediment concentration.
1. The following water quality ~~standard~~ standards for suspended sediment concentration, expressed in milligrams per liter (mg/L), are expressed as a ~~geometric mean~~ median value ~~(four-sample minimum)~~ determined from a minimum

of four samples collected at least seven days apart shall not be exceeded. The standard applies to a surface water that is at or near base flow and does not apply to a surface water during or soon after a precipitation event:

A&Wc, A&Ww
80 mg / L

A&Wc	A&Ww
25	80

2. The Director shall not use the results of a suspended sediment concentration sample collected during or within 48 hours after a local storm event to determine the median value.

E. Dissolved oxygen. The following are the water quality standards for dissolved oxygen, are expressed in milligrams per liter (mg/L). The dissolved oxygen concentration in a surface water shall not fall below the following minimum concentrations:

1.

Dissolved oxygen	A&Ww	A&Wc
Single sample minimum [4] [2]	6.0	7.0

2.

Dissolved oxygen in effluent-dependent waters (single sample minimum):	A&W edw
Three hours after sunrise to sunset	3.0
Sunset to three hours after sunrise	1.0

3. A surface water is in compliance meets with the water quality standard for dissolved oxygen if the percent saturation of dissolved oxygen is equal to or greater than 90% 90 percent.

F. Nutrient criteria. The following water quality standards for total phosphorus and total nitrogen, are expressed in milligrams per liter (mg/L), shall not be exceeded:. A minimum of 10 samples, each taken at least 10 days apart in a consecutive 12-month period, are required to determine a 90th percentile. Not more than 10 percent of the samples may exceed the 90th percentile value listed below:

		Annual Mean	90th percentile	Single Sample Maximum
1. Verde River and its tributaries from headwaters to Bartlett Lake:	Total phosphorus Total nitrogen	0.10 1.00	0.30 1.50	1.00 3.00
2. Black River, Tonto Creek, and their tributaries that are not located on tribal lands:	Total phosphorus Total nitrogen	0.10 0.50	0.20 1.00	0.80 2.00
3. Salt River and its tributaries that are not located on tribal lands but not Pinal Creek above Theodore Roosevelt Lake:	Total phosphorus Total nitrogen	0.12 0.60	0.30 1.20	1.00 2.00
4. Theodore Roosevelt, Apache, Canyon, and Saguaro Lakes:	Total phosphorus Total nitrogen	0.03 [5] 0.30 [5]	NNS NNS	0.60 [6] 1.00 [6]
5. Salt River below Stewart Mountain Dam to confluence with the Verde River:	Total phosphorus Total nitrogen	0.05 0.60	NNS NNS	0.20 3.00
6. Little Colorado River and its tributaries above River Reservoir in Greer, South Fork of Little Colorado River above South Fork Campground, Water Canyon Creek above Apache-Sitgreaves National Forest boundary:	Total phosphorus Total nitrogen	0.08 0.60	0.10 0.75	0.75 1.10
7. Little Colorado River at the crossing of Apache County Road No. 124:	Total phosphorus Total nitrogen	NNS NNS	NNS NNS	0.75 1.80
8. Little Colorado River above Lyman Lake to above the Amity Ditch diversion near crossing of Arizona Highway 273 (applies only when in-stream turbidity is less than 50 NTU):	Total phosphorus Total nitrogen	0.20 0.70	0.30 1.20	0.75 1.50
9. Colorado River, at Northern International Boundary near Morelos Dam:	Total phosphorus Total nitrogen	NNS NNS	0.33 2.50	NNS NNS

10. San Pedro River, from Curtis to Benson:	Total phosphorus Total nitrate as N	NNS NNS	NNS NNS	NNS 10.00
11. The discharge of wastewater to Show Low Creek and tributaries upstream of and including Fools Hollow Lake shall not exceed 0.16 mg/L total phosphates as P.				
12. The discharge of wastewater to the San Francisco River and tributaries upstream of Luna Lake Dam shall not exceed 1.0 mg/L total phosphates as P.				

Surface Water	Annual Mean	90th Percentile	Single Sample Maximum
1. Verde River and its tributaries from the Verde headwaters to Bartlett Lake:			
Total phosphorus	0.10	0.30	1.00
Total nitrogen	1.00	1.50	3.00
2. Black River, Tonto Creek, and their tributaries that are not located on tribal lands:			
Total phosphorus	0.10	0.20	0.80
Total nitrogen	0.50	1.00	2.00
3. Salt River and its tributaries above Roosevelt Reservoir, excluding Pinal Creek, that are not located on tribal lands:			
Total phosphorus	0.12	0.30	1.00
Total nitrogen	0.60	1.20	2.00
4. Salt River below Stewart Mountain Dam to its confluence with the Verde River:			
Total phosphorus	0.05		0.20
Total nitrogen	0.60		3.00
5. Little Colorado River and its tributaries above River Reservoir in Greer, South Fork of Little Colorado River above South Fork Campground, and Water Canyon Creek above Apache-Sitgreaves National Forest boundary:			
Total phosphorus	0.08	0.10	0.75
Total nitrogen	0.60	0.75	1.10
6. Little Colorado River at the crossing of Apache County Road No. 124:			
Total phosphorus			0.75
Total nitrogen			1.80
7. Little Colorado River above Lyman Lake to above the Amity Ditch diversion near crossing of Arizona Highway 273 (applies only when in-stream turbidity is less than 50 NTU):			
Total phosphorus	0.20	0.30	0.75
Total nitrogen	0.70	1.20	1.50
8. Colorado River at the Northern International Boundary near Morelos Dam:			
Total phosphorus		0.33	
Total nitrogen		2.50	
9. Oak Creek from its headwaters at 35°01'30"/111°44'12" to its confluence with the Verde River at 34°40'41"/111°56'30" and the West Fork of Oak Creek from its headwaters at 35°02'44"/111°54'48" to its confluence with Oak Creek at 34°59'14"/111°44'46".			
Total phosphorus	1.00	1.50	2.50
Total nitrogen	0.10	0.25	0.30
10. No discharge of wastewater to Show Low Creek or its tributaries upstream of and including Fools Hollow Lake shall exceed 0.16 mg/L total phosphates as P.			
11. No discharge of wastewater to the San Francisco River or its tributaries upstream of Luna Lake Dam shall exceed 1.0 mg/L total phosphates as P.			

G. The following water quality standards for radiochemicals shall not be exceeded in surface waters with the domestic water source designated use:

1. The concentration of gross alpha particle activity, including radium-226, but excluding radon and uranium, shall not exceed 15 picocuries per liter of water.
2. The concentration of combined radium-226 and radium-228 shall not exceed five picocuries per liter of water.

~~3. The concentration of strontium-90 shall not exceed 8 eight picocuries per liter of water.~~
~~4. The concentration of tritium shall not exceed 20,000 picocuries per liter of water.~~
~~5. The average annual concentration of beta particle activity and photon emitters from manmade radionuclides shall not produce an annual dose equivalent to the total body or any internal organ greater than four millirems per year.~~

Footnotes:

[1] Includes A&Wc, A&Ww, A&Wedw, and A&We.

~~[2] Does not apply to Cholla Lake.~~

~~[3] Does not apply to a wastewater treatment plant discharge to a dry watercourse that creates an effluent-dependent water or to a stormwater discharge.~~

[~~4~~2] The dissolved oxygen water quality standard for a lake ~~shall apply~~ applies below the water surface but not at a depth greater than one meter.

~~[5] Means the annual mean of representative composite samples taken from the surface and at two and five meter depths.~~

~~[6] Means the maximum for any set of representative composite samples taken from the surface and at two and five meter depths.~~

R18-11-110. Salinity Standards for the Colorado River

A. The flow-weighted average annual salinity in the lower main stem of the Colorado River shall ~~be maintained at or below~~ not exceed the following ~~concentrations~~ criteria:

Location	Total Dissolved Solids
Below Hoover Dam	723 mg/L
Below Parker Dam	747 mg/L
At Imperial Dam	879 mg/L

B. ~~To preserve the basin-wide approach to salinity control developed by the Colorado River Basin states and to ensure compliance with the numeric criteria for sali.nity in subsection (A), the Department adopts the~~ The plan of implementation contained in the "~~1999~~ 2005 Review, Water Quality Standards for Salinity, Colorado River System," approved October 2005, ~~Colorado River Basin Salinity Control Forum, 106 West 500 South, Suite 101, Bountiful, Utah 84010-6232 (June, 1999), which is incorporated by reference and on file with the Office of the Secretary of State and the Department~~ is incorporated by reference to preserve the basin-wide approach to salinity control developed by the Colorado River Basin Salinity Control Forum and to ensure compliance with the numeric criteria for salinity in subsection (A). ~~This incorporation by reference contains no future editions or amendments.~~ This material does not include any later amendments or editions of the incorporated material. Copies of the incorporated material are available for inspection at the Arizona Department of Environmental Quality, 1110 West Washington Street, Phoenix, Arizona 85007 or may be obtained from the Colorado River Basin Salinity Control Forum, 106 West 500 South, Suite 101, Bountiful, Utah 84010-6232.

R18-11-111. Analytical Methods

A. A person conducting an analysis of a sample taken to determine compliance with a water quality standard shall use an ~~approved~~ analytical method prescribed in ~~9 A.A.C. 14, Article 6~~ A.A.C. R9-14-610, 40 CFR 136.3, or an alternative analytical method ~~that is~~ approved ~~by the Director of the Arizona Department of Health Services~~ under ~~R9-16-610(B)~~ A.A.C. R9-14-610(C).

B. A test result from a sample taken to determine compliance with a water quality standard is valid only if the sample is analyzed by a laboratory that is licensed by the Arizona Department of Health Services, an out-of-state laboratory licensed under A.R.S. § 36-495.14, or a laboratory exempted under A.R.S. § 36-495.02, for the analysis performed.

R18-11-112. ~~Unique~~ Outstanding Arizona Waters

A. The Director shall classify a surface water as ~~a unique water~~ an outstanding Arizona water (OAW) by rule. ~~The Director shall consider nominations to classify a surface water as a unique water during the triennial review of water quality standards for surface waters.~~

B. The Director may adopt, ~~by rule~~ under R18-11-115, a site-specific ~~water quality standards~~ standard to maintain and protect existing water quality in ~~a unique water~~ an OAW.

C. Any person may nominate a surface water for classification as ~~a unique water~~ an OAW by filing a nomination with the ~~Department~~ Director. The nomination ~~to classify a surface water as a unique water~~ shall include:

1. A map and a description of the surface water;
2. A written statement in support of the nomination, including specific reference to the applicable criteria for ~~unique water~~ an OAW classification prescribed in subsection (D);
3. Supporting evidence demonstrating that the ~~applicable unique water~~ criteria prescribed in subsection (D) are met; and
4. Available water quality data relevant to establishing the baseline water quality of the proposed ~~unique water~~ OAW.

D. The Director may classify a surface water as ~~a unique water upon finding that the surface water is an outstanding state resource water~~ an OAW based upon the following criteria:

1. The surface water is a perennial or intermittent water;

2. The surface water is in a free-flowing condition. For purposes of this subsection, "in a free-flowing condition" means that a surface water does not have an impoundment, diversion, channelization, rip-rapping or other bank armor, or another hydrological modification within the reach nominated for ~~a unique water~~ an OAW classification;
3. The surface water has good water quality. For purposes of this subsection, "good water quality" means that the surface water has water quality that meets or ~~exceeds~~ is better than applicable surface water quality standards. A surface water that is listed as impaired under ~~§ 303(d) of the Clean Water Act (33 U.S.C. § 1313)~~ R18-11-604(E) is ineligible for ~~unique waters~~ OAW classification; and
4. The surface water meets one or both of the following conditions:
   a. The surface water is of exceptional recreational or ecological significance because of its unique attributes, ~~including but not limited to, attributes related to~~ such as the geology, flora~~,~~ and fauna, water quality, aesthetic ~~values~~ value, or the wilderness ~~characteristics~~ characteristic of the surface water~~.~~;
   b. ~~Threatened or endangered species are known to be~~ An endangered or threatened species is associated with the surface water and the existing water quality is essential to the species' maintenance and propagation ~~of a threatened or endangered species~~ or the surface water provides critical habitat for ~~a~~ the threatened or endangered species. ~~Endangered or~~ An endangered or threatened species ~~are~~ is identified in "Endangered and Threatened Wildlife ~~and Plants~~," 50 CFR ~~§~~ 17.11 (revised 2005), and ~~§~~ "Endangered and Threatened Plants," 50 CFR 17.12 (revised ~~as of October 1, 2000~~ 2005). ~~which~~ This material is incorporated by reference ~~and on file with the Department and the Office of the Secretary of State. This incorporation by reference contains no future editions or amendments.~~ and does not include any later amendments or editions of the incorporated material. Copies of the incorporated material are available for inspection at the Arizona Department of Environmental Quality, 1110 West Washington Street, Phoenix, Arizona 85007 or may be obtained from the National Archives and Records Administration at http://www.access.gpo.gov/nara/cfr/cfr-table-search.html#page1.

E. The Director shall hold at least one public meeting in the local area of a surface water that is nominated for classification as an OAW to solicit public comment on the nomination.

F. The Director shall consider the following factors when deciding whether to classify a surface water as an OAW:
1. Whether there is the ability to manage the surface water and its watershed to maintain and protect existing water quality;
2. The social and economic impact of Tier 3 antidegradation protection;
3. The public comments in support of, or in opposition to, an OAW classification;
4. The timing of the nomination relative to the triennial review of surface water quality standards;
5. The consistency of an OAW classification with applicable water quality management plans; and
6. Whether the nominated surface water is located within a national or state park, national monument, national recreation area, wilderness area, riparian conservation area, area of critical environmental concern, or it has another special use designation (for example, Wild and Scenic River).

~~**E.**~~**G.** The following surface waters are classified as ~~unique water~~ OAWs:
1. The West Fork of the Little Colorado River, ~~above~~ from its headwaters at 33°55'02"/109°33'30" to Government Springs at 33°59'33"/109°27'54" (approximately 9.1 river miles);
2. Oak Creek, ~~including the West Fork of Oak Creek~~ from its headwaters at 35°01'30"/111°44'12" to its confluence with the Verde River at 34°40'41"/111°56'30" (approximately 50.3 river miles);
3. West Fork of Oak Creek, from its headwaters at 35°02'44"/111°54'48" to its confluence with Oak Creek at 34°59'14"/111°44'46" (approximately 15.8 river miles);

~~3.~~4. ~~Peoples~~ Peeples Canyon Creek, ~~tributary to the Santa Maria River~~ from its headwaters at 34°23'57"/113°19'45" to its confluence with the Santa Maria River at 34°20'36"/113°15'12" (approximately 8.1 river miles);

~~4.~~5. Burro Creek, ~~above its confluence with Boulder Creek~~ from its headwaters at 34°52'46.5"/113°05'13.5" to its confluence with Boulder Creek at 34°374.5"/113°18'36" (approximately 29.5 miles);

~~5.~~6. Francis Creek, ~~in Mohave and Yavapai counties~~ from its headwaters at 34°54'38"/113°20'30" to its confluence with Burro Creek at 34°44'29"/113°14'37" (approximately 22.9 river miles);

~~6.~~7. Bonita Creek, ~~tributary to the upper Gila River~~ from its boundary of the San Carlos Indian Reservation at 33°03'08"/109°33'41" to its confluence with the Gila River at 32°53'36"/109°28'43" (approximately 14.7 river miles);

~~7.~~8. Cienega Creek, from its confluence with Gardner Canyon and Spring Water Canyon at ~~R18E T17S~~ 31°47'38.5"/110°35'21.5" to the USGS gaging station at 32°02'09"/110°40'34"~~, in Pima County~~ (approximately 28.3 river miles);

~~8.~~9. Aravaipa Creek, from its confluence with Stowe Gulch at 32°52'10"/110°22'03" to the downstream boundary of the Aravaipa Canyon Wilderness Area at 32°54'23"/110°33'42" (approximately 15.5 river miles);

~~9.~~10. Cave Creek ~~and the South Fork of Cave Creek (Chiricahua Mountains)~~, from ~~the~~ its headwaters at 31°50'30"/109°17'04.5" to the Coronado National Forest boundary at 31°54'38"/109°08'40" (approximately 10.4 river miles);

11. South Fork of Cave Creek, from its headwaters at 31°50'20"/109°16'33" to its confluence with Cave Creek at 31°53'04"/109°10'30" (approximately 8.6 river miles);

~~10.~~12. Buehman Canyon Creek, from its headwaters ~~(Lat. 32°24'55.5" N, Long. 110°39'43.5"W)~~ at 32°52'0.5"/110°39'54.5" to ~~approximately 9.8 miles downstream (Lat. 32°24'31.5" N, Long. 10°32'08" W)~~ its confluence with unnamed tributary at 32°24'31.5"/110°32'08" (approximately 9.8 river miles);

~~11.~~13. Lee Valley Creek, from its headwaters at 33°55'49"/109°31'34" to its confluence with Lee Valley Reservoir at 33°56'28"/109°30'15.5" (approximately 1.6 river miles);

~~12.~~14. Bear Wallow Creek, from its headwaters at 33°35'54"/109°26'54.5" to the boundary of the San Carlos Indian Reservation at 33°37'52"/109°29'44" (approximately 4.25 river miles);

~~13.~~15. North Fork of Bear Wallow Creek, from its headwaters at 33°34'47.5"/109°21'59.5" to its confluence with Bear Wallow Creek at 33°35'54"/109°26'54.5" (approximately 3.8 river miles);

~~14.~~16. South Fork of Bear Wallow Creek, from its headwaters at 33°34'38.5"/109°23'58" to its confluence with Bear Wallow Creek at 33°35'54"/109°26'54.5" (approximately 3.8 river miles);

~~15.~~17. Snake Creek, from its headwaters at 33°37'21.5"/109°26'11" to its confluence with the Black River at 33°40'31.5"/109°28'58.5" (approximately 6.2 river miles);

~~17.~~18. Hay Creek, from its headwaters at 33°51'00"/109°28'48" to its confluence with the West Fork of the Black River at 33°48'30"/109°25'19" (approximately 5.5 river miles);

~~18.~~19. Stinky Creek, from the ~~Fort~~ White Mountain Apache Indian Reservation boundary at 33°52'36.5"/109°29'45" to its confluence with the West Fork of the Black River at 33°51'21.5"/109°27'09.5" (approximately 3.0 river miles); ~~and~~

~~19.~~20. KP Creek, from its headwaters at 33°34'03"/109°21'19" to its confluence with the Blue River at 33°31'44"/109°12'04.5" (approximately 12.7 river miles)~~.~~;

21. Davidson Canyon, from the unnamed spring at 31°59'00"/110°38'46" to its confluence with Cienega Creek; and

22. Fossil Creek, from its headwaters at the confluence of Sandrock and Calf Pen Canyons above Fossil Springs at 34°26'48.7"/111°32'25" to its confluence with the Verde River at 34°18'21.8"/111°40'31.6" (approximately 17.2 river miles).

~~F. The Department shall hold at least one public meeting in the local area of a nominated unique water to solicit public comment on the nomination.~~

~~G. The Director may consider the following factors when making a decision whether to classify a nominated surface water as a unique water:~~

~~1. Whether there is the ability to manage the unique water and its watershed to maintain and protect existing water quality;~~

~~2. The social and economic impact of Tier 3 antidegradation protection;~~

~~3. The public comments in support or opposition to a unique waters classification;~~

~~4. The support or opposition of federal and state land management and natural resources agencies to a nomination;~~

~~5. Agency resource constraints;~~

~~6. The timing of the unique water nomination relative to the triennial review of surface water quality standards;~~

~~7. The consistency of a unique water classification with applicable water quality management plans (for example, § 208 water quality management plans); and~~

~~8. Whether the nominated surface water is located within a national or state park, national monument, national recreation area, wilderness area, riparian conservation area, area of critical environmental concern, or it has another special use designation (for example, Wild and Scenic River designation).~~

~~H. The following water quality standards apply to the listed unique waters. Water quality standards prescribed in this subsection supplement the water quality standards prescribed by this Article.~~

~~1. The West Fork of the Little Colorado River, above Government Springs:~~

~~**Parameter**~~	~~**Standard**~~
~~pH (standard units)~~	~~No change due to discharge~~
~~Temperature~~	~~No increase due to discharge~~
~~Dissolved oxygen~~	~~No decrease due to discharge~~
~~Total dissolved solids~~	~~No increase due to discharge~~
~~Chromium (as Cr)(D)~~	~~10 µg / L~~

~~2. Oak Creek, including the West Fork of Oak:~~

~~**Parameter**~~	~~**Standard**~~
~~pH (standard units)~~	~~No change due to discharge~~
~~Nitrogen (T)~~	~~1.00 mg / L (annual mean)~~
	~~1.50 mg / L (90th percentile)~~
	~~2.50 mg / L (single sample max.)~~
~~Phosphorus (T)~~	~~0.10 mg / L (annual mean)~~
	~~0.25 mg / L (90th percentile)~~

	~~0.30 mg / L (single sample max.)~~
~~Chromium (as Cr) (D)~~	~~5 µg / L~~
~~Turbidity change due to discharge~~	~~3 NTUs~~

~~3. Peoples Canyon Creek, tributary to the Santa Maria:~~

~~**Parameter**~~	~~**Standard**~~
~~Temperature~~	~~No increase due to discharge~~
~~Dissolved oxygen~~	~~No decrease due to discharge~~
~~Turbidity change due to discharge~~	~~5 NTUs~~
~~Arsenic (T)~~	~~20 µg / L~~
~~Manganese (T)~~	~~500 µg / L~~

~~4. Burro Creek, above its confluence with Boulder Creek:~~

~~**Parameter**~~	~~**Standard**~~
~~Manganese (T)~~	~~500 µg / L~~

~~5. Francis Creek, in Mohave and Yavapai counties:~~

~~**Parameter**~~	~~**Standard**~~
~~Manganese (T)~~	~~500 µg / L~~

~~6. Cienega Creek, from its confluence with Gardner Canyon and Spring Water Canyon at R18E T17S to Del Lago Dam, in Pima County:~~

~~**Parameter**~~	~~**Standard**~~
~~pH~~	~~No change due to discharge~~
~~Temperature~~	~~No increase due to discharge~~
~~Dissolved oxygen~~	~~No decrease due to discharge~~
~~Total dissolved solids~~	~~No increase due to discharge~~
~~Turbidity~~	~~10 NTUs~~

~~7. Bonita Creek, tributary to the Upper Gila River:~~

~~**Parameter**~~	~~**Standard**~~
~~pH~~	~~No change due to discharge~~
~~Temperature~~	~~No increase due to discharge~~
~~Dissolved oxygen~~	~~No decrease due to discharge~~
~~Total dissolved solids~~	~~No increase due to discharge~~
~~Turbidity~~	~~15 NTUs~~

~~Abbreviations:~~
~~"(D)" means dissolved fraction~~
~~"(T)" means total recoverable~~
~~"NTUs" means nephelometric turbidity units~~
~~"mg / L" means milligrams per liter~~
~~"µg / L" means micrograms per liter~~

H. The designation of Fossil Creek as an OAW under subsection (G)(22) takes effect on June 30, 2010.

R18-11-113. ~~Effluent-dependent~~ Effluent-Dependent Waters

A. The Director shall classify a surface water as an effluent-dependent water by rule.

B. The Director may adopt, ~~by rule,~~ under R18-11-115, a site-specific water quality ~~standards~~ standard for an effluent-dependent water.

C. Any person may submit a petition for rule adoption requesting that the Director classify a surface water as an effluent-dependent water. The petition ~~for rule adoption~~ shall include:

1. A map and a description of the surface water~~,~~;
2. Information that demonstrates that the surface water consists of ~~discharges of treated wastewater~~ a point source discharge of wastewater; and
3. Information that demonstrates that, without a point source discharge of a wastewater, the receiving water is an ephemeral water ~~in the absence of the discharge of treated wastewater~~.

~~**D.** The following surface waters are classified as effluent-dependent waters:~~

~~1. In the Colorado River Main Stem Basin:~~
   ~~a. Bright Angel Wash from the South Rim Grand Canyon WWTP outfall to its confluence with Coconino Wash,~~
   ~~b. Cataract Creek from the Williams WWTP outfall to one kilometer downstream from the outfall,~~
   c. ~~Holy Moses Wash from the Kingman WWTP outfall to three kilometers downstream from the outfall, and~~
   ~~d. Transept Canyon from the North Rim Grand Canyon WWTP outfall to one kilometer downstream from the outfall.~~
~~2. In the Little Colorado River Basin:~~
   ~~a. Dry Lake,~~
   ~~b. Lake Humphreys,~~
   ~~c. Lower Walnut Canyon Lake,~~
   ~~d. Ned Lake,~~
   ~~e. Pintail Lake,~~
   ~~f. Telephone Lake,~~
   g. ~~Rio de Flag from the City of Flagstaff WWTP outfall to its confluence with San Francisco Wash, and~~
   ~~h. Whale Lake.~~
~~3. In the Middle Gila River Basin:~~
   ~~a. Unnamed wash from the Town of Prescott Valley WWTP outfall to its confluence with the Agua Fria River, and the Agua Fria River below its confluence with the unnamed wash receiving treated wastewater from the Prescott Valley WWTP to State Route 169;~~
   ~~b. Agua Fria river from the El Mirage WWTP outfall to two kilometers downstream from the outfall;~~
   ~~c. Gila River from the Florence WWTP outfall to Felix Road,~~
   ~~d. Gila River from its confluence with the Salt River to Gillespie Dam;~~
   ~~e. Queen Creek from the Town of Superior WWTP outfall to its confluence with Potts Canyon;~~
   ~~f. Unnamed wash from the Gila Bend WWTP outfall to its confluence with the Gila River;~~
   ~~g. Unnamed wash from the Luke AFB WWTP outfall to its confluence with the Agua Fria River; and~~
   ~~h. Unnamed wash from the Queen Valley WWTP outfall to its confluence with Queen Creek.~~
~~4. In the Rios de Mexico Basin:~~
   ~~a. Mule Gulch, from the Bisbee WWTP outfall to the Highway 80 bridge, and~~
   ~~b. Unnamed wash from the Bisbee-Douglas International Airport WWTP outfall to Whitewater Draw.~~
~~5. In the Salt River Basin:~~
   ~~a. Unnamed wash from the Globe WWTP outfall to its confluence with Pinal Creek and Pinal Creek from its confluence with the unnamed wash to Radium, and~~
   ~~b. Salt River from the 23rd Avenue WWTP outfall to its confluence with the Gila River.~~
~~6. In the San Pedro River Basin:~~
   ~~a. Unnamed wash from the Mt. Lemmon WWTP outfall to 0.25 kilometers downstream, and~~
   ~~b. Walnut Gulch from the Tombstone WWTP outfall to its confluence with Tombstone Gulch.~~
~~7. In the Santa Cruz Basin:~~
   ~~a. Santa Cruz River from the Nogales International WWTP outfall to Tubac Bridge,~~
   ~~b. Santa Cruz River from the Roger Road WWTP outfall to Baumgartner Road crossing,~~
   ~~c. Unnamed wash from the Oracle WWTP outfall to five kilometers downstream, and~~
   ~~d. Sonoita Creek from the Town of Patagonia WWTP outfall to 750 feet downstream.~~
~~8. In the Upper Gila River Basin:~~
   ~~a. Bennett Wash from the Arizona Department of Corrections-Safford WWTP outfall to the Gila River. and~~
   ~~b. Unnamed wash from the Arizona Department of Corrections-Globe WWTP outfall to the boundary of the San Carlos Indian Reservation.~~
~~9. In the Verde River Basin:~~
   ~~a. American Gulch from the Northern Gila County Sanitary District WWTP outfall to the East Verde River,~~
   ~~b. Bitter Creek from the Jerome WWTP outfall to 2.5 kilometers downstream from the outfall, and~~
   ~~c. Jacks Canyon Wash from the Big Park WWTP outfall to its confluence with Dry Beaver Creek.~~
~~10. In the Willcox Playa Basin: Lake Cochise~~

~~E.~~D. The ~~NPDES permit issuing authority~~ Director shall use the water quality standards that apply to an effluent-dependent water to derive ~~discharge limitations~~ water quality-based effluent limits for a point source discharge ~~from a wastewater treatment plant~~ of wastewater to an ephemeral water ~~that changes that ephemeral water into an effluent-dependent water~~.

E. The Director may use aquatic and wildlife (edw) acute standards only to derive water quality based effluent limits for a sporadic, infrequent, or emergency point source discharge to an ephemeral water or to an effluent-dependent water. The Director shall consider the following factors when deciding whether to apply A&Wedw (acute) standards:
1. The amount, frequency, and duration of the discharge,
2. The length of time water may be present in the receiving water,
3. The distance to a downstream water with aquatic and wildlife chronic standards, and

4. The likelihood of chronic exposure to pollutants.

F. The Director may establish alternative water quality-based effluent limits in an AZPDES permit based on seasonal differences in the discharge.

~~**F.** The site-specific standard of 36 µg / L for dissolved copper for the aquatic and wildlife (effluent-dependent water) designated use applies to the Rio de Flag from the City of Flagstaff WWTP outfall to its confluence with the San Francisco Wash.~~

R18-11-114. Mixing Zones

A. The Director may establish a mixing zone for a point source discharge to a surface water as a condition of ~~a NPDES~~ an AZPDES permit. ~~Mixing zones are~~ A mixing zone is prohibited in an ephemeral ~~waters~~ water or where there is no water for dilution.

B. The owner or operator of a point source seeking the establishment of a mixing zone shall submit a ~~mixing zone application to the Department on a standard form that is available from the Department~~ request to the Director for a mixing zone as part of an application for an AZPDES permit. The ~~application~~ request shall include:

1. ~~Identification~~ An identification of the pollutant for which the mixing zone is requested;
2. A proposed outfall design;
3. A definition of the boundary of the proposed mixing zone. For purposes of this subsection, the boundary of a mixing zone means the location where the concentration of ~~treated~~ wastewater across a transect of the surface water differs by less than ~~5%~~ five percent; and
4. A complete and detailed description of the existing physical, biological, and chemical conditions of the receiving water and the predicted impact of the proposed mixing zone on those conditions.

C. The ~~Department~~ Director shall review the ~~application~~ request for a mixing zone to determine whether the ~~application~~ written request is complete. If the ~~application~~ request is incomplete, the ~~Department~~ Director shall ~~identify in writing~~ provide the applicant with a list of the additional information required ~~that must be submitted to the Department to complete the mixing zone application~~.

D. The Director shall consider the following factors when deciding whether to grant or deny a request for a mixing zone:

1. The assimilative capacity of the receiving water;
2. The likelihood of adverse human health effects;
3. The location of drinking water plant intakes and public swimming areas;
4. The predicted exposure of biota and the likelihood that resident biota will be adversely affected;
5. Bioaccumulation ~~and bioconcentration~~;
6. Whether there will be acute toxicity in the mixing zone, and, if so, the size of the ~~area of acute toxicity~~ zone of initial dilution;
7. The known or predicted safe exposure levels for the pollutant ~~of concern~~ for which the mixing zone is requested;
8. The size of the mixing zone;
9. The location of the mixing zone relative to biologically sensitive areas in the surface water;
10. The concentration gradient of the pollutant within the mixing zone;
11. Sediment deposition;
12. The potential for attracting aquatic life to the mixing zone; and
13. The cumulative impacts of other mixing zones and other discharges to the surface water.

E. Director determination.

1. The Director shall deny ~~the~~ a request to establish a mixing zone if a water quality ~~standards~~ standard will be violated outside the boundaries of the proposed mixing zone ~~will be violated~~. The Director shall notify the owner or operator of the denial ~~of a request for a mixing zone shall be~~ in writing and shall state the reason for the denial.
2. If the Director ~~determines that~~ approves the request to establish a mixing zone ~~should be established~~, the Director shall establish the mixing zone as a condition of ~~a NPDES~~ an AZPDES permit. The Director ~~may~~ shall include any mixing zone ~~conditions~~ condition in the AZPDES permit that ~~the Director deems~~ is necessary to protect human health and the designated uses of the surface water.

F. Any person who is adversely affected by the Director's decision to grant or deny a request for a mixing zone may appeal the decision ~~to an administrative law judge~~ under A.R.S. § 49-321 et seq. and A.R.S. § 41-1092 et seq.

G. The ~~Department~~ Director shall reevaluate a mixing zone upon issuance, reissuance, or modification of the ~~National Pollutant Discharge Elimination System~~ AZPDES permit for the point source or a modification of the outfall structure.

~~**H.** The length of a mixing zone shall not exceed 500 meters in a stream. The total horizontal area allocated to all mixing zones on a lake shall not exceed 10% of the surface area of the lake. Adjacent mixing zones in a lake shall be no closer than the greatest horizontal dimension of any individual mixing zone.~~

~~**I.** A mixing zone shall provide for a zone of passage of not less than 50% of the cross-sectional area of a river or stream.~~

~~**J.** The discharge outfall shall be designed to maximize initial dilution of the treated wastewater in a surface water.~~

H. Mixing zone requirements.

1. The length of a mixing zone shall not exceed 500 meters in a stream.
2. The total horizontal area allocated to all mixing zones on a lake shall not exceed 10 percent of the surface area of the

lake.
3. Adjacent mixing zones in a lake shall not overlap or be located closer together than the greatest horizontal dimension of the largest mixing zone.
4. A mixing zone shall provide for a zone of passage of not less than 50 percent of the cross-sectional area of a river or stream.
5. The design of any discharge outfall shall maximize initial dilution of the wastewater in a surface water.
6. The size of the zone of initial dilution in a mixing zone shall prevent lethality to organisms passing through the zone of initial dilution.

K. ~~A mixing zone is prohibited~~ The Director shall not establish a mixing zone in an AZPDES permit for the following persistent, bioaccumulative pollutants:
1. Chlordane,
2. DDT and its metabolites (DDD and DDE),
3. Dieldrin,
4. Dioxin,
5. Endrin,
6. Endrin aldehyde,
7. Heptachlor,
8. Heptachlor epoxide,
9. Lindane,
10. Mercury,
11. Polychlorinated biphenyls (PCBs), and
12. Toxaphene.

R18-11-115. ~~Repealed~~ Site-specific Standards

A. The Director shall adopt a site-specific standard by rule.

B. The Director may adopt a site-specific standard based upon a request or upon the Director's initiative for any of the following reasons:
1. Local physical, chemical, or hydrological conditions of a surface water such as pH, hardness, or temperature alters the biological availability or toxicity of a pollutant;
2. The sensitivity of resident aquatic organisms that occur in a surface water to a pollutant differs from the sensitivity of the species used to derive the numeric water quality standards to protect aquatic life in Appendix A;
3. Resident aquatic organisms that occur in a surface water represent a narrower mix of species than those in the dataset used by the Department to derive numeric water quality standards to protect aquatic life in Appendix A; or
4. The natural background concentration of a pollutant is greater than the numeric water quality standard to protect aquatic life prescribed in Appendix A.

C. Site-specific study. A person shall conduct a study to support the development of a site-specific standard using one of the following procedures:
1. The Recalculation Procedure, Appendix L, pages 90 - 98, Water Quality Standards Handbook, Second Edition, EPA 823-B-94-005b, August 1994. This material is incorporated by reference and does not include any later amendments or editions of the incorporated material. A copy of the incorporated material is available for inspection at the Arizona Department of Environmental Quality, 1110 West Washington Street, Phoenix, Arizona 85007 or: may be obtained from the U.S. Environmental Protection Agency, Office of Water at http://www.epa.gov/waterscience/standards/handbook/ handbookappxL.pdf.
2. Water-Effects Ratio for Metals, Appendix L, pages 1 - 89, Water Quality Standards Handbook, Second Edition, EPA 823-B-94-005b, August 1994. This material is incorporated by reference and does not include any later amendments or editions of the incorporated material. A copy of the incorporated material is available for inspection at the Arizona Department of Environmental Quality, 1110 West Washington Street, Phoenix, Arizona 85007 or: may be obtained from the U.S. Environmental Protection Agency, Office of Water at http://www.epa.gov/waterscience/standards/handbook/ handbookappxL.pdf.
3. Streamlined Water Effects Ratio Procedure for Discharges of Copper, EPA-822-R-01-005, March 2001. This material is incorporated by reference and does not include any later amendments or editions of the incorporated material. A copy of the incorporated material is available for inspection at the Arizona Department of Environmental Quality, 1110 West Washington Street, Phoenix, Arizona 85007 or: may be obtained from the U.S. Environmental Protection Agency, Office of Water at http://www.epa.gov/ost/criteria/copper/copper.pdf.
4. Natural background.
   a. A person seeking to develop a site-specific standard based on natural background shall provide a study outline to the Director and obtain the Director's approval before conducting the study.
      i. The person may use statistical or modeling approaches to determine natural background concentration.
      ii. Modeling approaches include Better Assessment Science Integrating Source and Nonpoint Sources (Basins), Hydrologic Simulation Program-Fortran (HSPF), and Hydrologic Engineering Center (HEC) programs

developed by the U.S. Army Corps of Engineers.

b. The Director may establish a site-specific standard at a concentration equal to the natural background concentration.

c. For purposes of this subsection, “natural background” means the concentration of a pollutant in a surface water due only to non-anthropogenic sources.

R18-11-116. Resource ~~management agencies~~ Management Agencies

Nothing in this Article ~~shall be construed to prohibit~~ prohibits fisheries management activities by the Arizona Game and Fish Department or the U.S. Fish and Wildlife Service. This ~~provision~~ Article does not exempt fish hatcheries from ~~National Pollutant Discharge Elimination System~~ AZPDES permit requirements.

R18-11-117. Canals and ~~Municipal~~ Urban Park Lakes

A. Nothing in this Article ~~shall be construed to prevent~~ prevents the routine physical or mechanical maintenance of canals, drains, and the ~~municipal park~~ urban lakes identified in Appendix B. Physical or mechanical maintenance includes dewatering, lining, dredging, and the physical, biological, or chemical control of weeds and algae. Increases in turbidity that result from physical or mechanical maintenance activities are permitted in canals, drains, and the ~~municipal park~~ urban lakes identified in Appendix B.

B. The discharge of lubricating oil ~~that is~~ associated with the start-up of well pumps ~~which~~ that discharge to canals is not a violation of R18-11-108(B).

R18-11-118. Dams and Flood Control Structures

~~**A.**~~ Increases in turbidity that result from the routine physical or mechanical maintenance of a dam or flood control structure are not violations of this Article.

~~**B.**~~ Nothing in this Article ~~shall be construed to require~~ requires the release of water from a dam or a flood control structure.

R18-11-121. Schedules of Compliance

A. ~~A~~ The Director may establish a schedule in an AZPDES permit to bring an existing point source into compliance with a new or revised water quality standard ~~may be established in a National Pollutant Discharge Elimination System permit for an existing point source~~. A compliance schedule in an AZPDES permit for an existing point source, other than a ~~storm water~~ stormwater discharge, shall require ~~compliance~~ the permittee to comply with a discharge limitation based upon a new or revised water quality standard no later than three years after the effective date of the ~~National Pollutant Discharge Elimination System~~ AZPDES permit. ~~For a schedule of compliance to be granted, the owner or operator of the existing point source~~ The permittee shall demonstrate that all requirements under § 301(b) and § 306 of the Clean Water Act [33 U.S.C. ~~§~~ 1311(b) and ~~§~~ 1316] ~~have been~~ are achieved and that the point source cannot comply with a discharge limitation based upon the new or revised water quality standard through the application of existing water pollution control technology, operational changes, or source reduction.

B. ~~A~~ The Director may establish a schedule of compliance ~~may be established~~ in ~~a National Pollutant Discharge Elimination System~~ an AZPDES permit for a new point source. The first ~~National Pollutant Discharge Elimination System~~ AZPDES permit issued to a new point source may contain a schedule of compliance only when necessary to allow ~~a reasonable opportunity~~ the permittee to attain compliance with a new or revised water quality standard that becomes effective after commencement of construction but less than three years before ~~commencement of~~ the discharge begins. For purposes of this subsection, “commencement of construction” means that the owner or operator of the point source has obtained the federal, state, and local approvals or permits necessary to begin physical construction of the point source and either:

1. Onsite physical construction has begun; or
2. The owner or operator has entered into a contract for physical construction of the point source and the contract cannot be cancelled or modified without substantial loss. For purposes of this subsection, “substantial loss” means in excess of ~~10%~~ 10 percent of the total cost incurred for physical construction.

C. ~~A~~ The Director may establish a schedule of compliance ~~may be established~~ in ~~a National Pollutant Discharge Elimination System~~ an AZPDES permit for a recommencing point source discharge. The first ~~National Pollutant Discharge Elimination System~~ AZPDES permit issued to a recommencing point source ~~discharge~~ discharger may contain a schedule of compliance only when necessary ~~to allow a reasonable opportunity~~ to attain compliance with a new or revised water quality standard that ~~becomes~~ is effective less than three years before recommencement of the discharge.

D. ~~A~~ The Director may establish a schedule to bring a point source discharge of ~~storm water~~ stormwater into compliance with a water quality standard ~~may be established~~ in ~~a National Pollutant Discharge Elimination System~~ an AZPDES permit. A compliance schedule for a ~~storm water~~ stormwater discharge shall require implementation of all reasonable and cost-effective best management practices to control the discharge of pollutants in ~~storm water~~ stormwater.

R18-11-122. Variances

A. The Director ~~may grant~~ shall consider a variance from a water quality standard for a point source discharge if the discharger demonstrates that treatment more advanced than that required to comply with technology-based effluent limitations is necessary to comply with the water quality standard and:

1. It is not technically feasible to achieve compliance within the next five years,

2. The cost of the treatment would result in substantial and widespread economic and social impact, or
3. Human-caused conditions or sources of pollution prevent attainment of the water quality standard and cannot be remedied within the next five years.

~~**B.** A variance may be granted only on a pollutant-specific basis. A point source discharge is required to comply with all other applicable water quality standards for which a variance is not granted.~~

~~**C.** A variance applies only to a specific point source discharge. The granting of a variance does not modify a water quality standard. Other point source dischargers to the surface water shall comply with applicable water quality standards, including any water quality standard for which a variance has been granted for a specific point source discharge.~~

B. If the Director grants a variance for a point source discharge:
1. The Director shall issue the variance for a fixed term not to exceed five years,
2. The variance shall apply only on a pollutant-specific basis. The point source discharge shall meet all other applicable water quality standards for which a variance is not granted, and
3. The variance shall not modify a water quality standard. Other point source discharges to the surface water shall meet applicable water quality standards.

~~**D.**~~**C.** ~~A variance is for a fixed term not to exceed five years.~~ Upon expiration of a variance, a point source discharger shall either comply with the water quality standard or apply for renewal of the variance. To renew a variance, the applicant shall demonstrate reasonable progress towards compliance with the water quality standard during the term of the variance.

~~**E.**~~**D.** The ~~Department~~ Director shall reevaluate a variance upon the issuance, reissuance, or modification of the ~~National Pollutant Discharge Elimination System~~ AZPDES permit for the point source discharge.

~~**F.**~~**E.** A person who seeks a variance from a water quality standard shall submit a written request for a variance to the ~~Department~~ Director. A request for a variance shall include the following information:
1. Identification of the specific pollutant and water quality standard for which a variance is sought;
2. Identification of the receiving surface water;
3. For an existing point source discharge, a detailed description of the existing discharge control technologies that are used to achieve compliance with applicable water quality standards. For a new point source discharge, a detailed description of the proposed discharge control technologies that will be used to achieve compliance with applicable water quality standards;
4. Documentation that the existing or proposed discharge control technologies will comply with applicable technology-based effluent limitations and that more advanced treatment technology is necessary to achieve compliance with the water quality standard for which a variance is sought;
5. A detailed discussion of the reasons why compliance with the water quality standard cannot be achieved;
6. A detailed discussion of the discharge control technologies that are available for achieving compliance with the water quality standard for which a variance is sought;
7. Documentation of one of the following:
   a. That it is not technically feasible to install and operate any of the available discharge control technologies to achieve compliance with the water quality standard for which a variance is sought,
   b. That installation and operation of each of the available discharge technologies to achieve compliance with the water quality standard would result in substantial and widespread economic and social impact, or
   c. That human-caused conditions or sources of pollution prevent the attainment of the water quality standard for which the variance is sought and it is not possible to remedy the conditions or sources of pollution within the next five years;
8. Documentation that the point source discharger has reduced, to the maximum extent practicable, the discharge of the pollutant for which a variance is sought through implementation of a local pretreatment, source reduction, or waste minimization program~~,~~; and
9. A detailed description of proposed interim discharge limitations that represent the highest level of treatment achievable by the point source discharger during the term of the variance. ~~Interim discharge limitations shall not be less stringent than technology-based effluent limitations.~~

~~**G.**~~**F.** ~~In making a decision on whether to grant or deny the request for a variance, the~~ The Director shall consider the following factors when deciding whether to grant or deny a variance request:
1. Bioaccumulation ~~and bioconcentration~~,
2. The predicted exposure of biota and the likelihood that resident biota will be adversely affected,
3. The known or predicted safe exposure levels for the pollutant ~~of concern~~ for which the variance is requested, and
4. The likelihood of adverse human health effects.

~~**H.**~~**G.** The ~~Department~~ Director shall issue a public notice and ~~shall~~ provide an opportunity for a public hearing on whether the request for a variance should be granted or denied under ~~procedures prescribed in R18-1-401 and R18-1-402~~ A.A.C. R18-9-A907 and A.A.C. R18-9-A908. An interested party may request a public hearing on a variance under A.A.C. R18-9-A908(B).

H. Any variance granted by the Director is subject to review and approval by the Regional Administrator.

I. Any person who is adversely affected by a decision of the Director to grant or deny a variance and who has exercised any right to comment on the decision may appeal the decision ~~to an administrative law judge~~ under A.R.S. § 49-321 et seq. and A.R.S. § 41-1092 et seq.

J. The ~~Department~~ Director shall not grant a variance for a point source discharge to ~~a unique water~~ an OAW listed in ~~R18-11-112~~ R18-11-112(G).

~~**K.** A variance is subject to review and approval by the Regional Administrator of the U.S. Environmental Protection Agency.~~

R18-11-123. ~~Prohibition Against~~ Discharge Prohibitions

A. The discharge of ~~treated~~ wastewater to ~~Sabino Creek is~~ the following surface waters is prohibited~~.~~:
1. Sabino Canyon Creek;
2. Vekol Wash, upstream of the Ak-Chin Indian Reservation; and
3. Smith Wash, upstream of the Ak-Chin Indian Reservation.

B. The discharge to Lake Powell of human body wastes and the wastes from toilets and other receptacles intended to receive or retain ~~those~~ wastes ~~on~~ from a vessel ~~to Lake Powell~~ is prohibited.

Appendix A~~:~~. Numeric Water Quality ~~Criteria~~ Standards

~~**Appendix A: Numeric Water Quality Criteria**~~
~~**Table 1. Human Health and Agricultural Designated Uses**~~

PARAMETER	CAS* NUMBER	DWS (µg/L)	FC (µg/L)	FBC (µg/L)	PBC (µg/L)	AgI (µg/L)	AgL (µg/L)
Acenaphthene	83-32-9	420	2670	84,000	84,000	NNS	NNS
Acenaphthylene	208-96-8	NNS	NNS	NNS	NNS	NNS	NNS
Acrolein	107-02-8	3.5	25	700	700	NNS	NNS
Acrylonitrile	107-13-1	0.07	0.7	3	56,000	NNS	NNS
Alachlor	15972-60-8	2	NNS	14,000	14,000	NNS	NNS
Aldrin	309-00-2	0.002	0.0001	0.08	42	p	p
Ammonia	7664-41-7	NNS	NNS	NNS	NNS	NNS	NNS
Anthracene	120-12-7	2100	1000	420,000	420,000	NNS	NNS
Antimony (as Sb)	7440-36-0	6 T	4,300 T	560 T	560 T	NNS	NNS
Arsenic (as As)	7440-38-2	50 T	1450 T	50 T	420 T	2000 T	200 T
Asbestos	1332-21-4	a	NNS	NNS	NNS	NNS	NNS
Atrazine	1912-24-9	3	NNS	49,000	49,000	NNS	NNS
Barium (as Ba)	7440-39-3	2000 T	NNS	98,000 T	98,000 T	NNS	NNS
Benzene	71-43-2	5	140	93	93	NNS	NNS
Benzidine	92-87-5	0.0002	0.001	0.01	4,200	0.01	0.01
Benz (a) anthracene	56-55-3	0.048	0.49	1.9	1.9	NNS	NNS
Benzo (a) pyrene	50-32-8	0.2	0.05	0.2	0.2	NNS	NNS
Benzo (ghi) perylene	191-24-2	NNS	NNS	NNS	NNS	NNS	NNS
Benzo (k) fluoranthene	207-08-9	0.048	0.49	1.9	1.9	NNS	NNS
3,4-Benzofluoranthene	205-99-2	0.048	0.49	1.9	1.9	NNS	NNS
Beryllium (as Be)	7440-41-7	4 T	1,130 T	2,800 T	2,800 T	NNS	NNS
Bis (2-chloroethoxy) methane	111-91-1	NNS	NNS	NNS	NNS	NNS	NNS
Bis (2-chloroethyl) ether	111-44-4	0.03	1.4	1.3	1.3	NNS	NNS
Bis (2-chloroisopropyl) ether	108-60-1	280	174,400	56,000	56,000	NNS	NNS
Boron (as B)	7440-42-8	630 T	NNS	126,000 T	126,000 T	1000 T	NNS
Bromodichloromethane	75-27-4	TTHM	46	TTHM	28,000	NNS	NNS
p-Bromodiphenyl ether	101-55-3	NNS	NNS	NNS	NNS	NNS	NNS
Bromoform	75-25-2	TTHM	360	180	28,000	NNS	NNS
Bromomethane	74-83-9	9.8	4020	2000	2000	NNS	NNS
Butyl benzyl phthalate	85-68-7	1400	5200	280,000	280,000	NNS	NNS
Cadmium (as Cd)	7440-43-9	5 T	84 T	700 T	700 T	50 T	50 T
Carbofuran	1563-66-2	40	NNS	7,000	7,000	NNS	NNS

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Table 1. Human Health and Agricultural Designated Uses

PARAMETER	CAS* NUMBER	DWS (μg/L)	FC (μg/L)	FBC (μg/L)	PBC (μg/L)	AgI (μg/L)	AgL (μg/L)
Carbon tetrachloride	56-23-5	5	4	11	980	NNS	NNS
Chlordane	57-74-9	2	0.002	4	700	NNS	NNS
Chlorine (total residual)	7782-50-5	700	NNS	140,000	140,000	NNS	NNS
Chlorobenzene	108-90-7	100	20,900	28,000	28,000	NNS	NNS
p-Chloro-m-cresol	59-50-7	NNS	NNS	NNS	NNS	NNS	NNS
2-Chloroethyl vinyl ether	110-75-8	NNS	NNS	NNS	NNS	NNS	NNS
Chloroform	67-66-3	TTHM	470	230	14,000	NNS	NNS
Chloromethane	74-87-3	NNS	NNS	NNS	NNS	NNS	NNS
Chloronapthalene beta	91-58-7	560	4,300	112,000	112,000	NNS	NNS
2-Chlorophenol	95-57-8	35	400	7,000	7,000	NNS	NNS
4-Chlorophenyl phenyl ether	7005-72-3	NNS	NNS	NNS	NNS	NNS	NNS
Chromium (as Cr III)	16065-83-1	10,500 T	1,010,000 T	2,100,000 T	2,100,000 T	NNS	NNS
Chromium (as Cr VI)	18540-29-9	21 T	2,000T	4,200 T	4,200 T	NNS	NNS
Chromium (Total as Cr)	7440-47-3	100 T	NNS	100 T	100 T	1000 T	1000 T
Chrysene	218-01-9	0.479	4.92	19.2	19	NNS	NNS
Copper (as Cu)	7440-50-8	1,300 T	NNS	1,300 T	1,300 T	5000 T	500 T
Cyanide	57-12-5	200 T	215,000 T	28,000 T	28,000 T	NNS	200 T
Dalapon	75-99-0	200	161,500	42,000	42,000	NNS	NNS
Dibenz (ah) anthracene	53-70-3	0.048	0.20	1.9	1.9	NNS	NNS
Dibromochloromethane	124-48-1	TTHM	34	TTHM	28,000	NNS	NNS
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	0.2	NNS	2,800	2,800	NNS	NNS
1,2-Dibromoethane (EDB)	106-93-4	0.05	NNS	0.05	0.05	NNS	NNS
Dibutyl phthalate	84-74-2	700	12,100	140,000	140,000	NNS	NNS
1,2-Dichlorobenzene	95-50-1	600	2800	126,000	126,000	NNS	NNS
1,3-Dichlorobenzene	541-73-1	NNS	NNS	NNS	NNS	NNS	NNS
1,4-Dichlorobenzene	106-46-7	75	77,500	560,000	560,000	NNS	NNS
3,3'-Dichlorobenzidine	91-94-1	0.08	0.08	3.1	3.1	NNS	NNS
p,p'-Dichlorodiphenyldichloroethane (DDD)	72-54-8	0.15	0.001	5.8	5.8	0.001	0.001
p,p'-Dichlorodiphenyldichloroethylene (DDE)	72-55-9	0.1	0.001	4.1	4.1	0.001	0.001
p,p'-Dichlorodiphenyltrichloroethane (DDT)	50-29-3	0.1	0.0006	4.1	700	0.001	0.001
1,1-Dichloroethane	75-34-3	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dichloroethane	107-06-2	5	100	15	280,000	NNS	NNS
1,1-Dichloroethylene	75-35-4	7	320	230	12,600	NNS	NNS
1,2-cis-Dichloroethylene	156-59-2	70	NNS	70	70	NNS	NNS
1,2-trans-Dichloroethylene	156-60-5	100	136,000	28,000	28,000	NNS	NNS
Dichloromethane	75-09-2	5	1600	190	84,000	NNS	NNS

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~~Table 1. Human Health and Agricultural Designated Uses~~

~~PARAMETER~~	~~CAS* NUMBER~~	~~DWS (µg/L)~~	~~FC (µg/L)~~	~~FBC (µg/L)~~	~~PBC (µg/L)~~	~~AgI (µg/L)~~	~~AgL (µg/L)~~
~~2,4-Dichlorophenol~~	~~120-83-2~~	~~21~~	~~800~~	~~4,200~~	~~4,200~~	~~NNS~~	~~NNS~~
~~2,4-Dichlorophenoxyacetic acid (2,4-D)~~	~~94-75-7~~	~~70~~	~~NNS~~	~~14,000~~	~~14,000~~	~~NNS~~	~~NNS~~
~~1,2-Dichloropropane~~	~~78-87-5~~	~~5~~	~~236,000~~	~~126,000~~	~~126,000~~	~~NNS~~	~~NNS~~
~~1,3-Dichloropropene~~	~~542-75-6~~	~~2~~	~~1,700~~	~~420~~	~~420~~	~~NNS~~	~~NNS~~
~~Dieldrin~~	~~60-57-1~~	~~0.002~~	~~0.0001~~	~~0.09~~	~~70~~	~~p~~	~~p~~
~~Diethyl phthalate~~	~~84-66-2~~	~~5600~~	~~118,000~~	~~1,120,000~~	~~1,120,000~~	~~NNS~~	~~NNS~~
~~Di (2-ethylhexyl) adipate~~	~~103-23-1~~	~~400~~	~~NNS~~	~~1,200~~	~~840,000~~	~~NNS~~	~~NNS~~
~~Di (2-ethylhexyl) phthalate~~	~~117-81-7~~	~~6~~	~~7.4~~	~~100~~	~~28,000~~	~~NNS~~	~~NNS~~
~~2,4-Dimethylphenol~~	~~105-67-9~~	~~140~~	~~2300~~	~~28,000~~	~~28,000~~	~~NNS~~	~~NNS~~
~~Dimethyl phthalate~~	~~131-11-3~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~
~~4,6-Dinitro-o-cresol~~	~~534-52-1~~	~~28~~	~~7,800~~	~~5,600~~	~~5,600~~	~~NNS~~	~~NNS~~
~~2,4-Dinitrophenol~~	~~51-28-5~~	~~14~~	~~14,400~~	~~2,800~~	~~2,800~~	~~NNS~~	~~NNS~~
~~2,4-Dinitrotoluene~~	~~121-14-2~~	~~14~~	~~5,700~~	~~2,800~~	~~2,800~~	~~NNS~~	~~NNS~~
~~2,6-Dinitrotoluene~~	~~606-20-2~~	~~0.05~~	~~NNS~~	~~2~~	~~5,600~~	~~NNS~~	~~NNS~~
~~Di-n-octyl phthalate~~	~~117-84-0~~	~~2800~~	~~NNS~~	~~560,000~~	~~560,000~~	~~NNS~~	~~NNS~~
~~Dinoseb~~	~~88-85-7~~	~~7~~	~~NNS~~	~~1,400~~	~~1,400~~	~~NNS~~	~~NNS~~
~~1,2-Diphenylhydrazine~~	~~122-66-7~~	~~0.04~~	~~0.5~~	~~1.8~~	~~1.8~~	~~NNS~~	~~NNS~~
~~Diquat~~	~~85-00-7~~	~~20~~	~~NNS~~	~~3,080~~	~~3,080~~	~~NNS~~	~~NNS~~
~~Endosulfan sulfate~~	~~1031-07-8~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~
~~Endosulfan (Total)~~	~~115-29-7~~	~~42~~	~~240~~	~~8,400~~	~~8,400~~	~~NNS~~	~~NNS~~
~~Endothall~~	~~145-73-3~~	~~100~~	~~NNS~~	~~28,000~~	~~28,000~~	~~NNS~~	~~NNS~~
~~Endrin~~	~~72-20-8~~	~~2~~	~~0.8~~	~~420~~	~~420~~	~~0.004~~	~~0.004~~
~~Endrin aldehyde~~	~~7421-93-3~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~
~~Ethylbenzene~~	~~100-41-4~~	~~700~~	~~28,700~~	~~140,000~~	~~140,000~~	~~NNS~~	~~NNS~~
~~Ethyl chloride~~	~~75-00-3~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~
~~Fluoranthene~~	~~206-44-0~~	~~280~~	~~380~~	~~56,000~~	~~56,000~~	~~NNS~~	~~NNS~~
~~Fluorene~~	~~86-73-7~~	~~280~~	~~14,400~~	~~56,000~~	~~56,000~~	~~NNS~~	~~NNS~~
~~Fluoride~~	~~7782-41-4~~	~~4000~~	~~NNS~~	~~84,000~~	~~84,000~~	~~NNS~~	~~NNS~~
~~Glyphosate~~	~~1071-83-6~~	~~700~~	~~1,077,000~~	~~140,000~~	~~140,000~~	~~NNS~~	~~NNS~~
~~Heptachlor~~	~~76-44-8~~	~~0.4~~	~~0.0002~~	~~0.4~~	~~700~~	~~NNS~~	~~NNS~~
~~Heptachlor epoxide~~	~~1024-57-3~~	~~0.2~~	~~0.0001~~	~~0.2~~	~~18~~	~~NNS~~	~~NNS~~
~~Hexachlorobenzene~~	~~118-74-1~~	~~1~~	~~0.001~~	~~1~~	~~1,120~~	~~NNS~~	~~NNS~~
~~Hexachlorobutadiene~~	~~87-68-3~~	~~0.45~~	~~50~~	~~18~~	~~280~~	~~NNS~~	~~NNS~~
~~Hexachlorocyclohexane alpha~~	~~319-84-6~~	~~0.006~~	~~0.01~~	~~0.22~~	~~11,200~~	~~NNS~~	~~NNS~~
~~Hexachlorocyclohexane beta~~	~~319-85-7~~	~~0.02~~	~~0.02~~	~~0.78~~	~~840~~	~~NNS~~	~~NNS~~
~~Hexachlorocyclohexane delta~~	~~319-86-8~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~	~~NNS~~
~~Hexachlorocyclohexane gamma (lindane)~~	~~58-89-9~~	~~0.2~~	~~25~~	~~420~~	~~420~~	~~NNS~~	~~NNS~~
~~Hexachlorocyclopentadiene~~	~~77-47-4~~	~~50~~	~~580~~	~~9,800~~	~~9,800~~	~~NNS~~	~~NNS~~
~~Hexachloroethane~~	~~67-72-1~~	~~2.5~~	~~9~~	~~100~~	~~1,400~~	~~NNS~~	~~NNS~~
~~Indeno (1,2,3-cd) pyrene~~	~~193-39-5~~	~~0.048~~	~~0.49~~	~~1.9~~	~~1.9~~	~~NNS~~	~~NNS~~
~~Isophorone~~	~~78-59-1~~	~~37~~	~~2,600~~	~~1,500~~	~~280,000~~	~~NNS~~	~~NNS~~

Appendix A: Numeric Water Quality Criteria
Table 1. Human Health and Agricultural Designated Uses

PARAMETER	CAS* NUMBER	DWS (µg/L)	FC (µg/L)	FBC (µg/L)	PBC (µg/L)	AgI (µg/L)	AgL (µg/L)
Lead (as Pb)	7439-97-1	15 T	NNS	15 T	15 T	10000 T	100 T
Manganese (as Mn)	7439-96-5	980 T	NNS	196,000 T	196,000 T	10000	NNS
Mercury (as Hg)	7439-97-6	2 T	0.6 T	420 T	420 T	NNS	10 T
Methoxychlor	72-43-5	40	NNS	7,000	7,000	NNS	NNS
Naphthalene	91-20-3	140	20,500	28,000	28,000	NNS	NNS
Nickel (as Ni)	7440-02-0	140 T	4,600 T	28,000 T	28,000 T	NNS	NNS
Nitrate (as N)	14797-55-8	10000	NNS	2,240,000	2,240,000	NNS	NNS
Nitrite (as N)	14797-65-0	1000	NNS	140,000	140,000	NNS	NNS
Nitrate/Nitrite (as Total N)		10000	NNS	NNS	NNS	NNS	NNS
Nitrobenzene	98-95-3	3.5	1,900	700	700	NNS	NNS
o-Nitrophenol	88-75-5	NNS	NNS	NNS	NNS	NNS	NNS
p-Nitrophenol	100-02-7	NNS	NNS	NNS	NNS	NNS	NNS
N-nitrosodimethylamine	62-75-9	0.001	8	0.03	0.03	NNS	NNS
N-nitrosodiphenylamine	86-30-6	7.1	16	290	290	NNS	NNS
N-nitrosodi-n-propylamine	621-64-7	0.005	1.4	0.2	133,000	NNS	NNS
Oxamyl	23135-22-0	200	NNS	35,000	35,000	NNS	NNS
Pentachlorophenol	87-86-5	1	1000	12	42,000	NNS	NNS
Phenanthrene	85-01-8	NNS	NNS	NNS	NNS	NNS	NNS
Phenol	108-95-2	4200	1,000	840,000	840,000	NNS	NNS
Picloram	1918-02-1	500	24,300	98,000	98,000	NNS	NNS
Polychlorinatedbiphenyls (PCBs)	1336-36-3	0.5	0.007	28	28	0.001	0.001
Pyrene	129-00-0	210	10,800	42,000	42,000	NNS	NNS
Selenium (as Se)	7782-49-2	50 T	9000 T	7,000 T	7,000 T	20 T	50 T
Silver (as Ag)	7440-22-4	35 T	107,700 T	7,000 T	7,000 T	NNS	NNS
Simazine	112-34-9	4	NNS	7,000	7,000	NNS	NNS
Styrene	100-42-5	100	NNS	280,000	280,000	NNS	NNS
Sulfides		NNS	NNS	NNS	NNS	NNS	NNS
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	1746-01-6	0.0000003	0.000000004	0.00009	1.4	NNS	NNS
1,1,2,2-Tetrachloroethane	79-34-5	0.17	11	7	56,000	NNS	NNS
Tetrachloroethylene	127-18-4	5	3,500	14,000	14,000	NNS	NNS
Thallium (as Tl)	7440-28-0	2 T	7.2 T	112 T	112 T	NNS	NNS
Toluene	108-88-3	1000	201,000	280,000	280,000	NNS	NNS
Toxaphene	8001-35-2	3	0.001	1.3	1400	0.005	0.005
1,2,4-Trichlorobenzene	120-82-1	70	950	14,000	14,000	NNS	NNS
1,1,1-Trichloroethane	71-55-6	200	NNS	200	200	1000	NNS
1,1,2-Trichloroethane	79-00-5	5	42	25	5,600	NNS	NNS
Trichloroethylene	79-01-6	5	203,200	280,000	280,000	NNS	NNS
2,4,6-Trichlorophenol	88-06-2	3.2	6.5	130	130	NNS	NNS
2-(2,4,5-Trichlorophenoxy) proprionic acid (2,4,5-TP)	93-72-1	50	NNS	11,200	11,200	NNS	NNS

Appendix A: Numeric Water Quality Criteria
Table 1. Human Health and Agricultural Designated Uses

PARAMETER	CAS* NUMBER	DWS (µg/L)	FC (µg/L)	FBC (µg/L)	PBC (µg/L)	AgI (µg/L)	AgL (µg/L)
Trihalomethanes, Total		100	NNS	NNS	NNS	NNS	NNS
Uranium (as Ur)	7440-61-1	35 D	NNS	NNS	NNS	NNS	NNS
Vinyl chloride	75-01-4	2	13	2	4,200	NNS	NNS
Xylenes (Total)	1330-20-7	10000	NNS	2,800,000	2,800,000	NNS	NNS
Zinc (as Zn)	7440-66-6	2100 T	69,000 T	420,000 T	420,000 T	10000 T	25000 T

Appendix A: Numeric Water Quality Criteria
Table 2. Aquatic & Wildlife Designated Uses

PARAMETER	CAS NUMBER	A&Wc Acute (µg/L)	A&Wc Chronic (µg/L)	A&Ww Acute (µg/L)	A&Ww Chronic (µg/L)	A&Wedw Acute (µg/L)	A&Wedw Chronic (µg/L)	A&We Acute (µg/L)
Acenaphthene	83-32-9	850	550	850	550	850	550	NNS
Acenaphthylene	208-96-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Acrolein	107-02-8	34	30	34	30	34	30	NNS
Acrylonitrile	107-13-1	3800	250	3800	250	3800	250	NNS
Alachlor	15972-60-8	2500	170	2500	170	2500	170	NNS
Aldrin	309-00-2	2.0	NNS	2.0	NNS	2.0	NNS	4.5
Ammonia	7664-41-7	b	b	b	b	NNS	NNS	NNS
Anthracene	120-12-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Antimony (as Sb)	7440-36-0	88 D	30 D	88 D	30 D	1000 D	600 D	NNS
Arsenic (as As)	7440-38-2	360 D	190 D	360 D	190 D	360 D	190 D	440 D
Asbestos	1332-21-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Atrazine	1912-24-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Barium (as Ba)	7440-39-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Benzene	71-43-2	2700	180	2700	180	8800	560	NNS
Benzidine	92-87-5	1300	89	1300	89	1300	89	10000
Benz (a) anthracene	56-55-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Benzo (a) pyrene	50-32-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Benzo (ghi) perylene	191-24-2	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Benzo (k) fluoranthene	207-08-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS
3,4-Benzofluoranthene	205-99-2	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Beryllium (as Be)	7440-41-7	65 D	5.3 D	65 D	5.3 D	65 D	5.3 D	NNS
Bis (2-chloroethoxy) methane	111-91-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Bis (2-chlorethyl) ether	111-44-4	120000	6700	120000	6700	120000	6700	NNS
Bis (2-chloroisopropyl) ether	108-60-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Boron (as B)	7440-42-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Bromodichloromethane	75-27-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS
p-Bromodiphenyl ether	101-55-3	180	14	180	14	180	14	NNS
Bromoform	75-25-2	15000	10000	15000	10000	15000	10000	NNS
Bromomethane	74-83-9	5500	360	5500	360	5500	360	NNS
Butyl benzyl phthalate	85-68-7	1700	130	1700	130	1700	130	NNS
Cadmium (as Cd)	7440-43-9	c D	c D	c D	c D	c D	c D	c D
Carbofuran	1563-66-2	650	50	650	50	650	50	NNS
Carbon tetrachloride	56-23-5	18000	1100	18000	1100	18000	1100	NNS
Chlordane	57-74-9	2.4	0.004	2.4	0.21	2.4	0.21	3.2
Chlorine (total residual)	7782-50-5	11	5.0	11	5.0	11	5.0	NNS
Chlorobenzene	108-90-7	3800	260	3800	260	3800	260	NNS
p-Chloro-m-cresol	59-50-7	15	4.7	15	4.7	15	4.7	48000
2-Chloroethyl vinyl ether	110-75-8	180000	9800	180000	9800	180000	9800	NNS
Chloroform	67-66-3	14000	900	14000	900	14000	900	NNS

Chloromethane	74-87-3	270000	15000	270000	15000	270000	15000	NNS
Chloronapthalene beta	91-58-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS
2-Chlorophenol	95-57-8	2200	150	2200	150	2200	150	NNS
4-Chlorophenyl phenyl ether	7005-72-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Chromium (as Cr III)	16065-83-1	d D	d D	d D	d D	d D	d D	d D
Chromium (as Cr VI)	18540-29-9	16 D	11 D	16 D	11 D	16 D	11 D	34 D
Chromium (Total as Cr)	7440-47-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Chrysene	218-01-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Copper (as Cu)	7440-50-8	e D	e D	e D	e D	e D	e D	e D
Cyanide	57-12-5	22 T	5.2 T	41 T	9.7 T	41 T	9.7 T	84 T
Dibenz (ah) anthracene	53-70-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Dibromochloromethane	124-48-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dibromoethane (EDB)	106-93-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Dibutyl phthalate	84-74-2	470	35	470	35	470	35	1100
1,2-Dichlorobenzene	95-50-1	790	300	1200	470	1200	470	5900
1,3-Dichlorobenzene	541-73-1	2500	970	2500	970	2500	970	NNS
1,4-Dichlorobenzene	106-46-7	560	210	2000	780	2000	780	6500
3,3'-Dichlorobenzidine	91-94-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS
p,p'-Dichlorodiphenyldichloroethane (DDD)	72-54-8	1.1	0.001	1.1	0.02	1.1	0.02	1.1
p,p'-Dichlorodiphenyldichloroethylene (DDE)	72-55-9	1.1	0.001	1.1	0.02	1.1	0.02	1.1
p,p'-Dichlorodiphenyltrichloroethane (DDT)	50-29-3	1.1	0.001	1.1	0.001	1.1	0.001	1.1
1,1-Dichloroethane	75-34-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dichloroethane	107-06-2	59000	41000	59000	41000	59000	41000	NNS
1,1-Dichloroethylene	75-35-4	15000	950	15000	950	15000	950	NNS
1,2-cis-Dichloroethylene	156-59-2	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-trans-Dichloroethylene	156-60-5	68000	3900	68000	3900	68000	3900	NNS
Dichloromethane	75-09-2	97000	5500	97000	5500	97000	5500	NNS
2,4-Dichlorophenol	120-83-2	1000	88	1000	88	1000	88	NNS
2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dichloropropane	78-87-5	26000	9200	26000	9200	26000	9200	NNS
1,3-Dichloropropene	542-75-6	3000	1100	3000	1100	3000	1100	NNS
Dieldrin	60-57-1	2.5	0.002	2.5	0.002	2.5	0.005	4
Diethyl phthalate	84-66-2	26000	1600	26000	1600	26000	1600	NNS
Di(2-ethylhexyl) phthalate	117-81-7	400	360	400	360	400	360	3100
2,4-Dimethylphenol	105-67-9	1000	310	1000	310	1100	310	150000
Dimethyl phthalate	131-11-3	17000	1000	17000	1000	17000	1000	NNS
4,6-Dinitro-o-cresol	534-52-1	310	24	310	24	310	24	NNS
2,4-Dinitrophenol	51-28-5	110	9.2	110	9.2	110	9.2	NNS
2,4-Dinitrotoluene	121-14-2	14000	860	14000	860	14000	860	NNS
2,6-Dinitrotoluene	606-20-2	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Di-n-octyl phthalate	117-84-0	NNS	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Diphenylhydrazine	122-66-7	130	11	130	11	130	11	NNS
Endosulfan sulfate	1031-07-8	0.22	0.06	0.22	0.06	0.22	0.06	3.0
Endosulfan (Total)	115-29-7	0.22	0.06	0.22	0.06	0.22	0.06	3.0
Endrin	72-20-8	0.18	0.002	0.2	0.08	0.2	0.08	0.7
Endrin aldehyde	7421-93-3	0.18	0.002	0.2	0.08	0.2	0.08	0.7
Ethylbenzene	100-41-4	23000	1400	23000	1400	23000	1400	NNS

Ethyl chloride	75-00-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Fluoranthene	206-44-0	2000	1600	2000	1600	2000	1600	NNS
Fluorene	86-73-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Fluorine	7782-41-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Heptachlor	76-44-8	0.52	0.004	0.52	0.004	0.58	0.013	0.9
Heptachlor epoxide	1024-57-3	0.52	0.004	0.52	0.004	0.58	0.013	0.9
Hexachlorobenzene	118-74-1	6.0	3.7	NNS	NNS	NNS	NNS	NNS
Hexachlorobutadiene	87-68-3	45	8.2	45	8.2	45	8.2	NNS
Hexachlorocyclohexane alpha	319-84-6	1600	130	1600	130	1600	130	1600
Hexachlorocyclohexane beta	319-85-7	1600	130	1600	130	1600	130	1600
Hexachlorocyclohexane delta	319-86-8	1600	130	1600	130	1600	130	1600
Hexachlorocyclohexane gamma (lindane)	58-89-9	2.0	0.08	3.4	0.28	7.6	0.61	11
Hexachlorocyclopentadiene	77-47-4	3.5	0.3	3.5	0.3	3.5	0.3	NNS
Hexachloroethane	67-72-1	490	350	490	350	490	350	850
Indeno (1,2,3-cd) pyrene	193-39-5	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Isophorone	78-59-1	59000	43000	59000	43000	59000	43000	NNS
Lead (as Pb)	7439-97-1	f D	f D	f D	f D	f D	f D	f D
Manganese (as Mn)	7439-96-5	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Mercury (as Hg)	7439-97-6	2.4 D	0.01 D	2.4 D	0.01 D	2.6 D	0.2 D	5.0 D
Methoxychlor	72-43-5	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Naphthalene	91-20-3	1100	210	3200	580	3200	580	NNS
Nickel (as Ni)	7440-02-0	g D	g D	g D	g D	g D	g D	g D
Nitrate (as N)	14797-55-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Nitrite (as N)	14797-65-0	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Nitrate/Nitrite (as Total N)		NNS	NNS	NNS	NNS	NNS	NNS	NNS
Nitrobenzene	98-95-3	1300	850	1300	850	1300	850	NNS
o-Nitrophenol	88-75-5	NNS	NNS	NNS	NNS	NNS	NNS	NNS
p-Nitrophenol	100-02-7	4100	3000	4100	3000	4100	3000	NNS
N-nitrosodimethylamine	62-75-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS
N-nitrosodiphenylamine	86-30-6	2900	200	2900	200	2900	200	NNS
N-nitrosodi-n-propylamine	621-64-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Pentachlorophenol	87-86-5	h	h	h	h	h	h	h
Phenanthrene	85-01-8	30	6.3	30	6.3	54	6.3	NNS
Phenol	108-95-2	5100	730	7000	1000	7000	1000	180000
Polychlorinatedbiphenyls (PCBs)	1336-36-3	2.0	0.01	2.0	0.02	2.0	0.02	11
Pyrene	129-00-0	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Selenium (as Se)	7782-49-2	20 T	2.0 T	20 T	2.0 T	50 T	2.0 T	33 T
Silver (as Ag)	7440-22-4	i D	NNS	i D	NNS	i D	NNS	i D
Styrene	100-42-5	5600	370	5600	370	5600	370	NNS
Sulfides n		100	NNS	100	NNS	100	NNS	100
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	1746-01-6	0.01	0.005	0.01	0.005	0.12	0.01	0.1
1,1,2,2-Tetrachloroethane	79-34-5	4700	3200	4700	3200	4700	3200	NNS
Tetrachloroethylene	127-18-4	2600	280	6500	680	6500	680	15000
Thallium (as Tl)	7440-28-0	700 D	150 D	700 D	150 D	700 D	150 D	NNS
Toluene	108-88-3	8700	180	8700	180	8700	180	NNS
Toxaphene	8001-35-2	0.73	0.0002	0.73	0.02	0.73	0.02	11
1,2,4-Trichlorobenzene	120-82-1	750	130	1700	300	NNS	NNS	NNS
1,1,1-Trichloroethane	71-55-6	2600	1600	2600	1600	2600	1600	NNS
1,1,2-Trichloroethane	79-00-5	18000	12000	18000	12000	18000	12000	NNS
Trichloroethylene	79-01-6	20000	1300	20000	1300	20000	1300	NNS
2,4,6-Trichlorophenol	88-06-2	160	25	160	25	160	25	3000

2-(2,4,5-Trichlorophenoxy) proprionic acid (2,4,5-TP)	93-72-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Trihalomethanes, Total		NNS	NNS	NNS	NNS	NNS	NNS	NNS
Uranium (as Ur)	7440-61-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Vinyl chloride	75-01-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Xylenes (Total)	1330-20-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS
Zinc (as Zn)	7440-66-6	j D	j D	j D	j D	j D	j D	j D

Footnotes

a. The standard to protect this use is 7 million fibers (longer than 10 micrometers) per liter.

b. Values for ammonia are contained in separate tables located at the end of Appendix A.

c. Cadmium
A&We acute standard: (e(1.128 [ln(Hardness)] - 3.6867)) * (1.136672-ln(hardness) * (0.041838))
A&Wc chronic standard: (e(0.7852 [ln(Hardness)] - 2.715)) * (1.101672-ln(hardness) * (0.041838))
A&Ww acute standard: (e(1.128 [ln(Hardness)] - 3.6867)) * (1.136672-ln(hardness) * (0.041838))
A&Ww chronic standard: (e(0.7852 [ln(Hardness)] - 2.715)) * (1.101672-ln(hardness) * (0.041838))
A&Wedw acute standard: (e(1.128 [ln(Hardness)] - 3.6867)) * (1.136672-ln(hardness) * (0.041838))
A&Wedw chronic standard: (e(0.7852 [ln(Hardness)] - 2.715)) * (1.101672-ln(hardness) * (0.041838))
A&We acute standard: (e(1.128 [ln(Hardness)] - 0.9691)) * (1.136672-ln(hardness) * (0.041838))
(See Footnote k)

d. Chromium III
A&Wc acute standard: (e(0.8190 [ln(Hardness)] + 3.7256)) * (0.316)
A&Wc chronic standard: (e(0.8190 [ln(Hardness)] + 0.6848)) * (0.86)
A&Ww acute standard: (e(0.8190 [ln(Hardness)] + 3.7256)) * (0.316)
A&Ww chronic standard: (e(0.8190 [ln(Hardness)] + 0.6848)) * (0.86)
A&Wedw acute standard: (e(0.8190 [ln(Hardness)] + 3.7256)) * (0.316)
A&Wedw chronic standard: (e(0.8190 [ln(Hardness)] + 0.6848)) * (0.86)
A&We acute standard: (e(0.8190 [ln(Hardness)] + 4.9361)) * (0.316)
(See Footnote k)

e. Copper
A&Wc acute standard: (e(0.9422 [ln(Hardness)] - 1.7)) * (0.96)
A&Wc chronic standard: (e(0.8545 [ln(Hardness)] - 1.702)) * (0.96)
A&Ww acute standard: (e(0.9422 [ln(Hardness)] - 1.7)) * (0.96)
A&Ww chronic standard: (e(0.8545 [ln(Hardness)] - 1.702)) * (0.96)
A&Wedw acute standard: (e(0.9422 [ln(Hardness)] - 1.7)) * (0.96)
A&Wedw chronic standard: (e(0.8545 [ln(Hardness)] - 1.702)) * (0.96)
A&We acute standard: (e(0.9422 [ln(Hardness)] - 1.1514)) * (0.96)
(See Footnote k)

f. Lead
A&Wc acute standard: (e(1.2730 [ln(Hardness)] - 1.460)) * (1.46203-ln(hardness) * (0.145712))
A&Wc chronic standard: (e(1.2730 [ln(Hardness)] - 4.705)) * (1.46203-ln(hardness) * (0.145712))
A&Ww acute standard: (e(1.2730 [ln(Hardness)] - 1.460)) * (1.46203-ln(hardness) * (0.145712))
A&Ww chronic standard: (e(1.2730 [ln(Hardness)] - 4.705)) * (1.46203-ln(hardness) * (0.145712))
A&Wedw acute standard: (e(1.2730 [ln(Hardness)] - 1.460)) * (1.46203-ln(hardness) * (0.145712))
A&Wedw chronic standard: (e(1.2730 [ln(Hardness)] - 4.705)) * (1.46203-ln(hardness) * (0.145712))
A&We acute standard: (e(1.2730 [ln(Hardness)] - 0.7131)) * (1.46203-ln(hardness) * (0.145712))
(See Footnote k)

g. Nickel
A&Wc acute standard: (e(0.8460 [ln(Hardness)] + 2.255)) * (0.998)
A&Wc chronic standard: (e(0.8460 [ln(Hardness)] + 0.0584)) * (0.997)
A&Ww acute standard: (e(0.8460 [ln(Hardness)] + 2.255)) * (0.998)
A&Ww chronic standard: (e(0.8460 [ln(Hardness)] + 0.0584)) * (0.997)
A&Wedw acute standard: (e(0.8460 [ln(Hardness)] + 2.255)) * (0.998)
A&Wedw chronic standard: (e(0.8460 [ln(Hardness)] + 0.0584)) * (0.997)
A&We acute standard: (e(0.8460 [ln(Hardness)] + 4.4389)) * (0.998)
(See Footnote k)

h. Pentachlorophenol
A&Wc acute standard: e(1.005 (pH) - 4.830)
A&Wc chronic standard: e(1.005 (pH) - 5.290)
A&Ww acute standard: e(1.005 (pH) - 4.830)
A&Ww chronic standard: e(1.005 (pH) - 5.290)
A&Wedw acute standard: e(1.005 (pH) - 4.830)
A&Wedw chronic standard: e(1.005 (pH) - 5.290)

~~A&We acute standard: e(1.005 (pH) - 3.4306)~~
~~(See Footnote l)~~

~~i. Silver~~
~~A&Wc acute standard: (e(1.72 [ln(Hardness)] - 6.52)) * (0.85)~~
~~A&Ww acute standard: (e(1.72 [ln(Hardness)] - 6.52)) * (0.85)~~
~~A&Wedw acute standard: (e(1.72 [ln(Hardness)] - 6.52)) * (0.85)~~
~~A&We acute standard: (e(1.72 [ln(Hardness)] - 6.52)) * (0.85)~~
~~(See Footnote k)~~

~~j. Zinc~~
~~A&Wc acute standard: (e(0.8473 [ln(Hardness)] + 0.884)) * (0.978)~~
~~A&Wc chronic standard: (e(0.8473 [ln(Hardness)] + 0.884)) * (0.978)~~
~~A&Ww acute standard: (e(0.8473 [ln(Hardness)] + 0.884)) * 0.978)~~
~~A&Ww chronic standard: (e(0.8473 [ln(Hardness)] + 0.884)) * (0.978)~~
~~A&Wedw acute standard: (e(0.8473 [ln(Hardness)] + 0.884)) * (0.978)~~
~~A&Wedw chronic standard: (e(0.8473 [ln(Hardness)] + 0.884)) * (0.978)~~
~~A&We acute standard: (e(0.8473 [ln(Hardness)] + 3.1342)) * (0.978)~~
~~(See Footnote k)~~

~~k. Hardness, expressed as mg/L CaCO3, is inserted into the equation where it says "Hardness." Hardness is determined according to the following criteria:~~
~~1. If the receiving water body has an A&Wc or A&Ww designated use, then hardness is based on the hardness of the receiving water body from a sample taken at the same time that the sample for the metal is taken, except that the hardness may not exceed 400 mg / L CaCO3.~~
~~2. If the receiving water has an A&Wedw or A&We designated use, then the hardness is based on the hardness of the effluent from a sample taken at the same time that the sample for the metal is taken, except that the hardness may not exceed 400 mg / L CaCO3.~~

~~l. The pH is inserted into the equation where it says "pH". pH is determined according to the following criteria:~~
~~1. If the receiving water has an A&Wc or A&Ww designated use, then pH is based on the pH of the receiving water body from a sample taken at the same time that the sample for pentachlorophenol is taken.~~
~~2. If the receiving water body has an A&Wedw or A&We designated use, then the pH is based on the pH of the effluent from a sample taken at the same time that the sample for pentachlorophenol is taken.~~

~~m. The mathematical equations for the pH-dependent and hardness-dependent parameters represent the water quality standards. Criteria for the hardness-dependent and pH-dependent parameters have been calculated and are presented in separate tables at the end of Appendix A for the convenience of the user.~~

~~n. In lakes, the acute criteria for sulfide apply only to water samples taken from the epilimnion, or the upper layer of a lake or reservoir.~~

~~o. Bromoform, chloroform, chlorodibromomethane, and dichlorobromomethane are trihalomethanes regulated by the total trihalomethane numeric standard. The total trihalomethane standard is exceeded when the sum of these four compounds exceeds 100 µg / L.~~

~~p. The standard to protect this use is 0.003 µg/L aldrin/dieldrin.~~

~~µg / L- micrograms per liter~~
~~NNS - No numeric standard~~
~~D - Dissolved~~
~~T - Total recoverable~~
~~TTHM - indicates that the chemical is a trihalomethane. See Trihalomethanes, Total for DWS standard.~~

APPENDIX A. NUMERIC WATER QUALITY STANDARDS

Table 1. Water Quality Criteria By Designated Use

PARAMETER	CAS NUMBER	DWS (µg/L)	FC (µg/L)	FBC (µg/L)	PBC (µg/L)	A&Wc Acute (µg/L)	A&Wc Chronic (µg/L)	A&Ww Acute (µg/L)	A&Ww Chronic (µg/L)	A&Wedw Acute (µg/L)	A&Wedw Chronic (µg/L)	A&We Acute (µg/L)	AgI (µg/L)	AgL (µg/L)
Acenaphthene	83329	420	198	56,000	56,000	850	550	850	550	850	550			
Acrolein	107028	3.5	1.9	467	467	34	30	34	30	34	30			
Acrylonitrile	107131	0.06	0.2	3	37,333	3,800	250	3,800	250	3,800	250			
Alachlor	15972608	2		9,333	9,333	2,500	170	2,500	170	2,500	170			
Aldrin	309002	0.002	0.00005	0.08	28	3		3		3		4.5	0.003	See (b)
Alpha Particles (Gross) Radioactivity		15 pCi/L												
Ammonia	7664417					See (e) & Table 25	See (e) & Table 26	See (e) & Table 25	See (e) & Table 26	See (e) & Table 25	See (e) & Table 26			
Anthracene	120127	2,100	74	280,000	280,000									
Antimony	7440360	6 T	640 T	747 T	747 T	88 D	30 D	88 D	30 D	1,000 D	600 D			
Arsenic	7440382	10 T	80 T	30 T	280 T	340 D	150 D	340 D	150 D	340 D	150 D	440 D	2,000 T	200 T
Asbestos	1332214	See (a)												
Atrazine	1912249	3		32,667	32,667									
Barium	7440393	2,000 T		98,000 T	98,000 T									
Benz(a)anthracene	56553	0.005	0.02	0.2	0.2									
Benzene	71432	5	114	93	3,733	2,700	180	2,700	180	8,800	560			
3, 4 Benzfluoranthene	205992	0.005	0.02	1.9	1.9									
Benzidine	92875	0.0002	0.0002	0.01	2,800	1,300	89	1,300	89	1,300	89	10,000	0.01	0.01
Benzo(a)pyrene	50328	0.2	0.02	0.2	0.2									
Benzo(k)fluoranthene	207089	0.005	0.02	1.9	1.9									
Beryllium	7440417	4 T	84 T	1,867 T	1,867 T									

APPENDIX A. NUMERIC WATER QUALITY STANDARDS

Table 1. Water Quality Criteria By Designated Use

PARAMETER	CAS NUMBER	DWS (µg/L)	FC (µg/L)	FBC (µg/L)	PBC (µg/L)	A&Wc Acute (µg/L)	A&Wc Chronic (µg/L)	A&Ww Acute (µg/L)	A&Ww Chronic (µg/L)	A&Wedw Acute (µg/L)	A&Wedw Chronic (µg/L)	A&We Acute (µg/L)	AgI (µg/L)	AgL (µg/L)
Beta particles and photon emitters		4 millirems /year												
Bis(2-chloroethyl) ether	111444	0.03	0.5	1	1	120,000	6,700	120,000	6,700	120,000	6,700			
Bis(2-chloroisopropyl) ether	108601	280	3,441	37,333	37,333									
Boron	7440428	1,400 T		186,667 T	186,667 T								1,000 T	
Bromodichloromethane	75274	TTHM See (g)	17	18,667	18,667									
p-Bromodiphenyl ether	101553					180	14	180	14	180	14			
Bromoform	75252	TTHM See (g)	133	180	18,667	15,000	10,000	15,000	10,000	15,000	10,000			
Bromomethane	74839	9.8	299	1,307	1,307	5,500	360	5,500	360	5,500	360			
Butyl benzyl phthalate	85687	1,400	386	186,667	186,667	1,700	130	1,700	130	1,700	130			
Cadmium	7440439	5 T	84 T	700 T	700 T	See (d) & Table 2	See (d) & Table 3	See (d) & Table 4	See (d) & Table 5	See (d) & Table 4	See (d) & Table 5	See (d) & Table 6	50	50
Carbofuran	1563662	40		4,667	4,667	650	50	650	50	650	50			
Carbon tetrachloride	56235	5	2	11	1,307	18,000	1,100	18,000	1,100	18,000	1,100			
Chlordane	57749	2	0.0008	4	467	2.4	0.004	2.4	0.2	2.4	0.2	3.2		
Chlorine (total residual)	7782505	4,000		4,000	4,000	19	11	19	11	19	11			
Chlorobenzene	108907	100	1,553	18,667	18,667	3,800	260	3,800	260	3,800	260			
2-Chloroethyl vinyl ether	110758					180,000	9,800	180,000	9,800	180,000	9,800			
Chloroform	67663	TTHM See (g)	2,133	9,333	9,333	14,000	900	14,000	900	14,000	900			
p-Chloro-m-cresol	59507					15	4.7	15	4.7	15	4.7	48,000		
Chloromethane	74873					270,000	15,000	270,000	15,000	270,000	15,000			
2-Chloronapthalene	91587	560	317	74,667	74,667									
2-Chlorophenol	95578	35	30	4,667	4,667	2,200	150	2,200	150	2,200	150			
Chloropyrifos	2921882	21		2,800	2,800	0.08	0.04	0.08	0.04	0.08	0.04			
Chromium III	16065831		75,000 T	1,400,000 T	1,400,000 T	See (d) & Table 7	See (d) & Table 8	See (d) & Table 7	See (d) & Table 8	See (d) & Table 7	See (d) & Table 8	See (d) & Table 9		
Chromium VI	18540299	21 T	150 T	2,800 T	2,800 T	16 D	11 D	16 D	11 D	16 D	11 D	34 D		
Chromium (Total)	7440473	100 T											1,000	1,000
Chrysene	218019	0.005	0.02	19	19									
Copper	7440508	1,300 T		1,300 T	1,300 T	See (d) & Table 10	See (d) & Table 11	See (d) & Table 10	See (d) & Table 11	See (d) & Table 10	See (d) & Table 11	See (d) & Table 12	5,000 T	500 T
Cyanide (as free cyanide)	57125	200 T	16,000 T	18,667 T	18,667 T	22 T	5.2 T	41 T	9.7 T	41 T	9.7 T	84 T		200 T
Dalapon	75990	200	8,000	28,000	28,000									
Dibenz (ah) anthracene	53703	0.005	0.02	1.9	1.9									
Dibromochloromethane	124481	TTHM See (g)	13	18,667	18,667									
1,2-Dibromo-3-chloropropane	96128	0.2												
1,2-Dibromoethane	106934	0.05		8,400	8,400									
Dibutyl phthalate	84742	700	899	93,333	93,333	470	35	470	35	470	35	1,100		
1,2-Dichlorobenzene	95501	600	205	84,000	84,000	790	300	1,200	470	1,200	470	5,900		
1,3-Dichlorobenzene	541731					2,500	970	2,500	970	2,500	970			
1,4-Dichlorobenzene	106467	75	5,755	373,333	373.333	560	210	2,000	780	2,000	780	6,500		
3,3'-Dichlorobenzidine	91941	0.08	0.03	3	3									
p,p'-Dichlorodiphenyl-trichloroethane (DDT) and metabolites (DDD) and (DDE)	50293	0.1	0.0002	4	467	1.1	0.001	1.1	0.001	1.1	0.001	1.1	0.001	0.001
1,2-Dichloroethane	107062	5	37	15	186,667	59,000	41,000	59,000	41,000	59,000	41,000			
1,1-Dichloroethylene	75354	7	7,143	46,667	46,667	15,000	950	15,000	950	15,000	950			
1,2-cis-Dichloroethylene	156592	70		70	70									
1,2-trans-Dichloroethylene	156605	100	10,127	18,667	18,667	68,000	3,900	68,000	3,900	68,000	3,900			
Dichloromethane	75092	5	593	190	56,000	97,000	5,500	97,000	5,500	97,000	5,500			
2,4-Dichlorophenol	120832	21	59	2,800	2,800	1,000	88	1,000	88	1,000	88			
2,4-Dichlorophenoxyacetic acid (2,4-D)	94757	70		9,333	9,333									
1,2-Dichloropropane	78875	5	17,518	84,000	84,000	26,000	9,200	26,000	9,200	26,000	9,200			
1,3-Dichloropropene	542756	0.7	42	420	28,000	3,000	1,100	3,000	1,100	3,000	1,100			
Dieldrin	60571	0.002	0.00005	0.09	47	0.2	0.06	0.2	0.06	0.2	0.06	4	0.003	See (b)
Diethyl phthalate	84662	5,600	8,767	746,667	746,667	26,000	1,600	26,000	1,600	26,000	1,600			
Di (2-ethylhexyl) adipate	103231	400		560,000	560,000									
Di (2-ethylhexyl) phthalate	117817	6	3	1,200	18,667	400	360	400	360	400	360	3,100		
2,4-Dimethylphenol	105679	140	171	18,667	18,667	1,000	310	1,000	310	1,000	310	150,000		
Dimethyl phthalate	131113					17,000	1,000	17,000	1,000	17,000	1,000			
4,6-Dinitro-o-cresol	534521	28	582	3,733	3.733	310	24	310	24	310	24			

APPENDIX A. NUMERIC WATER QUALITY STANDARDS

Table 1. Water Quality Criteria By Designated Use

PARAMETER	CAS NUMBER	DWS (µg/L)	FC (µg/L)	FBC (µg/L)	PBC (µg/L)	A&Wc Acute (µg/L)	A&Wc Chronic (µg/L)	A&Ww Acute (µg/L)	A&Ww Chronic (µg/L)	A&Wedw Acute (µg/L)	A&Wedw Chronic (µg/L)	A&We Acute (µg/L)	AgI (µg/L)	AgL (µg/L)
2,4-Dinitrophenol	51285	14	1,067	1,867	1,867	110	9.2	110	9.2	110	9.2			
2,4-Dinitrotoluene	121142	14	421	1,867	1,867	14,000	860	14,000	860	14,000	860			
2,6-Dinitrotoluene	606202	0.05		2	3,733									
Di-n-octyl phthalate	117840	2,800		373,333	373,333									
Dinoseb	88857	7		933	933									
1,2-Diphenylhydrazine	122667	0.04	0.2	1.8	1.8	130	11	130	11	130	11			
Diquat	85007	20		2,053	2,053									
Endosulfan sulfate	1031078	42	18	5,600	5,600	0.2	0.06	0.2	0.06	0.2	0.06	3		
Endosulfan (Total)	115297	42	18	5,600	5,600	0.2	0.06	0.2	0.06	0.2	0.06	3		
Endothall	145733	100		18,667	18,667									
Endrin	72208	2	0.06	280	280	0.09	0.04	0.09	0.04	0.09	0.04	0.7	0.004	0.004
Endrin aldehyde	7421933					0.09	0.04	0.09	0.04	0.09	0.04	0.7		
Ethylbenzene	100414	700	2,133	93,333	93,333	23,000	1,400	23,000	1,400	23,000	1,400			
Fluoranthene	206440	280	28	37,333	37,333	2,000	1,600	2,000	1,600	2,000	1,600			
Fluorene	86737	280	1,067	37,333	37,333									
Fluoride	7782414	4,000		140,000	140,000									
Glyphosate	1071836	700	266,667	93,333	93,333									
Guthion	86500						0.01		0.01		0.01			
Heptachlor	76448	0.4	0.00008	0.4	467	0.5	0.004	0.5	0.004	0.6	0.01	0.9		
Heptachlor epoxide	1024573	0.2	0.00004	0.2	12	0.5	0.004	0.5	0.004	0.6	0.01	0.9		
Hexachlorobenzene	118741	1	0.0003	1	747	6	3.7	6	3.7	6	3.7			
Hexachlorobutadiene	87683	0.4	18	18	187	45	8.2	45	8.2	45	8.2			
Hexachlorocyclohexane alpha	319846	0.006	0.005	0.22	7,467	1,600	130	1,600	130	1,600	130	1,600		
Hexachlorocyclohexane beta	319857	0.02	0.02	0.78	560	1,600	130	1,600	130	1,600	130	1,600		
Hexachlorocyclohexane delta	319868					1,600	130	1,600	130	1,600	130	1,600		
Hexachlorocyclohexane gamma (lindane)	58899	0.2	1.8	280	280	1		1		1		11		
Hexachlorocyclopentadi-ene	77474	50	74	11,200	11,200	3.5	0.3	3.5	0.3	3.5	0.3			
Hexachloroethane	67721	2.5	3.3	100	933	490	350	490	350	490	350	850		
Hydrogen sulfide	7783064						2 See (c)		2 See (c)		2 See (c)			
Indeno (1,2,3-cd) pyrene	193395	0.05	0.2	1.9	1.9									
Iron	7439896						1,000 D		1,000 D		1,000 D			
Isophorone	78591	37	961	1,500	186,667	59,000	43,000	59,000	43,000	59,000	43,000			
Lead	7439971	15 T		15 T	15 T	See (d) & Table 13	See (d) & Table 14	See (d) & Table 13	See (d) & Table 14	See (d) & Table 13	See (d) & Table 14	See (d) & Table 15	10,000 T	100 T
Malathion	121755	140		18,667	18,667		0.1		0.1		0.1			
Manganese	7439965	980		130,667	130,667								10,000	
Mercury	7439976	2 T		280 T	280 T	2.4 D	0.01 D	2.4 D	0.01 D	2.4 D	0.01 D	5 D		10 T
Methoxychlor	72435	40		4,667	4,667		0.03		0.03		0.03			
Methylmercury			0.3 mg/kg											
Mirex	2385855	1		187	187		0.001		0.001		0.001			
Naphthalene	91203	140	1,524	18,667	18,667	1,100	210	3,200	580	3,200	580			
Nickel	7440020	210 T	511 T	28,000 T	28,000 T	See (d) & Table 16	See (d) & Table 17	See (d) & Table 16	See (d) & Table 17	See (d) & Table 16	See (d) & Table 17	See (d) & Table 18		
Nitrate	14797558	10,000		3,733,333	3,733,333									
Nitrite	14797650	1,000		233,333	233,333									
Nitrate + Nitrite		10,000												
Nitrobenzene	98953	3.5	138	467	467	1,300	850	1,300	850	1,300	850			
p-Nitrophenol	100027					4,100	3,000	4,100	3,000	4,100	3,000			
N-nitrosodimethylamine	62759	0.001	3	0.03	0.03									
N-nitrosodi-n-pheny-lamine	86306	7.1	6	290	290	2,900	200	2,900	200	2,900	200			
N-nitrosodi-n-propy-lamine	621647	0.005	0.5	0.2	88,667									
Oxamyl	23135220	200		23,333	23,333									
Parathion	56382					0.07	0.01	0.07	0.01	0.07	0.01			
Paraquat	1910425	32		4,200	4,200	100	54	100	54	100	54			
Pentachlorophenol	87865	1	370	12	28,000	See (e) & Table 22	See (e) & Table 23	See (e) & Table 22	See (e) & Table 23	See (e) & Table 22	See (e) & Table 23	See (e) & Table 24		
Permethrin	52645531	350		46,667	46,667	0.3	0.2	0.3	0.2	0.3	0.2			
Phenanthrene	85018					30	6.3	30	6.3	30	6.3			
Phenol	108952	2,100	37	280,000	280,000	5,100	730	7,000	1,000	7,000	1,000	180,000		
Picloram	1918021	500	2,710	65,333	65,333									
Polychlorinatedbiphenyls (PCBs)	1336363	0.5	0.00006	19	19	2	0.01	2	0.02	2	0.02	11	0.001	0.001
Pyrene	129000	210	800	28,000	28,000									

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Table 1. Water Quality Criteria By Designated Use

PARAMETER	CAS NUMBER	DWS (µg/L)	FC (µg/L)	FBC (µg/L)	PBC (µg/L)	A&Wc Acute (µg/L)	A&Wc Chronic (µg/L)	A&Ww Acute (µg/L)	A&Ww Chronic (µg/L)	A&Wedw Acute (µg/L)	A&Wedw Chronic (µg/L)	A&We Acute (µg/L)	AgI (µg/L)	AgL (µg/L)
Radium 226 + Radium 228		5 pCi/L												
Selenium	7782492	50 T	667 T	4,667 T	4,667 T		2 T		2 T		2 T	33 T	20 T	50 T
Silver	7440224	35 T	8,000 T	4,667 T	4,667 T	See (d) & Table 19		See (d) & Table 19		See (d) & Table 19		See (d) & Table 19		
Simazine	112349	4		4,667	4,667									
Styrene	100425	100		186,667	186,667	5,600	370	5,600	370	5,600	370			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	1746016	0.00003	$5x10^{-9}$	0.00003	0.0009	0.01	0.005	0.01	0.005	0.01	0.005	0.1		
1,1,2,2-Tetrachloroethane	79345	0.2	4	7	93,333	4,700	3,200	4,700	3,200	4,700	3,200			
Tetrachloroethylene	127184	5	261	9,333	9,333	2,600	280	6,500	680	6,500	680	15,000		
Thallium	7440280	2 T	1 T	75 T	75 T	700 D	150 D	700 D	150 D	700 D	150 D			
Toluene	108883	1,000	29,907	373,333	373,333	8,700	180	8,700	180	8,700	180			
Toxaphene	8001352	3	0.0003	1.3	933	0.7	0.0002	0.7	0.0002	0.7	0.0002	11	0.005	0.005
Tributylin						0.5	0.07	0.5	0.07	0.5	0.07			
1,2,4-Trichlorobenzene	120821	70	70	9,333	9,333	750	130	1,700	300	1,700	300			
1,1,1-Trichloroethane	71556	200	428,571	1,866,667	1,866,667	2,600	1,600	2,600	1,600	2,600	1,600		1,000	
1,1,2-Trichloroethane	79005	5	16	25	3,733	18,000	12,000	18,000	12,000	18,000	12,000			
Trichloroethylene	79016	5	29	280,000	280	20,000	1,300	20,000	1,300	20,000	1,300			
2,4,6-Trichlorophenol	88062	3.2	2	130	130	160	25	160	25	160	25	3,000		
2,4,5-Trichlorophenoxy proprionic acid (2,4,5-TP)	93721	50		7,467	7,467									
Trihalomethanes (T)		80												
Uranium	7440611	30 D		2,800	2,800									
Vinyl chloride	75014	2	5	2	2,800									
Xylenes (T)	1330207	10,000		186,667	186,667									
Zinc	7440666	2,100 T	5,106 T	280,000 T	280,000 T	See (d) & Table 20	See (d) & Table 20	See (d) & Table 20	See (d) & Table 20	See (d) & Table 20	See (d) & Table 20	See (d) & Table 21	10,000 T	25,000 T

Footnotes

a. The asbestos standard is 7 million fibers (longer than 10 micrometers) per liter.

b. The aldrin/dieldrin standard is exceeded when the sum of the two compounds exceeds 0.003 µg/L.

c. In lakes, the acute criteria for hydrogen sulfide apply only to water samples taken from the epilimnion, or the upper layer of a lake or reservoir.

d. Hardness, expressed as mg/L $CaCO_3$, is determined according to the following criteria:
   i. If the receiving water body has an A&Wc or A&Ww designated use, then hardness is based on the hardness of the receiving water body from a sample taken at the same time that the sample for the metal is taken, except that the hardness may not exceed 400 mg/L $CaCO_3$.
   ii. If the receiving water has an A&Wedw or A&We designated use, then the hardness is based on the hardness of the effluent from a sample taken at the same time that the sample for the metal is taken, except that the hardness may not exceed 400 mg/L $CaCO_3$.

e. pH is determined according to the following criteria:
   i. If the receiving water has an A&Wc or A&Ww designated use, then pH is based on the pH of the receiving water body from a sample taken at the same time that the sample for pentachlorophenol or ammonia is taken.
   ii. If the receiving water body has an A&Wedw or A&We designated use, then the pH is based on the pH of the effluent from a sample taken at the same time that the sample for pentachlorophenol or ammonia is taken.

f. Table 1 abbreviations.
   i. µg/L = micrograms per liter,
   ii. mg/kg = milligrams per kilogram,
   iii. pCi/L = picocuries per liter,
   iv. D = dissolved,
   v. T = total recoverable,
   vi. TTHM indicates that the chemical is a trihalomethane.

g. The total trihalomethane (TTHM) standard is exceeded when the sum of these four compounds exceeds 80 µg/L, as a rolling annual average.

Table 2. Acute Water Quality Standards for Dissolved Cadmium Aquatic and Wildlife coldwater

Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L	Hard. mg/L	Std. µg/L
1	0.02	41	0.85	81	1.64	121	2.42	161	3.20	201	3.97	241	4.73	281	5.49	321	6.25	361	7.00
2	0.04	42	0.87	82	1.66	122	2.44	162	3.22	202	3.99	242	4.75	282	5.51	322	6.27	362	7.02
3	0.07	43	0.89	83	1.68	123	2.46	163	3.24	203	4.01	243	4.77	283	5.53	323	6.29	363	7.04
4	0.09	44	0.91	84	1.70	124	2.48	164	3.26	204	4.03	244	4.79	284	5.55	324	6.31	364	7.06
5	0.11	45	0.93	85	1.72	125	2.50	165	3.28	205	4.04	245	4.81	285	5.57	325	6.33	365	7.08
6	0.13	46	0.95	86	1.74	126	2.52	166	3.30	206	4.06	246	4.83	286	5.59	326	6.34	366	7.10
7	0.15	47	0.97	87	1.76	127	2.54	167	3.31	207	4.08	247	4.85	287	5.61	327	6.36	367	7.12
8	0.17	48	0.99	88	1.78	128	2.56	168	3.33	208	4.10	248	4.87	288	5.63	328	6.38	368	7.14
9	0.19	49	1.01	89	1.80	129	2.58	169	3.35	209	4.12	249	4.88	289	5.64	329	6.40	369	7.15
10	0.21	50	1.03	90	1.82	130	2.60	170	3.37	210	4.14	250	4.90	290	5.66	330	6.42	370	7.17
11	0.23	51	1.05	91	1.84	131	2.62	171	3.39	211	4.16	251	4.92	291	5.68	331	6.44	371	7.19
12	0.26	52	1.07	92	1.86	132	2.64	172	3.41	212	4.18	252	4.94	292	5.70	332	6.46	372	7.21
13	0.28	53	1.09	93	1.88	133	2.66	173	3.43	213	4.20	253	4.96	293	5.72	333	6.48	373	7.23
14	0.30	54	1.11	94	1.90	134	2.68	174	3.45	214	4.22	254	4.98	294	5.74	334	6.50	374	7.25
15	0.32	55	1.13	95	1.92	135	2.70	175	3.47	215	4.24	255	5.00	295	5.76	335	6.51	375	7.27
16	0.34	56	1.15	96	1.94	136	2.72	176	3.49	216	4.26	256	5.02	296	5.78	336	6.53	376	7.29
17	0.36	57	1.17	97	1.95	137	2.73	177	3.51	217	4.27	257	5.04	297	5.80	337	6.55	377	7.30
18	0.38	58	1.19	98	1.97	138	2.75	178	3.53	218	4.29	258	5.06	298	5.81	338	6.57	378	7.32
19	0.40	59	1.21	99	1.99	139	2.77	179	3.55	219	4.31	259	5.08	299	5.83	339	6.59	379	7.34
20	0.42	60	1.23	100	2.01	140	2.79	180	3.56	220	4.33	260	5.09	300	5.85	340	6.61	380	7.36
21	0.44	61	1.25	101	2.03	141	2.81	181	3.58	221	4.35	261	5.11	301	5.87	341	6.63	381	7.38
22	0.46	62	1.26	102	2.05	142	2.83	182	3.60	222	4.37	262	5.13	302	5.89	342	6.65	382	7.40
23	0.48	63	1.28	103	2.07	143	2.85	183	3.62	223	4.39	263	5.15	303	5.91	343	6.66	383	7.42
24	0.50	64	1.30	104	2.09	144	2.87	184	3.64	224	4.41	264	5.17	304	5.93	344	6.68	384	7.44
25	0.52	65	1.32	105	2.11	145	2.89	185	3.66	225	4.43	265	5.19	305	5.95	345	6.70	385	7.45
26	0.54	66	1.34	106	2.13	146	2.91	186	3.68	226	4.45	266	5.21	306	5.97	346	6.72	386	7.47
27	0.56	67	1.36	107	2.15	147	2.93	187	3.70	227	4.47	267	5.23	307	5.99	347	6.74	387	7.49
28	0.58	68	1.38	108	2.17	148	2.95	188	3.72	228	4.48	268	5.25	308	6.00	348	6.76	388	7.51
29	0.60	69	1.40	109	2.19	149	2.97	189	3.74	229	4.50	269	5.27	309	6.02	349	6.78	389	7.53
30	0.62	70	1.42	110	2.21	150	2.99	190	3.76	230	4.52	270	5.28	310	6.04	350	6.80	390	7.55
31	0.64	71	1.44	111	2.23	151	3.01	191	3.78	231	4.54	271	5.30	311	6.06	351	6.82	391	7.57
32	0.66	72	1.46	112	2.25	152	3.03	192	3.80	232	4.56	272	5.32	312	6.08	352	6.83	392	7.59
33	0.68	73	1.48	113	2.27	153	3.04	193	3.81	233	4.58	273	5.34	313	6.10	353	6.85	393	7.60
34	0.70	74	1.50	114	2.29	154	3.06	194	3.83	234	4.60	274	5.36	314	6.12	354	6.87	394	7.62
35	0.72	75	1.52	115	2.31	155	3.08	195	3.85	235	4.62	275	5.38	315	6.14	355	6.89	395	7.64
36	0.75	76	1.54	116	2.33	156	3.10	196	3.87	236	4.64	276	5.40	316	6.16	356	6.91	396	7.66
37	0.77	77	1.56	117	2.35	157	3.12	197	3.89	237	4.66	277	5.42	317	6.17	357	6.93	397	7.68
38	0.79	78	1.58	118	2.37	158	3.14	198	3.91	238	4.68	278	5.44	318	6.19	358	6.95	398	7.70
39	0.81	79	1.60	119	2.38	159	3.16	199	3.93	239	4.69	279	5.45	319	6.21	359	6.97	399	7.72
40	0.83	80	1.62	120	2.40	160	3.18	200	3.95	240	4.71	280	5.47	320	6.23	360	6.98	400	7.74

Table 3. ~~Acute~~ Chronic Water Quality Standards for ~~dissolved~~ Dissolved Cadmium
Aquatic and Wildlife ~~ephemeral~~ coldwater

~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~
~~1~~	~~NA~~	~~41~~	~~24.56~~	~~81~~	~~51.39~~	~~121~~	~~79.40~~	~~161~~	~~108.18~~	~~201~~	~~137.55~~	~~241~~	~~167.40~~	~~281~~	~~197.64~~	~~321~~	~~228.24~~	~~361~~	~~259.14~~
~~2~~	~~NA~~	~~42~~	~~25.21~~	~~82~~	~~52.08~~	~~122~~	~~80.11~~	~~162~~	~~108.90~~	~~202~~	~~138.29~~	~~242~~	~~168.15~~	~~282~~	~~198.40~~	~~322~~	~~229.01~~	~~362~~	~~259.91~~
~~3~~	~~NA~~	~~43~~	~~25.86~~	~~83~~	~~52.77~~	~~123~~	~~80.82~~	~~163~~	~~109.63~~	~~203~~	~~139.03~~	~~243~~	~~168.90~~	~~283~~	~~199.17~~	~~323~~	~~229.78~~	~~363~~	~~260.69~~
~~4~~	~~NA~~	~~44~~	~~26.51~~	~~84~~	~~53.46~~	~~124~~	~~81.53~~	~~164~~	~~110.36~~	~~204~~	~~139.77~~	~~244~~	~~169.65~~	~~284~~	~~199.93~~	~~324~~	~~230.54~~	~~364~~	~~261.46~~
~~5~~	~~NA~~	~~45~~	~~27.17~~	~~85~~	~~54.15~~	~~125~~	~~82.24~~	~~165~~	~~111.09~~	~~205~~	~~140.51~~	~~245~~	~~170.40~~	~~285~~	~~200.69~~	~~325~~	~~231.31~~	~~365~~	~~262.24~~
~~6~~	~~NA~~	~~46~~	~~27.82~~	~~86~~	~~54.84~~	~~126~~	~~82.96~~	~~166~~	~~111.82~~	~~206~~	~~141.25~~	~~246~~	~~171.16~~	~~286~~	~~201.45~~	~~326~~	~~232.08~~	~~366~~	~~263.02~~
~~7~~	~~NA~~	~~47~~	~~28.48~~	~~87~~	~~55.53~~	~~127~~	~~83.67~~	~~167~~	~~112.55~~	~~207~~	~~142.00~~	~~247~~	~~171.91~~	~~287~~	~~202.21~~	~~327~~	~~232.85~~	~~367~~	~~263.79~~
~~8~~	~~NA~~	~~48~~	~~29.14~~	~~88~~	~~56.22~~	~~128~~	~~84.38~~	~~168~~	~~113.28~~	~~208~~	~~142.74~~	~~248~~	~~172.66~~	~~288~~	~~202.97~~	~~328~~	~~233.62~~	~~368~~	~~264.57~~
~~9~~	~~NA~~	~~49~~	~~29.80~~	~~89~~	~~56.92~~	~~129~~	~~85.10~~	~~169~~	~~114.01~~	~~209~~	~~143.48~~	~~249~~	~~173.41~~	~~289~~	~~203.74~~	~~329~~	~~234.39~~	~~369~~	~~265.35~~
~~10~~	~~NA~~	~~50~~	~~30.46~~	~~90~~	~~57.61~~	~~130~~	~~85.81~~	~~170~~	~~114.74~~	~~210~~	~~144.22~~	~~250~~	~~174.17~~	~~290~~	~~204.50~~	~~330~~	~~235.16~~	~~370~~	~~266.13~~
~~11~~	~~NA~~	~~51~~	~~31.12~~	~~91~~	~~58.31~~	~~131~~	~~86.53~~	~~171~~	~~115.47~~	~~211~~	~~144.97~~	~~251~~	~~174.92~~	~~291~~	~~205.26~~	~~331~~	~~235.93~~	~~371~~	~~266.90~~
~~12~~	~~NA~~	~~52~~	~~31.78~~	~~92~~	~~59.00~~	~~132~~	~~87.24~~	~~172~~	~~116.20~~	~~212~~	~~145.71~~	~~252~~	~~175.68~~	~~292~~	~~206.02~~	~~332~~	~~236.71~~	~~372~~	~~267.68~~
~~13~~	~~NA~~	~~53~~	~~32.44~~	~~93~~	~~59.70~~	~~133~~	~~87.96~~	~~173~~	~~116.93~~	~~213~~	~~146.46~~	~~253~~	~~176.43~~	~~293~~	~~206.79~~	~~333~~	~~237.48~~	~~373~~	~~268.46~~
~~14~~	~~NA~~	~~54~~	~~33.11~~	~~94~~	~~60.39~~	~~134~~	~~88.68~~	~~174~~	~~117.66~~	~~214~~	~~147.20~~	~~254~~	~~177.18~~	~~294~~	~~207.55~~	~~334~~	~~238.25~~	~~374~~	~~269.24~~
~~15~~	~~NA~~	~~55~~	~~33.77~~	~~95~~	~~61.09~~	~~135~~	~~89.39~~	~~175~~	~~118.40~~	~~215~~	~~147.94~~	~~255~~	~~177.94~~	~~295~~	~~208.31~~	~~335~~	~~239.02~~	~~375~~	~~270.02~~
~~16~~	~~NA~~	~~56~~	~~34.44~~	~~96~~	~~61.79~~	~~136~~	~~90.11~~	~~176~~	~~119.13~~	~~216~~	~~148.69~~	~~256~~	~~178.69~~	~~296~~	~~209.08~~	~~336~~	~~239.79~~	~~376~~	~~270.79~~
~~17~~	~~NA~~	~~57~~	~~35.11~~	~~97~~	~~62.48~~	~~137~~	~~90.83~~	~~177~~	~~119.86~~	~~217~~	~~149.43~~	~~257~~	~~179.45~~	~~297~~	~~209.84~~	~~337~~	~~240.56~~	~~377~~	~~271.57~~
~~18~~	~~NA~~	~~58~~	~~35.78~~	~~98~~	~~63.18~~	~~138~~	~~91.55~~	~~178~~	~~120.59~~	~~218~~	~~150.18~~	~~258~~	~~180.21~~	~~298~~	~~210.61~~	~~338~~	~~241.33~~	~~378~~	~~272.35~~
~~19~~	~~NA~~	~~59~~	~~36.45~~	~~99~~	~~63.88~~	~~139~~	~~92.26~~	~~179~~	~~121.33~~	~~219~~	~~150.93~~	~~259~~	~~180.96~~	~~299~~	~~211.37~~	~~339~~	~~242.11~~	~~379~~	~~273.13~~
~~20~~	~~NA~~	~~60~~	~~37.12~~	~~100~~	~~64.58~~	~~140~~	~~92.98~~	~~180~~	~~122.06~~	~~220~~	~~151.67~~	~~260~~	~~181.72~~	~~300~~	~~212.13~~	~~340~~	~~242.88~~	~~380~~	~~273.91~~
~~21~~	~~NA~~	~~61~~	~~37.79~~	~~101~~	~~65.28~~	~~141~~	~~93.70~~	~~181~~	~~122.80~~	~~221~~	~~152.42~~	~~261~~	~~182.47~~	~~301~~	~~212.90~~	~~341~~	~~243.65~~	~~381~~	~~274.69~~
~~22~~	~~NA~~	~~62~~	~~38.46~~	~~102~~	~~65.98~~	~~142~~	~~94.42~~	~~182~~	~~123.53~~	~~222~~	~~153.16~~	~~262~~	~~183.23~~	~~302~~	~~213.66~~	~~342~~	~~244.42~~	~~382~~	~~275.47~~
~~23~~	~~NA~~	~~63~~	~~39.13~~	~~103~~	~~66.68~~	~~143~~	~~95.14~~	~~183~~	~~124.27~~	~~223~~	~~153.91~~	~~263~~	~~183.99~~	~~303~~	~~214.43~~	~~343~~	~~245.20~~	~~383~~	~~276.25~~
~~24~~	~~NA~~	~~64~~	~~39.81~~	~~104~~	~~67.38~~	~~144~~	~~95.86~~	~~184~~	~~125.00~~	~~224~~	~~154.66~~	~~264~~	~~184.74~~	~~304~~	~~215.20~~	~~344~~	~~245.97~~	~~384~~	~~277.03~~
~~25~~	~~14.35~~	~~65~~	~~40.48~~	~~105~~	~~68.09~~	~~145~~	~~96.58~~	~~185~~	~~125.74~~	~~225~~	~~155.40~~	~~265~~	~~185.50~~	~~305~~	~~215.96~~	~~345~~	~~246.74~~	~~385~~	~~277.81~~
~~26~~	~~14.98~~	~~66~~	~~41.16~~	~~106~~	~~68.79~~	~~146~~	~~97.31~~	~~186~~	~~126.47~~	~~226~~	~~156.15~~	~~266~~	~~186.26~~	~~306~~	~~216.73~~	~~346~~	~~247.51~~	~~386~~	~~278.59~~
~~27~~	~~15.60~~	~~67~~	~~41.84~~	~~107~~	~~69.49~~	~~147~~	~~98.03~~	~~187~~	~~127.21~~	~~227~~	~~156.90~~	~~267~~	~~187.01~~	~~307~~	~~217.49~~	~~347~~	~~248.29~~	~~387~~	~~279.37~~
~~28~~	~~16.23~~	~~68~~	~~42.51~~	~~108~~	~~70.20~~	~~148~~	~~98.75~~	~~188~~	~~127.95~~	~~228~~	~~157.65~~	~~268~~	~~187.77~~	~~308~~	~~218.26~~	~~348~~	~~249.06~~	~~388~~	~~280.15~~
~~29~~	~~16.86~~	~~69~~	~~43.19~~	~~109~~	~~70.90~~	~~149~~	~~99.47~~	~~189~~	~~128.68~~	~~229~~	~~158.40~~	~~269~~	~~188.53~~	~~309~~	~~219.03~~	~~349~~	~~249.84~~	~~389~~	~~280.93~~
~~30~~	~~17.49~~	~~70~~	~~43.87~~	~~110~~	~~71.61~~	~~150~~	~~100.20~~	~~190~~	~~129.42~~	~~230~~	~~159.14~~	~~270~~	~~189.29~~	~~310~~	~~219.79~~	~~350~~	~~250.61~~	~~390~~	~~281.71~~
~~31~~	~~18.13~~	~~71~~	~~44.55~~	~~111~~	~~72.31~~	~~151~~	~~100.92~~	~~191~~	~~130.16~~	~~231~~	~~159.89~~	~~271~~	~~190.05~~	~~311~~	~~220.56~~	~~351~~	~~251.38~~	~~391~~	~~282.49~~
~~32~~	~~18.76~~	~~72~~	~~45.23~~	~~112~~	~~73.02~~	~~152~~	~~101.64~~	~~192~~	~~130.89~~	~~232~~	~~160.64~~	~~272~~	~~190.81~~	~~312~~	~~221.33~~	~~352~~	~~252.16~~	~~392~~	~~283.27~~
~~33~~	~~19.40~~	~~73~~	~~45.91~~	~~113~~	~~73.72~~	~~153~~	~~102.37~~	~~193~~	~~131.63~~	~~233~~	~~161.39~~	~~273~~	~~191.56~~	~~313~~	~~222.09~~	~~353~~	~~252.93~~	~~393~~	~~284.05~~
~~34~~	~~20.04~~	~~74~~	~~46.60~~	~~114~~	~~74.43~~	~~154~~	~~103.09~~	~~194~~	~~132.37~~	~~234~~	~~162.14~~	~~274~~	~~192.32~~	~~314~~	~~222.86~~	~~354~~	~~253.71~~	~~394~~	~~284.83~~
~~35~~	~~20.68~~	~~75~~	~~47.28~~	~~115~~	~~75.14~~	~~155~~	~~103.82~~	~~195~~	~~133.11~~	~~235~~	~~162.89~~	~~275~~	~~193.08~~	~~315~~	~~223.63~~	~~355~~	~~254.48~~	~~395~~	~~285.61~~
~~36~~	~~21.32~~	~~76~~	~~47.96~~	~~116~~	~~75.85~~	~~156~~	~~104.54~~	~~196~~	~~133.85~~	~~236~~	~~163.64~~	~~276~~	~~193.84~~	~~316~~	~~224.40~~	~~356~~	~~255.26~~	~~396~~	~~286.40~~
~~37~~	~~21.97~~	~~77~~	~~48.65~~	~~117~~	~~76.56~~	~~157~~	~~105.27~~	~~197~~	~~134.59~~	~~237~~	~~164.39~~	~~277~~	~~194.60~~	~~317~~	~~225.16~~	~~357~~	~~256.03~~	~~397~~	~~287.18~~
~~38~~	~~22.61~~	~~78~~	~~49.33~~	~~118~~	~~77.27~~	~~158~~	~~106.00~~	~~198~~	~~135.33~~	~~238~~	~~165.14~~	~~278~~	~~195.36~~	~~318~~	~~225.93~~	~~358~~	~~256.81~~	~~398~~	~~287.96~~
~~39~~	~~23.26~~	~~79~~	~~50.02~~	~~119~~	~~77.97~~	~~159~~	~~106.72~~	~~199~~	~~136.07~~	~~239~~	~~165.89~~	~~279~~	~~196.12~~	~~319~~	~~226.70~~	~~359~~	~~257.58~~	~~399~~	~~288.74~~
~~40~~	~~23.91~~	~~80~~	~~50.71~~	~~120~~	~~78.68~~	~~160~~	~~107.45~~	~~200~~	~~136.81~~	~~240~~	~~166.64~~	~~280~~	~~196.88~~	~~320~~	~~227.47~~	~~360~~	~~258.36~~	~~400~~	~~289.52~~
Hard mg/L	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**	**Hard mg/L**	**Std. µg/L**
1	0.01	41	0.13	81	0.21	121	0.28	161	0.34	201	0.40	241	0.45	281	0.50	321	0.55	361	0.60
2	0.02	42	0.13	82	0.21	122	0.28	162	0.34	202	0.40	242	0.45	282	0.50	322	0.55	362	0.60
3	0.02	43	0.14	83	0.22	123	0.28	163	0.35	203	0.40	243	0.46	283	0.51	323	0.55	363	0.60
4	0.03	44	0.14	84	0.22	124	0.29	164	0.35	204	0.40	244	0.46	284	0.51	324	0.56	364	0.60
5	0.03	45	0.14	85	0.22	125	0.29	165	0.35	205	0.40	245	0.46	285	0.51	325	0.56	365	0.60
6	0.03	46	0.14	86	0.22	126	0.29	166	0.35	206	0.41	246	0.46	286	0.51	326	0.56	366	0.60
7	0.04	47	0.15	87	0.22	127	0.29	167	0.35	207	0.41	247	0.46	287	0.51	327	0.56	367	0.61
8	0.04	48	0.15	88	0.23	128	0.29	168	0.35	208	0.41	248	0.46	288	0.51	328	0.56	368	0.61
9	0.05	49	0.15	89	0.23	129	0.29	169	0.35	209	0.41	249	0.46	289	0.51	329	0.56	369	0.61
10	0.05	50	0.15	90	0.23	130	0.30	170	0.36	210	0.41	250	0.46	290	0.51	330	0.56	370	0.61
11	0.05	51	0.15	91	0.23	131	0.30	171	0.36	211	0.41	251	0.47	291	0.52	331	0.56	371	0.61
12	0.06	52	0.16	92	0.23	132	0.30	172	0.36	212	0.41	252	0.47	292	0.52	332	0.57	372	0.61
13	0.06	53	0.16	93	0.23	133	0.30	173	0.36	213	0.42	253	0.47	293	0.52	333	0.57	373	0.61
14	0.06	54	0.16	94	0.24	134	0.30	174	0.36	214	0.42	254	0.47	294	0.52	334	0.57	374	0.61
15	0.07	55	0.16	95	0.24	135	0.30	175	0.36	215	0.42	255	0.47	295	0.52	335	0.57	375	0.62

Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L
16	0.07	56	0.16	96	0.24	136	0.30	176	0.36	216	0.42	256	0.47	296	0.52	336	0.57	376	0.62
17	0.07	57	0.17	97	0.24	137	0.31	177	0.37	217	0.42	257	0.47	297	0.52	337	0.57	377	0.62
18	0.07	58	0.17	98	0.24	138	0.31	178	0.37	218	0.42	258	0.47	298	0.52	338	0.57	378	0.62
19	0.08	59	0.17	99	0.24	139	0.31	179	0.37	219	0.42	259	0.48	299	0.53	339	0.57	379	0.62
20	0.08	60	0.17	100	0.25	140	0.31	180	0.37	220	0.43	260	0.48	300	0.53	340	0.57	380	0.62
21	0.08	61	0.17	101	0.25	141	0.31	181	0.37	221	0.43	261	0.48	301	0.53	341	0.58	381	0.62
22	0.09	62	0.18	102	0.25	142	0.31	182	0.37	222	0.43	262	0.48	302	0.53	342	0.58	382	0.62
23	0.09	63	0.18	103	0.25	143	0.32	183	0.37	223	0.43	263	0.48	303	0.53	343	0.58	383	0.62
24	0.09	64	0.18	104	0.25	144	0.32	184	0.38	224	0.43	264	0.48	304	0.53	344	0.58	384	0.63
25	0.09	65	0.18	105	0.25	145	0.32	185	0.38	225	0.43	265	0.48	305	0.53	345	0.58	385	0.63
26	0.10	66	0.18	106	0.26	146	0.32	186	0.38	226	0.43	266	0.48	306	0.53	346	0.58	386	0.63
27	0.10	67	0.19	107	0.26	147	0.32	187	0.38	227	0.43	267	0.49	307	0.54	347	0.58	387	0.63
28	0.10	68	0.19	108	0.26	148	0.32	188	0.38	228	0.44	268	0.49	308	0.54	348	0.58	388	0.63
29	0.10	69	0.19	109	0.26	149	0.32	189	0.38	229	0.44	269	0.49	309	0.54	349	0.59	389	0.63
30	0.11	70	0.19	110	0.26	150	0.33	190	0.38	230	0.44	270	0.49	310	0.54	350	0.59	390	0.63
31	0.11	71	0.19	111	0.26	151	0.33	191	0.39	231	0.44	271	0.49	311	0.54	351	0.59	391	0.63
32	0.11	72	0.20	112	0.27	152	0.33	192	0.39	232	0.44	272	0.49	312	0.54	352	0.59	392	0.63
33	0.11	73	0.20	113	0.27	153	0.33	193	0.39	233	0.44	273	0.49	313	0.54	353	0.59	393	0.64
34	0.12	74	0.20	114	0.27	154	0.33	194	0.39	234	0.44	274	0.50	314	0.54	354	0.59	394	0.64
35	0.12	75	0.20	115	0.27	155	0.33	195	0.39	235	0.45	275	0.50	315	0.55	355	0.59	395	0.64
36	0.12	76	0.20	116	0.27	156	0.33	196	0.39	236	0.45	276	0.50	316	0.55	356	0.59	396	0.64
37	0.12	77	0.21	117	0.27	157	0.34	197	0.39	237	0.45	277	0.50	317	0.55	357	0.59	397	0.64
38	0.13	78	0.21	118	0.28	158	0.34	198	0.40	238	0.45	278	0.50	318	0.55	358	0.60	398	0.64
39	0.13	79	0.21	119	0.28	159	0.34	199	0.40	239	0.45	279	0.50	319	0.55	359	0.60	399	0.64
40	0.13	80	0.21	120	0.28	160	0.34	200	0.40	240	0.45	280	0.50	320	0.55	360	0.60	400	0.64

Table 4. Acute Water Quality Standards for ~~dissolved~~ Dissolved Cadmium Aquatic and Wildlife ~~coldwater,~~ warmwater, and edw

~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~	~~Hard. mg/L~~	~~Std. ug/L~~
~~1~~	~~NA~~	~~41~~	~~1.62~~	~~81~~	~~3.39~~	~~121~~	~~5.24~~	~~161~~	~~7.14~~	~~201~~	~~9.08~~	~~241~~	~~11.05~~	~~281~~	~~13.05~~	~~321~~	~~15.07~~	~~361~~	~~17.11~~
~~2~~	~~NA~~	~~42~~	~~1.66~~	~~82~~	~~3.44~~	~~122~~	~~5.29~~	~~162~~	~~7.19~~	~~202~~	~~9.13~~	~~242~~	~~11.10~~	~~282~~	~~13.10~~	~~322~~	~~15.12~~	~~362~~	~~17.16~~
~~3~~	~~NA~~	~~43~~	~~1.71~~	~~83~~	~~3.48~~	~~123~~	~~5.34~~	~~163~~	~~7.24~~	~~203~~	~~9.18~~	~~243~~	~~11.15~~	~~283~~	~~13.15~~	~~323~~	~~15.17~~	~~363~~	~~17.21~~
~~4~~	~~NA~~	~~44~~	~~1.75~~	~~84~~	~~3.53~~	~~124~~	~~5.38~~	~~164~~	~~7.29~~	~~204~~	~~9.23~~	~~244~~	~~11.20~~	~~284~~	~~13.20~~	~~324~~	~~15.22~~	~~364~~	~~17.27~~
~~5~~	~~NA~~	~~45~~	~~1.79~~	~~85~~	~~3.58~~	~~125~~	~~5.43~~	~~165~~	~~7.34~~	~~205~~	~~9.28~~	~~245~~	~~11.25~~	~~285~~	~~13.25~~	~~325~~	~~15.27~~	~~365~~	~~17.32~~
~~6~~	~~NA~~	~~46~~	~~1.84~~	~~86~~	~~3.62~~	~~126~~	~~5.48~~	~~166~~	~~7.38~~	~~206~~	~~9.33~~	~~246~~	~~11.30~~	~~286~~	~~13.30~~	~~326~~	~~15.33~~	~~366~~	~~17.37~~
~~7~~	~~NA~~	~~47~~	~~1.88~~	~~87~~	~~3.67~~	~~127~~	~~5.52~~	~~167~~	~~7.43~~	~~207~~	~~9.38~~	~~247~~	~~11.35~~	~~287~~	~~13.35~~	~~327~~	~~15.38~~	~~367~~	~~17.42~~
~~8~~	~~NA~~	~~48~~	~~1.92~~	~~88~~	~~3.71~~	~~128~~	~~5.57~~	~~168~~	~~7.48~~	~~208~~	~~9.43~~	~~248~~	~~11.40~~	~~288~~	~~13.40~~	~~328~~	~~15.43~~	~~368~~	~~17.47~~
~~9~~	~~NA~~	~~49~~	~~1.97~~	~~89~~	~~3.76~~	~~129~~	~~5.62~~	~~169~~	~~7.53~~	~~209~~	~~9.47~~	~~249~~	~~11.45~~	~~289~~	~~13.45~~	~~329~~	~~15.48~~	~~369~~	~~17.52~~
~~10~~	~~NA~~	~~50~~	~~2.01~~	~~90~~	~~3.80~~	~~130~~	~~5.67~~	~~170~~	~~7.58~~	~~210~~	~~9.52~~	~~250~~	~~11.50~~	~~290~~	~~13.50~~	~~330~~	~~15.53~~	~~370~~	~~17.57~~
~~11~~	~~NA~~	~~51~~	~~2.05~~	~~91~~	~~3.85~~	~~131~~	~~5.71~~	~~171~~	~~7.62~~	~~211~~	~~9.57~~	~~251~~	~~11.55~~	~~291~~	~~13.55~~	~~331~~	~~15.58~~	~~371~~	~~17.62~~
~~12~~	~~NA~~	~~52~~	~~2.10~~	~~92~~	~~3.90~~	~~132~~	~~5.76~~	~~172~~	~~7.67~~	~~212~~	~~9.62~~	~~252~~	~~11.60~~	~~292~~	~~13.60~~	~~332~~	~~15.63~~	~~372~~	~~17.68~~
~~13~~	~~NA~~	~~53~~	~~2.14~~	~~93~~	~~3.94~~	~~133~~	~~5.81~~	~~173~~	~~7.72~~	~~213~~	~~9.67~~	~~253~~	~~11.65~~	~~293~~	~~13.65~~	~~333~~	~~15.68~~	~~373~~	~~17.73~~
~~14~~	~~NA~~	~~54~~	~~2.19~~	~~94~~	~~3.99~~	~~134~~	~~5.86~~	~~174~~	~~7.77~~	~~214~~	~~9.72~~	~~254~~	~~11.70~~	~~294~~	~~13.71~~	~~334~~	~~15.73~~	~~374~~	~~17.78~~
~~15~~	~~NA~~	~~55~~	~~2.23~~	~~95~~	~~4.03~~	~~135~~	~~5.90~~	~~175~~	~~7.82~~	~~215~~	~~9.77~~	~~255~~	~~11.75~~	~~295~~	~~13.76~~	~~335~~	~~15.78~~	~~375~~	~~17.83~~
~~16~~	~~NA~~	~~56~~	~~2.27~~	~~96~~	~~4.08~~	~~136~~	~~5.95~~	~~176~~	~~7.87~~	~~216~~	~~9.82~~	~~256~~	~~11.80~~	~~296~~	~~13.81~~	~~336~~	~~15.83~~	~~376~~	~~17.88~~
~~17~~	~~NA~~	~~57~~	~~2.32~~	~~97~~	~~4.13~~	~~137~~	~~6.00~~	~~177~~	~~7.91~~	~~217~~	~~9.87~~	~~257~~	~~11.85~~	~~297~~	~~13.86~~	~~337~~	~~15.89~~	~~377~~	~~17.93~~
~~18~~	~~NA~~	~~58~~	~~2.36~~	~~98~~	~~4.17~~	~~138~~	~~6.05~~	~~178~~	~~7.96~~	~~218~~	~~9.92~~	~~258~~	~~11.90~~	~~298~~	~~13.91~~	~~338~~	~~15.94~~	~~378~~	~~17.98~~
~~19~~	~~NA~~	~~59~~	~~2.41~~	~~99~~	~~4.22~~	~~139~~	~~6.09~~	~~179~~	~~8.01~~	~~219~~	~~9.97~~	~~259~~	~~11.95~~	~~299~~	~~13.96~~	~~339~~	~~15.99~~	~~379~~	~~18.04~~
~~20~~	~~NA~~	~~60~~	~~2.45~~	~~100~~	~~4.26~~	~~140~~	~~6.14~~	~~180~~	~~8.06~~	~~220~~	~~10.02~~	~~260~~	~~12.00~~	~~300~~	~~14.01~~	~~340~~	~~16.04~~	~~380~~	~~18.09~~
~~21~~	~~NA~~	~~61~~	~~2.50~~	~~101~~	~~4.31~~	~~141~~	~~6.19~~	~~181~~	~~8.11~~	~~221~~	~~10.06~~	~~261~~	~~12.05~~	~~301~~	~~14.06~~	~~341~~	~~16.09~~	~~381~~	~~18.14~~
~~22~~	~~NA~~	~~62~~	~~2.54~~	~~102~~	~~4.36~~	~~142~~	~~6.24~~	~~182~~	~~8.16~~	~~222~~	~~10.11~~	~~262~~	~~12.10~~	~~302~~	~~14.11~~	~~342~~	~~16.14~~	~~382~~	~~18.19~~
~~23~~	~~NA~~	~~63~~	~~2.58~~	~~103~~	~~4.40~~	~~143~~	~~6.28~~	~~183~~	~~8.21~~	~~223~~	~~10.16~~	~~263~~	~~12.15~~	~~303~~	~~14.16~~	~~343~~	~~16.19~~	~~383~~	~~18.24~~
~~24~~	~~NA~~	~~64~~	~~2.63~~	~~104~~	~~4.45~~	~~144~~	~~6.33~~	~~184~~	~~8.25~~	~~224~~	~~10.21~~	~~264~~	~~12.20~~	~~304~~	~~14.21~~	~~344~~	~~16.24~~	~~384~~	~~18.29~~

Table 4. Acute Water Quality Standards for ~~dissolved~~ Dissolved Cadmium Aquatic and Wildlife ~~coldwater,~~ warmwater, and edw

~~25~~	~~0.95~~	~~65~~	~~2.67~~	~~105~~	~~4.50~~	~~145~~	~~6.38~~	~~185~~	~~8.30~~	~~225~~	~~10.26~~	~~265~~	~~12.25~~	~~305~~	~~14.26~~	~~345~~	~~16.29~~	~~385~~	~~18.34~~
~~26~~	~~0.99~~	~~66~~	~~2.72~~	~~106~~	~~4.54~~	~~146~~	~~6.43~~	~~186~~	~~8.35~~	~~226~~	~~10.31~~	~~266~~	~~12.30~~	~~306~~	~~14.31~~	~~346~~	~~16.34~~	~~386~~	~~18.40~~
~~27~~	~~1.03~~	~~67~~	~~2.76~~	~~107~~	~~4.59~~	~~147~~	~~6.47~~	~~187~~	~~8.40~~	~~227~~	~~10.36~~	~~267~~	~~12.35~~	~~307~~	~~14.36~~	~~347~~	~~16.40~~	~~387~~	~~18.45~~
~~28~~	~~1.07~~	~~68~~	~~2.81~~	~~108~~	~~4.64~~	~~148~~	~~6.52~~	~~188~~	~~8.45~~	~~228~~	~~10.41~~	~~268~~	~~12.40~~	~~308~~	~~14.41~~	~~348~~	~~16.45~~	~~388~~	~~18.50~~
~~29~~	~~1.11~~	~~69~~	~~2.85~~	~~109~~	~~4.68~~	~~149~~	~~6.57~~	~~189~~	~~8.50~~	~~229~~	~~10.46~~	~~269~~	~~12.45~~	~~309~~	~~14.46~~	~~349~~	~~16.50~~	~~389~~	~~18.55~~
~~30~~	~~1.16~~	~~70~~	~~2.90~~	~~110~~	~~4.73~~	~~150~~	~~6.62~~	~~190~~	~~8.55~~	~~230~~	~~10.51~~	~~270~~	~~12.50~~	~~310~~	~~14.51~~	~~350~~	~~16.55~~	~~390~~	~~18.60~~
~~31~~	~~1.20~~	~~71~~	~~2.94~~	~~111~~	~~4.77~~	~~151~~	~~6.66~~	~~191~~	~~8.59~~	~~231~~	~~10.56~~	~~271~~	~~12.55~~	~~311~~	~~14.56~~	~~351~~	~~16.60~~	~~391~~	~~18.65~~
~~32~~	~~1.24~~	~~72~~	~~2.99~~	~~112~~	~~4.82~~	~~152~~	~~6.71~~	~~192~~	~~8.64~~	~~232~~	~~10.61~~	~~272~~	~~12.60~~	~~312~~	~~14.61~~	~~352~~	~~16.65~~	~~392~~	~~18.71~~
~~33~~	~~1.28~~	~~73~~	~~3.03~~	~~113~~	~~4.87~~	~~153~~	~~6.76~~	~~193~~	~~8.69~~	~~233~~	~~10.66~~	~~273~~	~~12.65~~	~~313~~	~~14.67~~	~~353~~	~~16.70~~	~~393~~	~~18.76~~
~~34~~	~~1.32~~	~~74~~	~~3.08~~	~~114~~	~~4.91~~	~~154~~	~~6.81~~	~~194~~	~~8.74~~	~~234~~	~~10.71~~	~~274~~	~~12.70~~	~~314~~	~~14.72~~	~~354~~	~~16.75~~	~~394~~	~~18.81~~
~~35~~	~~1.37~~	~~75~~	~~3.12~~	~~115~~	~~4.96~~	~~155~~	~~6.86~~	~~195~~	~~8.79~~	~~235~~	~~10.76~~	~~275~~	~~12.75~~	~~315~~	~~14.77~~	~~355~~	~~16.80~~	~~395~~	~~18.86~~
~~36~~	~~1.41~~	~~76~~	~~3.17~~	~~116~~	~~5.01~~	~~156~~	~~6.90~~	~~196~~	~~8.84~~	~~236~~	~~10.81~~	~~276~~	~~12.80~~	~~316~~	~~14.82~~	~~356~~	~~16.86~~	~~396~~	~~18.91~~
~~37~~	~~1.45~~	~~77~~	~~3.21~~	~~117~~	~~5.06~~	~~157~~	~~6.95~~	~~197~~	~~8.89~~	~~237~~	~~10.86~~	~~277~~	~~12.85~~	~~317~~	~~14.87~~	~~357~~	~~16.91~~	~~397~~	~~18.96~~
~~38~~	~~1.49~~	~~78~~	~~3.26~~	~~118~~	~~5.10~~	~~158~~	~~7.00~~	~~198~~	~~8.94~~	~~238~~	~~10.90~~	~~278~~	~~12.90~~	~~318~~	~~14.92~~	~~358~~	~~16.96~~	~~398~~	~~19.01~~
~~39~~	~~1.54~~	~~79~~	~~3.30~~	~~119~~	~~5.15~~	~~159~~	~~7.05~~	~~199~~	~~8.98~~	~~239~~	~~10.95~~	~~279~~	~~12.95~~	~~319~~	~~14.97~~	~~359~~	~~17.01~~	~~399~~	~~19.07~~
~~40~~	~~1.58~~	~~80~~	~~3.35~~	~~120~~	~~5.20~~	~~160~~	~~7.10~~	~~200~~	~~9.03~~	~~240~~	~~11.00~~	~~280~~	~~13.00~~	~~320~~	~~15.02~~	~~360~~	~~17.06~~	~~400~~	~~19.12~~

Table 4. Acute Water Quality Standards for ~~dissolved~~ Dissolved Cadmium Aquatic and Wildlife ~~coldwater,~~ warmwater, and edw

Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L
1	0.09	41	3.30	81	6.41	121	9.47	161	12.50	201	15.51	241	18.49	281	21.47	321	24.42	361	27.37
2	0.17	42	3.38	82	6.49	122	9.55	162	12.58	202	15.58	242	18.57	282	21.54	322	24.50	362	27.44
3	0.26	43	3.46	83	6.57	123	9.62	163	12.65	203	15.66	243	18.64	283	21.61	323	24.57	363	27.52
4	0.34	44	3.54	84	6.64	124	9.70	164	12.73	204	15.73	244	18.72	284	21.69	324	24.64	364	27.59
5	0.42	45	3.62	85	6.72	125	9.78	165	12.80	205	15.81	245	18.79	285	21.76	325	24.72	365	27.66
6	0.51	46	3.70	86	6.80	126	9.85	166	12.88	206	15.88	246	18.87	286	21.84	326	24.79	366	27.74
7	0.59	47	3.77	87	6.87	127	9.93	167	12.95	207	15.96	247	18.94	287	21.91	327	24.87	367	27.81
8	0.67	48	3.85	88	6.95	128	10.00	168	13.03	208	16.03	248	19.02	288	21.98	328	24.94	368	27.88
9	0.75	49	3.93	89	7.03	129	10.08	169	13.10	209	16.11	249	19.09	289	22.06	329	25.01	369	27.96
10	0.83	50	4.01	90	7.10	130	10.16	170	13.18	210	16.18	250	19.16	290	22.13	330	25.09	370	28.03
11	0.92	51	4.09	91	7.18	131	10.23	171	13.25	211	16.26	251	19.24	291	22.21	331	25.16	371	28.10
12	1.00	52	4.17	92	7.26	132	10.31	172	13.33	212	16.33	252	19.31	292	22.28	332	25.23	372	28.18
13	1.08	53	4.24	93	7.33	133	10.38	173	13.40	213	16.40	253	19.39	293	22.35	333	25.31	373	28.25
14	1.16	54	4.32	94	7.41	134	10.46	174	13.48	214	16.48	254	19.46	294	22.43	334	25.38	374	28.32
15	1.24	55	4.40	95	7.49	135	10.53	175	13.56	215	16.55	255	19.54	295	22.50	335	25.46	375	28.40
16	1.32	56	4.48	96	7.56	136	10.61	176	13.63	216	16.63	256	19.61	296	22.58	336	25.53	376	28.47
17	1.40	57	4.55	97	7.64	137	10.69	177	13.71	217	16.70	257	19.68	297	22.65	337	25.60	377	28.54
18	1.48	58	4.63	98	7.72	138	10.76	178	13.78	218	16.78	258	19.76	298	22.72	338	25.68	378	28.62
19	1.56	59	4.71	99	7.79	139	10.84	179	13.86	219	16.85	259	19.83	299	22.80	339	25.75	379	28.69
20	1.64	60	4.79	100	7.87	140	10.91	180	13.93	220	16.93	260	19.91	300	22.87	340	25.82	380	28.77
21	1.72	61	4.87	101	7.95	141	10.99	181	14.01	221	17.00	261	19.98	301	22.95	341	25.90	381	28.84
22	1.80	62	4.94	102	8.02	142	11.07	182	14.08	222	17.08	262	20.06	302	23.02	342	25.97	382	28.91
23	1.88	63	5.02	103	8.10	143	11.14	183	14.16	223	17.15	263	20.13	303	23.09	343	26.05	383	28.99
24	1.96	64	5.10	104	8.18	144	11.22	184	14.23	224	17.23	264	20.20	304	23.17	344	26.12	384	29.06
25	2.04	65	5.18	105	8.25	145	11.29	185	14.31	225	17.30	265	20.28	305	23.24	345	26.19	385	29.13
26	2.12	66	5.25	106	8.33	146	11.37	186	14.38	226	17.38	266	20.35	306	23.32	346	26.27	386	29.21
27	2.20	67	5.33	107	8.40	147	11.44	187	14.46	227	17.45	267	20.43	307	23.39	347	26.34	387	29.28
28	2.28	68	5.41	108	8.48	148	11.52	188	14.53	228	17.53	268	20.50	308	23.46	348	26.41	388	29.35
29	2.36	69	5.49	109	8.56	149	11.59	189	14.61	229	17.60	269	20.58	309	23.54	349	26.49	389	29.43
30	2.44	70	5.56	110	8.63	150	11.67	190	14.68	230	17.67	270	20.65	310	23.61	350	26.56	390	29.50

Table 4. Acute Water Quality Standards for ~~dissolved~~ Dissolved Cadmium Aquatic and Wildlife ~~coldwater,~~ warmwater, and edw

Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L
31	2.52	71	5.64	111	8.71	151	11.75	191	14.76	231	17.75	271	20.72	311	23.69	351	26.63	391	29.57
32	2.60	72	5.72	112	8.79	152	11.82	192	14.83	232	17.82	272	20.80	312	23.76	352	26.71	392	29.65
33	2.67	73	5.79	113	8.86	153	11.90	193	14.91	233	17.90	273	20.87	313	23.83	353	26.78	393	29.72
34	2.75	74	5.87	114	8.94	154	11.97	194	14.98	234	17.97	274	20.95	314	23.91	354	26.85	394	29.79
35	2.83	75	5.95	115	9.01	155	12.05	195	15.06	235	18.05	275	21.02	315	23.98	355	26.93	395	29.87
36	2.91	76	6.03	116	9.09	156	12.12	196	15.13	236	18.12	276	21.09	316	24.05	356	27.00	396	29.94
37	2.99	77	6.10	117	9.17	157	12.20	197	15.21	237	18.20	277	21.17	317	24.13	357	27.08	397	30.01
38	3.07	78	6.18	118	9.24	158	12.27	198	15.28	238	18.27	278	21.24	318	24.20	358	27.15	398	30.08
39	3.15	79	6.26	119	9.32	159	12.35	199	15.36	239	18.35	279	21.32	319	24.28	359	27.22	399	30.16
40	3.23	80	6.33	120	9.40	160	12.43	200	15.43	240	18.42	280	21.39	320	24.35	360	27.30	400	30.23

Table 5. Chronic Water Quality Standards for ~~dissolved~~ Dissolved Cadmium Aquatic and Wildlife ~~coldwater,~~ warmwater, and edw

Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L
1	NA	41	1.16	81	1.92	121	2.58	161	3.18	201	3.75	241	4.28	281	4.80	321	5.29	361	5.77
2	NA	42	1.18	82	1.93	122	2.59	162	3.20	202	3.76	242	4.30	282	4.81	322	5.30	362	5.78
3	NA	43	1.20	83	1.95	123	2.61	163	3.21	203	3.77	243	4.31	283	4.82	323	5.32	363	5.79
4	NA	44	1.22	84	1.97	124	2.62	164	3.23	204	3.79	244	4.32	284	4.84	324	5.33	364	5.81
5	NA	45	1.24	85	1.98	125	2.64	165	3.24	205	3.80	245	4.34	285	4.85	325	5.34	365	5.82
6	NA	46	1.26	86	2.00	126	2.65	166	3.25	206	3.82	246	4.35	286	4.86	326	5.35	366	5.83
7	NA	47	1.28	87	2.02	127	2.67	167	3.27	207	3.83	247	4.36	287	4.87	327	5.36	367	5.84
8	NA	48	1.30	88	2.04	128	2.69	168	3.28	208	3.84	248	4.38	288	4.89	328	5.38	368	5.85
9	NA	49	1.32	89	2.05	129	2.70	169	3.30	209	3.86	249	4.39	289	4.90	329	5.39	369	5.86
10	NA	50	1.34	90	2.07	130	2.72	170	3.31	210	3.87	250	4.40	290	4.91	330	5.40	370	5.88
11	NA	51	1.36	91	2.09	131	2.73	171	3.33	211	3.88	251	4.41	291	4.92	331	5.41	371	5.89
12	NA	52	1.38	92	2.10	132	2.75	172	3.34	212	3.90	252	4.43	292	4.94	332	5.42	372	5.90
13	NA	53	1.40	93	2.12	133	2.76	173	3.35	213	3.91	253	4.44	293	4.95	333	5.44	373	5.91
14	NA	54	1.42	94	2.14	134	2.78	174	3.37	214	3.92	254	4.45	294	4.96	334	5.45	374	5.92
15	NA	55	1.44	95	2.15	135	2.79	175	3.38	215	3.94	255	4.47	295	4.97	335	5.46	375	5.93
16	NA	56	1.46	96	2.17	136	2.81	176	3.40	216	3.95	256	4.48	296	4.98	336	5.47	376	5.95
17	NA	57	1.48	97	2.19	137	2.82	177	3.41	217	3.97	257	4.49	297	5.00	337	5.48	377	5.96
18	NA	58	1.50	98	2.20	138	2.84	178	3.43	218	3.98	258	4.50	298	5.01	338	5.50	378	5.97
19	NA	59	1.51	99	2.22	139	2.85	179	3.44	219	3.99	259	4.52	299	5.02	339	5.51	379	5.98
20	NA	60	1.53	100	2.24	140	2.87	180	3.45	220	4.01	260	4.53	300	5.03	340	5.52	380	5.99
21	NA	61	1.55	101	2.25	141	2.88	181	3.47	221	4.02	261	4.54	301	5.05	341	5.53	381	6.00
22	NA	62	1.57	102	2.27	142	2.90	182	3.48	222	4.03	262	4.56	302	5.06	342	5.54	382	6.02
23	NA	63	1.59	103	2.29	143	2.91	183	3.50	223	4.05	263	4.57	303	5.07	343	5.56	383	6.03
24	NA	64	1.61	104	2.30	144	2.93	184	3.51	224	4.06	264	4.58	304	5.08	344	5.57	384	6.04
25	0.80	65	1.63	105	2.32	145	2.94	185	3.53	225	4.07	265	4.59	305	5.10	345	5.58	385	6.05
26	0.83	66	1.65	106	2.34	146	2.96	186	3.54	226	4.09	266	4.61	306	5.11	346	5.59	386	6.06
27	0.85	67	1.66	107	2.35	147	2.97	187	3.55	227	4.10	267	4.62	307	5.12	347	5.60	387	6.07
28	0.87	68	1.68	108	2.37	148	2.99	188	3.57	228	4.11	268	4.63	308	5.13	348	5.62	388	6.08
29	0.89	69	1.70	109	2.39	149	3.00	189	3.58	229	4.13	269	4.65	309	5.15	349	5.63	389	6.10
30	0.92	70	1.72	110	2.40	150	3.02	190	3.60	230	4.14	270	4.66	310	5.16	350	5.64	390	6.11
31	0.94	71	1.74	111	2.42	151	3.03	191	3.61	231	4.15	271	4.67	311	5.17	351	5.65	391	6.12
32	0.96	72	1.76	112	2.43	152	3.05	192	3.62	232	4.17	272	4.68	312	5.18	352	5.66	392	6.13
33	0.98	73	1.77	113	2.45	153	3.06	193	3.64	233	4.18	273	4.70	313	5.19	353	5.68	393	6.14
34	1.01	74	1.79	114	2.47	154	3.08	194	3.65	234	4.19	274	4.71	314	5.21	354	5.69	394	6.15
35	1.03	75	1.81	115	2.48	155	3.09	195	3.66	235	4.21	275	4.72	315	5.22	355	5.70	395	6.17
36	1.05	76	1.83	116	2.50	156	3.11	196	3.68	236	4.22	276	4.73	316	5.23	356	5.71	396	6.18
37	1.07	77	1.84	117	2.51	157	3.12	197	3.69	237	4.23	277	4.75	317	5.24	357	5.72	397	6.19
38	1.09	78	1.86	118	2.53	158	3.14	198	3.71	238	4.24	278	4.76	318	5.26	358	5.73	398	6.20
39	1.11	79	1.88	119	2.54	159	3.15	199	3.72	239	4.26	279	4.77	319	5.27	359	5.75	399	6.21
40	1.14	80	1.90	120	2.56	160	3.17	200	3.73	240	4.27	280	4.78	320	5.28	360	5.76	400	6.22

Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L
1	0.02	41	0.30	81	0.48	121	0.64	161	0.78	201	0.91	241	1.03	281	1.15	321	1.26	361	1.37
2	0.04	42	0.31	82	0.49	122	0.64	162	0.78	202	0.91	242	1.04	282	1.15	322	1.26	362	1.37
3	0.05	43	0.31	83	0.49	123	0.65	163	0.79	203	0.92	243	1.04	283	1.16	323	1.27	363	1.37
4	0.06	44	0.32	84	0.50	124	0.65	164	0.79	204	0.92	244	1.04	284	1.16	324	1.27	364	1.38
5	0.07	45	0.32	85	0.50	125	0.66	165	0.79	205	0.92	245	1.05	285	1.16	325	1.27	365	1.38
6	0.08	46	0.33	86	0.51	126	0.66	166	0.80	206	0.93	246	1.05	286	1.16	326	1.27	366	1.38
7	0.09	47	0.33	87	0.51	127	0.66	167	0.80	207	0.93	247	1.05	287	1.17	327	1.28	367	1.38
8	0.10	48	0.34	88	0.51	128	0.67	168	0.80	208	0.93	248	1.05	288	1.17	328	1.28	368	1.39
9	0.10	49	0.34	89	0.52	129	0.67	169	0.81	209	0.94	249	1.06	289	1.17	329	1.28	369	1.39
10	0.11	50	0.35	90	0.52	130	0.67	170	0.81	210	0.94	250	1.06	290	1.17	330	1.28	370	1.39
11	0.12	51	0.35	91	0.53	131	0.68	171	0.81	211	0.94	251	1.06	291	1.18	331	1.29	371	1.39
12	0.13	52	0.36	92	0.53	132	0.68	172	0.82	212	0.95	252	1.07	292	1.18	332	1.29	372	1.40
13	0.14	53	0.36	93	0.53	133	0.68	173	0.82	213	0.95	253	1.07	293	1.18	333	1.29	373	1.40
14	0.14	54	0.37	94	0.54	134	0.69	174	0.82	214	0.95	254	1.07	294	1.19	334	1.30	374	1.40
15	0.15	55	0.37	95	0.54	135	0.69	175	0.83	215	0.95	255	1.07	295	1.19	335	1.30	375	1.40
16	0.16	56	0.38	96	0.55	136	0.69	176	0.83	216	0.96	256	1.08	296	1.19	336	1.30	376	1.41
17	0.16	57	0.38	97	0.55	137	0.70	177	0.83	217	0.96	257	1.08	297	1.19	337	1.30	377	1.41
18	0.17	58	0.38	98	0.55	138	0.70	178	0.84	218	0.96	258	1.08	298	1.20	338	1.31	378	1.41
19	0.18	59	0.39	99	0.56	139	0.71	179	0.84	219	0.97	259	1.09	299	1.20	339	1.31	379	1.41
20	0.18	60	0.39	100	0.56	140	0.71	180	0.84	220	0.97	260	1.09	300	1.20	340	1.31	380	1.42
21	0.19	61	0.40	101	0.57	141	0.71	181	0.85	221	0.97	261	1.09	301	1.21	341	1.31	381	1.42
22	0.20	62	0.40	102	0.57	142	0.72	182	0.85	222	0.98	262	1.10	302	1.21	342	1.32	382	1.42
23	0.20	63	0.41	103	0.57	143	0.72	183	0.85	223	0.98	263	1.10	303	1.21	343	1.32	383	1.42
24	0.21	64	0.41	104	0.58	144	0.72	184	0.86	224	0.98	264	1.10	304	1.21	344	1.32	384	1.43
25	0.21	65	0.42	105	0.58	145	0.73	185	0.86	225	0.99	265	1.10	305	1.22	345	1.32	385	1.43
26	0.22	66	0.42	106	0.58	146	0.73	186	0.86	226	0.99	266	1.11	306	1.22	346	1.33	386	1.43
27	0.23	67	0.42	107	0.59	147	0.73	187	0.87	227	0.99	267	1.11	307	1.22	347	1.33	387	1.43
28	0.23	68	0.43	108	0.59	148	0.74	188	0.87	228	0.99	268	1.11	308	1.22	348	1.33	388	1.44
29	0.24	69	0.43	109	0.60	149	0.74	189	0.87	229	1.00	269	1.12	309	1.23	349	1.34	389	1.44
30	0.24	70	0.44	110	0.60	150	0.74	190	0.88	230	1.00	270	1.12	310	1.23	350	1.34	390	1.44
31	0.25	71	0.44	111	0.60	151	0.75	191	0.88	231	1.00	271	1.12	311	1.23	351	1.34	391	1.44
32	0.25	72	0.45	112	0.61	152	0.75	192	0.88	232	1.01	272	1.12	312	1.24	352	1.34	392	1.45
33	0.26	73	0.45	113	0.61	153	0.75	193	0.89	233	1.01	273	1.13	313	1.24	353	1.35	393	1.45
34	0.26	74	0.46	114	0.61	154	0.76	194	0.89	234	1.01	274	1.13	314	1.24	354	1.35	394	1.45
35	0.27	75	0.46	115	0.62	155	0.76	195	0.89	235	1.02	275	1.13	315	1.24	355	1.35	395	1.46
36	0.28	76	0.46	116	0.62	156	0.76	196	0.90	236	1.02	276	1.14	316	1.25	356	1.35	396	1.46
37	0.28	77	0.47	117	0.63	157	0.77	197	0.90	237	1.02	277	1.14	317	1.25	357	1.36	397	1.46
38	0.29	78	0.47	118	0.63	158	0.77	198	0.90	238	1.02	278	1.14	318	1.25	358	1.36	398	1.46
39	0.29	79	0.48	119	0.63	159	0.77	199	0.91	239	1.03	279	1.14	319	1.26	359	1.36	399	1.47
40	0.30	80	0.48	120	0.64	160	0.78	200	0.91	240	1.03	280	1.15	320	1.26	360	1.36	400	1.47

Table 6. Acute Water Quality Standards for Dissolved Cadmium Aquatic and Wildlife ephemeral

Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L	Hard mg/L	Std. µg/L
1	0.25	41	9.58	81	18.58	121	27.45	161	36.23	201	44.94	241	53.59	281	62.21	321	70.78	361	79.32
2	0.50	42	9.80	82	18.80	122	27.67	162	36.45	202	45.15	242	53.81	282	62.42	322	70.99	362	79.53
3	0.75	43	10.03	83	19.03	123	27.89	163	36.66	203	45.37	243	54.03	283	62.64	323	71.21	363	79.74
4	0.99	44	10.26	84	19.25	124	28.11	164	36.88	204	45.59	244	54.24	284	62.85	324	71.42	364	79.95
5	1.23	45	10.49	85	19.47	125	28.33	165	37.10	205	45.81	245	54.46	285	63.06	325	71.63	365	80.17
6	1.47	46	10.71	86	19.69	126	28.55	166	37.32	206	46.02	246	54.67	286	63.28	326	71.85	366	80.38
7	1.71	47	10.94	87	19.92	127	28.77	167	37.54	207	46.24	247	54.89	287	63.49	327	72.06	367	80.59
8	1.95	48	11.17	88	20.14	128	28.99	168	37.76	208	46.46	248	55.10	288	63.71	328	72.27	368	80.81
9	2.18	49	11.39	89	20.36	129	29.21	169	37.97	209	46.67	249	55.32	289	63.92	329	72.49	369	81.02
10	2.42	50	11.62	90	20.58	130	29.43	170	38.19	210	46.89	250	55.54	290	64.14	330	72.70	370	81.23
11	2.65	51	11.84	91	20.81	131	29.65	171	38.41	211	47.11	251	55.75	291	64.35	331	72.92	371	81.44
12	2.89	52	12.07	92	21.03	132	29.87	172	38.63	212	47.32	252	55.97	292	64.57	332	73.13	372	81.66
13	3.13	53	12.30	93	21.25	133	30.09	173	38.85	213	47.54	253	56.18	293	64.78	333	73.34	373	81.87
14	3.36	54	12.52	94	21.47	134	30.31	174	39.06	214	47.76	254	56.40	294	65.00	334	73.56	374	82.08
15	3.59	55	12.75	95	21.70	135	30.53	175	39.28	215	47.97	255	56.61	295	65.21	335	73.77	375	82.30
16	3.83	56	12.97	96	21.92	136	30.75	176	39.50	216	48.19	256	56.83	296	65.42	336	73.98	376	82.51
17	4.06	57	13.20	97	22.14	137	30.97	177	39.72	217	48.41	257	57.04	297	65.64	337	74.20	377	82.72
18	4.29	58	13.42	98	22.36	138	31.19	178	39.94	218	48.62	258	57.26	298	65.85	338	74.41	378	82.93
19	4.53	59	13.65	99	22.58	139	31.41	179	40.15	219	48.84	259	57.48	299	66.07	339	74.62	379	83.15
20	4.76	60	13.87	100	22.81	140	31.63	180	40.37	220	49.06	260	57.69	300	66.28	340	74.84	380	83.36
21	4.99	61	14.10	101	23.03	141	31.85	181	40.59	221	49.27	261	57.91	301	66.50	341	75.05	381	83.57
22	5.22	62	14.32	102	23.25	142	32.07	182	40.81	222	49.49	262	58.12	302	66.71	342	75.26	382	83.78
23	5.45	63	14.55	103	23.47	143	32.29	183	41.03	223	49.71	263	58.34	303	66.93	343	75.48	383	84.00
24	5.68	64	14.77	104	23.69	144	32.50	184	41.24	224	49.92	264	58.55	304	67.14	344	75.69	384	84.21
25	5.91	65	15.00	105	23.91	145	32.72	185	41.46	225	50.14	265	58.77	305	67.35	345	75.90	385	84.42
26	6.14	66	15.22	106	24.13	146	32.94	186	41.68	226	50.35	266	58.98	306	67.57	346	76.12	386	84.64
27	6.37	67	15.45	107	24.36	147	33.16	187	41.90	227	50.57	267	59.20	307	67.78	347	76.33	387	84.85
28	6.60	68	15.67	108	24.58	148	33.38	188	42.11	228	50.79	268	59.41	308	68.00	348	76.54	388	85.06
29	6.83	69	15.90	109	24.80	149	33.60	189	42.33	229	51.00	269	59.63	309	68.21	349	76.76	389	85.27
30	7.06	70	16.12	110	25.02	150	33.82	190	42.55	230	51.22	270	59.84	310	68.42	350	76.97	390	85.49
31	7.29	71	16.34	111	25.24	151	34.04	191	42.77	231	51.44	271	60.06	311	68.64	351	77.18	391	85.70
32	7.52	72	16.57	112	25.46	152	34.26	192	42.98	232	51.65	272	60.27	312	68.85	352	77.40	392	85.91
33	7.75	73	16.79	113	25.68	153	34.48	193	43.20	233	51.87	273	60.49	313	69.07	353	77.61	393	86.12
34	7.98	74	17.02	114	25.90	154	34.70	194	43.42	234	52.08	274	60.70	314	69.28	354	77.82	394	86.33
35	8.21	75	17.24	115	26.12	155	34.91	195	43.63	235	52.30	275	60.92	315	69.49	355	78.04	395	86.55
36	8.44	76	17.46	116	26.34	156	35.13	196	43.85	236	52.52	276	61.13	316	69.71	356	78.25	396	86.76
37	8.67	77	17.69	117	26.57	157	35.35	197	44.07	237	52.73	277	61.35	317	69.92	357	78.46	397	86.97
38	8.89	78	17.91	118	26.79	158	35.57	198	44.29	238	52.95	278	61.56	318	70.14	358	78.68	398	87.18
39	9.12	79	18.13	119	27.01	159	35.79	199	44.50	239	53.16	279	61.78	319	70.35	359	78.89	399	87.40
40	9.35	80	18.36	120	27.23	160	36.01	200	44.72	240	53.38	280	61.99	320	70.56	360	79.10	400	87.61

Table 7. Acute Water Quality Standards for ~~dissolved~~ Dissolved Chromium III
Aquatic and Wildlife coldwater, warmwater and edw

Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L	Hard mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 13	41	275	81	479	121	666	161	842	201	1009	241	1171	281	1328	321	1481	361	1630
2	~~NA~~ 23	42	280	82	484	122	671	162	846	202	1013	242	1175	282	1332	322	1485	362	1634
3	~~NA~~ 32	43	285	83	489	123	675	163	850	203	1017	243	1179	283	1336	323	1488	363	1638
4	~~NA~~ 41	44	291	84	494	124	680	164	854	204	1022	244	1183	284	1340	324	1492	364	1641
5	~~NA~~ 49	45	296	85	499	125	684	165	859	205	1026	245	1187	285	1343	325	1496	365	1645
6	~~NA~~ 57	46	302	86	504	126	688	166	863	206	1030	246	1191	286	1347	326	1500	366	1649
7	~~NA~~ 65	47	307	87	508	127	693	167	867	207	1034	247	1195	287	1351	327	1504	367	1653
8	~~NA~~ 72	48	312	88	513	128	697	168	871	208	1038	248	1199	288	1355	328	1507	368	1656
9	~~NA~~ 79	49	318	89	518	129	702	169	876	209	1042	249	1203	289	1359	329	1511	369	1660
10	~~NA~~ 86	50	323	90	523	130	706	170	880	210	1046	250	1207	290	1363	330	1515	370	1664
11	~~NA~~ 93	51	328	91	527	131	711	171	884	211	1050	251	1211	291	1367	331	1519	371	1667
12	~~NA~~ 100	52	334	92	532	132	715	172	888	212	1054	252	1215	292	1370	332	1522	372	1671
13	~~NA~~ 107	53	339	93	537	133	720	173	893	213	1058	253	1219	293	1374	333	1526	373	1675
14	~~NA~~ 114	54	344	94	542	134	724	174	897	214	1062	254	1223	294	1378	334	1530	374	1678
15	~~NA~~ 120	55	349	95	546	135	729	175	901	215	1067	255	1226	295	1382	335	1534	375	1682
16	~~NA~~ 127	56	354	96	551	136	733	176	905	216	1071	256	1230	296	1386	336	1537	376	1686
17	~~NA~~ 133	57	360	97	556	137	737	177	909	217	1075	257	1234	297	1390	337	1541	377	1689
18	~~NA~~ 140	58	365	98	560	138	742	178	914	218	1079	258	1238	298	1393	338	1545	378	1693
19	~~NA~~ 146	59	370	99	565	139	746	179	918	219	1083	259	1242	299	1397	339	1549	379	1697
20	~~NA~~ 152	60	375	100	570	140	751	180	922	220	1087	260	1246	300	1401	340	1552	380	1700
21	~~NA~~ 159	61	380	101	574	141	755	181	926	221	1091	261	1250	301	1405	341	1556	381	1704
22	~~NA~~ 165	62	385	102	579	142	759	182	930	222	1095	262	1254	302	1409	342	1560	382	1708
23	~~NA~~ 171	63	390	103	584	143	764	183	935	223	1099	263	1258	303	1413	343	1564	383	1711
24	~~NA~~ 177	64	395	104	588	144	768	184	939	224	1103	264	1262	304	1416	344	1567	384	1715
25	183	65	400	105	593	145	772	185	943	225	1107	265	1266	305	1420	345	1571	385	1719
26	189	66	405	106	598	146	777	186	947	226	1111	266	1270	306	1424	346	1575	386	1722
27	195	67	410	107	602	147	781	187	951	227	1115	267	1274	307	1428	347	1578	387	1726
28	201	68	415	108	607	148	785	188	955	228	1119	268	1277	308	1432	348	1582	388	1730
29	207	69	420	109	611	149	790	189	960	229	1123	269	1281	309	1435	349	1586	389	1733
30	213	70	425	110	616	150	794	190	964	230	1127	270	1285	310	1439	350	1590	390	1737
31	218	71	430	111	621	151	799	191	968	231	1131	271	1289	311	1443	351	1593	391	1741
32	224	72	435	112	625	152	803	192	972	232	1135	272	1293	312	1447	352	1597	392	1744
33	230	73	440	113	630	153	807	193	976	233	1139	273	1297	313	1451	353	1601	393	1748
34	235	74	445	114	634	154	811	194	980	234	1143	274	1301	314	1454	354	1604	394	1751
35	241	75	450	115	639	155	816	195	985	235	1147	275	1305	315	1458	355	1608	395	1755
36	247	76	455	116	643	156	820	196	989	236	1151	276	1309	316	1462	356	1612	396	1759
37	252	77	460	117	648	157	824	197	993	237	1155	277	1312	317	1466	357	1616	397	1762
38	258	78	465	118	652	158	829	198	997	238	1159	278	1316	318	1470	358	1619	398	1766
39	263	79	470	119	657	159	833	199	1001	239	1163	279	1320	319	1473	359	1623	399	1770
40	269	80	475	120	662	160	837	200	1005	240	1167	280	1324	320	1477	360	1627	400	1773

Table 8. Chronic Water Quality Standards for ~~dissolved~~ Dissolved Chromium III
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 1.71	41	35.71	81	62.37	121	86.64	161	109.47	201	131.29	241	152.33	281	172.74	321	192.63	361	212.08
2	~~NA~~ 3.01	42	36.42	82	63.00	122	87.22	162	110.03	202	131.82	242	152.84	282	173.24	322	193.12	362	212.56
3	~~NA~~ 4.19	43	37.13	83	63.63	123	87.81	163	110.58	203	132.36	243	153.36	283	173.75	323	193.62	363	213.04
4	~~NA~~ 5.31	44	37.83	84	64.25	124	88.39	164	111.14	204	132.89	244	153.88	284	174.25	324	194.11	364	213.52
5	~~NA~~ 6.37	45	38.54	85	64.88	125	88.98	165	111.69	205	133.42	245	154.39	285	174.75	325	194.60	365	214.00
6	~~NA~~ 7.40	46	39.24	86	65.50	126	89.56	166	112.25	206	133.96	246	154.91	286	175.25	326	195.09	366	214.48
7	~~NA~~ 8.40	47	39.93	87	66.13	127	90.14	167	112.80	207	134.49	247	155.43	287	175.76	327	195.58	367	214.96
8	~~NA~~ 9.37	48	40.63	88	66.75	128	90.72	168	113.35	208	135.02	248	155.94	288	176.26	328	196.07	368	215.44
9	~~NA~~ 10.31	49	41.32	89	67.37	129	91.30	169	113.90	209	135.55	249	156.46	289	176.76	329	196.56	369	215.92
10	~~NA~~ 11.24	50	42.01	90	67.99	130	91.88	170	114.46	210	136.08	250	156.97	290	177.26	330	197.05	370	216.40
11	~~NA~~ 12.16	51	42.70	91	68.61	131	92.46	171	115.01	211	136.61	251	157.48	291	177.76	331	197.53	371	216.88
12	~~NA~~ 13.05	52	43.38	92	69.22	132	93.04	172	115.56	212	137.14	252	158.00	292	178.26	332	198.02	372	217.36
13	~~NA~~ 13.94	53	44.06	93	69.84	133	93.61	173	116.11	213	137.67	253	158.51	293	178.76	333	198.51	373	217.84
14	~~NA~~ 14.81	54	44.74	94	70.45	134	94.19	174	116.66	214	138.20	254	159.02	294	179.26	334	199.00	374	218.32
15	~~NA~~ 15.67	55	45.42	95	71.07	135	94.76	175	117.21	215	138.73	255	159.54	295	179.76	335	199.49	375	218.79
16	~~NA~~ 16.52	56	46.10	96	71.68	136	95.34	176	117.75	216	139.26	256	160.05	296	180.26	336	199.97	376	219.27
17	~~NA~~ 17.36	57	46.77	97	72.29	137	95.91	177	118.30	217	139.79	257	160.56	297	180.76	337	200.46	377	219.75
18	~~NA~~ 18.20	58	47.44	98	72.90	138	96.49	178	118.85	218	140.31	258	161.07	298	181.25	338	200.95	378	220.23
19	~~NA~~ 19.02	59	48.11	99	73.51	139	97.06	179	119.40	219	140.84	259	161.58	299	181.75	339	201.44	379	220.70
20	~~NA~~ 19.84	60	48.78	100	74.11	140	97.63	180	119.94	220	141.37	260	162.09	300	182.25	340	201.92	380	221.18
21	~~NA~~ 20.64	61	49.44	101	74.72	141	98.20	181	120.49	221	141.89	261	162.60	301	182.75	341	202.41	381	221.66
22	~~NA~~ 21.45	62	50.10	102	75.33	142	98.77	182	121.03	222	142.42	262	163.11	302	183.24	342	202.89	382	222.13
23	~~NA~~ 22.24	63	50.76	103	75.93	143	99.34	183	121.58	223	142.94	263	163.62	303	183.74	343	203.38	383	222.61
24	~~NA~~ 23.03	64	51.42	104	76.53	144	99.91	184	122.12	224	143.47	264	164.13	304	184.24	344	203.87	384	223.09
25	23.81	65	52.08	105	77.14	145	100.48	185	122.66	225	143.99	265	164.64	305	184.73	345	204.35	385	223.56
26	24.59	66	52.74	106	77.74	146	101.04	186	123.21	226	144.52	266	165.15	306	185.23	346	204.84	386	224.04
27	25.36	67	53.39	107	78.34	147	101.61	187	123.75	227	145.04	267	165.66	307	185.72	347	205.32	387	224.51
28	26.13	68	54.04	108	78.94	148	102.18	188	124.29	228	145.56	268	166.17	308	186.22	348	205.81	388	224.99
29	26.89	69	54.69	109	79.53	149	102.74	189	124.83	229	146.09	269	166.67	309	186.72	349	206.29	389	225.46
30	27.65	70	55.34	110	80.13	150	103.31	190	125.37	230	146.61	270	167.18	310	187.21	350	206.77	390	225.94
31	28.40	71	55.99	111	80.73	151	103.87	191	125.91	231	147.13	271	167.69	311	187.70	351	207.26	391	226.41
32	29.15	72	56.63	112	81.32	152	104.43	192	126.45	232	147.65	272	168.20	312	188.20	352	207.74	392	226.88
33	29.89	73	57.27	113	81.92	153	104.99	193	126.99	233	148.17	273	168.70	313	188.69	353	208.22	393	227.36
34	30.63	74	57.92	114	82.51	154	105.56	194	127.53	234	148.69	274	169.21	314	189.19	354	208.71	394	227.83
35	31.37	75	58.56	115	83.10	155	106.12	195	128.07	235	149.21	275	169.71	315	189.68	355	209.19	395	228.31
36	32.10	76	59.20	116	83.69	156	106.68	196	128.61	236	149.73	276	170.22	316	190.17	356	209.67	396	228.78
37	32.83	77	59.83	117	84.28	157	107.24	197	129.14	237	150.25	277	170.72	317	190.66	357	210.15	397	229.25
38	33.55	78	60.47	118	84.87	158	107.80	198	129.68	238	150.77	278	171.23	318	191.16	358	210.64	398	229.72
39	34.28	79	61.10	119	85.46	159	108.35	199	130.22	239	151.29	279	171.73	319	191.65	359	211.12	399	230.20
40	34.99	80	61.74	120	86.05	160	108.91	200	130.75	240	151.81	280	172.24	320	192.14	360	211.60	400	230.67

~~Table 6.~~Table 9. Acute Water Quality Standards for ~~dissolved~~ Dissolved Chromium III Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 44	41	921	81	1609	121	2235	161	2824	201	3386	241	3929	281	4456	321	4969	361	5470
2	~~NA~~ 78	42	939	82	1625	122	2250	162	2838	202	3400	242	3942	282	4469	322	4981	362	5483
3	~~NA~~ 108	43	958	83	1641	123	2265	163	2852	203	3414	243	3956	283	4481	323	4994	363	5495
4	~~NA~~ 137	44	976	84	1657	124	2280	164	2867	204	3428	244	3969	284	4494	324	5007	364	5507
5	~~NA~~ 164	45	994	85	1673	125	2295	165	2881	205	3441	245	3982	285	4507	325	5019	365	5520
6	~~NA~~ 191	46	1012	86	1690	126	2310	166	2895	206	3455	246	3996	286	4520	326	5032	366	5532
7	~~NA~~ 217	47	1030	87	1706	127	2325	167	2909	207	3469	247	4009	287	4533	327	5045	367	5545
8	~~NA~~ 242	48	1048	88	1722	128	2340	168	2924	208	3483	248	4022	288	4546	328	5057	368	5557
9	~~NA~~ 266	49	1066	89	1738	129	2355	169	2938	209	3496	249	4035	289	4559	329	5070	369	5569
10	~~NA~~ 290	50	1084	90	1754	130	2370	170	2952	210	3510	250	4049	290	4572	330	5082	370	5582
11	~~NA~~ 314	51	1101	91	1770	131	2385	171	2966	211	3524	251	4062	291	4585	331	5095	371	5594
12	~~NA~~ 337	52	1119	92	1785	132	2400	172	2981	212	3537	252	4075	292	4598	332	5108	372	5606
13	~~NA~~ 360	53	1137	93	1801	133	2415	173	2995	213	3551	253	4088	293	4611	333	5120	373	5619
14	~~NA~~ 382	54	1154	94	1817	134	2429	174	3009	214	3565	254	4102	294	4624	334	5133	374	5631
15	~~NA~~ 404	55	1172	95	1833	135	2444	175	3023	215	3578	255	4115	295	4637	335	5145	375	5643
16	~~NA~~ 426	56	1189	96	1849	136	2459	176	3037	216	3592	256	4128	296	4649	336	5158	376	5656
17	~~NA~~ 448	57	1206	97	1865	137	2474	177	3051	217	3606	257	4141	297	4662	337	5171	377	5668
18	~~NA~~ 469	58	1224	98	1880	138	2489	178	3066	218	3619	258	4155	298	4675	338	5183	378	5680
19	~~NA~~ 491	59	1241	99	1896	139	2503	179	3080	219	3633	259	4168	299	4688	339	5196	379	5693
20	~~NA~~ 512	60	1258	100	1912	140	2518	180	3094	220	3646	260	4181	300	4701	340	5208	380	5705
21	~~NA~~ 532	61	1275	101	1927	141	2533	181	3108	221	3660	261	4194	301	4714	341	5221	381	5717
22	~~NA~~ 553	62	1292	102	1943	142	2548	182	3122	222	3673	262	4207	302	4726	342	5233	382	5730
23	~~NA~~ 574	63	1309	103	1958	143	2562	183	3136	223	3687	263	4220	303	4739	343	5246	383	5742
24	~~NA~~ 594	64	1326	104	1974	144	2577	184	3150	224	3701	264	4234	304	4752	344	5258	384	5754
25	614	65	1343	105	1990	145	2592	185	3164	225	3714	265	4247	305	4765	345	5271	385	5766
26	634	66	1360	106	2005	146	2606	186	3178	226	3728	266	4260	306	4778	346	5283	386	5779
27	654	67	1377	107	2021	147	2621	187	3192	227	3741	267	4273	307	4790	347	5296	387	5791
28	674	68	1394	108	2036	148	2635	188	3206	228	3755	268	4286	308	4803	348	5308	388	5803
29	694	69	1411	109	2051	149	2650	189	3220	229	3768	269	4299	309	4816	349	5321	389	5815
30	713	70	1427	110	2067	150	2665	190	3234	230	3781	270	4312	310	4829	350	5333	390	5828
31	733	71	1444	111	2082	151	2679	191	3248	231	3795	271	4325	311	4841	351	5346	391	5840
32	752	72	1461	112	2098	152	2694	192	3262	232	3808	272	4338	312	4854	352	5358	392	5852
33	771	73	1477	113	2113	153	2708	193	3276	233	3822	273	4351	313	4867	353	5371	393	5864
34	790	74	1494	114	2128	154	2723	194	3289	234	3835	274	4364	314	4880	354	5383	394	5877
35	809	75	1510	115	2143	155	2737	195	3303	235	3849	275	4377	315	4892	355	5396	395	5889
36	828	76	1527	116	2159	156	2752	196	3317	236	3862	276	4390	316	4905	356	5408	396	5901
37	847	77	1543	117	2174	157	2766	197	3331	237	3875	277	4404	317	4918	357	5421	397	5913
38	865	78	1560	118	2189	158	2780	198	3345	238	3889	278	4417	318	4931	358	5433	398	5925
39	884	79	1576	119	2204	159	2795	199	3359	239	3902	279	4430	319	4943	359	5445	399	5938
40	903	80	1592	120	2220	160	2809	200	3372	240	3916	280	4443	320	4956	360	5458	400	5950

~~Table 11.~~Table 10. Acute Water Quality Standards for ~~dissolved~~ Dissolved Copper Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 0.18	41	5.80	81	11.02	121	16.08	161	21.05	201	25.94	241	30.78	281	35.57	321	40.33	361	45.05
2	~~NA~~ 0.34	42	5.93	82	11.15	122	16.21	162	21.17	202	26.07	242	30.90	282	35.69	322	40.45	362	45.16
3	~~NA~~ 0.49	43	6.07	83	11.28	123	16.33	163	21.30	203	26.19	243	31.02	283	35.81	323	40.56	363	45.28
4	~~NA~~ 0.65	44	6.20	84	11.40	124	16.46	164	21.42	204	26.31	244	31.14	284	35.93	324	40.68	364	45.40
5	~~NA~~ 0.80	45	6.33	85	11.53	125	16.58	165	21.54	205	26.43	245	31.26	285	36.05	325	40.80	365	45.52
6	~~NA~~ 0.95	46	6.47	86	11.66	126	16.71	166	21.66	206	26.55	246	31.38	286	36.17	326	40.92	366	45.63
7	~~NA~~ 1.10	47	6.60	87	11.79	127	16.83	167	21.79	207	26.67	247	31.50	287	36.29	327	41.04	367	45.75
8	~~NA~~ 1.24	48	6.73	88	11.91	128	16.96	168	21.91	208	26.79	248	31.62	288	36.41	328	41.16	368	45.87
9	~~NA~~ 1.39	49	6.86	89	12.04	129	17.08	169	22.03	209	26.92	249	31.74	289	36.53	329	41.27	369	45.99
10	~~NA~~ 1.54	50	6.99	90	12.17	130	17.21	170	22.16	210	27.04	250	31.86	290	36.65	330	41.39	370	46.10
11	~~NA~~ 1.68	51	7.13	91	12.30	131	17.33	171	22.28	211	27.16	251	31.98	291	36.77	331	41.51	371	46.22

~~Table 11.~~Table 10. Acute Water Quality Standards for ~~dissolved~~ Dissolved Copper
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
12	~~NA~~ 1.82	52	7.26	92	12.42	132	17.46	172	22.40	212	27.28	252	32.10	292	36.89	332	41.63	372	46.34
13	~~NA~~ 1.97	53	7.39	93	12.55	133	17.58	173	22.52	213	27.40	253	32.22	293	37.00	333	41.75	373	46.46
14	~~NA~~ 2.11	54	7.52	94	12.68	134	17.71	174	22.65	214	27.52	254	32.34	294	37.12	334	41.86	374	46.57
15	~~NA~~ 2.25	55	7.65	95	12.81	135	17.83	175	22.77	215	27.64	255	32.46	295	37.24	335	41.98	375	46.69
16	~~NA~~ 2.39	56	7.78	96	12.93	136	17.96	176	22.89	216	27.76	256	32.58	296	37.36	336	42.10	376	46.81
17	~~NA~~ 2.53	57	7.91	97	13.06	137	18.08	177	23.02	217	27.89	257	32.70	297	37.48	337	42.22	377	46.92
18	~~NA~~ 2.67	58	8.04	98	13.19	138	18.20	178	23.14	218	28.01	258	32.82	298	37.60	338	42.34	378	47.04
19	~~NA~~ 2.81	59	8.17	99	13.31	139	18.33	179	23.26	219	28.13	259	32.94	299	37.72	339	42.45	379	47.16
20	~~NA~~ 2.95	60	8.31	100	13.44	140	18.45	180	23.38	220	28.25	260	33.06	300	37.84	340	42.57	380	47.28
21	~~NA~~ 3.09	61	8.44	101	13.57	141	18.58	181	23.50	221	28.37	261	33.18	301	37.96	341	42.69	381	47.39
22	~~NA~~ 3.23	62	8.57	102	13.69	142	18.70	182	23.63	222	28.49	262	33.30	302	38.07	342	42.81	382	47.51
23	~~NA~~ 3.37	63	8.70	103	13.82	143	18.82	183	23.75	223	28.61	263	33.42	303	38.19	343	42.93	383	47.63
24	~~NA~~ 3.50	64	8.83	104	13.95	144	18.95	184	23.87	224	28.73	264	33.54	304	38.31	344	43.04	384	47.74
25	3.64	65	8.96	105	14.07	145	19.07	185	23.99	225	28.85	265	33.66	305	38.43	345	43.16	385	47.86
26	3.78	66	9.09	106	14.20	146	19.20	186	24.12	226	28.97	266	33.78	306	38.55	346	43.28	386	47.98
27	3.91	67	9.22	107	14.32	147	19.32	187	24.24	227	29.09	267	33.90	307	38.67	347	43.40	387	48.10
28	4.05	68	9.34	108	14.45	148	19.44	188	24.36	228	29.22	268	34.02	308	38.79	348	43.52	388	48.21
29	4.19	69	9.47	109	14.58	149	19.57	189	24.48	229	29.34	269	34.14	309	38.91	349	43.63	389	48.33
30	4.32	70	9.60	110	14.70	150	19.69	190	24.60	230	29.46	270	34.26	310	39.02	350	43.75	390	48.45
31	4.46	71	9.73	111	14.83	151	19.82	191	24.73	231	29.58	271	34.38	311	39.14	351	43.87	391	48.56
32	4.59	72	9.86	112	14.95	152	19.94	192	24.85	232	29.70	272	34.50	312	39.26	352	43.99	392	48.68
33	4.73	73	9.99	113	15.08	153	20.06	193	24.97	233	29.82	273	34.62	313	39.38	353	44.10	393	48.80
34	4.86	74	10.12	114	15.20	154	20.19	194	25.09	234	29.94	274	34.74	314	39.50	354	44.22	394	48.92
35	5.00	75	10.25	115	15.33	155	20.31	195	25.21	235	30.06	275	34.86	315	39.62	355	44.34	395	49.03
36	5.13	76	10.38	116	15.46	156	20.43	196	25.34	236	30.18	276	34.98	316	39.74	356	44.46	396	49.15
37	5.27	77	10.51	117	15.58	157	20.56	197	25.46	237	30.30	277	35.10	317	39.85	357	44.58	397	49.27
38	5.40	78	10.63	118	15.71	158	20.68	198	25.58	238	30.42	278	35.22	318	39.97	358	44.69	398	49.38
39	5.53	79	10.76	119	15.83	159	20.80	199	25.70	239	30.54	279	35.34	319	40.09	359	44.81	399	49.50
40	5.67	80	10.89	120	15.96	160	20.93	200	25.82	240	30.66	280	35.46	320	40.21	360	44.93	400	49.62

~~Table 9.~~Table 11. Chronic Water Quality Standards for ~~dissolved~~ Dissolved Copper
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 0.18	41	4.18	81	7.48	121	10.54	161	13.45	201	16.26	241	18.99	281	21.65	321	24.26	361	26.82
2	~~NA~~ 0.32	42	4.27	82	7.56	122	10.61	162	13.52	202	16.33	242	19.06	282	21.72	322	24.33	362	26.89
3	~~NA~~ 0.45	43	4.35	83	7.64	123	10.69	163	13.60	203	16.40	243	19.13	283	21.78	323	24.39	363	26.95
4	~~NA~~ 0.57	44	4.44	84	7.72	124	10.76	164	13.67	204	16.47	244	19.19	284	21.85	324	24.45	364	27.01
5	~~NA~~ 0.69	45	4.53	85	7.79	125	10.84	165	13.74	205	16.54	245	19.26	285	21.92	325	24.52	365	27.08
6	~~NA~~ 0.81	46	4.61	86	7.87	126	10.91	166	13.81	206	16.61	246	19.33	286	21.98	326	24.58	366	27.14
7	~~NA~~ 0.92	47	4.70	87	7.95	127	10.99	167	13.88	207	16.68	247	19.39	287	22.05	327	24.65	367	27.20
8	~~NA~~ 1.03	48	4.78	88	8.03	128	11.06	168	13.95	208	16.75	248	19.46	288	22.11	328	24.71	368	27.27
9	~~NA~~ 1.14	49	4.87	89	8.11	129	11.13	169	14.02	209	16.81	249	19.53	289	22.18	329	24.78	369	27.33
10	~~NA~~ 1.25	50	4.95	90	8.18	130	11.21	170	14.09	210	16.88	250	19.59	290	22.24	330	24.84	370	27.39
11	~~NA~~ 1.36	51	5.04	91	8.26	131	11.28	171	14.16	211	16.95	251	19.66	291	22.31	331	24.91	371	27.46

~~Table 9.~~ Table 11. Chronic Water Quality Standards for ~~dissolved~~ Dissolved Copper Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
12	~~NA~~ 1.46	52	5.12	92	8.34	132	11.35	172	14.24	212	17.02	252	19.73	292	22.38	332	24.97	372	27.52
13	~~NA~~ 1.57	53	5.21	93	8.42	133	11.43	173	14.31	213	17.09	253	19.80	293	22.44	333	25.03	373	27.58
14	~~NA~~ 1.67	54	5.29	94	8.49	134	11.50	174	14.38	214	17.16	254	19.86	294	22.51	334	25.10	374	27.65
15	~~NA~~ 1.77	55	5.37	95	8.57	135	11.57	175	14.45	215	17.23	255	19.93	295	22.57	335	25.16	375	27.71
16	~~NA~~ 1.87	56	5.46	96	8.65	136	11.65	176	14.52	216	17.29	256	20.00	296	22.64	336	25.23	376	27.77
17	~~NA~~ 1.97	57	5.54	97	8.73	137	11.72	177	14.59	217	17.36	257	20.06	297	22.70	337	25.29	377	27.83
18	~~NA~~ 2.07	58	5.62	98	8.80	138	11.79	178	14.66	218	17.43	258	20.13	298	22.77	338	25.35	378	27.90
19	~~NA~~ 2.17	59	5.71	99	8.88	139	11.87	179	14.73	219	17.50	259	20.20	299	22.83	339	25.42	379	27.96
20	~~NA~~ 2.26	60	5.79	100	8.96	140	11.94	180	14.80	220	17.57	260	20.26	300	22.90	340	25.48	380	28.02
21	~~NA~~ 2.36	61	5.87	101	9.03	141	12.01	181	14.87	221	17.64	261	20.33	301	22.96	341	25.55	381	28.09
22	~~NA~~ 2.46	62	5.95	102	9.11	142	12.08	182	14.94	222	17.70	262	20.40	302	23.03	342	25.61	382	28.15
23	~~NA~~ 2.55	63	6.03	103	9.18	143	12.16	183	15.01	223	17.77	263	20.46	303	23.09	343	25.68	383	28.21
24	~~NA~~ 2.65	64	6.12	104	9.26	144	12.23	184	15.08	224	17.84	264	20.53	304	23.16	344	25.74	384	28.28
25	2.74	65	6.20	105	9.34	145	12.30	185	15.15	225	17.91	265	20.60	305	23.22	345	25.80	385	28.34
26	2.83	66	6.28	106	9.41	146	12.37	186	15.22	226	17.98	266	20.66	306	23.29	346	25.87	386	28.40
27	2.93	67	6.36	107	9.49	147	12.45	187	15.29	227	18.04	267	20.73	307	23.35	347	25.93	387	28.46
28	3.02	68	6.44	108	9.56	148	12.52	188	15.36	228	18.11	268	20.79	308	23.42	348	25.99	388	28.53
29	3.11	69	6.52	109	9.64	149	12.59	189	15.43	229	18.18	269	20.86	309	23.48	349	26.06	389	28.59
30	3.20	70	6.60	110	9.72	150	12.66	190	15.50	230	18.25	270	20.93	310	23.55	350	26.12	390	28.65
31	3.29	71	6.68	111	9.79	151	12.74	191	15.57	231	18.32	271	20.99	311	23.61	351	26.19	391	28.72
32	3.38	72	6.76	112	9.87	152	12.81	192	15.64	232	18.38	272	21.06	312	23.68	352	26.25	392	28.78
33	3.47	73	6.84	113	9.94	153	12.88	193	15.71	233	18.45	273	21.13	313	23.74	353	26.31	393	28.84
34	3.56	74	6.92	114	10.02	154	12.95	194	15.78	234	18.52	274	21.19	314	23.81	354	26.38	394	28.90
35	3.65	75	7.00	115	10.09	155	13.02	195	15.85	235	18.59	275	21.26	315	23.87	355	26.44	395	28.97
36	3.74	76	7.08	116	10.17	156	13.10	196	15.92	236	18.65	276	21.32	316	23.94	356	26.50	396	29.03
37	3.83	77	7.16	117	10.24	157	13.17	197	15.99	237	18.72	277	21.39	317	24.00	357	26.57	397	29.09
38	3.92	78	7.24	118	10.32	158	13.24	198	16.05	238	18.79	278	21.46	318	24.07	358	26.63	398	29.15
39	4.01	79	7.32	119	10.39	159	13.31	199	16.12	239	18.86	279	21.52	319	24.13	359	26.70	399	29.22
40	4.09	80	7.40	120	10.47	160	13.38	200	16.19	240	18.92	280	21.59	320	24.20	360	26.76	400	29.28

~~Table 10.~~ Table 12. Acute Water Quality Standards for ~~dissolved~~ Dissolved Copper Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 0.30	41	10.04	81	19.07	121	27.84	161	36.43	201	44.91	241	53.28	281	61.57	321	69.80	361	77.97
2	~~NA~~ 0.58	42	10.27	82	19.29	122	28.05	162	36.65	202	45.12	242	53.49	282	61.78	322	70.00	362	78.17
3	~~NA~~ 0.85	43	10.50	83	19.52	123	28.27	163	36.86	203	45.33	243	53.70	283	61.99	323	70.21	363	78.37
4	~~NA~~ 1.12	44	10.73	84	19.74	124	28.49	164	37.07	204	45.54	244	53.90	284	62.19	324	70.41	364	78.58
5	~~NA~~ 1.38	45	10.96	85	19.96	125	28.70	165	37.29	205	45.75	245	54.11	285	62.40	325	70.62	365	78.78
6	~~NA~~ 1.64	46	11.19	86	20.18	126	28.92	166	37.50	206	45.96	246	54.32	286	62.61	326	70.82	366	78.98
7	~~NA~~ 1.90	47	11.42	87	20.40	127	29.14	167	37.71	207	46.17	247	54.53	287	62.81	327	71.03	367	79.19
8	~~NA~~ 2.15	48	11.65	88	20.62	128	29.35	168	37.92	208	46.38	248	54.74	288	63.02	328	71.23	368	79.39
9	~~NA~~ 2.41	49	11.88	89	20.84	129	29.57	169	38.14	209	46.59	249	54.94	289	63.22	329	71.44	369	79.59
10	~~NA~~ 2.66	50	12.11	90	21.06	130	29.78	170	38.35	210	46.80	250	55.15	290	63.43	330	71.64	370	79.80
11	~~NA~~ 2.91	51	12.33	91	21.28	131	30.00	171	38.56	211	47.01	251	55.36	291	63.64	331	71.85	371	80.00

~~Table 10.~~<u>Table 12.</u> Acute Water Quality Standards for ~~dissolved~~ <u>Dissolved</u> Copper
Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>
12	~~NA~~ <u>3.16</u>	52	12.56	92	21.50	132	30.22	172	38.77	212	47.22	252	55.57	292	63.84	332	72.05	372	80.20
13	~~NA~~ <u>3.40</u>	53	12.79	93	21.72	133	30.43	173	38.99	213	47.43	253	55.78	293	64.05	333	72.26	373	80.41
14	~~NA~~ <u>3.65</u>	54	13.02	94	21.94	134	30.65	174	39.20	214	47.64	254	55.98	294	64.25	334	72.46	374	80.61
15	~~NA~~ <u>3.89</u>	55	13.24	95	22.16	135	30.86	175	39.41	215	47.85	255	56.19	295	64.46	335	72.66	375	80.81
16	~~NA~~ <u>4.14</u>	56	13.47	96	22.38	136	31.08	176	39.62	216	48.06	256	56.40	296	64.67	336	72.87	376	81.02
17	~~NA~~ <u>4.38</u>	57	13.70	97	22.60	137	31.29	177	39.84	217	48.27	257	56.61	297	64.87	337	73.07	377	81.22
18	~~NA~~ <u>4.62</u>	58	13.92	98	22.82	138	31.51	178	40.05	218	48.48	258	56.81	298	65.08	338	73.28	378	81.42
19	~~NA~~ <u>4.86</u>	59	14.15	99	23.04	139	31.72	179	40.26	219	48.68	259	57.02	299	65.28	339	73.48	379	81.62
20	~~NA~~ <u>5.11</u>	60	14.37	100	23.26	140	31.94	180	40.47	220	48.89	260	57.23	300	65.49	340	73.69	380	81.83
21	~~NA~~ <u>5.35</u>	61	14.60	101	23.48	141	32.15	181	40.68	221	49.10	261	57.44	301	65.69	341	73.89	381	82.03
22	~~NA~~ <u>5.59</u>	62	14.83	102	23.70	142	32.37	182	40.89	222	49.31	262	57.64	302	65.90	342	74.09	382	82.23
23	~~NA~~ <u>5.82</u>	63	15.05	103	23.92	143	32.58	183	41.11	223	49.52	263	57.85	303	66.11	343	74.30	383	82.44
24	~~NA~~ <u>6.06</u>	64	15.28	104	24.14	144	32.80	184	41.32	224	49.73	264	58.06	304	66.31	344	74.50	384	82.64
25	6.30	65	15.50	105	24.36	145	33.01	185	41.53	225	49.94	265	58.26	305	66.52	345	74.71	385	82.84
26	6.54	66	15.73	106	24.57	146	33.23	186	41.74	226	50.15	266	58.47	306	66.72	346	74.91	386	83.04
27	6.77	67	15.95	107	24.79	147	33.44	187	41.95	227	50.36	267	58.68	307	66.93	347	75.11	387	83.25
28	7.01	68	16.17	108	25.01	148	33.65	188	42.16	228	50.57	268	58.89	308	67.13	348	75.32	388	83.45
29	7.25	69	16.40	109	25.23	149	33.87	189	42.37	229	50.78	269	59.09	309	67.34	349	75.52	389	83.65
30	7.48	70	16.62	110	25.45	150	34.08	190	42.59	230	50.99	270	59.30	310	67.54	350	75.73	390	83.85
31	7.72	71	16.85	111	25.66	151	34.30	191	42.80	231	51.19	271	59.51	311	67.75	351	75.93	391	84.06
32	7.95	72	17.07	112	25.88	152	34.51	192	43.01	232	51.40	272	59.71	312	67.95	352	76.13	392	84.26
33	8.18	73	17.29	113	26.10	153	34.72	193	43.22	233	51.61	273	59.92	313	68.16	353	76.34	393	84.46
34	8.42	74	17.52	114	26.32	154	34.94	194	43.43	234	51.82	274	60.13	314	68.36	354	76.54	394	84.66
35	8.65	75	17.74	115	26.53	155	35.15	195	43.64	235	52.03	275	60.33	315	68.57	355	76.74	395	84.87
36	8.88	76	17.96	116	26.75	156	35.37	196	43.85	236	52.24	276	60.54	316	68.77	356	76.95	396	85.07
37	9.12	77	18.18	117	26.97	157	35.58	197	44.06	237	52.45	277	60.75	317	68.98	357	77.15	397	85.27
38	9.35	78	18.41	118	27.19	158	35.79	198	44.27	238	52.65	278	60.95	318	69.18	358	77.36	398	85.47
39	9.58	79	18.63	119	27.40	159	36.01	199	44.48	239	52.86	279	61.16	319	69.39	359	77.56	399	85.68
40	9.81	80	18.85	120	27.62	160	36.22	200	44.69	240	53.07	280	61.37	320	69.59	360	77.76	400	85.88

~~Table 14.~~<u>Table 13.</u> Acute Water Quality Standards for ~~dissolved~~ <u>Dissolved</u> Lead
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>	Hard. mg/L	Std. ~~ug/L~~ <u>µg/L</u>
1	~~NA~~ <u>0.34</u>	41	24.17	81	51.30	121	79.43	161	108.02	201	136.86	241	165.82	281	194.81	321	223.79	361	252.72
2	~~NA~~ <u>0.76</u>	42	24.82	82	52.00	122	80.14	162	108.74	202	137.59	242	166.55	282	195.54	322	224.52	362	253.44
3	~~NA~~ <u>1.22</u>	43	25.48	83	52.69	123	80.85	163	109.46	203	138.31	243	167.27	283	196.26	323	225.24	363	254.16
4	~~NA~~ <u>1.71</u>	44	26.14	84	53.39	124	81.56	164	110.18	204	139.03	244	167.99	284	196.99	324	225.96	364	254.89
5	~~NA~~ <u>2.21</u>	45	26.81	85	54.08	125	82.27	165	110.90	205	139.76	245	168.72	285	197.71	325	226.69	365	255.61
6	~~NA~~ <u>2.73</u>	46	27.47	86	54.78	126	82.98	166	111.62	206	140.48	246	169.44	286	198.44	326	227.41	366	256.33
7	~~NA~~ <u>3.26</u>	47	28.13	87	55.48	127	83.69	167	112.34	207	141.20	247	170.17	287	199.16	327	228.14	367	257.05
8	~~NA~~ <u>3.80</u>	48	28.80	88	56.17	128	84.41	168	113.06	208	141.93	248	170.89	288	199.89	328	228.86	368	257.77
9	~~NA~~ <u>4.35</u>	49	29.47	89	56.87	129	85.12	169	113.78	209	142.65	249	171.62	289	200.61	329	229.58	369	258.50
10	~~NA~~ <u>4.91</u>	50	30.14	90	57.57	130	85.83	170	114.50	210	143.37	250	172.34	290	201.34	330	230.31	370	259.22
11	~~NA~~ <u>5.47</u>	51	30.81	91	58.27	131	86.54	171	115.22	211	144.10	251	173.07	291	202.06	331	231.03	371	259.94

~~Table 14.~~Table 13. Acute Water Quality Standards for ~~dissolved~~ Dissolved Lead
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
12	~~NA~~ 6.04	52	31.48	92	58.97	132	87.26	172	115.94	212	144.82	252	173.79	292	202.79	332	231.75	372	260.66
13	~~NA~~ 6.62	53	32.15	93	59.67	133	87.97	173	116.66	213	145.54	253	174.52	293	203.51	333	232.48	373	261.38
14	~~NA~~ 7.20	54	32.82	94	60.37	134	88.68	174	117.38	214	146.27	254	175.24	294	204.24	334	233.20	374	262.10
15	~~NA~~ 7.79	55	33.49	95	61.07	135	89.40	175	118.10	215	146.99	255	175.97	295	204.96	335	233.92	375	262.83
16	~~NA~~ 8.38	56	34.17	96	61.77	136	90.11	176	118.82	216	147.71	256	176.69	296	205.69	336	234.65	376	263.55
17	~~NA~~ 8.98	57	34.84	97	62.47	137	90.83	177	119.54	217	148.44	257	177.42	297	206.41	337	235.37	377	264.27
18	~~NA~~ 9.58	58	35.52	98	63.18	138	91.54	178	120.26	218	149.16	258	178.14	298	207.13	338	236.09	378	264.99
19	~~NA~~ 10.18	59	36.20	99	63.88	139	92.25	179	120.98	219	149.89	259	178.87	299	207.86	339	236.82	379	265.71
20	~~NA~~ 10.79	60	36.88	100	64.58	140	92.97	180	121.70	220	150.61	260	179.59	300	208.58	340	237.54	380	266.43
21	~~NA~~ 11.40	61	37.56	101	65.28	141	93.68	181	122.42	221	151.33	261	180.32	301	209.31	341	238.26	381	267.15
22	~~NA~~ 12.02	62	38.24	102	65.99	142	94.40	182	123.14	222	152.06	262	181.04	302	210.03	342	238.99	382	267.88
23	~~NA~~ 12.64	63	38.92	103	66.69	143	95.12	183	123.87	223	152.78	263	181.77	303	210.76	343	239.71	383	268.60
24	~~NA~~ 13.26	64	39.60	104	67.40	144	95.83	184	124.59	224	153.51	264	182.49	304	211.48	344	240.43	384	269.32
25	13.88	65	40.28	105	68.10	145	96.55	185	125.31	225	154.23	265	183.22	305	212.21	345	241.16	385	270.04
26	14.51	66	40.97	106	68.81	146	97.26	186	126.03	226	154.95	266	183.94	306	212.93	346	241.88	386	270.76
27	15.14	67	41.65	107	69.51	147	97.98	187	126.75	227	155.68	267	184.67	307	213.65	347	242.60	387	271.48
28	15.77	68	42.33	108	70.22	148	98.70	188	127.47	228	156.40	268	185.39	308	214.38	348	243.33	388	272.20
29	16.40	69	43.02	109	70.93	149	99.41	189	128.20	229	157.13	269	186.12	309	215.10	349	244.05	389	272.92
30	17.04	70	43.71	110	71.63	150	100.13	190	128.92	230	157.85	270	186.84	310	215.83	350	244.77	390	273.64
31	17.68	71	44.39	111	72.34	151	100.85	191	129.64	231	158.58	271	187.57	311	216.55	351	245.49	391	274.36
32	18.32	72	45.08	112	73.05	152	101.56	192	130.36	232	159.30	272	188.29	312	217.28	352	246.22	392	275.08
33	18.96	73	45.77	113	73.75	153	102.28	193	131.08	233	160.02	273	189.02	313	218.00	353	246.94	393	275.80
34	19.61	74	46.46	114	74.46	154	103.00	194	131.81	234	160.75	274	189.74	314	218.72	354	247.66	394	276.52
35	20.25	75	47.15	115	75.17	155	103.72	195	132.53	235	161.47	275	190.47	315	219.45	355	248.38	395	277.25
36	20.90	76	47.84	116	75.88	156	104.43	196	133.25	236	162.20	276	191.19	316	220.17	356	249.11	396	277.97
37	21.55	77	48.53	117	76.59	157	105.15	197	133.97	237	162.92	277	191.92	317	220.90	357	249.83	397	278.69
38	22.20	78	49.22	118	77.30	158	105.87	198	134.70	238	163.65	278	192.64	318	221.62	358	250.55	398	279.41
39	22.86	79	49.92	119	78.01	159	106.59	199	135.42	239	164.37	279	193.36	319	222.34	359	251.27	399	280.13
40	23.51	80	50.61	120	78.72	160	107.31	200	136.14	240	165.10	280	194.09	320	223.07	360	252.00	400	280.85

~~Table 15.~~Table 14. Chronic Water Quality Standards for ~~dissolved~~ Dissolved Lead
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 0.01	41	0.94	81	2.00	121	3.10	161	4.21	201	5.33	241	6.46	281	7.59	321	8.72	361	9.85
2	~~NA~~ 0.03	42	0.97	82	2.03	122	3.12	162	4.24	202	5.36	242	6.49	282	7.62	322	8.75	362	9.88
3	~~NA~~ 0.05	43	0.99	83	2.05	123	3.15	163	4.27	203	5.39	243	6.52	283	7.65	323	8.78	363	9.90
4	~~NA~~ 0.07	44	1.02	84	2.08	124	3.18	164	4.29	204	5.42	244	6.55	284	7.68	324	8.81	364	9.93
5	~~NA~~ 0.09	45	1.04	85	2.11	125	3.21	165	4.32	205	5.45	245	6.57	285	7.70	325	8.83	365	9.96
6	~~NA~~ 0.11	46	1.07	86	2.13	126	3.23	166	4.35	206	5.47	246	6.60	286	7.73	326	8.86	366	9.99
7	~~NA~~ 0.13	47	1.10	87	2.16	127	3.26	167	4.38	207	5.50	247	6.63	287	7.76	327	8.89	367	10.02
8	~~NA~~ 0.15	48	1.12	88	2.19	128	3.29	168	4.41	208	5.53	248	6.66	288	7.79	328	8.92	368	10.05
9	~~NA~~ 0.17	49	1.15	89	2.22	129	3.32	169	4.43	209	5.56	249	6.69	289	7.82	329	8.95	369	10.07
10	~~NA~~ 0.19	50	1.17	90	2.24	130	3.34	170	4.46	210	5.59	250	6.72	290	7.85	330	8.97	370	10.10
11	~~NA~~ 0.21	51	1.20	91	2.27	131	3.37	171	4.49	211	5.62	251	6.74	291	7.87	331	9.00	371	10.13

~~Table 15.~~Table 14. Chronic Water Quality Standards for ~~dissolved~~ Dissolved Lead
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
12	~~NA~~ 0.24	52	1.23	92	2.30	132	3.40	172	4.52	212	5.64	252	6.77	292	7.90	332	9.03	372	10.16
13	~~NA~~ 0.26	53	1.25	93	2.33	133	3.43	173	4.55	213	5.67	253	6.80	293	7.93	333	9.06	373	10.19
14	~~NA~~ 0.28	54	1.28	94	2.35	134	3.46	174	4.57	214	5.70	254	6.83	294	7.96	334	9.09	374	10.21
15	~~NA~~ 0.30	55	1.31	95	2.38	135	3.48	175	4.60	215	5.73	255	6.86	295	7.99	335	9.12	375	10.24
16	~~NA~~ 0.33	56	1.33	96	2.41	136	3.51	176	4.63	216	5.76	256	6.89	296	8.02	336	9.14	376	10.27
17	~~NA~~ 0.35	57	1.36	97	2.43	137	3.54	177	4.66	217	5.78	257	6.91	297	8.04	337	9.17	377	10.30
18	~~NA~~ 0.37	58	1.38	98	2.46	138	3.57	178	4.69	218	5.81	258	6.94	298	8.07	338	9.20	378	10.33
19	~~NA~~ 0.40	59	1.41	99	2.49	139	3.60	179	4.71	219	5.84	259	6.97	299	8.10	339	9.23	379	10.35
20	~~NA~~ 0.42	60	1.44	100	2.52	140	3.62	180	4.74	220	5.87	260	7.00	300	8.13	340	9.26	380	10.38
21	~~NA~~ 0.44	61	1.46	101	2.54	141	3.65	181	4.77	221	5.90	261	7.03	301	8.16	341	9.28	381	10.41
22	~~NA~~ 0.47	62	1.49	102	2.57	142	3.68	182	4.80	222	5.93	262	7.05	302	8.18	342	9.31	382	10.44
23	~~NA~~ 0.49	63	1.52	103	2.60	143	3.71	183	4.83	223	5.95	263	7.08	303	8.21	343	9.34	383	10.47
24	~~NA~~ 0.52	64	1.54	104	2.63	144	3.73	184	4.85	224	5.98	264	7.11	304	8.24	344	9.37	384	10.49
25	0.54	65	1.57	105	2.65	145	3.76	185	4.88	225	6.01	265	7.14	305	8.27	345	9.40	385	10.52
26	0.57	66	1.60	106	2.68	146	3.79	186	4.91	226	6.04	266	7.17	306	8.30	346	9.43	386	10.55
27	0.59	67	1.62	107	2.71	147	3.82	187	4.94	227	6.07	267	7.20	307	8.33	347	9.45	387	10.58
28	0.61	68	1.65	108	2.74	148	3.85	188	4.97	228	6.09	268	7.22	308	8.35	348	9.48	388	10.61
29	0.64	69	1.68	109	2.76	149	3.87	189	5.00	229	6.12	269	7.25	309	8.38	349	9.51	389	10.64
30	0.66	70	1.70	110	2.79	150	3.90	190	5.02	230	6.15	270	7.28	310	8.41	350	9.54	390	10.66
31	0.69	71	1.73	111	2.82	151	3.93	191	5.05	231	6.18	271	7.31	311	8.44	351	9.57	391	10.69
32	0.71	72	1.76	112	2.85	152	3.96	192	5.08	232	6.21	272	7.34	312	8.47	352	9.59	392	10.72
33	0.74	73	1.78	113	2.87	153	3.99	193	5.11	233	6.24	273	7.37	313	8.50	353	9.62	393	10.75
34	0.76	74	1.81	114	2.90	154	4.01	194	5.14	234	6.26	274	7.39	314	8.52	354	9.65	394	10.78
35	0.79	75	1.84	115	2.93	155	4.04	195	5.16	235	6.29	275	7.42	315	8.55	355	9.68	395	10.80
36	0.81	76	1.86	116	2.96	156	4.07	196	5.19	236	6.32	276	7.45	316	8.58	356	9.71	396	10.83
37	0.84	77	1.89	117	2.98	157	4.10	197	5.22	237	6.35	277	7.48	317	8.61	357	9.74	397	10.86
38	0.87	78	1.92	118	3.01	158	4.13	198	5.25	238	6.38	278	7.51	318	8.64	358	9.76	398	10.89
39	0.89	79	1.95	119	3.04	159	4.15	199	5.28	239	6.41	279	7.54	319	8.66	359	9.79	399	10.92
40	0.92	80	1.97	120	3.07	160	4.18	200	5.31	240	6.43	280	7.56	320	8.69	360	9.82	400	10.94

~~Table 13.~~Table 15. Acute Water Quality Standards for ~~dissolved~~ Dissolved Lead
Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 0.72	41	51.00	81	108.27	121	167.63	161	227.98	201	288.85	241	349.96	281	411.15	321	472.30	361	533.35
2	~~NA~~ 1.61	42	52.39	82	109.74	122	169.13	162	229.50	202	290.37	242	351.49	282	412.68	322	473.83	362	534.87
3	~~NA~~ 2.58	43	53.78	83	111.21	123	170.63	163	231.01	203	291.90	243	353.02	283	414.21	323	475.36	363	536.40
4	~~NA~~ 3.61	44	55.18	84	112.67	124	172.13	164	232.53	204	293.42	244	354.54	284	415.73	324	476.89	364	537.92
5	~~NA~~ 4.67	45	56.57	85	114.14	125	173.63	165	234.05	205	294.95	245	356.07	285	417.26	325	478.41	365	539.45
6	~~NA~~ 5.76	46	57.97	86	115.61	126	175.13	166	235.57	206	296.48	246	357.60	286	418.79	326	479.94	366	540.97
7	~~NA~~ 6.88	47	59.38	87	117.08	127	176.63	167	237.08	207	298.00	247	359.13	287	420.32	327	481.47	367	542.49
8	~~NA~~ 8.02	48	60.78	88	118.55	128	178.13	168	238.60	208	299.53	248	360.66	288	421.85	328	483.00	368	544.02
9	~~NA~~ 9.18	49	62.19	89	120.03	129	179.64	169	240.12	209	301.05	249	362.19	289	423.38	329	484.52	369	545.54
10	~~NA~~ 10.35	50	63.60	90	121.50	130	181.14	170	241.64	210	302.58	250	363.72	290	424.91	330	486.05	370	547.06
11	~~NA~~ 11.54	51	65.01	91	122.98	131	182.65	171	243.16	211	304.11	251	365.25	291	426.44	331	487.58	371	548.59

~~Table 13.~~Table 15. Acute Water Quality Standards for ~~dissolved~~ Dissolved Lead
Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
12	~~NA~~ 12.75	52	66.43	92	124.45	132	184.15	172	244.68	212	305.64	252	366.78	292	427.97	332	489.10	372	550.11
13	~~NA~~ 13.97	53	67.85	93	125.93	133	185.66	173	246.20	213	307.16	253	368.31	293	429.50	333	490.63	373	551.63
14	~~NA~~ 15.20	54	69.26	94	127.41	134	187.16	174	247.72	214	308.69	254	369.84	294	431.03	334	492.16	374	553.16
15	~~NA~~ 16.44	55	70.69	95	128.89	135	188.67	175	249.24	215	310.22	255	371.37	295	432.56	335	493.68	375	554.68
16	~~NA~~ 17.69	56	72.11	96	130.37	136	190.17	176	250.76	216	311.74	256	372.90	296	434.09	336	495.21	376	556.20
17	~~NA~~ 18.95	57	73.54	97	131.85	137	191.68	177	252.28	217	313.27	257	374.43	297	435.62	337	496.74	377	557.72
18	~~NA~~ 20.21	58	74.96	98	133.33	138	193.19	178	253.80	218	314.80	258	375.96	298	437.15	338	498.26	378	559.25
19	~~NA~~ 21.49	59	76.39	99	134.81	139	194.70	179	255.32	219	316.33	259	377.49	299	438.68	339	499.79	379	560.77
20	~~NA~~ 22.77	60	77.83	100	136.30	140	196.21	180	256.85	220	317.85	260	379.02	300	440.20	340	501.32	380	562.29
21	~~NA~~ 24.07	61	79.26	101	137.78	141	197.72	181	258.37	221	319.38	261	380.55	301	441.73	341	502.84	381	563.81
22	~~NA~~ 25.36	62	80.70	102	139.27	142	199.23	182	259.89	222	320.91	262	382.08	302	443.26	342	504.37	382	565.34
23	~~NA~~ 26.67	63	82.13	103	140.75	143	200.74	183	261.41	223	322.44	263	383.61	303	444.79	343	505.90	383	566.86
24	~~NA~~ 27.98	64	83.57	104	142.24	144	202.25	184	262.93	224	323.97	264	385.14	304	446.32	344	507.42	384	568.38
25	29.30	65	85.01	105	143.73	145	203.76	185	264.46	225	325.49	265	386.67	305	447.85	345	508.95	385	569.90
26	30.62	66	86.46	106	145.21	146	205.27	186	265.98	226	327.02	266	388.20	306	449.38	346	510.47	386	571.42
27	31.95	67	87.90	107	146.70	147	206.78	187	267.50	227	328.55	267	389.73	307	450.91	347	512.00	387	572.94
28	33.28	68	89.35	108	148.19	148	208.29	188	269.03	228	330.08	268	391.26	308	452.44	348	513.53	388	574.47
29	34.62	69	90.79	109	149.68	149	209.80	189	270.55	229	331.61	269	392.79	309	453.96	349	515.05	389	575.99
30	35.96	70	92.24	110	151.18	150	211.32	190	272.07	230	333.14	270	394.32	310	455.49	350	516.58	390	577.51
31	37.31	71	93.69	111	152.67	151	212.83	191	273.60	231	334.67	271	395.85	311	457.02	351	518.10	391	579.03
32	38.66	72	95.14	112	154.16	152	214.34	192	275.12	232	336.19	272	397.38	312	458.55	352	519.63	392	580.55
33	40.02	73	96.60	113	155.65	153	215.86	193	276.65	233	337.72	273	398.91	313	460.08	353	521.15	393	582.07
34	41.38	74	98.05	114	157.15	154	217.37	194	278.17	234	339.25	274	400.44	314	461.61	354	522.68	394	583.59
35	42.74	75	99.51	115	158.64	155	218.89	195	279.69	235	340.78	275	401.97	315	463.13	355	524.20	395	585.11
36	44.11	76	100.97	116	160.14	156	220.40	196	281.22	236	342.31	276	403.50	316	464.66	356	525.73	396	586.63
37	45.48	77	102.43	117	161.64	157	221.92	197	282.74	237	343.84	277	405.03	317	466.19	357	527.25	397	588.15
38	46.86	78	103.89	118	163.13	158	223.43	198	284.27	238	345.37	278	406.56	318	467.72	358	528.78	398	589.67
39	48.24	79	105.35	119	164.63	159	224.95	199	285.79	239	346.90	279	408.09	319	469.25	359	530.30	399	591.19
40	49.62	80	106.81	120	166.13	160	226.46	200	287.32	240	348.43	280	409.62	320	470.77	360	531.83	400	592.71

Table 16. Acute Water Quality Standards for ~~dissolved~~ Dissolved Nickel
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 10	41	220	81	392	121	550	161	701	201	845	241	985	281	1122	321	1256	361	1387
2	~~NA~~ 17	42	225	82	396	122	554	162	704	202	849	242	989	282	1126	322	1259	362	1390
3	~~NA~~ 24	43	229	83	400	123	558	163	708	203	852	243	992	283	1129	323	1263	363	1394
4	~~NA~~ 31	44	234	84	404	124	562	164	712	204	856	244	996	284	1132	324	1266	364	1397
5	~~NA~~ 37	45	238	85	408	125	566	165	715	205	859	245	999	285	1136	325	1269	365	1400
6	~~NA~~ 43	46	243	86	412	126	569	166	719	206	863	246	1003	286	1139	326	1272	366	1403
7	~~NA~~ 49	47	247	87	416	127	573	167	723	207	867	247	1006	287	1142	327	1276	367	1407
8	~~NA~~ 55	48	252	88	420	128	577	168	726	208	870	248	1010	288	1146	328	1279	368	1410
9	~~NA~~ 61	49	256	89	424	129	581	169	730	209	874	249	1013	289	1149	329	1282	369	1413
10	~~NA~~ 67	50	260	90	428	130	585	170	734	210	877	250	1017	290	1153	330	1286	370	1416
11	~~NA~~ 72	51	265	91	432	131	588	171	737	211	881	251	1020	291	1156	331	1289	371	1420
12	~~NA~~ 78	52	269	92	436	132	592	172	741	212	884	252	1023	292	1159	332	1292	372	1423
13	~~NA~~ 83	53	274	93	440	133	596	173	744	213	888	253	1027	293	1163	333	1296	373	1426
14	~~NA~~ 89	54	278	94	444	134	600	174	748	214	891	254	1030	294	1166	334	1299	374	1429
15	~~NA~~ 94	55	282	95	448	135	604	175	752	215	895	255	1034	295	1169	335	1302	375	1433
16	~~NA~~ 99	56	287	96	452	136	607	176	755	216	898	256	1037	296	1173	336	1305	376	1436
17	~~NA~~ 105	57	291	97	456	137	611	177	759	217	902	257	1041	297	1176	337	1309	377	1439
18	~~NA~~ 110	58	295	98	460	138	615	178	763	218	905	258	1044	298	1179	338	1312	378	1442
19	~~NA~~ 115	59	300	99	464	139	619	179	766	219	909	259	1047	299	1183	339	1315	379	1445
20	~~NA~~ 120	60	304	100	468	140	622	180	770	220	912	260	1051	300	1186	340	1319	380	1449
21	~~NA~~ 125	61	308	101	472	141	626	181	774	221	916	261	1054	301	1189	341	1322	381	1452
22	~~NA~~ 130	62	312	102	476	142	630	182	777	222	919	262	1058	302	1193	342	1325	382	1455

Table 16. Acute Water Quality Standards for ~~dissolved~~ Dissolved Nickel
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
23	~~NA~~ 135	63	317	103	480	143	634	183	781	223	923	263	1061	303	1196	343	1328	383	1458
24	~~NA~~ 140	64	321	104	484	144	637	184	784	224	926	264	1064	304	1199	344	1332	384	1462
25	145	65	325	105	488	145	641	185	788	225	930	265	1068	305	1203	345	1335	385	1465
26	150	66	329	106	492	146	645	186	792	226	933	266	1071	306	1206	346	1338	386	1468
27	155	67	334	107	496	147	649	187	795	227	937	267	1075	307	1209	347	1341	387	1471
28	159	68	338	108	500	148	652	188	799	228	940	268	1078	308	1213	348	1345	388	1474
29	164	69	342	109	504	149	656	189	802	229	944	269	1082	309	1216	349	1348	389	1478
30	169	70	346	110	508	150	660	190	806	230	947	270	1085	310	1219	350	1351	390	1481
31	174	71	350	111	511	151	664	191	810	231	951	271	1088	311	1223	351	1355	391	1484
32	179	72	355	112	515	152	667	192	813	232	954	272	1092	312	1226	352	1358	392	1487
33	183	73	359	113	519	153	671	193	817	233	958	273	1095	313	1229	353	1361	393	1490
34	188	74	363	114	523	154	675	194	820	234	961	274	1099	314	1233	354	1364	394	1494
35	193	75	367	115	527	155	678	195	824	235	965	275	1102	315	1236	355	1368	395	1497
36	197	76	371	116	531	156	682	196	827	236	968	276	1105	316	1239	356	1371	396	1500
37	202	77	375	117	535	157	686	197	831	237	972	277	1109	317	1243	357	1374	397	1503
38	207	78	379	118	539	158	689	198	835	238	975	278	1112	318	1246	358	1377	398	1506
39	211	79	384	119	542	159	693	199	838	239	979	279	1115	319	1249	359	1381	399	1510
40	216	80	388	120	546	160	697	200	842	240	982	280	1119	320	1253	360	1384	400	1513

Table 17. Chronic Water Quality Standards for~~dissolved~~ Dissolved Nickel
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 1.06	41	24.46	81	43.51	121	61.11	161	77.81	201	93.88	241	109.46	281	124.64	321	139.50	361	154.07
2	~~NA~~ 1.90	42	24.96	82	43.97	122	61.53	162	78.22	202	94.27	242	109.84	282	125.02	322	139.86	362	154.43
3	~~NA~~ 2.68	43	25.47	83	44.42	123	61.96	163	78.63	203	94.67	243	110.23	283	125.39	323	140.23	363	154.79
4	~~NA~~ 3.42	44	25.97	84	44.87	124	62.39	164	79.03	204	95.06	244	110.61	284	125.77	324	140.60	364	155.15
5	~~NA~~ 4.12	45	26.47	85	45.33	125	62.81	165	79.44	205	95.46	245	110.99	285	126.14	325	140.96	365	155.51
6	~~NA~~ 4.81	46	26.96	86	45.78	126	63.24	166	79.85	206	95.85	246	111.38	286	126.52	326	141.33	366	155.87
7	~~NA~~ 5.48	47	27.46	87	46.23	127	63.66	167	80.26	207	96.24	247	111.76	287	126.89	327	141.70	367	156.23
8	~~NA~~ 6.14	48	27.95	88	46.68	128	64.09	168	80.66	208	96.64	248	112.14	288	127.26	328	142.07	368	156.59
9	~~NA~~ 6.78	49	28.44	89	47.12	129	64.51	169	81.07	209	97.03	249	112.52	289	127.64	329	142.43	369	156.95
10	~~NA~~ 7.41	50	28.93	90	47.57	130	64.93	170	81.47	210	97.42	250	112.91	290	128.01	330	142.80	370	157.31
11	~~NA~~ 8.04	51	29.42	91	48.02	131	65.35	171	81.88	211	97.81	251	113.29	291	128.38	331	143.16	371	157.67
12	~~NA~~ 8.65	52	29.91	92	48.46	132	65.78	172	82.28	212	98.21	252	113.67	292	128.76	332	143.53	372	158.03
13	~~NA~~ 9.26	53	30.39	93	48.91	133	66.20	173	82.69	213	98.60	253	114.05	293	129.13	333	143.90	373	158.39
14	~~NA~~ 9.86	54	30.88	94	49.35	134	66.62	174	83.09	214	98.99	254	114.43	294	129.50	334	144.26	374	158.75
15	~~NA~~ 10.45	55	31.36	95	49.80	135	67.04	175	83.50	215	99.38	255	114.81	295	129.88	335	144.63	375	159.11
16	~~NA~~ 11.03	56	31.84	96	50.24	136	67.46	176	83.90	216	99.77	256	115.19	296	130.25	336	144.99	376	159.47
17	~~NA~~ 11.61	57	32.32	97	50.68	137	67.88	177	84.30	217	100.16	257	115.57	297	130.62	337	145.36	377	159.82
18	~~NA~~ 12.19	58	32.80	98	51.13	138	68.30	178	84.71	218	100.55	258	115.95	298	130.99	338	145.72	378	160.18
19	~~NA~~ 12.76	59	33.28	99	51.57	139	68.71	179	85.11	219	100.94	259	116.33	299	131.36	339	146.09	379	160.54
20	~~NA~~ 13.33	60	33.76	100	52.01	140	69.13	180	85.51	220	101.33	260	116.71	300	131.74	340	146.45	380	160.90
21	~~NA~~ 13.89	61	34.23	101	52.45	141	69.55	181	85.91	221	101.72	261	117.09	301	132.11	341	146.81	381	161.26
22	~~NA~~ 14.45	62	34.71	102	52.89	142	69.97	182	86.31	222	102.11	262	117.47	302	132.48	342	147.18	382	161.62
23	~~NA~~ 15.00	63	35.18	103	53.32	143	70.38	183	86.71	223	102.50	263	117.85	303	132.85	343	147.54	383	161.97

Table 17. Chronic Water Quality Standards for~~dissolved~~ Dissolved Nickel
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
24	~~NA~~ 15.55	64	35.65	104	53.76	144	70.80	184	87.12	224	102.89	264	118.23	304	133.22	344	147.91	384	162.33
25	16.10	65	36.12	105	54.20	145	71.22	185	87.52	225	103.28	265	118.61	305	133.59	345	148.27	385	162.69
26	16.64	66	36.59	106	54.63	146	71.63	186	87.92	226	103.67	266	118.99	306	133.96	346	148.63	386	163.05
27	17.18	67	37.06	107	55.07	147	72.05	187	88.32	227	104.05	267	119.37	307	134.33	347	149.00	387	163.40
28	17.72	68	37.53	108	55.51	148	72.46	188	88.71	228	104.44	268	119.75	308	134.70	348	149.36	388	163.76
29	18.25	69	37.99	109	55.94	149	72.87	189	89.11	229	104.83	269	120.12	309	135.07	349	149.72	389	164.12
30	18.78	70	38.46	110	56.37	150	73.29	190	89.51	230	105.22	270	120.50	310	135.44	350	150.09	390	164.47
31	19.31	71	38.92	111	56.81	151	73.70	191	89.91	231	105.60	271	120.88	311	135.81	351	150.45	391	164.83
32	19.83	72	39.39	112	57.24	152	74.11	192	90.31	232	105.99	272	121.26	312	136.18	352	150.81	392	165.19
33	20.36	73	39.85	113	57.67	153	74.53	193	90.71	233	106.38	273	121.63	313	136.55	353	151.17	393	165.54
34	20.88	74	40.31	114	58.10	154	74.94	194	91.10	234	106.76	274	122.01	314	136.92	354	151.54	394	165.90
35	21.40	75	40.77	115	58.53	155	75.35	195	91.50	235	107.15	275	122.39	315	137.29	355	151.90	395	166.26
36	21.91	76	41.23	116	58.96	156	75.76	196	91.90	236	107.53	276	122.76	316	137.66	356	152.26	396	166.61
37	22.43	77	41.69	117	59.39	157	76.17	197	92.29	237	107.92	277	123.14	317	138.02	357	152.62	397	166.97
38	22.94	78	42.15	118	59.82	158	76.58	198	92.69	238	108.30	278	123.52	318	138.39	358	152.98	398	167.32
39	23.45	79	42.60	119	60.25	159	76.99	199	93.09	239	108.69	279	123.89	319	138.76	359	153.34	399	167.68
40	23.96	80	43.06	120	60.68	160	77.40	200	93.48	240	109.07	280	124.27	320	139.13	360	153.71	400	168.04

~~**Table 18. Water Quality Standards for dissolved Silver**~~
~~**Aquatic and Wildlife coldwater, warmwater, edw and ephemeral**~~

~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~	~~Hard.~~	~~Std.~~
~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~	~~mg/L~~	~~ug/L~~
~~1~~	~~NA~~	~~41~~	~~0.74~~	~~81~~	~~2.40~~	~~121~~	~~4.79~~	~~161~~	~~7.83~~	~~201~~	~~11.46~~	~~241~~	~~15.66~~	~~281~~	~~20.40~~	~~321~~	~~25.65~~	~~361~~	~~31.39~~
~~2~~	~~NA~~	~~42~~	~~0.78~~	~~82~~	~~2.45~~	~~122~~	~~4.86~~	~~162~~	~~7.91~~	~~202~~	~~11.56~~	~~242~~	~~15.78~~	~~282~~	~~20.52~~	~~322~~	~~25.78~~	~~362~~	~~31.54~~
~~3~~	~~NA~~	~~43~~	~~0.81~~	~~83~~	~~2.50~~	~~123~~	~~4.93~~	~~163~~	~~7.99~~	~~203~~	~~11.66~~	~~243~~	~~15.89~~	~~283~~	~~20.65~~	~~323~~	~~25.92~~	~~363~~	~~31.69~~
~~4~~	~~NA~~	~~44~~	~~0.84~~	~~84~~	~~2.56~~	~~124~~	~~4.99~~	~~164~~	~~8.08~~	~~204~~	~~11.76~~	~~244~~	~~16.00~~	~~284~~	~~20.77~~	~~324~~	~~26.06~~	~~364~~	~~31.84~~
~~5~~	~~NA~~	~~45~~	~~0.87~~	~~85~~	~~2.61~~	~~125~~	~~5.06~~	~~165~~	~~8.16~~	~~205~~	~~11.86~~	~~245~~	~~16.11~~	~~285~~	~~20.90~~	~~325~~	~~26.20~~	~~365~~	~~31.99~~
~~6~~	~~NA~~	~~46~~	~~0.91~~	~~86~~	~~2.66~~	~~126~~	~~5.13~~	~~166~~	~~8.25~~	~~206~~	~~11.96~~	~~246~~	~~16.23~~	~~286~~	~~21.03~~	~~326~~	~~26.34~~	~~366~~	~~32.14~~
~~7~~	~~NA~~	~~47~~	~~0.94~~	~~87~~	~~2.72~~	~~127~~	~~5.20~~	~~167~~	~~8.33~~	~~207~~	~~12.06~~	~~247~~	~~16.34~~	~~287~~	~~21.15~~	~~327~~	~~26.48~~	~~367~~	~~32.29~~
~~8~~	~~NA~~	~~48~~	~~0.98~~	~~88~~	~~2.77~~	~~128~~	~~5.27~~	~~168~~	~~8.42~~	~~208~~	~~12.16~~	~~248~~	~~16.45~~	~~288~~	~~21.28~~	~~328~~	~~26.61~~	~~368~~	~~32.44~~
~~9~~	~~NA~~	~~49~~	~~1.01~~	~~89~~	~~2.82~~	~~129~~	~~5.35~~	~~169~~	~~8.51~~	~~209~~	~~12.26~~	~~249~~	~~16.57~~	~~289~~	~~21.41~~	~~329~~	~~26.75~~	~~369~~	~~32.59~~
~~10~~	~~NA~~	~~50~~	~~1.05~~	~~90~~	~~2.88~~	~~130~~	~~5.42~~	~~170~~	~~8.59~~	~~210~~	~~12.36~~	~~250~~	~~16.68~~	~~290~~	~~21.53~~	~~330~~	~~26.89~~	~~370~~	~~32.74~~
~~11~~	~~NA~~	~~51~~	~~1.08~~	~~91~~	~~2.93~~	~~131~~	~~5.49~~	~~171~~	~~8.68~~	~~211~~	~~12.46~~	~~251~~	~~16.80~~	~~291~~	~~21.66~~	~~331~~	~~27.03~~	~~371~~	~~32.90~~
~~12~~	~~NA~~	~~52~~	~~1.12~~	~~92~~	~~2.99~~	~~132~~	~~5.56~~	~~172~~	~~8.77~~	~~212~~	~~12.56~~	~~252~~	~~16.91~~	~~292~~	~~21.79~~	~~332~~	~~27.18~~	~~372~~	~~33.05~~
~~13~~	~~NA~~	~~53~~	~~1.16~~	~~93~~	~~3.05~~	~~133~~	~~5.63~~	~~173~~	~~8.86~~	~~213~~	~~12.67~~	~~253~~	~~17.03~~	~~293~~	~~21.92~~	~~333~~	~~27.32~~	~~373~~	~~33.20~~
~~14~~	~~NA~~	~~54~~	~~1.20~~	~~94~~	~~3.10~~	~~134~~	~~5.71~~	~~174~~	~~8.94~~	~~214~~	~~12.77~~	~~254~~	~~17.14~~	~~294~~	~~22.05~~	~~334~~	~~27.46~~	~~374~~	~~33.35~~
~~15~~	~~NA~~	~~55~~	~~1.23~~	~~95~~	~~3.16~~	~~135~~	~~5.78~~	~~175~~	~~9.03~~	~~215~~	~~12.87~~	~~255~~	~~17.26~~	~~295~~	~~22.18~~	~~335~~	~~27.60~~	~~375~~	~~33.51~~
~~16~~	~~NA~~	~~56~~	~~1.27~~	~~96~~	~~3.22~~	~~136~~	~~5.85~~	~~176~~	~~9.12~~	~~216~~	~~12.97~~	~~256~~	~~17.38~~	~~296~~	~~22.31~~	~~336~~	~~27.74~~	~~376~~	~~33.66~~
~~17~~	~~NA~~	~~57~~	~~1.31~~	~~97~~	~~3.27~~	~~137~~	~~5.93~~	~~177~~	~~9.21~~	~~217~~	~~13.08~~	~~257~~	~~17.49~~	~~297~~	~~22.44~~	~~337~~	~~27.88~~	~~377~~	~~33.82~~
~~18~~	~~NA~~	~~58~~	~~1.35~~	~~98~~	~~3.33~~	~~138~~	~~6.00~~	~~178~~	~~9.30~~	~~218~~	~~13.18~~	~~258~~	~~17.61~~	~~298~~	~~22.57~~	~~338~~	~~28.03~~	~~378~~	~~33.97~~
~~19~~	~~NA~~	~~59~~	~~1.39~~	~~99~~	~~3.39~~	~~139~~	~~6.08~~	~~179~~	~~9.39~~	~~219~~	~~13.29~~	~~259~~	~~17.73~~	~~299~~	~~22.70~~	~~339~~	~~28.17~~	~~379~~	~~34.13~~
~~20~~	~~NA~~	~~60~~	~~1.43~~	~~100~~	~~3.45~~	~~140~~	~~6.15~~	~~180~~	~~9.48~~	~~220~~	~~13.39~~	~~260~~	~~17.85~~	~~300~~	~~22.83~~	~~340~~	~~28.31~~	~~380~~	~~34.28~~
~~21~~	~~NA~~	~~61~~	~~1.47~~	~~101~~	~~3.51~~	~~141~~	~~6.23~~	~~181~~	~~9.57~~	~~221~~	~~13.50~~	~~261~~	~~17.97~~	~~301~~	~~22.96~~	~~341~~	~~28.45~~	~~381~~	~~34.44~~
~~22~~	~~NA~~	~~62~~	~~1.52~~	~~102~~	~~3.57~~	~~142~~	~~6.31~~	~~182~~	~~9.66~~	~~222~~	~~13.60~~	~~262~~	~~18.08~~	~~302~~	~~23.09~~	~~342~~	~~28.60~~	~~382~~	~~34.59~~
~~23~~	~~NA~~	~~63~~	~~1.56~~	~~103~~	~~3.63~~	~~143~~	~~6.38~~	~~183~~	~~9.76~~	~~223~~	~~13.71~~	~~263~~	~~18.20~~	~~303~~	~~23.22~~	~~343~~	~~28.74~~	~~383~~	~~34.75~~
~~24~~	~~NA~~	~~64~~	~~1.60~~	~~104~~	~~3.69~~	~~144~~	~~6.46~~	~~184~~	~~9.85~~	~~224~~	~~13.81~~	~~264~~	~~18.32~~	~~304~~	~~23.35~~	~~344~~	~~28.89~~	~~384~~	~~34.90~~
~~25~~	~~0.32~~	~~65~~	~~1.64~~	~~105~~	~~3.75~~	~~145~~	~~6.54~~	~~185~~	~~9.94~~	~~225~~	~~13.92~~	~~265~~	~~18.44~~	~~305~~	~~23.49~~	~~345~~	~~29.03~~	~~385~~	~~35.06~~
~~26~~	~~0.34~~	~~66~~	~~1.69~~	~~106~~	~~3.81~~	~~146~~	~~6.61~~	~~186~~	~~10.03~~	~~226~~	~~14.02~~	~~266~~	~~18.56~~	~~306~~	~~23.62~~	~~346~~	~~29.18~~	~~386~~	~~35.22~~
~~27~~	~~0.36~~	~~67~~	~~1.73~~	~~107~~	~~3.88~~	~~147~~	~~6.69~~	~~187~~	~~10.12~~	~~227~~	~~14.13~~	~~267~~	~~18.68~~	~~307~~	~~23.75~~	~~347~~	~~29.32~~	~~387~~	~~35.37~~
~~28~~	~~0.39~~	~~68~~	~~1.78~~	~~108~~	~~3.94~~	~~148~~	~~6.77~~	~~188~~	~~10.22~~	~~228~~	~~14.24~~	~~268~~	~~18.80~~	~~308~~	~~23.89~~	~~348~~	~~29.47~~	~~388~~	~~35.53~~
~~29~~	~~0.41~~	~~69~~	~~1.82~~	~~109~~	~~4.00~~	~~149~~	~~6.85~~	~~189~~	~~10.31~~	~~229~~	~~14.35~~	~~269~~	~~18.92~~	~~309~~	~~24.02~~	~~349~~	~~29.61~~	~~389~~	~~35.69~~
~~30~~	~~0.43~~	~~70~~	~~1.87~~	~~110~~	~~4.06~~	~~150~~	~~6.93~~	~~190~~	~~10.41~~	~~230~~	~~14.45~~	~~270~~	~~19.04~~	~~310~~	~~24.15~~	~~350~~	~~29.76~~	~~390~~	~~35.85~~
~~31~~	~~0.46~~	~~71~~	~~1.91~~	~~111~~	~~4.13~~	~~151~~	~~7.01~~	~~191~~	~~10.50~~	~~231~~	~~14.56~~	~~271~~	~~19.17~~	~~311~~	~~24.29~~	~~351~~	~~29.91~~	~~391~~	~~36.01~~
~~32~~	~~0.49~~	~~72~~	~~1.96~~	~~112~~	~~4.19~~	~~152~~	~~7.09~~	~~192~~	~~10.59~~	~~232~~	~~14.67~~	~~272~~	~~19.29~~	~~312~~	~~24.42~~	~~352~~	~~30.05~~	~~392~~	~~36.16~~
~~33~~	~~0.51~~	~~73~~	~~2.01~~	~~113~~	~~4.26~~	~~153~~	~~7.17~~	~~193~~	~~10.69~~	~~233~~	~~14.78~~	~~273~~	~~19.41~~	~~313~~	~~24.56~~	~~353~~	~~30.20~~	~~393~~	~~36.32~~
~~34~~	~~0.54~~	~~74~~	~~2.06~~	~~114~~	~~4.32~~	~~154~~	~~7.25~~	~~194~~	~~10.79~~	~~234~~	~~14.89~~	~~274~~	~~19.53~~	~~314~~	~~24.69~~	~~354~~	~~30.35~~	~~394~~	~~36.48~~
~~35~~	~~0.57~~	~~75~~	~~2.10~~	~~115~~	~~4.39~~	~~155~~	~~7.33~~	~~195~~	~~10.88~~	~~235~~	~~15.00~~	~~275~~	~~19.65~~	~~315~~	~~24.83~~	~~355~~	~~30.49~~	~~395~~	~~36.64~~
~~36~~	~~0.60~~	~~76~~	~~2.15~~	~~116~~	~~4.45~~	~~156~~	~~7.41~~	~~196~~	~~10.98~~	~~236~~	~~15.11~~	~~276~~	~~19.78~~	~~316~~	~~24.96~~	~~356~~	~~30.64~~	~~396~~	~~36.80~~
~~37~~	~~0.62~~	~~77~~	~~2.20~~	~~117~~	~~4.52~~	~~157~~	~~7.49~~	~~197~~	~~11.07~~	~~237~~	~~15.22~~	~~277~~	~~19.90~~	~~317~~	~~25.10~~	~~357~~	~~30.79~~	~~397~~	~~36.96~~
~~38~~	~~0.65~~	~~78~~	~~2.25~~	~~118~~	~~4.59~~	~~158~~	~~7.58~~	~~198~~	~~11.17~~	~~238~~	~~15.33~~	~~278~~	~~20.03~~	~~318~~	~~25.23~~	~~358~~	~~30.94~~	~~398~~	~~37.12~~
~~39~~	~~0.68~~	~~79~~	~~2.30~~	~~119~~	~~4.65~~	~~159~~	~~7.66~~	~~199~~	~~11.27~~	~~239~~	~~15.44~~	~~279~~	~~20.15~~	~~319~~	~~25.37~~	~~359~~	~~31.09~~	~~399~~	~~37.28~~
~~40~~	~~0.71~~	~~80~~	~~2.35~~	~~120~~	~~4.72~~	~~160~~	~~7.74~~	~~200~~	~~11.37~~	~~240~~	~~15.55~~	~~280~~	~~20.27~~	~~320~~	~~25.51~~	~~360~~	~~31.24~~	~~400~~	~~37.44~~

~~Table 12.~~Table 18. Acute Water Quality Standards for ~~dissolved~~ Dissolved Nickel
Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 85	41	1956	81	3479	121	4886	161	6221	201	7506	241	8752	281	9966	321	11154	361	12319
2	~~NA~~ 152	42	1996	82	3516	122	4920	162	6254	202	7538	242	8783	282	9996	322	11183	362	12348
3	~~NA~~ 214	43	2036	83	3552	123	4954	163	6287	203	7569	243	8813	283	10026	323	11213	363	12377
4	~~NA~~ 273	44	2076	84	3588	124	4988	164	6319	204	7601	244	8844	284	10056	324	11242	364	12405
5	~~NA~~ 330	45	2116	85	3624	125	5022	165	6352	205	7632	245	8875	285	10086	325	11271	365	12434
6	~~NA~~ 385	46	2156	86	3660	126	5056	166	6385	206	7664	246	8905	286	10116	326	11301	366	12463
7	~~NA~~ 438	47	2195	87	3696	127	5090	167	6417	207	7695	247	8936	287	10146	327	11330	367	12492
8	~~NA~~ 491	48	2235	88	3732	128	5124	168	6450	208	7727	248	8967	288	10176	328	11359	368	12521
9	~~NA~~ 542	49	2274	89	3768	129	5158	169	6482	209	7758	249	8997	289	10206	329	11389	369	12549
10	~~NA~~ 593	50	2313	90	3804	130	5192	170	6514	210	7790	250	9028	290	10235	330	11418	370	12578
11	~~NA~~ 643	51	2352	91	3839	131	5226	171	6547	211	7821	251	9058	291	10265	331	11447	371	12607
12	~~NA~~ 692	52	2391	92	3875	132	5259	172	6579	212	7852	252	9089	292	10295	332	11476	372	12636
13	~~NA~~ 740	53	2430	93	3911	133	5293	173	6612	213	7884	253	9119	293	10325	333	11506	373	12664
14	~~NA~~ 788	54	2469	94	3946	134	5327	174	6644	214	7915	254	9150	294	10355	334	11535	374	12693
15	~~NA~~ 835	55	2508	95	3982	135	5360	175	6676	215	7946	255	9180	295	10385	335	11564	375	12722
16	~~NA~~ 882	56	2546	96	4017	136	5394	176	6708	216	7978	256	9211	296	10414	336	11593	376	12751
17	~~NA~~ 929	57	2585	97	4053	137	5427	177	6741	217	8009	257	9241	297	10444	337	11622	377	12779
18	~~NA~~ 975	58	2623	98	4088	138	5461	178	6773	218	8040	258	9272	298	10474	338	11652	378	12808
19	~~NA~~ 1020	59	2661	99	4123	139	5494	179	6805	219	8071	259	9302	299	10504	339	11681	379	12837
20	~~NA~~ 1066	60	2699	100	4158	140	5528	180	6837	220	8102	260	9332	300	10533	340	11710	380	12865
21	~~NA~~ 1110	61	2737	101	4193	141	5561	181	6869	221	8133	261	9363	301	10563	341	11739	381	12894
22	~~NA~~ 1155	62	2775	102	4229	142	5594	182	6901	222	8165	262	9393	302	10593	342	11768	382	12922
23	~~NA~~ 1199	63	2813	103	4264	143	5628	183	6934	223	8196	263	9423	303	10622	343	11797	383	12951
24	~~NA~~ 1243	64	2851	104	4299	144	5661	184	6966	224	8227	264	9454	304	10652	344	11826	384	12980
25	1287	65	2888	105	4334	145	5694	185	6998	225	8258	265	9484	305	10682	345	11855	385	13008
26	1330	66	2926	106	4368	146	5727	186	7030	226	8289	266	9514	306	10711	346	11884	386	13037
27	1374	67	2963	107	4403	147	5761	187	7062	227	8320	267	9544	307	10741	347	11913	387	13065
28	1416	68	3001	108	4438	148	5794	188	7093	228	8351	268	9575	308	10770	348	11943	388	13094
29	1459	69	3038	109	4473	149	5827	189	7125	229	8382	269	9605	309	10800	349	11972	389	13123
30	1502	70	3075	110	4508	150	5860	190	7157	230	8413	270	9635	310	10830	350	12001	390	13151
31	1544	71	3112	111	4542	151	5893	191	7189	231	8444	271	9665	311	10859	351	12030	391	13180
32	1586	72	3149	112	4577	152	5926	192	7221	232	8475	272	9695	312	10889	352	12059	392	13208
33	1628	73	3186	113	4611	153	5959	193	7253	233	8506	273	9726	313	10918	353	12088	393	13237
34	1669	74	3223	114	4646	154	5992	194	7285	234	8536	274	9756	314	10948	354	12116	394	13265
35	1711	75	3260	115	4680	155	6025	195	7316	235	8567	275	9786	315	10977	355	12145	395	13294
36	1752	76	3297	116	4715	156	6058	196	7348	236	8598	276	9816	316	11007	356	12174	396	13322
37	1793	77	3333	117	4749	157	6090	197	7380	237	8629	277	9846	317	11036	357	12203	397	13350
38	1834	78	3370	118	4783	158	6123	198	7411	238	8660	278	9876	318	11066	358	12232	398	13379
39	1875	79	3407	119	4818	159	6156	199	7443	239	8691	279	9906	319	11095	359	12261	399	13407
40	1915	80	3443	120	4852	160	6189	200	7475	240	8721	280	9936	320	11124	360	12290	400	13436

Table 19. Water Quality Standards for Dissolved Silver
Aquatic and Wildlife coldwater, warmwater, edw, and ephemeral

Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L
1	0.001	41	0.69	81	2.24	121	4.46	161	7.30	201	10.69	241	14.60	281	19.02	321	23.91	361	29.26
2	0.004	42	0.72	82	2.29	122	4.53	162	7.38	202	10.78	242	14.71	282	19.14	322	24.04	362	29.40
3	0.01	43	0.75	83	2.33	123	4.59	163	7.45	203	10.87	243	14.81	283	19.25	323	24.17	363	29.54
4	0.01	44	0.78	84	2.38	124	4.66	164	7.53	204	10.96	244	14.92	284	19.37	324	24.30	364	29.68
5	0.02	45	0.81	85	2.43	125	4.72	165	7.61	205	11.06	245	15.02	285	19.49	325	24.43	365	29.82
6	0.03	46	0.85	86	2.48	126	4.79	166	7.69	206	11.15	246	15.13	286	19.61	326	24.56	366	29.96
7	0.03	47	0.88	87	2.53	127	4.85	167	7.77	207	11.24	247	15.24	287	19.72	327	24.69	367	30.11
8	0.04	48	0.91	88	2.58	128	4.92	168	7.85	208	11.34	248	15.34	288	19.84	328	24.82	368	30.25
9	0.05	49	0.94	89	2.63	129	4.98	169	7.93	209	11.43	249	15.45	289	19.96	329	24.95	369	30.39

Table 19. Water Quality Standards for Dissolved Silver
Aquatic and Wildlife coldwater, warmwater, edw, and ephemeral

Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L	Hard. mg/L	Std. ug/L
10	0.06	50	0.98	90	2.68	130	5.05	170	8.01	210	11.52	250	15.56	290	20.08	330	25.08	370	30.53
11	0.07	51	1.01	91	2.74	131	5.12	171	8.09	211	11.62	251	15.66	291	20.20	331	25.21	371	30.67
12	0.08	52	1.04	92	2.79	132	5.19	172	8.18	212	11.71	252	15.77	292	20.32	332	25.34	372	30.81
13	0.10	53	1.08	93	2.84	133	5.25	173	8.26	213	11.81	253	15.88	293	20.44	333	25.47	373	30.96
14	0.11	54	1.11	94	2.89	134	5.32	174	8.34	214	11.91	254	15.99	294	20.56	334	25.60	374	31.10
15	0.12	55	1.15	95	2.95	135	5.39	175	8.42	215	12.00	255	16.09	295	20.68	335	25.73	375	31.24
16	0.14	56	1.19	96	3.00	136	5.46	176	8.51	216	12.10	256	16.20	296	20.80	336	25.87	376	31.39
17	0.15	57	1.22	97	3.05	137	5.53	177	8.59	217	12.19	257	16.31	297	20.92	337	26.00	377	31.53
18	0.17	58	1.26	98	3.11	138	5.60	178	8.67	218	12.29	258	16.42	298	21.04	338	26.13	378	31.67
19	0.18	59	1.30	99	3.16	139	5.67	179	8.76	219	12.39	259	16.53	299	21.16	339	26.26	379	31.82
20	0.20	60	1.34	100	3.22	140	5.74	180	8.84	220	12.48	260	16.64	300	21.28	340	26.40	380	31.96
21	0.22	61	1.37	101	3.27	141	5.81	181	8.93	221	12.58	261	16.75	301	21.41	341	26.53	381	32.11
22	0.24	62	1.41	102	3.33	142	5.88	182	9.01	222	12.68	262	16.86	302	21.53	342	26.67	382	32.25
23	0.26	63	1.45	103	3.38	143	5.95	183	9.10	223	12.78	263	16.97	303	21.65	343	26.80	383	32.40
24	0.28	64	1.49	104	3.44	144	6.02	184	9.18	224	12.88	264	17.08	304	21.78	344	26.93	384	32.54
25	0.30	65	1.53	105	3.50	145	6.09	185	9.27	225	12.98	265	17.19	305	21.90	345	27.07	385	32.69
26	0.32	66	1.57	106	3.56	146	6.17	186	9.35	226	13.08	266	17.31	306	22.02	346	27.20	386	32.84
27	0.34	67	1.62	107	3.61	147	6.24	187	9.44	227	13.18	267	17.42	307	22.15	347	27.34	387	32.98
28	0.36	68	1.66	108	3.67	148	6.31	188	9.53	228	13.28	268	17.53	308	22.27	348	27.47	388	33.13
29	0.38	69	1.70	109	3.73	149	6.39	189	9.61	229	13.38	269	17.64	309	22.39	349	27.61	389	33.28
30	0.41	70	1.74	110	3.79	150	6.46	190	9.70	230	13.48	270	17.76	310	22.52	350	27.75	390	33.42
31	0.43	71	1.78	111	3.85	151	6.54	191	9.79	231	13.58	271	17.87	311	22.64	351	27.88	391	33.57
32	0.45	72	1.83	112	3.91	152	6.61	192	9.88	232	13.68	272	17.98	312	22.77	352	28.02	392	33.72
33	0.48	73	1.87	113	3.97	153	6.68	193	9.97	233	13.78	273	18.10	313	22.90	353	28.16	393	33.87
34	0.50	74	1.92	114	4.03	154	6.76	194	10.06	234	13.88	274	18.21	314	23.02	354	28.29	394	34.02
35	0.53	75	1.96	115	4.09	155	6.84	195	10.15	235	13.98	275	18.33	315	23.15	355	28.43	395	34.16
36	0.55	76	2.01	116	4.15	156	6.91	196	10.24	236	14.09	276	18.44	316	23.27	356	28.57	396	34.31
37	0.58	77	2.05	117	4.21	157	6.99	197	10.33	237	14.19	277	18.56	317	23.40	357	28.71	397	34.46
38	0.61	78	2.10	118	4.28	158	7.06	198	10.42	238	14.29	278	18.67	318	23.53	358	28.85	398	34.61
39	0.64	79	2.14	119	4.34	159	7.14	199	10.51	239	14.40	279	18.79	319	23.66	359	28.99	399	34.76
40	0.67	80	2.19	120	4.40	160	7.22	200	10.60	240	14.50	280	18.90	320	23.78	360	29.12	400	34.91

Table 20. Acute and Chronic Water Quality Standards for ~~dissolved~~ Dissolved Zinc
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 2.4	41	55.1	81	98.0	121	137.7	161	175.4	201	211.7	241	246.9	281	281.2	321	314.8	361	347.7
2	~~NA~~ 4.3	42	56.2	82	99.0	122	138.7	162	176.4	202	212.6	242	247.8	282	282.1	322	315.6	362	348.5
3	~~NA~~ 6.0	43	57.3	83	100.1	123	139.6	163	177.3	203	213.5	243	248.6	283	282.9	323	316.4	363	349.4
4	~~NA~~ 7.7	44	58.4	84	101.1	124	140.6	164	178.2	204	214.4	244	249.5	284	283.8	324	317.3	364	350.2
5	~~NA~~ 9.3	45	59.6	85	102.1	125	141.6	165	179.1	205	215.3	245	250.4	285	284.6	325	318.1	365	351.0
6	~~NA~~ 10.8	46	60.7	86	103.1	126	142.5	166	180.0	206	216.2	246	251.2	286	285.5	326	318.9	366	351.8
7	~~NA~~ 12.3	47	61.8	87	104.1	127	143.5	167	181.0	207	217.1	247	252.1	287	286.3	327	319.8	367	352.6

Table 20. Acute and Chronic Water Quality Standards for ~~dissolved~~ Dissolved Zinc
Aquatic and Wildlife coldwater, warmwater and edw

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
8	~~NA~~ 13.8	48	62.9	88	105.2	128	144.4	168	181.9	208	217.9	248	253.0	288	287.1	328	320.6	368	353.4
9	~~NA~~ 15.2	49	64.0	89	106.2	129	145.4	169	182.8	209	218.8	249	253.8	289	288.0	329	321.4	369	354.2
10	~~NA~~ 16.7	50	65.1	90	107.2	130	146.4	170	183.7	210	219.7	250	254.7	290	288.8	330	322.2	370	355.1
11	~~NA~~ 18.1	51	66.2	91	108.2	131	147.3	171	184.6	211	220.6	251	255.6	291	289.7	331	323.1	371	355.9
12	~~NA~~ 19.4	52	67.3	92	109.2	132	148.3	172	185.5	212	221.5	252	256.4	292	290.5	332	323.9	372	356.7
13	~~NA~~ 20.8	53	68.4	93	110.2	133	149.2	173	186.4	213	222.4	253	257.3	293	291.4	333	324.7	373	357.5
14	~~NA~~ 22.1	54	69.5	94	111.2	134	150.2	174	187.4	214	223.3	254	258.1	294	292.2	334	325.6	374	358.3
15	~~NA~~ 23.5	55	70.6	95	112.2	135	151.1	175	188.3	215	224.1	255	259.0	295	293.0	335	326.4	375	359.1
16	~~NA~~ 24.8	56	71.7	96	113.2	136	152.1	176	189.2	216	225.0	256	259.9	296	293.9	336	327.2	376	359.9
17	~~NA~~ 26.1	57	72.8	97	114.2	137	153.0	177	190.1	217	225.9	257	260.7	297	294.7	337	328.0	377	360.7
18	~~NA~~ 27.4	58	73.9	98	115.2	138	153.9	178	191.0	218	226.8	258	261.6	298	295.6	338	328.9	378	361.5
19	~~NA~~ 28.7	59	74.9	99	116.2	139	154.9	179	191.9	219	227.7	259	262.4	299	296.4	339	329.7	379	362.4
20	~~NA~~ 30.0	60	76.0	100	117.2	140	155.8	180	192.8	220	228.6	260	263.3	300	297.2	340	330.5	380	363.2
21	~~NA~~ 31.2	61	77.1	101	118.2	141	156.8	181	193.7	221	229.4	261	264.2	301	298.1	341	331.3	381	364.0
22	~~NA~~ 32.5	62	78.2	102	119.2	142	157.7	182	194.6	222	230.3	262	265.0	302	298.9	342	332.2	382	364.8
23	~~NA~~ 33.7	63	79.2	103	120.2	143	158.7	183	195.5	223	231.2	263	265.9	303	299.8	343	333.0	383	365.6
24	~~NA~~ 35.0	64	80.3	104	121.1	144	159.6	184	196.4	224	232.1	264	266.7	304	300.6	344	333.8	384	366.4
25	36.2	65	81.3	105	122.1	145	160.5	185	197.3	225	232.9	265	267.6	305	301.4	345	334.6	385	367.2
26	37.4	66	82.4	106	123.1	146	161.5	186	198.3	226	233.8	266	268.4	306	302.3	346	335.4	386	368.0
27	38.6	67	83.5	107	124.1	147	162.4	187	199.2	227	234.7	267	269.3	307	303.1	347	336.3	387	368.8
28	39.9	68	84.5	108	125.1	148	163.3	188	200.1	228	235.6	268	270.2	308	304.0	348	337.1	388	369.6
29	41.1	69	85.6	109	126.1	149	164.3	189	201.0	229	236.5	269	271.0	309	304.8	349	337.9	389	370.4
30	42.2	70	86.6	110	127.0	150	165.2	190	201.9	230	237.3	270	271.9	310	305.6	350	338.7	390	371.2
31	43.4	71	87.7	111	128.0	151	166.2	191	202.8	231	238.2	271	272.7	311	306.5	351	339.5	391	372.1
32	44.6	72	88.7	112	129.0	152	167.1	192	203.7	232	239.1	272	273.6	312	307.3	352	340.4	392	372.9
33	45.8	73	89.8	113	130.0	153	168.0	193	204.6	233	239.9	273	274.4	313	308.1	353	341.2	393	373.7
34	47.0	74	90.8	114	130.9	154	168.9	194	205.5	234	240.8	274	275.3	314	309.0	354	342.0	394	374.5
35	48.1	75	91.8	115	131.9	155	169.9	195	206.3	235	241.7	275	276.1	315	309.8	355	342.8	395	375.3
36	49.3	76	92.9	116	132.9	156	170.8	196	207.2	236	242.6	276	277.0	316	310.6	356	343.6	396	376.1
37	50.5	77	93.9	117	133.9	157	171.7	197	208.1	237	243.4	277	277.8	317	311.5	357	344.5	397	376.9
38	51.6	78	94.9	118	134.8	158	172.7	198	209.0	238	244.3	278	278.7	318	312.3	358	345.3	398	377.7
39	52.8	79	96.0	119	135.8	159	173.6	199	209.9	239	245.2	279	279.5	319	313.1	359	346.1	399	378.5
40	53.9	80	97.0	120	136.8	160	174.5	200	210.8	240	246.0	280	280.4	320	314.0	360	346.9	400	379.3

~~Table 19.~~Table 21. Acute Water Quality Standards for ~~dissolved~~ Dissolved Zinc
Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L	Hard. mg/L	Std. ~~ug/L~~ µg/L
1	~~NA~~ 22	41	522	81	930	121	1307	161	1665	201	2009	241	2343	281	2669	321	2987	361	3300
2	~~NA~~ 40	42	533	82	940	122	1316	162	1674	202	2018	242	2351	282	2677	322	2995	362	3307
3	~~NA~~ 57	43	544	83	950	123	1325	163	1682	203	2026	243	2360	283	2685	323	3003	363	3315
4	~~NA~~ 73	44	555	84	959	124	1334	164	1691	204	2034	244	2368	284	2693	324	3011	364	3323
5	~~NA~~ 88	45	565	85	969	125	1343	165	1700	205	2043	245	2376	285	2701	325	3019	365	3331
6	~~NA~~ 103	46	576	86	979	126	1353	166	1708	206	2051	246	2384	286	2709	326	3027	366	3338

~~Table 19.~~Table 21. Acute Water Quality Standards for ~~dissolved~~ Dissolved Zinc
Aquatic and Wildlife ephemeral

Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L	Hard. mg/L	Std. ~~ug/L~~ μg/L
7	~~NA~~ 117	47	587	87	988	127	1362	167	1717	207	2060	247	2392	287	2717	327	3034	367	3346
8	~~NA~~ 131	48	597	88	998	128	1371	168	1726	208	2068	248	2401	288	2725	328	3042	368	3354
9	~~NA~~ 145	49	608	89	1007	129	1380	169	1735	209	2077	249	2409	289	2733	329	3050	369	3362
10	~~NA~~ 158	50	618	90	1017	130	1389	170	1743	210	2085	250	2417	290	2741	330	3058	370	3369
11	~~NA~~ 171	51	629	91	1027	131	1398	171	1752	211	2093	251	2425	291	2749	331	3066	371	3377
12	~~NA~~ 184	52	639	92	1036	132	1407	172	1761	212	2102	252	2433	292	2757	332	3074	372	3385
13	~~NA~~ 197	53	649	93	1046	133	1416	173	1769	213	2110	253	2442	293	2765	333	3082	373	3392
14	~~NA~~ 210	54	660	94	1055	134	1425	174	1778	214	2119	254	2450	294	2773	334	3089	374	3400
15	~~NA~~ 223	55	670	95	1065	135	1434	175	1787	215	2127	255	2458	295	2781	335	3097	375	3408
16	~~NA~~ 235	56	680	96	1074	136	1443	176	1795	216	2135	256	2466	296	2789	336	3105	376	3416
17	~~NA~~ 248	57	691	97	1084	137	1452	177	1804	217	2144	257	2474	297	2797	337	3113	377	3423
18	~~NA~~ 260	58	701	98	1093	138	1461	178	1813	218	2152	258	2482	298	2805	338	3121	378	3431
19	~~NA~~ 272	59	711	99	1103	139	1470	179	1821	219	2161	259	2491	299	2813	339	3129	379	3439
20	~~NA~~ 284	60	721	100	1112	140	1479	180	1830	220	2169	260	2499	300	2821	340	3136	380	3446
21	~~NA~~ 296	61	732	101	1121	141	1488	181	1838	221	2177	261	2507	301	2829	341	3144	381	3454
22	~~NA~~ 308	62	742	102	1131	142	1497	182	1847	222	2186	262	2515	302	2837	342	3152	382	3462
23	~~NA~~ 320	63	752	103	1140	143	1506	183	1856	223	2194	263	2523	303	2845	343	3160	383	3469
24	~~NA~~ 332	64	762	104	1150	144	1515	184	1864	224	2202	264	2531	304	2853	344	3168	384	3477
25	344	65	772	105	1159	145	1523	185	1873	225	2211	265	2539	305	2861	345	3175	385	3485
26	355	66	782	106	1168	146	1532	186	1881	226	2219	266	2547	306	2869	346	3183	386	3492
27	367	67	792	107	1178	147	1541	187	1890	227	2227	267	2556	307	2876	347	3191	387	3500
28	378	68	802	108	1187	148	1550	188	1898	228	2236	268	2564	308	2884	348	3199	388	3508
29	390	69	812	109	1196	149	1559	189	1907	229	2244	269	2572	309	2892	349	3207	389	3515
30	401	70	822	110	1206	150	1568	190	1916	230	2252	270	2580	310	2900	350	3214	390	3523
31	412	71	832	111	1215	151	1577	191	1924	231	2260	271	2588	311	2908	351	3222	391	3531
32	423	72	842	112	1224	152	1586	192	1933	232	2269	272	2596	312	2916	352	3230	392	3538
33	435	73	852	113	1233	153	1594	193	1941	233	2277	273	2604	313	2924	353	3238	393	3546
34	446	74	862	114	1243	154	1603	194	1950	234	2285	274	2612	314	2932	354	3245	394	3554
35	457	75	871	115	1252	155	1612	195	1958	235	2294	275	2620	315	2940	355	3253	395	3561
36	468	76	881	116	1261	156	1621	196	1967	236	2302	276	2628	316	2948	356	3261	396	3569
37	479	77	891	117	1270	157	1630	197	1975	237	2310	277	2636	317	2956	357	3269	397	3577
38	490	78	901	118	1279	158	1638	198	1984	238	2318	278	2645	318	2964	358	3276	398	3584
39	501	79	911	119	1289	159	1647	199	1992	239	2327	279	2653	319	2971	359	3284	399	3592
40	512	80	920	120	1298	160	1656	200	2001	240	2335	280	2661	320	2979	360	3292	400	3599

~~Table 21.~~Table 22. Acute Water Quality Standards for Pentachlorophenol ~~Acute~~ Aquatic and Wildlife coldwater, warmwater and edw

pH	ug/L	pH	ug/L
3	0.163	7	9.070
3.1	0.180	7.1	10.029
3.2	0.199	7.2	11.090
3.3	0.220	7.3	12.262
3.4	0.243	7.4	13.558
3.5	0.269	7.5	14.992
3.6	0.298	7.6	16.577
3.7	0.329	7.7	18.329
3.8	0.364	7.8	20.267
3.9	0.402	7.9	22.410
4	0.445	8	24.779
4.1	0.492	8.1	27.399
4.2	0.544	8.2	30.296
4.3	0.601	8.3	33.498
4.4	0.665	8.4	37.040
4.5	0.735	8.5	40.956
4.6	0.813	8.6	45.286
4.7	0.899	8.7	50.074
4.8	0.994	8.8	55.368
4.9	1.099	8.9	61.222
5	1.215	9	67.694
5.1	1.344	9.1	74.851
5.2	1.486	9.2	82.765
5.3	1.643	9.3	91.515
5.4	1.817	9.4	101.190
5.5	2.009	9.5	111.888
5.6	2.221	9.6	123.717
5.7	2.456	9.7	136.797
5.8	2.716	9.8	151.260
5.9	3.003	9.9	167.252
6	3.320	10	184.934
6.1	3.671	10.1	204.486
6.2	4.059	10.2	226.105
6.3	4.488	10.3	250.010
6.4	4.963	10.4	276.442
6.5	5.488	10.5	305.668
6.6	6.068	10.6	337.984
6.7	6.709	10.7	373.717
6.8	7.419	10.8	413.228
6.9	8.203	10.9	456.916
		11	505.223

~~Table 22.~~Table 23. Chronic Water Quality Standards for Pentachlorophenol ~~Chronic~~ Aquatic and Wildlife coldwater, warmwater and edw

pH	ug/L	pH	ug/L
3	0.103	7	5.726
3.1	0.114	7.1	6.331
3.2	0.126	7.2	7.001
3.3	0.139	7.3	7.741
3.4	0.154	7.4	8.559
3.5	0.170	7.5	9.464
3.6	0.188	7.6	10.465
3.7	0.208	7.7	11.571
3.8	0.230	7.8	12.794
3.9	0.254	7.9	14.147
4	0.281	8	15.643
4.1	0.311	8.1	17.296
4.2	0.343	8.2	19.125
4.3	0.380	8.3	21.147
4.4	0.420	8.4	23.383
4.5	0.464	8.5	25.855
4.6	0.513	8.6	28.588
4.7	0.568	8.7	31.611
4.8	0.628	8.8	34.953
4.9	0.694	8.9	38.648
5	0.767	9	42.734
5.1	0.848	9.1	47.252
5.2	0.938	9.2	52.248
5.3	1.037	9.3	57.772
5.4	1.147	9.4	63.880
5.5	1.268	9.5	70.633
5.6	1.402	9.6	78.101
5.7	1.550	9.7	86.358
5.8	1.714	9.8	95.488
5.9	1.896	9.9	105.583
6	2.096	10	116.746
6.1	2.318	10.1	129.089
6.2	2.563	10.2	142.736
6.3	2.833	10.3	157.827
6.4	3.133	10.4	174.513
6.5	3.464	10.5	192.963
6.6	3.831	10.6	213.364
6.7	4.235	10.7	235.922
6.8	4.683	10.8	260.864
6.9	5.178	10.9	288.444
		11	318.939

~~Table 23.~~Table 24. Acute Water Quality Standards for Pentachlorophenol ~~Acute~~ Aquatic and Wildlife ephemeral

pH	ug/L	pH	ug/L
3	0.660	7	36.760
3.1	0.730	7.1	40.646
3.2	0.807	7.2	44.943
3.3	0.892	7.3	49.695
3.4	0.986	7.4	54.949
3.5	1.091	7.5	60.758
3.6	1.206	7.6	67.182
3.7	1.334	7.7	74.284
3.8	1.475	7.8	82.138
3.9	1.631	7.9	90.822
4	1.803	8	100.424
4.1	1.994	8.1	111.041
4.2	2.204	8.2	122.781
4.3	2.437	8.3	135.762
4.4	2.695	8.4	150.115
4.5	2.980	8.5	165.985
4.6	3.295	8.6	183.534
4.7	3.643	8.7	202.938
4.8	4.029	8.8	224.393
4.9	4.454	8.9	248.117
5	4.925	9	274.349
5.1	5.446	9.1	303.354
5.2	6.022	9.2	335.426
5.3	6.659	9.3	370.888
5.4	7.363	9.4	410.100
5.5	8.141	9.5	453.457
5.6	9.002	9.6	501.398
5.7	9.953	9.7	554.408
5.8	11.006	9.8	613.021
5.9	12.169	9.9	677.832
6	13.456	10	749.495
6.1	14.878	10.1	828.735
6.2	16.451	10.2	916.351
6.3	18.191	10.3	1013.231
6.4	20.114	10.4	1120.354
6.5	22.240	10.5	1238.802
6.6	24.591	10.6	1369.773
6.7	27.191	10.7	1514.590
6.8	30.066	10.8	1674.718
6.9	33.245	10.9	1851.775
		11	2047.552

~~Table 24.~~Table 25. Acute Criteria for Total Ammonia (in ~~mg N / L~~ mg/L as N)
Aquatic and Wildlife coldwater, warmwater, and edw

pH	A&Wc	A&Ww and A&W edw
6.5	32.6	48.8
6.6	31.3	46.8
6.7	29.8	44.6
6.8	28.1	42.0
6.9	26.2	39.1
7.0	24.1	36.1
7.1	22.0	32.8
7.2	19.7	29.5
7.3	17.5	26.2
7.4	15.4	23.0
7.5	13.3	19.9
7.6	11.4	17.0
7.7	9.65	14.4
7.8	8.11	12.1
7.9	6.77	10.1
8.0	5.62	8.40
8.1	4.64	6.95
8.2	3.83	5.72
8.3	3.15	4.71
8.4	2.59	3.88
8.5	2.14	3.20
8.6	1.77	2.65
8.7	1.47	2.20
8.8	1.23	1.84
8.9	1.04	1.56
9.0	0.885	1.32

~~Table 25.~~Table 26. Chronic Criteria for Total Ammonia (~~in mg N / L~~ mg/L as N)
~~for A&Wc, and A&Ww Designated Uses~~ Aquatic and Wildlife coldwater, warmwater, and edw

	Temperature, °C									
pH	**0**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.50	3.08	2.70	2.38	2.09
7.2	5.39	5.39	4.90	4.31	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.61	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.30	3.78	3.33	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.61	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.51	2.21	1.94	1.71	1.50	1.32
7.8	3.18	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.80	2.80	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	2.43	2.43	2.21	1.94	1.71	1.50	1.32	1.16	1.02	0.897
8.1	2.10	2.10	1.91	1.68	1.47	1.29	1.14	1.00	0.879	0.773
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.973	0.855	0.752	0.661
8.3	1.52	1.52	1.39	1.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	1.29	1.29	1.17	1.03	0.906	0.796	0.700	0.615	0.541	0.475

~~**Table 25.**~~Table 26. **Chronic Criteria for Total Ammonia (~~in mg N / L~~ mg/L as N) ~~for A&Wc, and A&Ww Designated Uses~~ Aquatic and Wildlife coldwater, warmwater, and edw**										
	Temperature, °C									
pH	**0**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
8.5	1.09	1.09	0.990	0.870	0.765	0.672	0.591	0.520	0.457	0.401
8.6	0.920	0.920	0.836	0.735	0.646	0.568	0.499	0.439	0.386	0.339
8.7	0.778	0.778	0.707	0.622	0.547	0.480	0.422	0.371	0.326	0.287
8.8	0.661	0.661	0.601	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.565	0.565	0.513	0.451	0.397	0.349	0.306	0.269	0.237	0.208
9.0	0.486	0.486	0.442	0.389	0.342	0.300	0.264	0.232	0.204	0.179

Appendix B. ~~List of~~ Surface Waters and Designated Uses

~~**Abbreviations**~~

~~**River Basins**~~
~~BW = Bill Williams~~
~~CM = Colorado Mainstem (includes Red Lake)~~
~~LC = Little Colorado~~
~~MG = Middle Gila (includes Gila River below San Carlos Indian Reservation, Salt River below Granite Reef Dam and Phoenix area waterbodies)~~
~~RM = Rios de Mexico (includes Rio Magdalena, Rio Sonoita, and Rio Yaqui Basins)~~
~~SC = Santa Cruz~~
~~SP = San Pedro~~
~~SR = Salt River (includes Salt River and tributaries above Granite Reef Dam)~~
~~UG = Upper Gila (includes Gila River and tributaries above San Carlos Indian Reservation)~~
~~VR = Verde River~~
~~WP = Wilcox Playa~~

~~**Designated Uses**~~
~~A&Wc = Aquatic and Wildlife cold water~~
~~A&Ww = Aquatic and Wildlife warm water~~
~~A&We = Aquatic and Wildlife ephemeral~~
~~A&Wedw = Aquatic and Wildlife effluent dependent water~~
~~FBC = Full-body Contact~~
~~PBC = Partial-body Contact~~
~~DWS = Domestic Water Source~~
~~FC = Fish Consumption~~
~~AgI = Agricultural Irrigation~~
~~AgL = Agricultural Livestock Watering~~

~~**Other**~~
~~U = Unique Water~~
~~EDW = Effluent-dependent Water~~
~~WWTP = Wastewater Treatment Plant~~
~~Km = kilometers~~

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~**BASIN**~~ **Watershed**	~~**SEGMENT**~~ **Surface Waters**	~~**LOCATION**~~ **Segment Description and Location (Latitude and Longitudes are in NAD 27)**	**Lake Category**	**Aquatic and Wildlife**				**Human Health**				**Agricultural**	
				A&Wc	**A&Ww**	**A&We**	**A&Wedw**	**FBC**	**PBC**	**DWS**	**FC**	**AgI**	**AgL**
BW	Alamo Lake	34°14'45"/113°35'00"	Deep		A&Ww			FBC			FC		AgL
BW	Big Sandy River	~~Tributary to the Santa Maria River~~ Headwaters to confluence at Alamo Lake at 34°18'36"/113°31'34"			A&Ww			FBC			FC		AgL
BW	Bill Williams River	~~Tributary to the~~ Alamo Lake to confluence with Colorado River at 34°18'04"/114°08'10"			A&Ww			FBC			FC		AgL
BW	Blue Tank	34°40'14"/112°58'16"			A&Ww			FBC			FC		AgL
BW	Boulder Creek	Headwaters to confluence with unnamed tributary at 34°41'14"/113°03'34"		A&Wc				FBC			FC	AgI	AgL
BW	Boulder Creek	Below confluence with unnamed tributary to confluence with Burro Creek at 34°36'47"/113°18'00"			A&Ww			FBC			FC	AgI	AgL
BW	Burro Creek ~~(Unique Water)~~ (OAW)	Headwaters to confluence with Boulder Creek at 34°36'47"/113°18'00"			A&Ww			FBC			FC		AgL
BW	Burro Creek	Below confluence with Boulder Creek to confluence with Big Sandy River at 34°32'24"/113°34"19.2"			A&Ww			FBC			FC		AgL
BW	Conger Creek	Headwaters to confluence with unnamed tributary at 34°45'13"/113°05'45"		A&Wc				FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife A&Wc	A&Ww	A&We	A&Wedw	Human Health FBC	PBC	DWS	FC	Agricultural AgI	AgL
BW	Conger Creek	Below confluence with unnamed tributary to confluence with Burro Creek at 34°46'05"/ 113°12'54"			A&Ww			FBC			FC		AgL
BW	Coors Lake	34°36'20"/113°11'25"	Igneous		A&Ww			FBC			FC		
BW	Copper Basin Wash	Headwaters to confluence with unnamed tributary at 34°28'11"/112°35'31"		A&Wc				FBC			FC		AgL
BW	Copper Basin Wash	Below confluence with unnamed tributary to Skull Valley Wash at 34°25'55"/112°41'42"				A&We			PBC				AgL
BW	Cottonwood Canyon	Headwaters to Bear Trap Spring at 34°45'10"/ 112°52'32"		A&Wc				FBC			FC		AgL
BW	Cottonwood Canyon	Below Bear Trap Spring to confluence at Smith Canyon at 34°37'34"/112°54'46.8"			A&Ww			FBC			FC		AgL
BW	Date Creek	~~Tributary to the~~ Headwaters to confluence with Santa Maria River at 34°18'11"/ 113°29'53"			A&Ww			FBC			FC		AgL
BW	Francis Creek ~~(Unique Water)~~ (OAW)	~~Tributary to~~ Headwaters to confluence with Burro Creek at 34°44'28"/113°14'35"			A&Ww			FBC		DWS	FC	AgI	AgL
BW	Kirkland Creek	~~Tributary to~~ Headwaters to confluence with Santa Maria River at 34°32'02"/112°59'38"			A&Ww			FBC			FC	AgI	AgL
BW	Knight Creek	~~Tributary to the~~ Headwaters to confluence with Big Sandy River at 34°55'16"/ 113°37'30"			A&Ww			FBC			FC		AgL
BW	~~Peoples~~ Peeples Canyon ~~(Unique Water)~~ (OAW)	~~Tributary to the~~ Headwaters to confluence with Santa Maria River at 34°20'35"/ 113°15'11"			A&Ww			FBC			FC		AgL
BW	Santa Maria River	~~Tributary to the Bill Williams River~~ Headwaters to confluence with Alamo Lake at 34°18'36"/113°31'34"			A&Ww			FBC			FC	AgI	AgL
BW	Trout Creek	Headwaters to confluence with unnamed tributary at 35°06'47"/113°13'01"		A&Wc				FBC			FC		AgL
BW	Trout Creek	Below confluence with unnamed tributary to confluence with Knight Creek at 34°55'16"/ 113°37'30"			A&Ww			FBC			FC		AgL
~~CM~~	~~A-10 Backwater~~	~~33°31'38"/114°33'19"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~	~~A-7 Backwater~~	~~33°34'39"/114°39'42"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~	~~Adobe Lake~~	~~33°02'39"/114°39'19"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~ CG	Agate Canyon Creek	~~Grand Canyon, tributary to~~ Headwaters to confluence with the Colorado River at 36°08'38"/112°16'48"			A&Ww			FBC			FC		
~~CM~~ CG	Beaver Dam Wash	~~Tributary to the~~ Headwaters to confluence with the Virgin River at 36°53'42"/113°55'09"			A&Ww			FBC			FC		AgL
~~CM~~ CG	Big Springs Tank	36°36'10"/112°20'58"		A&Wc				FBC			FC		AgL
~~CM~~ CG	Boucher Creek	~~Grand Canyon, tributary to~~ Headwaters to confluence with the Colorado River at 36°06'54"/112°13'44"			A&Ww			FBC			FC		
~~CM~~ CG	Bright Angel Creek	Headwaters to ~~confluence with~~ Roaring Springs Canyon at 36°11'34"/112°01'54"		A&Wc				FBC			FC		
~~CM~~ CG	Bright Angel Creek	Below ~~confluence with~~ Roaring Spring Canyon to Colorado River at 36°05'56"/ 112°05'27.6"			A&Ww			FBC			FC		
CG	Bright Angel Wash	Headwaters to South Rim of Grand Canyon WWTP outfall at 36°02'59"/112°09'02"				A&We			PBC				
~~CM~~ CG	Bright Angel Wash (EDW)	South ~~rim~~ Rim Grand Canyon WWTP outfall at 36°00'11"/112°39'06" to Coconino Wash					A&Wedw		PBC				AgL
~~CM~~ CG	Bulrush Canyon Wash	~~Tributary to~~ Headwaters to confluence with Kanab Creek at 36°46'55"/112°37'08"				A&We			PBC				
~~CM~~ CG	Cataract Creek	Headwaters to Santa Fe Reservoir		A&Wc				FBC		DWS	FC	AgI	AgL
~~CM~~ CG	Cataract Creek	Santa Fe Reservoir to Williams WWTP outfall at 35°15'40"/112°10'40"		A&Wc				FBC			FC	AgI	AgL
~~CM~~ CG	Cataract Creek (EDW)	Williams WWTP outfall to 1 km downstream					A&Wedw		PBC				
~~CM~~	~~Cataract Creek~~	~~Below 1 km downstream of Williams WWTP outfall to confluence of Red Lake Wash~~		~~A&We~~				~~FBC~~			~~FC~~		~~AgL~~
~~CM~~ CG	Cataract Creek	Red Lake Wash to Havasupai Reservation at 33°56'52"/112°30'38.3"				A&We			PBC				AgL
~~CM~~ CG	Cataract Lake	35°15'05"/112°12'58"	Igneous	A&Wc				FBC		DWS	FC		AgL
~~CM~~ CG	Chuar Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°11'36"/111°52'17"		A&Wc				FBC			FC		
~~CM~~ CG	Chuar Creek	Below ~~confluence with~~ unnamed tributary at 36°11'36.4"/111°52'17" to confluence with the Colorado River at 36°08'20.4"/ 111°48'58.7"			A&Ww			FBC			FC		
~~CM~~	~~Cibola Lake~~	~~33°14'20"/114°40'16"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~ CG	City Reservoir	35°13'57"/112°11'23"	Igneous	A&Wc				FBC		DWS	FC		

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
~~CM~~ CG	Clear Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°09'12"/111°58'25"		A&Wc				FBC			FC		
~~CM~~ CG	Clear Creek	Below confluence with unnamed tributary to confluence with Colorado River at 36°04'55"/112°02'09.6"			A&Ww			FBC			FC		
~~CM~~	~~Clear Lake~~	~~33°01'57"/114°31'26"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
CG	Coconino Wash (EDW)	South Grand Canyon Sanitary District Tusayan WRF outfall at 35°58'39"/112°08'25" to 1 km downstream at 35°58'36"/112°08'54"					A&Wedw		PBC				
~~CM~~ CG	Colorado River	Lake Powell to ~~Topock~~ Lake Mead		A&Wc				FBC		DWS	FC	AgI	AgL
~~CM~~	~~Colorado River~~	~~Topock to Morelos Dam~~			~~A&Ww~~			~~FBC~~		~~DWS~~	~~FC~~	~~AgI~~	~~AgL~~
~~CM~~ CG	Cottonwood Creek	Headwaters to confluence with unnamed tributary at 35°20'45.5"/113°35'31"		A&Wc				FBC			FC		AgL
~~CM~~ CG	Cottonwood Creek	Below confluence with unnamed tributary to confluence with Colorado River at 35°22'05"/113°40'04.8"			A&Ww			FBC			FC		AgL
~~CM~~ CG	Crystal Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°13'42"/112°11'48"		A&Wc				FBC			FC		
~~CM~~ CG	Crystal Creek	Below confluence with unnamed tributary to Colorado River at 36°08'06"/112°14'34.8"			A&Ww			FBC			FC		
~~CM~~ CG	Deer Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°26'16"/112°28'15.5"		A&Wc				FBC			FC		
~~CM~~ CG	Deer Creek	Below confluence with unnamed tributary to confluence with Colorado River at 36°23'20"/112°30'28.8"			A&Ww			FBC			FC		
~~CM~~ CG	Detrital Wash	~~Tributary~~ headwaters to Lake Mead at 36°02'20"/114°27'47"				A&We			PBC				
~~CM~~ CG	Dogtown Reservoir	35°12'40"/112°07'46"	Igneous	A&Wc				FBC		DWS	FC	AgI	AgL
~~CM~~ CG	Dragon Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with Milk Creek at 36°12'25"/112°09'33"		A&Wc				FBC			FC		
~~CM~~ CG	Dragon Creek	Below confluence with Milk Creek to confluence with Crystal Creek at 36°10'12"/112°12'10.8"			A&Ww			FBC			FC		
~~CM~~ CG	Garden Creek	~~Grand Canyon, tributary~~ Headwaters to confluence with Pipe Creek at 36°05'35"/112°06'40"			A&Ww			FBC			FC		
~~CM~~ CG	Gonzalez Lake	35°15'26"/112°12'07"	Shallow	~~A&We~~	A&Ww			FBC			FC	AgI	AgL
~~CM~~ CG	Grand Wash	~~Tributary~~ Headwaters to Lake Mead at 36°15'29"/114°00'18"				A&We			PBC				
~~CM~~ CG	Grapevine Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°03'29"/112°00'00"			A&Ww			FBC			FC		
~~CM~~ CG	Grapevine Wash	~~Tributary~~ Headwaters to Lake Mead at 36°06'29"/114°00'07"				A&We			PBC				
~~CM~~ CG	Hakatai Canyon Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°14'42"/112°22'59"			A&Ww			FBC			FC		
~~CM~~ CG	Hance Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°02'46"/111°57'07"			A&Ww			FBC			FC		
~~CM~~ CG	Havasu Canyon Creek	~~Below~~ From the Havasupai Indian Reservation; ~~tributary~~ boundary to confluence with the Colorado River at 36°18'29"/112°45'43"			A&Ww			FBC			FC		
~~CM~~ CG	Hermit Creek	~~Grand Canyon; headwaters~~ Headwaters to Hermit Pack Trail crossing at 36°03'23"/112°13'25"		A&Wc				FBC			FC		
~~CM~~ CG	Hermit Creek	Below Hermit Pack Trail crossing to confluence with the Colorado River at 36°06'00"/112°32'04"			A&Ww			FBC			FC		
~~CM~~	~~Holy Moses Wash (EDW)~~	~~Kingman WWTP outfall to 3 km downstream~~					~~A&Wedw~~		~~PBC~~				
~~CM~~ CG	Horn Creek	~~Grand Canyon; tributary~~ Headwaters to confluence with the Colorado River at 36°05'56"/112°07'59"			A&Ww			FBC			FC		
~~CM~~ CG	Hualapai Wash	~~Tributary~~ Headwaters to Lake Mead at 36°00'40"/114°07'37"				A&We			PBC				
~~CM~~	~~Hunter's Hole Backwater~~	~~32°31'15"/114°48'03"~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~CM~~	~~Imperial Reservoir~~	~~32°53'04"/114°27'40"~~			~~A&Ww~~			~~FBC~~		~~DWS~~	~~FC~~	~~AgI~~	~~AgL~~
~~CM~~	~~Island Lake~~	~~33°01'52"/114°35'07"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~ CG	Jacob Lake	36°42'26"/112°13'48"	Sedimentary	A&Wc	~~A&Ww~~			FBC			FC		
~~CM~~ CG	Kaibab Lake	35°17'04"/112°09'17"	Igneous	A&Wc				FBC		DWS	FC	AgI	AgL
~~CM~~ CG	Kanab Creek	~~Kanab Plateau; tributary~~ Headwaters to confluence with the Colorado River at 36°23'31"/112°37'44"			A&Ww			FBC		DWS	FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife A&Wc	A&Ww	A&We	A&Wedw	Human Health FBC	PBC	DWS	FC	Agricultural AgI	AgL
~~CM~~ CG	Kwagunt Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°13'29"/111°55'24"		A&Wc				FBC			FC		
~~CM~~ CG	Kwagunt Creek	Below confluence with unnamed tributary to confluence with the Colorado River at 36°15'47"/111°49'40.8"			A&Ww			FBC			FC		
~~CM~~	~~Laguna Reservoir~~	~~32°51'15"/114°28'38"~~			~~A&Ww~~			~~FBC~~		~~DWS~~	~~FC~~	~~AgI~~	~~AgL~~
~~CM~~	~~Lake Havasu~~	~~34°18'15"/114°08'15"~~			~~A&Ww~~			~~FBC~~		~~DWS~~	~~FC~~	~~AgI~~	~~AgL~~
~~CM~~ CG	Lake Mead	36°01'00"/114°44'15"	Deep	A&Wc				FBC		DWS	FC	AgI	AgL
~~CM~~	~~Lake Mohave~~	~~35°11'45"/114°34'00"~~		~~A&Wc~~				~~FBC~~		~~DWS~~	~~FC~~	~~AgI~~	~~AgL~~
~~CM~~ CG	Lake Powell	36°57'00"/111°29'15"	Deep	A&Wc				FBC		DWS	FC	AgI	AgL
~~CM~~ CG	Lonetree Canyon Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°04'48"/112°01'52"			A&Ww			FBC			FC		
~~CM~~	~~Martinez Lake~~	~~32°58'52"/114°28'23"~~			~~A&Ww~~			~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~CM~~ CG	Matkatamiba Creek	Below Havasupai Indian Reservation; ~~tributary~~ to confluence with the Colorado River at 36°20'38"/112°40'19"			A&Ww			FBC			FC		
~~CM~~	~~Mittry Lake~~	~~32°49'11"/114°27'41"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~	~~Mohave Wash~~	~~Tributary to Lake Havasu at 33°28'55"/114°35'56"~~				~~A&We~~			~~PBC~~				
~~CM~~ CG	Monument Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°05'53"/112°10'55"			A&Ww			FBC			FC		
~~CM~~ CG	Nankoweap Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°15'30"/111°57'23"		A&Wc				FBC			FC		
~~CM~~ CG	Nankoweap Creek	Below confluence with unnamed tributary to Colorado River at 36°18'25"/111°51'28.8"			A&Ww			FBC			FC		
~~CM~~ CG	National Canyon Creek	~~Grand Canyon; those reaches~~ Portion of the creek that flows into the Colorado River at 36°15'25"/112°53'34.8" that is not located on the Hualapai Indian Reservation			A&Ww			FBC			FC		
~~CM~~ CG	North Canyon Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°33'57"/111°55'39"		A&Wc				FBC			FC		
~~CM~~ CG	North Canyon Creek	Below confluence with unnamed tributary to Colorado River at 36°37'48"/111°45'46.8"			A&Ww			FBC			FC		
~~CM~~	~~Nortons Lake~~	~~33°02'35"/114°37'58"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~ CG	Olo Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°22'16"/112°38'56"			A&Ww			FBC			FC		
~~CM~~ CG	Parashant Canyon	Headwaters to confluence with unnamed tributary at 36°21'26"/113°28'10"		A&Wc				FBC			FC		
~~CM~~ CG	Parashant Canyon	Below confluence with unnamed tributary to the Colorado River			A&Ww			FBC			FC		
~~CM~~ CG	Paria River	~~Paria Plateau; tributary~~ Utah border to the Colorado River at 36°51'29"/111°36'04"			A&Ww			FBC			FC		
~~CM~~ CG	Phantom Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°10'04"/112°07'50"		A&Wc				FBC			FC		
~~CM~~ CG	Phantom Creek	Below confluence with unnamed tributary to Colorado River at 36°06'58"/112°05'09.6"			A&Ww			FBC			FC		
~~CM~~ CG	Pipe Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°05'56"/112°06'36"			A&Ww			FBC			FC		
~~CM~~	~~Pretty Water Lake~~	~~33°19'45"/114°42'15"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~	~~Quigley Ponds~~	~~32°43'00"/113°58'00"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~ CG	Red Canyon Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°02'42"/111°55'08"			A&Ww			FBC			FC		
~~CM~~ CG	Red Lake	35°40'00"/114°03'45"			A&Ww			FBC			FC		AgL
~~CM~~ CG	Redondo Lake	32°44'32"/114°29'02"	Shallow		A&Ww			FBC			FC		
~~CM~~ CG	Roaring Springs	Headwaters of Roaring Springs Creek at 36°11'35"/112°01'55.2"		A&Wc				FBC		DWS	FC		
~~CM~~ CG	Roaring Springs Canyon	~~Grand Canyon; tributary~~ Headwaters to Bright Angel Creek at 36°11'35"/112°01'55"		A&Wc				FBC			FC		
~~CM~~ CG	Rock Canyon	Tributary to Truxton Wash at 35°26'56"/113°36'29"				A&We			PBC				
~~CM~~ CG	Royal Arch Creek	~~Grand Canyon; tributary~~ Tributary to the Colorado River at 36°11'53"/112°26'56"			A&Ww			FBC			FC		
~~CM~~ CG	Ruby Canyon Creek	~~Grand Canyon; tributary~~ Tributary to the Colorado River at 36°11'24"/112°18'54"			A&Ww			FBC			FC		
~~CM~~ CG	Russell Tank	34°52'22"/111°52'44"		A&Wc				FBC			FC		AgL
~~CM~~	~~Sacramento Wash~~	~~Tributary to Topock Marsh at 34°43'48"/114°29'13"~~				~~A&We~~			~~PBC~~				
~~CM~~ CG	Saddle Canyon Creek	~~Marble Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°21'35.5"/112°22'46"		A&Wc				FBC			FC		

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
~~CM~~ CG	Saddle Canyon Creek	Below confluence with unnamed tributary to Colorado River at 36°22'52"/112°23'16.8"			A&Ww			FBC			FC		
~~CM~~ CG	Santa Fe Reservoir	35°14'26"/112°11'04"	Igneous	A&Wc				FBC		DWS	FC		
~~CM~~ CG	Sapphire Canyon Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°08'49"/112°17'28"			A&Ww			FBC			FC		
~~CM~~	~~Sawmill Canyon~~	~~Headwaters to abandoned gaging station at 35°09'46.5"/113°57'51"~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~CM~~	~~Sawmill Canyon~~	~~Below abandoned gaging station~~				~~A&We~~			~~PBC~~				~~AgL~~
~~CM~~ CG	Serpentine Canyon Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°12'22"/112°19'37"			A&Ww			FBC			FC		
~~CM~~ CG	Shinumo Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°18'21"/112°18'03"		A&Wc				FBC			FC		
~~CM~~ CG	Shinumo Creek	Below confluence with unnamed tributary to the Colorado River at 36°14'13"/112°20'52.8"			A&Ww			FBC			FC		
~~CM~~ CG	Short Creek	Tributary to the Virgin River at 36°58'23"/113°16'08"				A&We			PBC				
~~CM~~ CG	Slate Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°08'06"/112°14'42"			A&Ww			FBC			FC		
~~CM~~ CG	Spring Canyon Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°01'08"/113°21'00"			A&Ww			FBC			FC		
~~CM~~ CG	Stone Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°20'49"/112°27'14"			A&Ww			FBC			FC		
~~CM~~ CG	Tapeats Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 36°22'16"/112°28'05"		A&Wc				FBC			FC		
~~CM~~ CG	Thunder River	Tributary to Tapeats Creek at 36°23'31"/112°27'00"		A&Wc				FBC			FC		
~~CM~~	~~Topock Marsh~~	~~34°47'30"/114°31'00"~~			~~A&Ww~~			~~FBC~~		~~DWS~~	~~FC~~	~~AgI~~	~~AgL~~
~~CM~~ CG	Trail Canyon Creek	~~Grand Canyon; tributary~~ Headwaters to the Colorado River at 35°50'20"/113°19'37"			A&Ww			FBC			FC		
CG	Transept Canyon	Headwaters to North Rim WWTP outfall at 36°12'20"/112°03'35"				A&We			PBC				
~~CM~~ CG	Transept Canyon (EDW)	North Rim WWTP outfall to 1 km downstream					A&Wedw		PBC				
CG	Transept Canyon	1 km downstream of the North Rim WWTP outfall to Bright Angel Creek				A&We			PBC				
~~CM~~ CG	Travertine Canyon Creek	~~Grand Canyon; tributary~~ Tributary to the Colorado River at 36°06'11"/112°13'05"			A&Ww			FBC			FC		
~~CM~~ CG	Truxton Wash	Tributary to Red Lake ~~Playa~~ at 35°37'23"/114°03'00"				A&We			PBC				
~~CM~~ CG	Turquoise Canyon Creek	~~Grand Canyon; tributary~~ Tributary to the Colorado River at 36°09'14"/112°18'07"			A&Ww			FBC			FC		
~~CM~~	~~Unkar Creek~~	~~Grand Canyon; headwaters to confluence with unnamed tributary at 36°07'54"/111°54'03"~~		~~A&Wc~~				~~FBC~~			~~FC~~		
~~CM~~ CG	Unkar Creek	Below ~~conf~~ confluence with unnamed tributary to confluence with Colorado River at 36°04'48"/111°52'22.8"			A&Ww			FBC			FC		
CG	Unnamed Wash (EDW)	Grand Canyon NP Desert View WWTP outfall to Cedar Canyon					A&Wedw		PBC				
CG	Unnamed Wash (EDW)	Valle Airpark WRF outfall at 35°38'34"/112°09'22" to confluence with Spring Valley Wash at 35°38'29"/112°10'47"					A&Wedw		PBC				
~~CM~~ CG	Vasey's Paradise	~~Grand Canyon;~~ A spring at 36°26'49"/111°50'46"		A&Wc				FBC			FC		
~~CM~~ CG	Virgin River	Tributary to the Colorado River at 36°47'28"/114°06'11"			A&Ww			FBC			FC	AgI	AgL
~~CM~~ CG	Vishnu Creek	~~Grand Canyon; tributary~~ Tributary to the Colorado River at 36°03'18"/111°59'42"			A&Ww			FBC			FC		
~~CM~~ CG	Warm Springs Creek	~~Grand Canyon; tributary~~ Tributary to the Colorado River at 36°11'49"/113°04'55"			A&Ww			FBC			FC		
~~CM~~	~~Wellton Canal~~	~~Yuma Canal System~~								~~DWS~~		~~AgI~~	~~AgL~~
~~CM~~	~~Wellton Ponds~~	~~32°42'15"/114°06'15"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~ CG	West Cataract Creek	Tributary to Cataract Creek at 35°15'40"/112°11'38"		A&Wc				FBC			FC		AgL
~~CM~~ CG	White Creek	~~Grand Canyon; headwaters~~ Headwaters to confluence with unnamed tributary at 36°18'42"/112°21'03"		A&Wc				FBC			FC		
~~CM~~ CG	White Creek	Below confluence with unnamed tributary to the Colorado River at 36°15'22"/112°19'30"			A&Ww			FBC			FC		
~~CM~~ CG	Wright Canyon Creek	Headwaters to confluence with unnamed tributary at 35°20'54"/113°30'35"		A&Wc				FBC			FC		AgL
~~CM~~ CG	Wright Canyon Creek	Below confluence with unnamed tributary to confluence with Truxton Wash			A&Ww			FBC			FC		AgL
~~CM~~	~~YPG Pond~~	~~32°50'22"/114°26'25"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~CM~~	~~Yuma Area Canals~~	~~Above municipal water treatment plant intakes~~								~~DWS~~		~~AgI~~	~~AgL~~

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
~~CM~~	~~Yuma Area Canals~~	~~Below municipal water treatment plant intakes and all drains~~										~~AgI~~	~~AgL~~
CL	A-10 Backwater	33°31'38"/114°33'19"	Shallow		A&Ww			FBC			FC		
CL	A-7 Backwater	33°34'39"/114°39'42"	Shallow		A&Ww			FBC			FC		
CL	Adobe Lake	33°02'39"/114°39'19"	Shallow		A&Ww			FBC			FC		
CL	Cibola Lake	33°31'38"/114°33'19"	Shallow		A&Ww			FBC			FC		
CL	Clear Lake	33°01'57"/114°31'26"	Shallow		A&Ww			FBC			FC		
CL	Columbus Wash	Tributary to the Gila River at 33°00'25"/ 113°16'08"				A&We			PBC				
CL	Colorado River	Lake Mead to Topock Marsh		A&Wc				FBC		DWS	FC	AgI	AgL
CL	Colorado River	Topock Marsh to Morelos Dam			A&Ww			FBC		DWS	FC	AgI	AgL
CL	Gila River	Painted Rock Dam to the Colorado River at 32°43'12"/114°33'14"			A&Ww			FBC			FC	AgI	AgL
CL	Holy Moses Wash	Headwaters to Kingman WWTP outfall at 35°10'30"/114°03'43"				A&We			PBC				
CL	Holy Moses Wash (EDW)	Kingman WWTP outfall to 3 km downstream					A&Wedw		PBC				
CL	Holy Moses Wash	3 km downstream of Kingman WWTP outfall to confluence with Sawmill Wash at 35°09'43"/114°04'20"				A&We			PBC				
CL	Hunter's Hole Backwater	32°31'15"/114°48'03"	Shallow		A&Ww			FBC			FC		AgL
CL	Imperial Reservoir	32°53'04"/114°27'40"	Shallow		A&Ww			FBC		DWS	FC	AgI	AgL
CL	Island Lake	33°01'52"/114°35'07"	Shallow		A&Ww			FBC			FC		
CL	Laguna Reservoir	32°51'15"/114°28'38"	Shallow		A&Ww			FBC		DWS	FC	AgI	AgL
CL	Lake Havasu	34°18'15"/114°08'15"	Deep		A&Ww			FBC		DWS	FC	AgI	AgL
CL	Lake Mohave	35°11'45"/114°34'00"	Deep	A&Wc				FBC		DWS	FC	AgI	AgL
CL	Martinez Lake	32°58'52"/114°28'23"	Shallow		A&Ww			FBC			FC	AgI	AgL
CL	Mittry Lake	32°49'11"/114°27'41"	Shallow		A&Ww			FBC			FC		
CL	Mohave Wash	Headwaters to Lake Havasu at 33°28'55"/ 114°35'56"				A&We			PBC				
CL	Nortons Lake	33°02'35"/114°37'58"	Shallow		A&Ww			FBC			FC		
CL	Painted Rock (Borrow Pit) Lake	33°05'00"/113°01'20"	Sedimentary		A&Ww			FBC			FC	AgI	AgL
CL	Pretty Water Lake	33°19'45"/114°42'15"	Shallow		A&Ww			FBC			FC		
CL	Quigley Ponds	32°43'00"/113°58'00"	Shallow		A&Ww			FBC			FC		
CL	Sacramento Wash	Tributary to Topock Marsh at 34°43'48"/ 114°29'13"				A&We			PBC				
CL	Sawmill Canyon	Headwaters to abandoned gaging station at 35°09'46.5"/113°57'51"			A&Ww			FBC			FC		AgL
CL	Sawmill Canyon	Below abandoned gaging station to confluence with Sacramento Wash at 35°09'43"/ 113°58'01.2"				A&We			PBC				AgL
CL	Topock Marsh	34°47'30"/114°31'00"	Shallow		A&Ww			FBC		DWS	FC	AgI	AgL
CL	Tyson Wash (EDW)	Town of Quartzsite WWTP outfall at 33°42'30"/114°13'14" to 1 km downstream at 33°42'30"/114°13'45"					A&Wedw		PBC				
CL	Wellton Canal	Wellton-Mohawk Irrigation District								DWS		AgI	AgL
CL	Wellton Ponds	32°42'15"/114°06'15"			A&Ww			FBC			FC		
CL	YPG Pond	32°50'22"/114°26'25"			A&Ww			FBC			FC		
CL	Yuma Area Canals	Above municipal water treatment plant intakes								DWS		AgI	AgL
CL	Yuma Area Canals	Below municipal water treatment plant intakes and all drains										AgI	AgL
LC	Als Lake	35°02'17"/111°25'13"	Igneous		A&Ww			FBC			FC		AgL
LC	Ashurst Lake	35°01'10"/111°24'09"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Atcheson Reservoir	34°00'00"/109°20'41"	Igneous		A&Ww			FBC			FC	AgI	AgL
LC	Auger Creek	Tributary to Nutrioso Creek at 33°57'22"/ 109°12'58"		A&Wc				FBC			FC		AgL
LC	Barbershop Canyon Creek	Tributary to East Clear Creek at 34°33'00"/ 111°09'43"		A&Wc				FBC			FC		AgL
LC	Bear Canyon Creek	Tributary to General Springs Canyon at 34°32'18"/111°12'15"		A&Wc				FBC			FC		AgL
LC	Bear Canyon Creek	Tributary to Willow Creek at 34°27'29"/ 111°00'00"		A&Wc				FBC			FC		AgL
LC	Bear Canyon Lake	34°24'10"/111°00'09"	Sedimentary	A&Wc				FBC			FC	AgI	AgL
LC	Becker Lake	34°09'16"/109°18'18"	Shallow	A&Wc				FBC			FC		AgL
LC	Billy Creek	Tributary to Show Low Creek at 34°12'25"/ 110°00'00"		A&Wc				FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
LC	Black Canyon Creek	Tributary to Chevelon Creek at 34°47'38"/ 110°36'22"		A&Wc				FBC			FC	AgI	AgL
LC	Black Canyon Lake	34°19'50"/110°41'59"	Sedimentary	A&Wc				FBC		DWS	FC	AgI	AgL
LC	Blue Ridge Reservoir	34°33'15"/111°11'01"	Deep	A&Wc				FBC			FC	AgI	AgL
LC	Boot Lake	34°58'53"/111°20'00"	Igneous	A&Wc	~~A&Ww~~			FBC			FC		AgL
LC	Bow and Arrow Wash (EDW)	Estates at Pine Canyon WWTP outfall #1 at 35°09'31"/111°38'24" to confluence with Rio de Flag at 35°10'35"/111°36'42"					A&Wedw		PBC				
LC	Buck Springs Canyon Creek	Tributary to Leonard Canyon Creek at 34°28'52"/111°05'24"		A&Wc				FBC			FC		AgL
LC	Bunch Reservoir	34°02'12"/109°26'45"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Camillo Tank	34°55'03"/111°22'41"	Igneous		A&Ww			FBC			FC		AgL
LC	Carnero Lake	34°06'57"/109°31'39"	Shallow	A&Wc				FBC			FC		AgL
LC	Chevelon Canyon Lake	34°30'39"/110°49'28"	Sedimentary	A&Wc				FBC			FC	AgI	AgL
LC	Chevelon Creek	Tributary to the Little Colorado River at 34°57'04"/110°31'30"		A&Wc				FBC			FC	AgI	AgL
LC	Chevelon Creek, West Fork	Tributary to Chevelon Creek at 34°36'58"/ 110°46'05"		A&Wc				FBC			FC		AgL
LC	Chilson Tank	34°51'46"/111°22'52"	Igneous		A&Ww			FBC			FC		AgL
~~LC~~	~~Cholla Lake~~	~~34°56'00"/110°17'12"~~			~~A&Ww~~			~~FBC~~			~~FC~~		
LC	Clear Creek	Tributary to the Little Colorado River at 34°59'13"/110°38'17"		A&Wc				FBC		DWS	FC		AgL
LC	Clear Creek Reservoir	34°58'10"/110°38'33"	Shallow	A&Wc				FBC		DWS	FC	AgI	AgL
LC	Coconino Reservoir	35°00'16"/111°23'52"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Colter Creek	Tributary to Nutrioso Creek at 33°58'19"/ 109°12'29"		A&Wc				FBC			FC		AgL
LC	Colter Reservoir	33°56'40"/109°28'50"	Shallow	A&Wc				FBC			FC		AgL
LC	Concho Creek	Tributary to Carrizo Wash at 34°36'25"/ 109°33'54"		A&Wc				FBC			FC		AgL
LC	Concho Lake	34°26'36"/109°37'40"	Shallow	A&Wc				FBC			FC	AgI	AgL
LC	Cow Lake	34°53'19"/111°18'49"	Igneous		A&Ww			FBC			FC		AgL
LC	Coyote Creek	Tributary to the Little Colorado River at 34°18'22"/109°20'53"		A&Wc				FBC			FC	AgI	AgL
LC	Crisis Lake (Snake Tank #2)	34°47'51"/111°17'01"			A&Ww			FBC			FC		AgL
LC	Dane Canyon Creek	Tributary to Barbershop Canyon Creek at 34°30'29"/111°09'07"		A&Wc				FBC			FC		AgL
LC	Daves Tank	34°44'23"/111°17'08"			A&Ww			FBC			FC		AgL
LC	Deep Lake	35°03'30"/111°24'55"	Igneous		A&Ww			FBC			FC		AgL
LC	Dry Lake (EDW)	34°37'52"/110°23'40"	Igneous				A&Wedw		PBC				
LC	Ducksnest Lake	34°59'15"/111°23'53"			A&Ww			FBC			FC		AgL
LC	East Clear Creek	Tributary to Clear Creek at 34°38'31"/ 110°59'49"		A&Wc				FBC			FC	AgI	AgL
LC	Ellis Wiltbank Reservoir	34°05'25"/109°28'24"	Igneous		A&Ww			FBC			FC	AgI	AgL
LC	Fish Creek	Tributary to the Little Colorado River at 34°04'05"/109°26'49"		A&Wc				FBC			FC		AgL
LC	Fool's Hollow Lake	34°16'14"/110°04'15"	Igneous	A&Wc				FBC			FC		AgL
LC	General Springs Canyon Creek	Tributary to East Clear Creek at 34°32'17"/ 111°12'18"		A&Wc				FBC			FC		AgL
LC	Geneva Reservoir	34°01'44"/109°31'44"	Igneous		A&Ww			FBC			FC		AgL
LC	Hall Creek	Tributary to the Little Colorado River at 34°03'58"/109°27'07"		A&Wc				FBC			FC	AgI	AgL
LC	Hart Canyon Creek	Tributary to Willow Creek at 34°30'40"/ 110°59'28"		A&Wc				FBC			FC		AgL
LC	Hay Lake	34°00'11"/109°25'55"	Igneous	A&Wc	~~A&Ww~~			FBC			FC		AgL
LC	Hog Wallow Lake	33°58'57"/109°25'38"	Igneous	A&Wc	~~A&Ww~~			FBC			FC	AgI	AgL
LC	Horse Lake	35°03'53"/111°27'51"			A&Ww			FBC			FC		AgL
LC	Huffer Tank	34°27'45"/111°23'09"			A&Ww			FBC			FC		AgL
LC	Hulsey Creek	Tributary to Nutrioso Creek at 33°56'28"/ 109°11'28"		A&Wc				FBC			FC		AgL
LC	Hulsey Lake	33°55'57"/109°09'33"	Sedimentary	A&Wc				FBC			FC		AgL
LC	Indian Lake	35°00'38"/111°22'37"			A&Ww			FBC			FC		AgL
LC	Jack's Canyon Creek	Tributary to the Little Colorado River at 35°00'07"/110°39'07"		A&Wc				FBC			FC	AgI	AgL
LC	Jarvis Lake	33°58'59"/109°12'33"	Sedimentary		A&Ww			FBC			FC		AgL

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				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
LC	Kinnikinick Lake	34°53'52"/111°18'20"	Igneous	A&Wc				FBC			FC		AgL
LC	Knoll Lake	34°25'38"/111°05'10"	Sedimentary	A&Wc				FBC			FC		AgL
LC	Lake Hum-phreys (EDW)	35°11'51"/111°35'16"					A&Wedw		PBC				
LC	Lake Mary, Lower	35°06'22"/111°34'20"	Igneous	A&Wc				FBC		DWS	FC		AgL
LC	Lake Mary, Upper	35°04'45"/111°31'56"	Igneous	A&Wc				FBC		DWS	FC		AgL
LC	Lake of the Woods	34°09'39"/109°58'45"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Lee Valley Creek ~~(UW)~~ (OAW)	Headwaters to Lee Valley Reservoir		A&Wc				FBC			FC		
LC	Lee Valley Creek	From Lee Valley Reservoir to the East Fork of the Little Colorado River at 33°56'35"/ 109°29'06"		A&Wc				FBC			FC		AgL
LC	Lee Valley Reservoir	33°56'30"/109°30'00"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Leonard Canyon Creek	Tributary to Clear Creek at 34°37'26"/ 111°02'20"		A&Wc				FBC			FC		AgL
LC	Leonard Canyon Creek, East Fork	Tributary to Leonard Canyon Creek at 34°25'52"/111°05'06"		A&Wc				FBC			FC		AgL
LC	Leonard Canyon Creek, Middle Fork	Tributary to Leonard Canyon, West Fork at 34°26'17"/111°06'47"		A&Wc				FBC			FC		AgL
LC	Leonard Canyon Creek, West Fork	Tributary to Leonard Canyon, East Fork at 34°28'01"/111°05'28"		A&Wc				FBC			FC		AgL
LC	Lily Creek	Tributary to Coyote Creek at 33°59'46"/ 109°03'58"		A&Wc				FBC			FC		AgL
LC	Little Colorado River	Headwaters to Lyman Reservoir		A&Wc				FBC			FC	AgI	AgL
LC	Little Colorado River	Below Lyman Reservoir, to confluence with the Puerco River at 34°53'20"/110°07'41"		A&Wc				FBC		DWS	FC	AgI	AgL
LC	Little Colorado River	Below confluence with Puerco River to the boundary of the Navajo Nation			A&Ww			FBC		DWS	FC	AgI	AgL
LC	Little Colorado River, East Fork	Tributary to the Little Colorado River at 34°00'14"/109°27'22"		A&Wc				FBC			FC		AgL
LC	Little Colorado River, South Fork	Tributary to the Little Colorado River at 34°05'20"/109°24'58"		A&Wc				FBC			FC		AgL
LC	Little Colorado River, West Fork ~~(Unique Water)~~ (OAW)	Headwaters to Government Springs at 33°59'33"/109°27'52"		A&Wc				FBC			FC		
LC	Little Colorado River, West Fork	Below Government Springs to the Little Col-orado River at 34°00'14"/109°27'21.6"		A&Wc				FBC			FC		AgL
LC	Little George Reservoir	34°00'37"/109°19'15"	Igneous		A&Ww			FBC			FC	AgI	
LC	Little Mormon Lake	34°17'00"/109°58'03"	Igneous		A&Ww			FBC			FC	AgI	AgL
LC	Little Ortega Lake	34°22'45"/109°40'00"	Igneous	~~A&Ww~~ A&Wc				FBC			FC		
LC	Long Lake, Lower	34°46'45"/111°12'00"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Long Lake, Upper	35°00'00"/111°21'00"	Igneous	A&Wc	~~A&Ww~~			FBC			FC		AgL
LC	Long Tom Tank	34°20'37"/110°49'20"		A&Wc				FBC			FC		AgL
LC	Lower Walnut Canyon Lake (EDW)	35°12'04"/111°34'07"					A&Wedw		PBC				
LC	Lyman Reservoir	34°21'30"/109°21'30"	Deep	A&Wc				FBC			FC	AgI	AgL
LC	Mamie Creek	Tributary to Coyote Creek at 33°59'24"/ 109°03'50"		A&Wc				FBC			FC		AgL
LC	Marshall Lake	35°07'10"/111°32'01"	Igneous	A&Wc				FBC			FC		AgL
LC	McKay Reservoir	34°01'27"/110°29'07"		A&Wc				FBC			FC	AgI	AgL
LC	Merritt Draw Creek	Tributary to Barbershop Canyon Creek at 34°29'38"/111°09'54"		A&Wc				FBC			FC		AgL
LC	Mexican Hay Lake	34°01'57"/109°21'25"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Milk Creek	Tributary to Hulsey Creek at 33°56'31"/ 109°11'17"		A&Wc				FBC			FC		AgL
LC	Miller Canyon Creek	Tributary to East Clear Creek at 34°33'00"/ 111°14'17"		A&Wc				FBC			FC		AgL
LC	Miller Canyon Creek, East Fork	Tributary to Miller Canyon Creek at 34°30'18"/111°14'53"		A&Wc				FBC			FC		AgL
LC	Mineral Creek	Tributary to Little Ortega Lake at 34°22'52"/ 109°39'50"		A&Wc				FBC			FC	AgI	AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
LC	Mormon Lake	34°56'40"/111°27'10"	Shallow	A&Wc				FBC		DWS	FC	AgI	AgL
LC	Morton Lake	34°53'36"/111°17'39"	Igneous	A&Wc				FBC			FC		AgL
LC	Mud Lake	34°55'24"/111°21'18"	Shallow		A&Ww			FBC			FC		AgL
LC	Ned Lake (EDW)	32°17'18"/110°03'20"	EDW				A&Wedw		PBC				
LC	Nelson Reservoir	34°03'12"/109°11'18"	Sedimentary	A&Wc				FBC			FC	AgI	AgL
LC	Norton Reservoir	34°03'57"/109°31'21"	Igneous		A&Ww			FBC			FC		AgL
LC	Nutrioso Creek	Tributary to the Little Colorado River at 34°09'04"/109°17'35"		A&Wc				FBC			FC	AgI	AgL
LC	Paddy Creek	Tributary to Nutrioso Creek at 33°54'47"/109°10'16"		A&Wc				FBC			FC		AgL
LC	Phoenix Park Wash	Tributary to Dry Lake at 34°37'30"/110°22'12"				A&We			PBC				
LC	Pierce Seep	34°23'35"/110°31'22"		A&Wc					PBC				
LC	Pine Tank	34°46'49"/111°17'17"	Igneous		A&Ww			FBC			FC		AgL
LC	Pintail Lake (EDW)	34°18'06"/110°01'17"	EDW				A&Wedw		PBC				
LC	Pool Corral Lake	33°58'16"/109°24'53"	Igneous		A&Ww			FBC			FC	AgI	AgL
LC	Porter Creek	Tributary to Show Low Creek at 34°10'16"/109°58'48"		A&Wc				FBC			FC		AgL
LC	Potato Lake	34°27'44"/111°20'42"	Igneous	A&Wc				FBC			FC		AgL
LC	Pratt Lake	34°01'31"/109°04'16"	Sedimentary	A&Wc				FBC			FC		
LC	Puerco River	Tributary to the Little Colorado River at 34°53'20"/110°07'41"			A&Ww			FBC		DWS	FC	AgI	AgL
LC	Puerco River (EDW)	Sanders Unified School District WWTP outfall at 35°12'52"/109°19'40" to 0.5 km downstream at 35°12'39"/109°19'52"					A&Wedw		PBC				
LC	Rainbow Lake	34°09'03"/109°59'01"	Shallow Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Reagan Reservoir	34°02'09"/109°08'43"	Igneous		A&Ww			FBC			FC		AgL
LC	Rio de Flag	Headwaters to Flagstaff WWTP outfall at 35°12'21"/111°39'17"				A&We			PBC				
LC	Rio de Flag (EDW)	Flagstaff WWTP outfall at 35°12'21"/111°39'17" to the confluence with San Francisco Wash ~~at 35°14'04"/111°28'02.5"~~					A&Wedw		PBC				
LC	River Reservoir	34°02'01"/109°26'07"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Rogers Reservoir	33°58'30"/109°16'18"	Igneous		A&Ww			FBC			FC		AgL
LC	Rudd Creek	Tributary to Nutrioso Creek at 34°04'12"/109°11'56"		A&Wc				FBC			FC		AgL
LC	Russel Reservoir	33°59'29"/109°20'00"	Igneous		A&Ww			FBC			FC	AgI	AgL
~~LC~~	~~San Salvador Reservoir~~	~~33°58'51"/109°19'51"~~			~~A&Ww~~			~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
LC	Salt House Lake	33°57'06"/109°20'12"	Igneous		A&Ww			FBC			FC		AgL
LC	San Salvador Reservoir	33°58'51"/109°19'51"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Scott Reservoir	34°10'27"/109°57'27"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Show Low Creek	Tributary to Silver Creek at 34°25'26"/110°04'05"		A&Wc				FBC			FC	AgI	AgL
LC	Show Low Lake	34°11'25"/109°59'55"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Silver Creek	Tributary to the Little Colorado River at 34°44'24"/110°02'17"		A&Wc				FBC			FC	AgI	AgL
LC	Slade Reservoir	33°59'50"/109°20'00"	Igneous		A&Ww			FBC			FC	AgI	AgL
LC	Soldiers Annex Lake	34°47'13"/111°13'48"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Soldiers Lake	34°47'49"/110°13'59"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Spaulding Tank	34°30'17"/111°02'03"			A&Ww			FBC			FC		AgL
LC	Sponseller Lake	34°14'10"/109°50'42"	Igneous	A&Wc				FBC			FC		AgL
LC	St Johns Reservoir (Little Reservoir)	34°29'14"/109°21'57"	Igneous		A&Ww			FBC			FC	AgI	AgL
LC	Telephone Lake (EDW)	34°17'35"/110°02'39"	EDW				A&Wedw		PBC				
LC	Tremaine Lake	34°46'00"/111°14'10"	Igneous	A&Wc				FBC			FC		AgL
LC	Tunnel Reservoir	34°01'51"/109°26'32"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Turkey Draw (EDW)	High Country Pines II WWTP outfall at 34°25'35"/110°38'13" to confluence of Turkey Draw with Black Canyon Creek at 34°25'20"/110°36'36"					A&Wedw		PBC				
LC	Unnamed Wash (EDW)	Bison Ranch WWTP outfall at 34°23'31"/110°31'41" to Pierce Seep at 34°23'35"/110°31'22"					A&Wedw		PBC				
LC	Unnamed Wash (EDW)	Black Mesa Ranger Station WWTP outfall at 34°23'32"/110°53'32" to confluence of Oklahoma Flat Draw with Pierce Wash at 34°26'47"/110°29'25"					A&Wedw		PBC				

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
LC	Unnamed Wash (EDW)	Estates at Pine Canyon WWTP outfall at 35°09'17"/111°38'22" to confluence of unnamed wash with Bow Wash and Arrow Wash at 35°09'51"/111°27'29"					A&Wedw		PBC				
LC	Unnamed Wash (EDW)	Estates at Pine Canyon WWTP outfall #3 at 35°09'45"/111°38'48" to confluence with Rio de Flag at 35°10'05"/111°38'37					A&Wedw		PBC				
LC	Vail Lake	35°05'24"/111°30'42"	Igneous	A&Wc				FBC			FC		AgL
LC	Walnut Creek	Tributary to Billy Creek at 34°09'50"/ 109°58'48"		A&Wc				FBC			FC		AgL
LC	Water Canyon Creek	Tributary to the Little Colorado River at 34°06'47"/109°18'43"		A&Wc				FBC			FC		AgL
LC	Water Canyon Reservoir	34°00'15"/109°20'05"	Igneous		A&Ww			FBC			FC	AgI	AgL
LC	Whale Lake (EDW)	35°12'32"/111°34'42"	EDW				A&Wedw		PBC				
LC	Whipple Lake	34°16'47"/109°58'28"	Igneous		A&Ww			FBC			FC		AgL
LC	White Mountain Lake	34°21'54"/109°59'38"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	White Mountain Reservoir	34°00'15"/109°30'48"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Willow Creek	Tributary to Clear Creek at 34°38'31"/ 110°59'49"		A&Wc				FBC			FC		AgL
LC	Willow Springs Canyon Creek	Tributary to Chevelon Creek at 34°21'32"/ 110°53'20"		A&Wc				FBC			FC		AgL
LC	Willow Springs Lake	34°18'45"/110°52'34"	Sedimentary	A&Wc				FBC			FC	AgI	AgL
LC	Woodland Reservoir	34°07'36"/109°57'06"	Igneous	A&Wc				FBC			FC	AgI	AgL
LC	Woods Canyon Creek	Tributary to Chevelon Creek at 34°21'32"/ 110°53'20"		A&Wc				FBC			FC		AgL
LC	Woods Canyon Lake	34°20'05"/110°56'35"	Sedimentary	A&Wc				FBC		~~DWS~~	FC	AgI	AgL
LC	Zuni River	Tributary to the Little Colorado River at 34°38'42"/109°40'26"		A&Wc				FBC			FC	AgI	AgL
~~LG~~	~~Columbus Wash~~	~~Tributary to the Gila River at 33°00'25"/ 113°16'08"~~				~~A&We~~			~~PBC~~				
~~LG~~	~~Gila River~~	~~Painted Rock Dam to the Colorado River at 32°43'12"/114°33'14"~~			~~A&Ww~~			~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~LG~~	~~Painted Rock (Borrow Pit) Lake~~	~~33°05'00"/113°01'20"~~			~~A&Ww~~			~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
MG	Agua Fria River	Headwaters to confluence with unnamed EDW wash at 34°35'43"/112°16'29", receiving treated wastewater from the Prescott Valley WWTP				A&We			PBC				AgL
MG	Agua Fria River (EDW)	Below confluence with unnamed wash receiving treated wastewater from the Prescott Valley WWTP to State Route 169 at 34°31'43"/112°14'7.5"					A&Wedw		PBC				AgL
MG	Agua Fria River	State Route 169 to Lake Pleasant at 34°54'54.7"/112°14'7.5"			A&Ww			FBC		DWS	FC	AgI	AgL
MG	Agua Fria River	Below Lake Pleasant to the El Mirage WWTP at 33°34'36"/112°48'45"				A&We			PBC				AgL
MG	Agua Fria River (EDW)	El Mirage WWTP to 2 km downstream					A&Wedw		PBC				
MG	Agua Fria River	Below 2 km downstream of the El Mirage WWTP to ~~State Highway 85~~ Avondale WWTP outfall				A&We			PBC				
~~MG~~	~~Agua Fria River~~	~~Below State Highway 85~~			~~A&Ww~~			~~FBC~~			~~FC~~		
MG	Agua Fria River	Avondale WWTP outfall at 33°23'24"/ 112°21'50.4" to Gila River at 33°23'22"/ 112°21'48"					A&Wedw		PBC				
MG	Alvord Park Lake	~~Municipal Park~~ Urban Lake: 35th Avenue & Baseline Road, Phoenix at 33°22'34"/ 112°08'11"	Urban		A&Ww				PBC		FC		
MG	Andorra Wash (EDW)	Town of Cave Creek WWTP outfall #1 at 33°50'00"/111°56'32" to confluence with Cave Creek Wash at 33°49'54"/111°57'57.4"					A&Wedw		PBC				
MG	Antelope Creek	Tributary to Martinez Creek at 34°16'37"/ 112°08'46"			A&Ww			FBC			FC		AgL
MG	Arlington Canal	~~Above Wilson Avenue~~ From Gila River at 33°20'54"/112°35'39" to Gila River at 33°13'44"/112°46'15"											AgL
MG	Ash Creek	Headwaters to confluence with Tex Canyon at 34°34'44"/112°07'18"		A&Wc				FBC			FC	AgI	AgL
MG	Ash Creek	Below confluence with Tex Canyon to Agua Fria at 34°19'34"/112°04'30"			A&Ww			FBC			FC	AgI	AgL
MG	Beehive Tank	32°52'36"/111°02'19"			A&Ww			FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife A&Wc	A&Ww	A&We	A&Wedw	Human Health FBC	PBC	DWS	FC	Agricultural AgI	AgL
MG	Big Bug Creek	Headwaters to confluence with Eugene Gulch at 34°27'11"/112°18'28.5"		A&Wc				FBC			FC	AgI	AgL
MG	Big Bug Creek	Below confluence with Eugene Gulch to confluence with Agua Fria River at 34°18'54"/ 112°03'58"			A&Ww			FBC			FC	AgI	AgL
MG	Black Canyon Creek	Tributary to the Agua Fria River at 34°04'12"/ 112°09'29"			A&Ww			FBC			FC		AgL
MG	Blind Indian Creek	Tributary to the Hassayampa River at 34°12'40"/112°32'17"			A&Ww			FBC			FC		AgL
MG	Bonsall Park Lake	~~Municipal Park~~ Urban Lake; 59th Avenue & Bethany Home Road, Phoenix at 33°31'23"/ 112°11'05"	Urban		A&Ww				PBC		FC		
MG	Canal Park Lake	~~Municipal Park~~ Urban Lake; College Avenue & Curry Road, Tempe at 33°26'57"/ 111°56'14"	Urban		A&Ww				PBC		FC		
MG	Cave Creek	Headwaters to the Cave Creek Dam			A&Ww			FBC			FC		AgL
MG	Cave Creek	Cave Creek Dam to the Arizona Canal at 33°34'24"/112°06'25"				A&We			PBC				
MG	Centennial Wash	Tributary to the Gila River at 33°13'44"/ 112°46'16"				A&We			PBC				AgL
MG	Centennial Wash Ponds	33°55'10"/113°23'05"			A&Ww			FBC			FC		AgL
MG	Chaparral Park Lake	~~Municipal Park~~ Urban Lake; Hayden Road & Chaparral Road, Scottsdale at 33°30'41"/ 111°54'25"	Urban		A&Ww				PBC		FC	AgI	
MG	Cortez Park Lake	~~Municipal Park~~ Urban Lake; 35th Avenue & Dunlap, Glendale at 33°34'13"/112°07'51"	Urban		A&Ww				PBC		FC	AgI	
MG	Desert Breeze Lake	~~Municipal Park~~ Urban Lake; Galaxy Drive, West Chandler at 33°18'47.5"/111°55'08"	Urban		A&Ww				PBC		FC		
MG	Devils Canyon	Tributary to Mineral Creek at 33°12'58"/ 110°59'42"			A&Ww				FBC		FC		AgL
MG	Dobson Lake	~~Municipal Park~~ Urban Lake; Dobson Road & Los Lagos Vista Avenue, Mesa at 33°22'17"/ 111°53'12"	Urban		A&Ww				PBC		FC		
MG	Eldorado Park Lake	~~Municipal Park~~ Urban Lake; Miller Road & Oak Street, Tempe at 33°28'25"/111°54'51"	Urban		A&Ww				PBC		FC		
MG	Encanto Park Lake	~~Municipal Park~~ Urban Lake; 15th Avenue & Encanto Blvd., Phoenix at 33°28'36"/ 112°05'17"	Urban		A&Ww				PBC		FC	AgI	
MG	Fain Lake	~~Park Lake, city~~ City of Prescott Valley Park Lake 34°34'29"/112°21'03"	Urban		A&Ww				PBC		FC		
MG	French Gulch	Headwaters to confluence with Hassayampa River			A&Ww				PBC				AgL
MG	Galena Gulch	Tributary to the Agua Fria River at 34°28'37"/ 112°15'14"				A&We			PBC				AgL
MG	Gallaway Wash (EDW)	Town of Cave Creek WWTP outfall #2 at 33°49'58"/111°57'30" to confluence with Andorra Wash at 33°49'59"/111°57'41"					A&Wedw		PBC				
MG	Gila River	San Carlos Indian Reservation to the Ashurst-Hayden Dam at 33°06'01"/111°14'46"			A&Ww			FBC			FC	AgI	AgL
MG	Gila River	Ashurst-Hayden Dam to the Florence WWTP outfall at 33°02'30"/111°24'16"				A&We			PBC				AgL
MG	Gila River (EDW)	Florence WWTP outfall to Felix Road at 33°01'49"/111°17'16"					A&Wedw		PBC				
MG	Gila River	Felix Road to the Gila River Indian Reservation				A&We			PBC				AgL
MG	Gila River (EDW)	From the confluence with the Salt River to the Gillespie Dam at 33°13'45"/112°46'07"					A&Wedw		PBC		FC	AgI	AgL
MG	Gila River	Gillespie Dam to Painted Rock Dam at 33°04'23"/113°00'40"			A&Ww			FBC			FC	AgI	AgL
MG	Granada Park Lake	~~Municipal Park~~ Urban Lake; 6505 North 20th Street, Phoenix at 33°31'58.6"/112°02'06"	Urban		A&Ww				PBC		FC		
MG	Groom Creek	Tributary to the Hassayampa River at 34°27'14"/112°29'24"		A&Wc				FBC		DWS	FC		AgL
MG	Hank Raymond Lake	33°50'18"/112°16'07"			A&Ww			FBC			FC	AgI	AgL
MG	Hassayampa Lake	34°25'45"/112°25'29"	Igneous	A&Wc				FBC		DWS	FC		
MG	Hassayampa River	Headwaters to confluence with unnamed tributary at 34°26'09"/112°30'32"		A&Wc				FBC			FC	AgI	AgL
MG	Hassayampa River	Below confluence with unnamed tributary to 8 miles south of Wickenberg			A&Ww			FBC			FC	AgI	AgL
MG	Hassayampa River	8 miles south of Wickenburg to the Buckeye Irrigation Company Canal at 33°23'38"/ 112°22'22.8"				A&We			PBC				AgL
MG	Hassayampa River	Buckeye Irrigation Company canal to the Gila River at 33°19'34"/112°42'39.6"			A&Ww			FBC			FC		AgL
MG	Horsethief Lake	34°09'42"/112°17'56"	Igneous	A&Wc				FBC		DWS	FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
MG	Indian Bend Wash	Tributary to the Salt River at 33°26'13"/ 111°54'58"				A&We			PBC				
MG	Indian Bend Wash Lakes	~~Municipal Park~~ Urban Lakes; Scottsdale at 33°30'31"/111°54'24"	Urban		A&Ww				PBC		FC		
MG	Indian School Park Lake	~~Municipal Park~~ Urban Lake; Indian School Road & Hayden Road, Scottsdale at 33°29'45"/111°54'33"	Urban		A&Ww				PBC		FC		
MG	Kiwanis Park Lake	~~Municipal Park~~ Urban Lake; 6000 South Mill Avenue, Tempe at 33°22'27"/111°56'21"	Urban		A&Ww				PBC		FC	AgI	
MG	Lake Pleasant	33°51'15"/112°16'15"	Deep		A&Ww			FBC		DWS	FC	AgI	AgL
MG	Lion Canyon	Tributary to Weaver Creek at 34°10'12"/ 112°41'49"			A&Ww			FBC			FC		AgL
MG	Little Ash Creek	Tributary to Ash Creek at 34°20'46"/ 112°04'16"			A&Ww			FBC			FC		AgL
MG	Lynx Creek	Headwaters to confluence with unnamed tributary at 34°34'29"/112°21'05"		A&Wc				FBC			FC		AgL
MG	Lynx Creek	Below confluence with unnamed tributary to Agua Fria River at 34°37'49"/112°14'42"			A&Ww			FBC			FC		AgL
MG	Lynx Lake	34°31'08"/112°23'05"	Deep	A&Wc				FBC		DWS	FC	AgI	AgL
MG	Maricopa Park Lake	33°35'30"/112°18'16"	Urban		A&Ww				PBC		FC		
MG	Martinez Canyon	Tributary to Box Canyon at 33°06'33"/ 111°12'48"			A&Ww			FBC			FC		AgL
MG	Martinez Creek	Tributary to the Hassayampa River at 33°59'56"/112°44'38"			A&Ww			FBC			FC	AgI	AgL
MG	McKellips Park Lake	~~Municipal Park~~ Urban Lake; Miller Road & McKellips Road, Scottsdale at 33°27'14"/ 111°54'45"	Urban		A&Ww				PBC		FC	AgI	
MG	McMicken Wash (EDW)	Jomax WWTP outfall at 33°43'30"/ 112°20'11" to confluence of McMicken Wash with Agua Fria River at 33°39'39"/112°18'56"					A&Wedw		PBC				
MG	Mineral Creek	Tributary to the Gila River at 34°17'42"/ 112°13'34"			A&Ww			FBC			FC		AgL
MG	Minnehaha Creek	Tributary to the Hassayampa River at 34°11'49"/112°32'24"			A&Ww			FBC			FC		AgL
MG	Mountain Valley Park Ponds (EDW)	Town of Prescott Valley WWTP outfall 002 at 34°26'07"/112°18'48" to Navajo Wash					A&Wedw		PBC				
MG	New River	Headwaters to I-17 at 33°54'19.5"/112°08'46"			A&Ww			FBC			FC	AgI	AgL
MG	New River	Below I-17 to Agua Fria River at 33°30'47"/ 112°18'14"				A&We			PBC				AgL
MG	Painted Rock Reservoir	33°04'15"/113°00'30"	Sedimentary		A&Ww			FBC			FC	AgI	AgL
MG	Papago Park Ponds	~~Municipal Park~~ Urban Lake; Galvin Parkway, Phoenix at 33°26'56"/111°56'50"	Urban		A&Ww				PBC		FC		
MG	Papago Park South Pond	Urban Lake; Curry Road, Tempe	Urban		A&Ww				PBC		FC		
MG	Perry Mesa Tank	34°11'03"/112°01'59"			A&Ww			FBC			FC		AgL
MG	Phoenix Area Canals	Granite Reef Dam to all municipal WTP intakes								DWS		AgI	AgL
MG	Phoenix Area Canals	Below municipal WTP intakes and all other locations										AgI	AgL
MG	Picacho Reservoir	32°51'17"/111°28'49"	Shallow		A&Ww			FBC			FC	AgI	AgL
MG	Poland Creek	Headwaters to confluence with Lorena Gulch at 34°12'32"/112°19'07"		A&Wc				FBC			FC		AgL
MG	Poland Creek	Below confluence with Lorena Gulch to Black Canyon Creek at 34°14'20"/112°12'54"			A&Ww			FBC			FC		AgL
MG	Queen Creek	Headwaters to the Town of Superior WWTP outfall at 33°16'45"/111°17'25"			A&Ww	~~A&We~~			PBC				AgL
MG	Queen Creek (EDW)	Town of Superior WWTP outfall to confluence with Potts Canyon at 33°17'17"/ 111°11'36"					A&Wedw		PBC				
MG	Queen Creek	Potts Canyon to Queen Valley golf course at 33°17'55"/111°17'17"			A&Ww			FBC			FC		AgL
MG	Queen Creek	Below Queen Valley golf course to Gila River at 33°09'50"/111°53'16.8"				A&We			PBC				
MG	Riverview Park Lake	~~Municipal Park~~ Urban Lake; Dobson Road & 8th Street, Mesa at 33°25'50"/111°52'29"	Urban		A&Ww				PBC		FC		
MG	Roadrunner Park Lake	~~Municipal Park~~ Urban Lake; 36th Street & Cactus, Phoenix at 33°35'57"/112°00'18"	Urban		A&Ww				PBC		FC		
MG	Salt River	Verde River to 2 km below Granite Reef Dam (Granite Reef Dam is at 31°26'23"/ 111°12'40")			A&Ww			FBC		DWS	FC	AgI	AgL
MG	Salt River	2 km below Granite Reef Dam to City of Mesa NW WRF outfall at 33°26'45"/ 111°56'35"				A&We			PBC				

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
MG	Salt River (EDW)	City of Mesa NW WRF outfall at 33°26'45"/ 111°56'35" to Tempe Town Lake at 33°26'01"/111°54'55"					A&Wedw		PBC				
MG	Salt River	Below Tempe Town Lake to I-10 bridge				A&We			PBC				
MG	Salt River	I-10 bridge to the 23rd Avenue WWTP at 33°25'03"/112°06'41.6"			A&Ww				PBC		FC		
MG	Salt River (EDW)	23rd Avenue WWTP to confluence with Gila River at 33°22'55"/112°18'21.6"					A&Wedw		PBC		FC	AgI	AgL
MG	Siphon Draw (EDW)	Superstition Mountains WWTP outfall at 33°21'40"/111°33'30" to 6 km downstream at 32°21'01"/111°36'59"					A&Wedw		PBC				
MG	Sycamore Creek	Headwaters to confluence with Tank Canyon at 34°19'32"/111°50'12"		A&Wc				FBC			FC		AgL
MG	Sycamore Creek	Below confluence with Tank Canyon to the Agua Fria River at 34°19'30"/112°04'12"			A&Ww			FBC			FC		AgL
MG	Tempe Town Lake	At Mill Avenue Bridge at 33°26'30"/ 111°53'30"	Urban		A&Ww			FBC			FC		
MG	Tule Creek	Tributary to the Agua Fria River at 33°57'25"/ 112°14'13"			A&Ww			FBC			FC		AgL
MG	Turkey Creek	Headwaters to confluence with unnamed tributary at 34°19'28"/112°21'28"		A&Wc				FBC			FC	AgI	AgL
MG	Turkey Creek	Below confluence with unnamed tributary to Poland Creek at 34°14'20"/112°12'54"			A&Ww			FBC			FC	AgI	AgL
MG	Unnamed Wash (EDW)	City of Phoenix Cave Creek WRF outfall at 33°45'20"/112°00'59" to unnamed wash to 0.5 km downstream at 33°35'07"/112°01'12"					A&Wedw		PBC				
MG	Unnamed Wash (EDW)	Gila Bend WWTP outfall to the Gila River at 32°58'13"/112°43'46"					A&Wedw		PBC				
MG	Unnamed Wash (EDW)	Luke Air Force Base WWTP outfall to the Agua Fria River at 33°32'21"/112°19'15"					A&Wedw		PBC				
MG	Unnamed Wash (EDW)	Florence Gardens WWTP outfall at 33°03'49.54"/111°23'13.28" to confluence with Gila River at 33°02'59"/111°23'15"					A&Wedw		PBC				
MG	Unnamed Wash (EDW)	Prescott Valley WWTP outfall to the Agua Fria River at 34°35'16"/112°16'18"					A&Wedw		PBC				
MG	Unnamed Wash (EDW)	Queen Valley Sanitary District WWTP outfall at 33°17'38"/111°18'31" to the confluence with Queen Creek					A&Wedw		PBC				
MG	Wagner Wash (EDW)	Buckeye Festival Ranch WRF outfall at 33°39'14"/112°40'18" to 2 km downstream					A&Wedw		PBC				
MG	Vista Del Camino Park North	~~Municipal Park~~ Urban Lake; 7700 East Roosevelt Street, Scottsdale at 33°27'33"/ 111°54'49.3"			A&Ww				PBC		FC		
~~MG~~	~~Vista Del Camino Park South~~	~~Municipal Park Lake; 7700 East Roosevelt Street, Scottsdale~~			~~A&Ww~~				~~PBC~~		~~FC~~		
MG	Walnut Canyon Creek	Tributary to the Gila River at 33°06'47"/ 111°05'20"			A&Ww			FBC			FC		AgL
MG	Weaver Creek	Tributary to Martinez Creek at 34°03'18"/ 112°46'48"			A&Ww			FBC			FC		AgL
MG	White Canyon Creek	Tributary to Walnut Canyon Creek at 33°09'25"/111°04'48"			A&Ww			FBC			FC		AgL
~~RM~~	~~Abbot Canyon~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Ash Creek~~	~~Chiricahua Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~RM~~	~~Bear Creek~~	~~Headwaters to U.S./Mexico border at 31°19'59"/110°22'58.5"~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Blackwater Draw~~	~~San Bernardino Valley~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Buck Canyon~~	~~Headwaters to Buck Creek Tank at 31°33'06"/ 109°52'43"~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Buck Canyon~~	~~Below Buck Creek Tank~~				~~A&We~~			~~PBC~~				~~AgL~~
~~RM~~	~~California Gulch~~	~~South of Ruby~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Dixie Canyon~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Dry Canyon~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Gadwell Canyon~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Glance Creek~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Gold Gulch~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Holden Canyon Creek~~	~~Coronado National Forest~~			~~A&Ww~~			~~FBC~~			~~FC~~		
~~RM~~	~~Johnson Canyon~~	~~Chiricahua Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Leslie Canyon Creek~~	~~Chiricahua Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Mexican Canyon~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Mule Gulch~~	~~Headwaters to just above the Lavender Pit~~			~~A&Ww~~				~~PBC~~		~~FC~~		
~~RM~~	~~Mule Gulch~~	~~Just above the Lavender Pit to the Bisbee WWTP outfall~~				~~A&We~~			~~PBC~~				
~~RM~~	~~Mule Gulch (EDW)~~	~~Below the Bisbee WWTP outfall, to the Highway 80 bridge at 31°26'30"/109°49'28"~~					~~A&Wedw~~		~~PBC~~				

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
~~RM~~	~~Mule Gulch~~	~~Below the Highway 80 bridge~~				~~A&We~~			~~PBC~~				~~AgL~~
~~RM~~	~~Quitobaquito Spring~~	~~(Pond and Springs) 31°56'39"/113°01'06"~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Ruby Lakes~~	~~Near the town of Ruby~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Rucker Canyon Creek~~	~~Chiricahua Mtns; tributary to Whitewater Draw at 31°44'46"/109°26'06"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Rucker Canyon Lake~~	~~31°46'46"/109°18'30"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Soto Canyon~~	~~Mule Mountains~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Sycamore Canyon Creek~~	~~Headwaters to the U.S./Mexico border at 31°22'48"/111°13'19"~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~RM~~	~~Unnamed Wash (EDW)~~	~~Bisbee-Douglas International Airport WWTP outfall to Whitewater Draw~~					~~A&Wedw~~		~~PBC~~				
~~RM~~	~~Whitewater Draw~~	~~Headwaters to confluence with unnamed tributary at 31°20'36"/109°34'46"~~				~~A&We~~			~~PBC~~				~~AgL~~
~~RM~~	~~Whitewater Draw~~	~~Below confluence with unnamed tributary~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
SC	Agua Caliente Lake	~~Municipal Park~~ Urban Lake; 12325 East Roger Road, Tucson	Urban		A&Ww				PBC		FC		
SC	Agua Caliente Wash	Headwaters to Soldier Trail at 32°17'48"/110°42'58.5"			A&Ww			FBC			FC		AgL
SC	Agua Caliente Wash	Below Soldier Trail to Tanque Verde Creek at 32°14'35"/110°47'17"				A&We			PBC				AgL
SC	Aguirre Wash	Those reaches not located on the Tohono O'odham Indian Reservation				A&We			PBC				
SC	Alambre Wash	Tributary to Brawley Wash at 31°57'47"/111°23'28"				A&We			PBC				
SC	Alamo Wash	Tributary to Rillito Creek at 32°16'23"/110°54'18"				A&We			PBC				
SC	Altar Wash	Tributary to Brawley Wash at 31°57'47"/111°23'28"				A&We			PBC				
SC	Alum Gulch	Headwaters to 31°28'20"/110°43'51"				A&We			PBC				AgL
SC	Alum Gulch	From 31°28'20"/110°43'51" to 31°29'17"/110°44'25"			A&Ww			FBC			FC		AgL
SC	Alum Gulch	Below 31°29'17"/110°44'25" to Sonoita Creek at 31°30'58"/110°47'06"				A&We			PBC				AgL
SC	Arivaca Creek	Tributary to Altar Wash at 31°43'01"/111°25'41"			A&Ww			FBC			FC		AgL
SC	Arivaca Lake	31°31'50"/111°15'05"	Igneous		A&Ww			FBC			FC	AgI	AgL
SC	Atterbury Wash	Tributary to Pantano Wash at 32°10'52"/110°48'50"				A&We			PBC				AgL
SC	Bear Grass Tank	31°33'01"/111°11'32"			A&Ww			FBC			FC		AgL
SC	Big Wash	Tributary to Cañada del Oro at 32°24'47"/110°56'28"				A&We			PBC				
SC	Black Wash (EDW)	Pima County WWMD Avra Valley WWTP at 32°09'50"/111°10'49" to confluence with Brawley wash at 32°15'00"/111°14'34"					A&Wedw		PBC				
SC	Bog Hole Tank	31°28'34"/110°37'07"			A&Ww			FBC			FC		AgL
SC	Brawley Wash	Tributary to Los Robles Wash at 32°21'54"/111°17'31"				A&We			PBC				
SC	California Gulch	South of Ruby			A&Ww			FBC			FC		AgL
SC	Cañada del Oro	Headwaters to Highway 89 at 32°24'48"/110°56'14"			A&Ww			FBC			FC	AgI	AgL
SC	Cañada del Oro	Below Highway 89 to the Santa Cruz River at 32°19'30"/111°03'47"				A&We			PBC				AgL
SC	Cienega Creek	Headwaters to confluence with Gardner Canyon and Spring Water Canyon at ~~R18E, T17S.~~ 31°47'38"/110°35'17"			A&Ww			FBC			FC		AgL
SC	Cienega Creek ~~(Unique Water)~~ (OAW)	From confluence with Gardner Canyon and Spring Water Canyon ~~at R18E, T17S~~ to USGS gaging station at 32°02'09"/110°40'34" (becomes Pantano Wash below this point)			A&Ww			FBC			FC		AgL
SC	Davidson Canyon	Headwaters to unnamed spring at 31°59'00"/110°38'46"				A&We			PBC				AgL
SC	Davidson Canyon (OAW)	Unnamed Spring to confluence with unnamed tributary at 31°59'32.5"/110°38'43.5"			A&Ww			FBC			FC		AgL
SC	Davidson Canyon (OAW)	From confluence with unnamed tributary to unnamed spring at 32°00'54"/110°38'54"				A&We			PBC				AgL
SC	Davidson Canyon (OAW)	From unnamed spring at 32°00'54"/110°38'54" to confluence with Cienega Creek at 32°01'05"/110°38'32"			A&Ww			FBC			FC		AgL
SC	Empire Gulch	Headwaters to unnamed spring at 31°47'14"/110°38'13"				A&We			PBC				
SC	Empire Gulch	From 31°47'14" / 110°38'13" to31°47'11" / 110°00'39"			A&Ww			FBC			FC		
SC	Empire Gulch	Below 31°47"11" / 110°00'39" to 31°47'18" / 110°36'57"				A&We			PBC				AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SC	Empire Gulch	From 31°47'18" / 110°36'57" to confluence with Cienega Creek at 31°48'32"/110°35'20"			A&Ww			FBC			FC		
SC	Flux Canyon	Tributary to Alum Canyon at 31°30'22"/ 110°46'41"				A&We			PBC				AgL
SC	Gardner Canyon Creek	Headwaters to confluence with Sawmill Canyon at 31°42'51"/110°44'43"		A&Wc				FBC			FC		
SC	Gardner Canyon Creek	Below Sawmill Canyon to Cienega Creek at 31°47'38"/110°35'17"			A&Ww			FBC			FC		
SC	Greene Wash	Tributary to the Santa Cruz River at 33°00'54"/111°59'46"				A&We			PBC				
SC	Harshaw Creek	Tributary to Sonoita Creek at 31°32'35"/ 110°44'42"				A&We			PBC				AgL
SC	Hit Tank	32°43'57"/111°03'18"			A&Ww			FBC			FC		AgL
SC	Holden Canyon Creek	Headwaters to Mexico border at 31°23'38"/ 111°15'54" in the Coronado National Forest			A&Ww			FBC			FC		
SC	Huachuca Tank	31°21'11"/110°30'12"			A&Ww			FBC			FC		AgL
SC	Julian Wash	Tributary to the Santa Cruz River at 32°11'20"/110°59'13"				A&We			PBC				
SC	Kennedy Lake	~~Municipal Park~~ Urban Lake; Mission Road & Ajo Road, Tucson at 32°10'48.5"/111°00'27"	Urban		A&Ww				PBC		FC		
SC	Lakeside Lake	~~Municipal Park~~ Urban Lake; 8300 East Stella Road, Tucson at 32°11'10.5"/110°49'00"	Urban		A&Ww				PBC		FC		
SC	Lemmon Canyon Creek	Headwaters to confluence with unnamed tributary at 32°23'47"/110°47'46"		A&Wc				FBC			FC		
SC	Lemmon Canyon Creek	Below unnamed tributary to Sabino Canyon Creek at 32°23'02"/110°47'28"			A&Ww			FBC			FC		
SC	Los Robles Wash	Tributary to the Santa Cruz River at 32°32'13"/111°23'53"				A&We			PBC				
SC	Madera Canyon Creek	Headwaters to confluence with unnamed tributary at 31°43'42"/110°52'50"		A&Wc				FBC			FC		AgL
SC	Madera Canyon Creek	Below unnamed tributary to the Santa Cruz River at 31°46'55"/111°00'58"			A&Ww			FBC			FC		AgL
SC	Mattie Canyon	Tributary to Cienega Creek at 31°51'31"/ 110°34'25"			A&Ww			FBC			FC		AgL
SC	Nogales Wash	Tributary to Potrero Creek at 31°24'07"/ 110°57'11"			A&Ww				PBC				
SC	Oak Tree Canyon	Tributary to Cienega Creek at 31°48'43"/ 110°35'24"				A&We			PBC				
SC	Palisade Canyon Creek	Headwaters to confluence with unnamed tributary at 32°22'34"/110°45'35"		A&Wc				FBC			FC		
SC	Palisade Canyon Creek	Below unnamed tributary to Sabino Canyon Creek at 32°21'54"/110°46'23"			A&Ww			FBC			FC		
SC	Pantano Wash	Tributary to Tanque Verde Creek at 32°16'23"/110°54'18"				A&We			PBC				
SC	Paradise Lake	32°44'18"/111°40'42"	Urban		A&Ww			~~FBC~~	PBC			AgI	
SC	Parker Canyon Creek	Headwaters to confluence with unnamed tributary at 31°24'17"/110°28'44.5"		A&Wc				FBC			FC		
SC	Parker Canyon Creek	Below unnamed tributary to Mexico border at 31°19'59"/110°33'58"			A&Ww			FBC			FC		
SC	Parker Canyon Lake	31°25'35"/110°27'15"	Deep	A&Wc				FBC			FC	AgI	AgL
SC	Patagonia Lake	31°29'30"/110°52'00"	Deep	~~A&We~~	A&Ww			FBC		~~DWS~~	FC	AgI	AgL
SC	Peña Blanca Lake	31°24'12"/111°05'04"	Igneous	~~A&We~~	A&Ww			FBC			FC	AgI	AgL
SC	Potrero Creek	Headwaters to Interstate 19 at 31°23'24"/ 110°57'30"				A&We			PBC				AgL
SC	Potrero Creek	Below Interstate 19 to Santa Cruz River at 31°27'07"/110°57'40"			A&Ww			FBC			FC		AgL
SC	Puertocito Wash	Tributary to Altar Wash at 31°43'01"/ 111°25'41"				A&We			PBC				
SC	Quitobaquito Spring	(Pond and Springs) 31°56'39"/113°01'06"			A&Ww			FBC			FC		AgL
SC	Redrock Canyon Creek	Tributary to Harshaw Creek at 31°32'35"/ 110°44'13"			A&Ww			FBC			FC		
SC	Rillito Creek	Tributary to the Santa Cruz River at 32°18'50"/111°03'18"				A&We			PBC				AgL
SC	Romero Canyon Creek	Headwaters to confluence with unnamed tributary at 32°24'30"/110°50'35"		A&Wc				FBC			FC		
SC	Romero Canyon Creek	Below unnamed tributary to Sutherland Wash at 32°25'52"/110°53'56"			A&Ww			FBC			FC		
SC	Rose Canyon Creek	Tributary to Rose Canyon Lake at 32°23'10"/ 110°43'01"		A&Wc				FBC			FC		
SC	Rose Canyon Lake	32°23'13"/110°42'38"	Igneous	A&Wc				FBC			FC		AgL
SC	Ruby Lakes	Near the town of Ruby at 31°26'28.5"/ 111°14'19"	Igneous		A&Ww			FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SC	Sabino Canyon Creek	Headwaters to confluence with unnamed tributary at 32°23'28"/110°47'00"		A&Wc				FBC		DWS	FC	AgI	
SC	Sabino Canyon Creek	Below unnamed tributary to Tanque Verde River at 32°15'40"/110°49'30"			A&Ww			FBC		DWS	FC	AgI	
SC	Salero Ranch Tank	31°35'42"/110°53'22"			A&Ww			FBC			FC		AgL
SC	Santa Cruz River	Headwaters to the International Boundary at 31°19'58"/110°35'48"			A&Ww			FBC			FC	AgI	AgL
SC	Santa Cruz River	International Boundary to the Nogales International WWTP outfall at 31°27'24"/110°58'05"			A&Ww			FBC		DWS	FC	AgI	AgL
SC	Santa Cruz River (EDW)	Nogales International WWTP outfall to the Tubac Bridge at 31°36'25"/110°02'00"					A&Wedw		PBC				AgL
SC	Santa Cruz River	The Tubac Bridge to Roger ~~Rd~~ Road WWTP outfall				A&We			PBC				AgL
SC	Santa Cruz River (EDW)	Roger Road WWTP outfall to Baumgartner Road at 32°35'37"/111°28'08"					A&Wedw		PBC				
SC	Santa Cruz ~~River (Wash)~~ Wash	Baumgartner Road to the ~~Gila River~~ Ak Chin Indian Reservation				A&We			PBC				AgL
SC	Santa Cruz ~~River~~ Wash, West Branch	Tributary to the Santa Cruz ~~River~~ Wash at 32°12'07"/110°59'20"				A&We			PBC				AgL
SC	Santa Cruz ~~River~~ Wash, ~~N. Fork~~ North Branch	Tributary to the Santa Cruz ~~River~~ Wash at 32°55'55"/111°53'10"				A&We			PBC				
SC	Santa Cruz Wash, North Branch (EDW)	City of Casa Grande WRF outfall at 32°54'57"/111°47'13" to 1 km downstream at 32°54'49"/111°47'48"					A&Wedw		PBC				
SC	Santa Rosa Wash	Below Tohono O'odham Indian Reservation to the ~~Santa Cruz Wash at 32°53'49"/111°56'46"~~ Ak Chin Indian Reservation				A&We			PBC				
SC	Santa Rosa Wash (EDW)	Palo Verde Utilities WWTP outfall at 33°04'20"/112°01'47" to the Gila River Indian Reservation					A&Wedw		PBC				
SC	Soldier Lake	32°25'34"/110°44'41"		A&Wc				FBC			FC		AgL
SC	Sonoita Creek	Headwaters to the Town of Patagonia WWTP outfall at 31°32'15"/110°45'30"				A&We			PBC				AgL
SC	Sonoita Creek (EDW)	Town of Patagonia WWTP outfall to ~~750~~ permanent groundwater upwelling point approximately 1600 feet downstream of outfall					A&Wedw		PBC				AgL
SC	Sonoita Creek	Below ~~750~~ 1600 feet downstream of Town of Patagonia WWTP outfall to the Santa Cruz River at 31°29'43"/110°58'37"			A&Ww			FBC			FC	AgI	AgL
SC	Split Tank	31°28'15"/111°05'15"			A&Ww			FBC			FC		AgL
SC	Sutherland Wash	Tributary to Cañada del Oro at 32°25'05"/110°55'26"			A&Ww			FBC			FC		
SC	Sycamore Canyon	From 32°21'36" / 110°45'21" to Sycamore Reservoir			A&Ww			FBC			FC		
SC	Sycamore Canyon Creek	Headwaters to the U.S./Mexico border at 31°22'48"/111°13'19"			A&Ww			FBC			FC		AgL
SC	Sycamore Reservoir	32°20'57"/110°44'52"		A&Wc				FBC			FC		AgL
SC	Tanque Verde Creek	Headwaters to Houghton Road at 32°14'13"/110°46'04"			A&Ww			FBC			FC		AgL
SC	Tanque Verde Creek	Below Houghton Road to Rillito Creek at 32°16'08"/110°52'30"				A&We			PBC				AgL
SC	The Lake Tank	32°54'14"/111°04'14"			A&Ww			FBC			FC		AgL
SC	Three R Canyon	Headwaters to ~~Lat/Long:~~ 31°28'35"/110°46'19"				A&We			PBC				AgL
SC	Three R Canyon	From ~~Lat/Long:~~ 31°28'35"/110°46'19" to ~~Lat/Long:~~ 31°28'27"/110°47'12"			A&Ww			FBC			FC		AgL
SC	Three R Canyon	From ~~Lat/Long:~~ 31°28'27"/110°47'12" to Sonoita Creek at 31°29'56"/110°48'54"				A&We			PBC				AgL
SC	Tinaja Wash	~~Eastern foothills, Sierrita Mountains~~ Headwaters to the Santa Cruz River at 31°32'58.4"/111°02'45.7"				A&We			PBC				AgL
SC	Unnamed Wash (EDW)	Oracle Sanitary District WWTP outfall at 32°36'54"/110°48'02" to 5 km downstream					A&Wedw		PBC				
SC	Unnamed Wash	5 km downstream of the Oracle Sanitary District WWTP outfall				A&We			PBC				
SC	Unnamed Wash (EDW)	Arizona City Sanitary District WWTP outfall at 32°45'47"/111°44'20" to confluence with Santa Cruz Wash at 35°45'45"/111°46'43"					A&Wedw		PBC				
SC	Unnamed Wash (EDW)	Saddlebrook WWTP outfall at 32°32'00"/110°52'59" to confluence with Cañada del Oro at 32°30'20"/110°52'27"					A&Wedw		PBC				
SC	Vekol Wash	Those reaches not located on the Ak-Chin, Tohono O'odham and Gila River Indian Reservations				A&We			PBC				

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SC	Wakefield Canyon	Headwaters to confluence with unnamed tributary 31°52'47"/110°26'25"		A&Wc				FBC			FC		AgL
SC	Wakefield Canyon	Below confluence with unnamed tributary to Cienega Creek at 31°52'47.5"/110°26'25"			A&Ww			FBC			FC		AgL
SC	Wild Burro Canyon	Headwaters to confluence with unnamed tributary at 32°28'36"/111°05'18"			A&Ww			FBC			FC		AgL
SC	Wild Burro Canyon	Below confluence with unnamed tributary to Santa Cruz River at 32°28'34"/111°05'15.5"				A&We			PBC				AgL
SC	Williams Ranch Tanks	31°55'15"/110°25'30"			A&Ww			FBC			FC		AgL
SP	Abbot Canyon	Headwaters to confluence with Whitewater Draw at 31°33'32"/109°48'39.6"			A&Ww			FBC			FC		AgL
SP	Aravaipa Creek	Headwaters to confluence with Stowe Gulch at 32°52'10"/110°22'00"			A&Ww			FBC			FC		AgL
SP	Aravaipa Creek ~~(Unique Water)~~ (OAW)	Stowe Gulch confluence to downstream boundary of Aravaipa Canyon Wilderness Area at 32°54'23"/110°33'40"			A&Ww			FBC			FC		AgL
SP	Aravaipa Creek	Below downstream boundary of Aravaipa Canyon Wilderness Area to the San Pedro River at 32°50'20"/110°42'50"			A&Ww			FBC			FC		AgL
SP	Ash Creek	Chiricahua Mountains, near Whitewater Draw at 31°50'28"/109°40'01.2"			A&Ww			FBC			FC	AgI	AgL
SP	Babocomari ~~Creek~~ River	Tributary to the San Pedro River at 31°43'19"/110°11'35"			A&Ww			FBC			FC		AgL
SP	Bass Canyon Creek	Headwaters to confluence with unnamed tributary at 32°26'06"/110°13'18"		A&Wc				FBC			FC		AgL
SP	Bass Canyon Creek	Below confluence with unnamed tributary to Hot Springs Canyon Creek at 32°20'53"/110°15'14"			A&Ww			FBC			FC		AgL
SP	Bass Canyon Tank	32°24'00"/110°13'00"			A&Ww			FBC			FC		AgL
SP	Bear Creek	Headwaters to U.S./Mexico border at 31°19'59"/110°22'58.5"			A&Ww			FBC			FC		AgL
SP	Big Creek	Tributary to Pitchfork Canyon at 32°35'24"/109°57'07"		A&Wc				FBC			FC		AgL
SP	Blacktail Pond	Fort Huachuca Military Reservation at 31°24'13"/110°17'21"			A&Ww			FBC			FC		
SP	Blackwater Draw	Headwaters to the U.S./Mexico border at 31°20'02"/109°15'36" in the San Bernardino Valley			A&Ww			FBC			FC		AgL
SP	Booger Canyon Creek	Tributary to Aravaipa Creek at 32°54'54"/110°29'35"			A&Ww			FBC			FC		AgL
SP	Buck Canyon	Headwaters to Buck Creek Tank at 31°33'06"/109°52'43"			A&Ww			FBC			FC		AgL
SP	Buck Canyon	Below Buck Creek Tank to Dry Creek at 31°31'08"/109°18'25"				A&We			PBC				AgL
SP	Buehman Canyon Creek ~~(Unique Water)~~ (OAW)	Headwaters to confluence with unnamed tributary at 32°24'31.5"/110°32'08"			A&Ww			FBC			FC		AgL
SP	Buehman Canyon Creek	Below confluence with unnamed tributary at 32°25'41"/110°29'53"			A&Ww			FBC			FC		AgL
SP	Bull Tank	32°31'15"/110°12'45"			A&Ww			FBC			FC		AgL
SP	Bullock Canyon	Tributary to Buehman Canyon at 32°23'00"/110°33'04"			A&Ww			FBC			FC		AgL
SP	Carr Canyon Creek	Headwaters to confluence with unnamed tributary at 31°27'00"/110°15'45"		A&Wc				FBC			FC		AgL
SP	Carr Canyon Creek	Below confluence with unnamed tributary to the San Pedro River at 31°30'32"/110°07'37"			A&Ww			FBC			FC		AgL
SP	Copper Creek	Headwaters to confluence with Prospect Canyon at 32°44'48"/110°30'18"			A&Ww			FBC			FC		AgL
SP	Copper Creek	Below confluence with Prospect Canyon to the San Pedro River at 32°41'17"/110°36'43"				A&We			PBC				AgL
SP	Deer Creek	Headwaters to confluence with unnamed tributary at 32°59'56"/110°20'09"		A&Wc				FBC			FC		AgL
SP	Deer Creek	Below confluence with unnamed tributary to Aravaipa Creek at 32°54'25"/110°28'01"			A&Ww			FBC			FC		AgL
SP	Dixie Canyon	Headwaters to Mexican Canyon at 31°29'02"/109°45'04" in the Mule Mountains			A&Ww			FBC			FC		AgL
SP	Double R Canyon Creek	Tributary to Bass Canyon at 32°21'06"/110°14'23"			A&Ww			FBC			FC		
SP	Dry Canyon	Headwaters to Abbot Canyon at 31°33'25"/109°43'23" in the Mule Mountains			A&Ww			FBC			FC		AgL
SP	East Gravel Pit Pond	Fort Huachuca Military Reservation at 31°30'54"/110°19'42"	Sedimentary		A&Ww			FBC			FC		
SP	Espiritu Canyon Creek	Tributary to Soza Wash at 32°18'52"/110°28'35"			A&Ww			FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SP	Fly Pond	Fort Huachuca Military Reservation at 31°32'53"/110°21'14"			A&Ww			FBC			FC		
SP	Fourmile Canyon Creek	Tributary to Aravaipa Creek at 32°50'14"/ 110°20'08"			A&Ww			FBC			FC		AgL
SP	Fourmile Canyon, Left Prong	Headwaters to confluence with unnamed tributary at 32°43'14"/110°23'43"		A&Wc				FBC			FC		AgL
SP	Fourmile Canyon, Left Prong	Below confluence with unnamed tributary to Fourmile Canyon Creek at 32°47'33"/ 110°22'36"			A&Ww			FBC			FC		AgL
SP	Fourmile Canyon, Right Prong	Tributary to Fourmile Canyon at 32°47'33"/ 110°22'36"			A&Ww			FBC			FC		AgL
SP	Gadwell Canyon	Headwaters to Whitewater Draw at 31°36'50"/109°43'41" in the Mule Mountains			A&Ww			FBC			FC		AgL
SP	Garden Canyon Creek	Headwaters to confluence with unnamed tributary at 31°29'00"/110°19'42"		A&Wc				FBC		DWS	FC	AgI	
SP	Garden Canyon Creek	Below confluence with unnamed tributary to the San Pedro River at 31°41'46"/110°12'40"			A&Ww			FBC		DWS	FC	AgI	
SP	Glance Creek	Headwaters to Whitewater Draw at 31°27'04"/109°42'29" in the Mule Mountains			A&Ww			FBC			FC		AgL
SP	Gold Gulch	Headwaters to U.S./Mexico border at 31°20'10"/109°50'06" in the Mule Mountains			A&Ww			FBC			FC		AgL
SP	Golf Course Pond	Fort Huachuca Military Reservation at 31°32'14"/110°18'49"	Sedimentary		A&Ww			~~FBC~~	PBC		FC		
SP	Goudy Canyon Creek	Headwaers to Grant Creek at 32°35'13"/ 109°58'37" in the Pinaleno Mountains		A&Wc				FBC			FC		AgL
SP	Grant Creek	Headwaters to confluence with unnamed tributary at 32°38'09.5"/109°56'35"		A&Wc				FBC		DWS	FC		AgL
SP	Grant Creek	Below confluence with unnamed tributary to terminus near Willcox Playa at 32°33'43"/ 109°58'55"			A&Ww			FBC			FC		AgL
SP	Gravel Pit Pond	Fort Huachuca Military Reservation at 31°30'51"/110°19'47.6"	Sedimentary		A&Ww			FBC			FC		
SP	Greenbrush Draw	From Mexican border to confluence with San Pedro River				A&We			PBC				
SP	Hidden Pond	Fort Huachuca Military Reservation at 32°30'30"/109°22'17"			A&Ww			FBC			FC		
SP	High Creek	Headwaters to confluence with unnamed tributary at 32°33'07"/110°14'40"		A&Wc				FBC			FC		AgL
SP	High Creek	Below confluence with unnamed tributary to terminus near Willcox Playa at 32°31'41"/ 109°02'38"			A&Ww			FBC			FC		AgL
SP	Horse Camp Canyon Creek	Tributary to Aravaipa Creek at 32°55'07"/ 110°30'56"			A&Ww			FBC			FC		AgL
SP	Hot Springs Canyon Creek	Tributary to the San Pedro River at 32°17'24"/ 110°22'55"			A&Ww			FBC			FC		AgL
SP	Johnson Canyon	Headwaters to Whitewater Draw at 31°32'56"/109°46'19" in the Chiricahua Mountains			A&Ww			FBC			FC		AgL
SP	Lake Cochise (EDW)	South of Twin Lakes Municipal Golf Course at 32°13"58"/109°49'25"					A&Wedw		PBC				
SP	Leslie Canyon Creek	Headwaters to Whitewater Draw at 31°32'10"/109°40'12" in the Chiricahua Mountains			A&Ww			FBC			FC		AgL
SP	Lower Garden Canyon Pond	Fort Huachuca Military Reservation			A&Ww			FBC			FC		
SP	Mexican Canyon	Headwaters to Whitewater Draw at 31°29'13"/109°46'30" in the Mule Mountains			A&Ww			FBC			FC		AgL
SP	Miller Canyon Creek	Headwaters to Broken Arrow Ranch Road at 31°25'33"/110°15'08"		A&Wc				FBC		DWS	FC		AgL
SP	Miller Canyon Creek	Below Broken Arrow Ranch Road to the San Pedro River at 31°29'56"/110°07'37"			A&Ww			FBC		DWS	FC		AgL
SP	Moonshine Creek	Tributary to Post Creek at 32°40'52"/ 109°54'25"		A&Wc				FBC			FC		AgL
SP	Mule Gulch	Headwaters to just above the Lavender Pit at 31°26'23.7"/109°45'36.7"			A&Ww				PBC		FC		
SP	Mule Gulch	Just above the Lavender Pit to the Bisbee WWTP outfall at 31°25'30"/109°52'40"				A&We			PBC				
SP	Mule Gulch (EDW)	Below the Bisbee WWTP outfall to the Highway 80 bridge at 31°26'30"/109°49'28"					A&Wedw		PBC				
SP	Mule Gulch	Below the Highway 80 bridge to Whitewater Draw at 31°28'03"/109°42'21"				A&We			PBC				AgL
SP	Oak Grove Creek	Tributary to Turkey Creek at 32°45'32"/ 110°14'06"			A&Ww			FBC			FC		AgL
SP	Officers Club Pond	Fort Huachuca Military Reservation at 31°32'51"/110°21'35"	Sedimentary		A&Ww			~~FBC~~	PBC		FC		
SP	Paige Canyon Creek	Tributary to the San Pedro River at 32°17'10"/ 110°22'48"			A&Ww			FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SP	Parsons Canyon Creek	Tributary to Aravaipa Creek at 32°54'11"/ 110°27'40"			A&Ww			FBC			FC		AgL
SP	Pinery Creek	Headwaters to State Highway 181 at 32°00'24"/109°25'16"		A&Wc				FBC		DWS	FC		AgL
SP	Pinery Creek	Below State Highway 181 to terminus near Willcox Playa at 32°01'05"/109°34'23"			A&Ww			FBC		DWS	FC		AgL
SP	Post Creek	Tributary to Grant Creek at 32°40'05"/ 109°54'58"		A&Wc				FBC			FC	AgI	AgL
SP	Ramsey Canyon Creek	Headwaters to Forest Service Road #110 at 31°27'44"/110°17'27"		A&Wc				FBC			FC	AgI	AgL
SP	Ramsey Canyon Creek	Below Forest Service Road #110 to Carr Wash at 31°30'04"/110°09'11"			A&Ww			FBC			FC	AgI	AgL
SP	Rattlesnake Canyon	Headwaters to confluence with Brush Canyon at 32°38'27"/110°21'24"		A&Wc				FBC			FC		AgL
SP	Rattlesnake Canyon	Below confluence with Brush Canyon to Aravaipa Creek at 32°48'00"/110°17'32"			A&Ww			FBC			FC		AgL
SP	Redfield Canyon Creek	Headwaters to confluence with unnamed tributary at 32°33'39"/110°18'41"		A&Wc				FBC			FC		AgL
SP	Redfield Canyon Creek	Below confluence with unnamed tributary to the San Pedro River at 32°09'32"/110°17'56"			A&Ww			FBC			FC		AgL
SP	Riggs Flat Lake	32°42'27"/109°57'51"	Igneous	A&Wc				FBC			FC	AgI	AgL
SP	Rock Creek	Tributary to Turkey Creek at 31°53'20"/ 109°30'00" Alc						FBC			FC		AgL
SP	Rucker Canyon Creek	Headwaters to Whitewater Draw at 31°44'46"/109°26'06"	Igneous	A&Wc				FBC			FC		AgL
SP	Rucker Canyon Lake	31°46'46"/109°18'30"	Shallow	A&Wc				FBC			FC		AgL
SP	San Pedro River	U.S./ Mexico Border to Redington at 32°25'39"/110°29'33"			A&Ww			FBC			FC	AgI	AgL
SP	San Pedro River	Redington to the Gila River at 32°59'02"/ 110°46'55"			A&Ww			FBC			FC		AgL
SP	Snow Flat Lake	32°39'09"/109°51'52"	Igneous	A&Wc				FBC			FC	AgI	AgL
SP	Soldier Creek	Tributary to Post Creek at 32°40'52"/ 109°54'40"		A&Wc				FBC			FC		AgL
SP	Soldier Creek (EDW)	Fort Huachuca WWTP outfall to unnamed wash at 31°34'48"/110°18'35" to confluence with Soldier Creek to confluence with Babocomari River at 31°39'46"/110°17'24"					A&Wedw		PBC				
SP	Soto Canyon	Headwaters to Dixie Canyon at 31°29'46"/ 109°55'37" in the Mule Mountains			A&Ww			FBC			FC		AgL
SP	Swamp Springs Canyon Creek	Tributary to Redfield Canyon at 32°26'10"/ 110°19'30"			A&Ww			FBC			FC		AgL
SP	Sycamore Pond I	Fort Huachuca Military Reservation at 31°35'12"/110°26'09"	Sedimentary		A&Ww			FBC			FC		
SP	Sycamore Pond II	Fort Huachuca Military Reservation at 31°34'38.6"/110°26'07"	Sedimentary		A&Ww			FBC			FC		
SP	Turkey Creek	Tributary to Aravaipa Creek at 32°53'49"/ 110°26'35"			A&Ww			FBC			FC		AgL
SP	Turkey Creek	Headwaters to confluence with Rock Creek at 31°53'20"/109°30'00"		A&Wc				FBC			FC	AgI	AgL
SP	Turkey Creek	Below confluence with Rock Creek to terminus near Willcox Playa at 31°59'56"/ 109°49'01"			A&Ww			FBC			FC	AgI	AgL
SP	Unnamed Wash (EDW)	Mt. Lemmon WWTP outfall to 0.25 km downstream					A&Wedw		PBC				
SP	Virgus Canyon Creek	Tributary to Aravaipa Creek at 32°54'58"/ 110°31'16"			A&Ww			FBC			FC		AgL
SP	Walnut Gulch	Headwaters to Tombstone WWTP outfall at 31°43'47"/110°04'06"				A&We			PBC				
SP	Walnut Gulch (EDW)	Tombstone WWTP outfall to the confluence of Tombstone Wash at 31°44'02"/110°05'58"					A&Wedw		PBC				
SP	Walnut Gulch	Tombstone Wash to San Pedro River at 31°43'19"/110°11'35"				A&We			PBC				
SP	Ward Canyon Creek	Tributary to Turkey Creek at 31°51'47"/ 109°20'13"		A&Wc				FBC			FC		AgL
SP	Whitewater Draw	Headwaters to confluence with unnamed tributary at 31°20'36"/109°34'46"				A&We			PBC				AgL
SP	Whitewater Draw	Below confluence with unnamed tributary to U.S./Mexico border at 31°20'02"/109°34'44"			A&Ww			FBC			FC		AgL
SP	Willcox Playa	32°08'19"/109°50'59" in the Sulphur Springs Valley	Sedimentary		A&Ww			FBC			FC		AgL
SP	Woodcutters Pond	Fort Huachuca Military Reservation at 31°31'11.5"/110°20'15"	Igneous		A&Ww			FBC			FC		
SR	Ackre (Judge) Lake	33°37'00"/109°20'37"		A&Wc				FBC			FC	AgI	AgL
SR	Apache Lake	33°35'30"/111°20'30"	Deep	~~A&We~~	A&Ww			FBC		DWS	FC	AgI	AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SR	Barnhardt Creek	Headwaters to confluence with unnamed tributary at 34°05'36"/111°26'38"		A&Wc				FBC			FC		AgL
SR	Barnhardt Creek	Below confluence with unnamed tributary to Rye Creek at 34°06'58"/111°21'32"			A&Ww			FBC			FC		AgL
SR	Basin Lake	33°55'00"/109°26'05"	Igneous		A&Ww			FBC			FC		AgL
SR	Bear Creek	Tributary to the Black River at 33°43'26"/109°22'30"		A&Wc				FBC			FC	AgI	AgL
SR	Bear Wallow Creek ~~(UW)~~ (OAW)	Tributary to the Black River at 33°37'44"/109°31'23"		A&Wc				FBC			FC		AgL
SR	Bear Wallow Creek, North Fork ~~(UW)~~ (OAW)	Tributary to Bear Wallow Creek at 33°35'53"/109°26'49"		A&Wc				FBC			FC		AgL
SR	Bear Wallow Creek, South Fork ~~(UW)~~ (OAW)	Tributary to Bear Wallow Creek at 33°35'53"/109°26'49"		A&Wc				FBC			FC		AgL
SR	Beaver Creek	Tributary to the Black River at 33°43'44"/109°21'07"		A&Wc				FBC			FC	AgI	AgL
SR	Big Lake	33°52'45"/109°25'00"	Igneous	A&Wc				FBC		DWS	FC	AgI	AgL
SR	Black River	Tributary to the Salt River at 33°44'20"/110°13'30"		A&Wc				FBC		DWS	FC	AgI	AgL
SR	Black River, East Fork	Tributary to the Black River at 33°45'07"/109°21'43"		A&Wc				FBC		DWS	FC	AgI	AgL
SR	Black River, ~~N~~ North Fork of ~~E~~ East Fork	Tributary to Black River, East Fork at 33°56'17"/109°24'11"		A&Wc				FBC		DWS	FC	AgI	AgL
SR	Black River, West Fork	Tributary to the Black River at 33°45'07"/109°21'43"		A&Wc				FBC		DWS	FC	AgI	AgL
SR	Bloody Tanks Wash	Headwaters to Schultze Ranch at 33°22'29"/110°54'39"				A&We			PBC				AgL
SR	Bloody Tanks Wash	Schultze Ranch to Miami Wash at 33°25'05"/110°50'02"				A&We			PBC				
SR	Boggy Creek	Tributary to the Black River at 33°44'31"/109°26'20"		A&Wc				FBC			FC	AgI	AgL
SR	Boneyard Creek	Tributary to Black River, East Fork at 33°51'22"/109°18'50"		A&Wc				FBC			FC	AgI	AgL
SR	Boulder Creek	Tributary to LaBarge Creek at 33°30'54"/111°24'40"			A&Ww			FBC			FC		
SR	Campaign Creek	Tributary to Roosevelt Lake at 33°37'30"/111°00'04"			A&Ww			FBC			FC		AgL
SR	Canyon Creek	Headwaters to the White Mountain Apache Reservation at 33°57'53"/110°47'00"		A&Wc				FBC		DWS	FC	AgI	AgL
SR	Canyon Lake	33°33'15"/111°26'30"	Deep	~~A&Wc~~	A&Ww			FBC		DWS	FC	AgI	AgL
SR	Centerfire Creek	Tributary to the Black River at 33°42'47"/109°26'17"		A&Wc				FBC			FC	AgI	AgL
SR	Chambers Draw Creek	Tributary to North Fork of the East Fork of Black River~~, N Fork of E Fork~~ at 33°53'03"/109°20'13"		A&Wc				FBC			FC		AgL
SR	Cherry Creek	Headwaters to confluence with unnamed tributary at 34°05'09"/110°56'04"		A&Wc				FBC			FC	AgI	AgL
SR	Cherry Creek	Below unnamed tributary to the Salt River at 33°40'16"/110°48'03.6"			A&Ww			FBC			FC	AgI	AgL
SR	Christopher Creek	Tributary to Tonto Creek at 34°18'36"/111°04'23"		A&Wc				FBC			FC	AgI	AgL
SR	Cold Spring Canyon Creek	Headwaters to confluence with unnamed tributary at 33°49'50"/110°52'55"		A&Wc				FBC			FC		AgL
SR	Cold Spring Canyon Creek	Below confluence with unnamed tributary to Cherry Creek at 33°50'06"/110°51'28.8"			A&Ww			FBC			FC		AgL
SR	Conklin Creek	Tributary to the Black River at 33°41'49"/109°27'36"		A&Wc				FBC			FC	AgI	AgL
SR	Coon Creek	Headwaters to confluence with unnamed tributary at 33°46'42"/110°54'25"		A&Wc				FBC			FC		AgL
SR	Coon Creek	Below confluence with unnamed tributary to the Salt River at 33°39'47"/110°50'24"			A&Ww			FBC			FC		AgL
SR	Corduroy Creek	Tributary to Fish Creek at 33°59'46"/110°17'31"		A&Wc				FBC			FC	AgI	AgL
SR	Coyote Creek	Tributary to the Black River, East Fork at 33°50'53"/109°18'18"		A&Wc				FBC			FC	AgI	AgL
SR	Crescent Lake	33°54'36"/109°25'08"	Shallow	A&Wc				FBC			FC	AgI	AgL
SR	Deer Creek	Tributary to the Black River, East Fork at 33°48'07"/109°19'26"		A&Wc				FBC			FC		AgL
SR	Del Shay Creek	Tributary to Gun Creek at 34°00'22"/111°15'43"			A&Ww			FBC			FC		AgL
SR	Devils Chasm Creek	Headwaters to confluence with unnamed tributary at 33°48'46"/110°52'33"		A&Wc				FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SR	Devils Chasm Creek	Below confluence with unnamed tributary to Cherry Creek at 33°49'34"/110°54'18"			A&Ww			FBC			FC		AgL
SR	Dipping Vat Reservoir	33°55'54"/109°25'15"	Igneous		A&Ww			FBC			FC		AgL
SR	Double Cienega Creek	Tributary to Fish Creek at 33°38'35"/109°22'08"		A&Wc				FBC			FC		AgL
SR	Fish Creek	Tributary to the Black River at 33°42'40"/109°26'31"		A&Wc				FBC			FC	AgI	AgL
SR	Fish Creek	Tributary to the Salt River at 33°34'37"/111°21'11"			A&Ww			FBC			FC		
SR	Gold Creek	Headwaters to confluence with unnamed tributary at 33°59'47"/111°25'07"		A&Wc				FBC			FC		AgL
SR	Gold Creek	Below confluence with unnamed tributary to Tonto Creek at 33°58'55"/111°18'03.6"			A&Ww			FBC			FC		AgL
SR	Gordon Canyon Creek	Headwaters to confluence with Hog Canyon at 34°13'49"/111°00'27"		A&Wc				FBC			FC		AgL
SR	Gordon Canyon Creek	Below confluence with Hog Canyon to Haigler Creek at 34°11'56"/111°03'21"			A&Ww			FBC			FC		AgL
SR	Greenback Creek	Tributary to Tonto Creek at 33°47'38"/111°15'22"			A&Ww			FBC			FC		AgL
SR	Haigler Creek	Headwaters to confluence with unnamed tributary at 34°12'23.5"/111°00'11"		A&Wc				FBC			FC	AgI	AgL
SR	Haigler Creek	Below confluence with unnamed tributary to Tonto Creek at 34°12'54"/111°05'45.6"			A&Ww			FBC			FC	AgI	AgL
SR	Hannagan Creek	Tributary to Beaver Creek at 33°42'07"/109°14'46"		A&Wc				FBC			FC		AgL
SR	Hay Creek ~~(UW)~~ (OAW)	Tributary to the Black River, West Fork at 33°48'32"/109°25'16"		A&Wc				FBC			FC		AgL
SR	Home Creek	Tributary to the Black River, West Fork at 33°45'43"/109°22'48"		A&Wc				FBC			FC		AgL
SR	Horse Creek	Tributary to the Black River, West Fork at 33°45'11"/109°21'50"		A&Wc				FBC			FC		AgL
SR	Horse Camp Creek	Headwaters to confluence with unnamed tributary at 33°53'53"/110°50'10"		A&Wc				FBC			FC		AgL
SR	Horse Camp Creek	Below confluence with unnamed tributary to Cherry Creek at 33°52'08"/110°52'33.6"			A&Ww			FBC			FC		AgL
SR	Horton Creek	Tributary to Tonto Creek at 34°20'24"/111°05'42"		A&Wc				FBC			FC	AgI	AgL
SR	Houston Creek	Tributary to Tonto Creek at 34°07'30"/111°15'25"			A&Ww			FBC			FC		AgL
SR	Hunter Creek	Tributary to Christopher Creek at 34°18'29"/111°01'55"		A&Wc				FBC			FC		AgL
SR	LaBarge Creek	~~Superstition Wilderness Area; tributary~~ Headwaters to Canyon Lake at 33°31'34"/111°25'15.6"			A&Ww			FBC			FC		
SR	Lake Sierra Blanca	33°52'25"/109°16'05"		A&Wc				FBC			FC	AgI	AgL
SR	Miami Wash	Tributary to Pinal Creek at 33°27'04"/110°50'17"				A&We			PBC				
SR	Mule Creek	Tributary to Canyon Creek at 34°16'34"/110°48'00"		A&Wc				FBC		DWS	FC	AgI	AgL
SR	Open Draw Creek	Tributary to the East Fork of Black River~~,~~ ~~East Fork~~ at 33°49'52"/109°18'18"		A&Wc				FBC			FC		AgL
SR	P B Creek	Headwaters to Forest Service Road #203 at 33°57'08"/110°56'09"		A&Wc				FBC			FC		AgL
SR	P B Creek	Below Forest Service Road #203 to Cherry Creek at 33°55'34"/110°54'18"			A&Ww			FBC			FC		AgL
SR	Pinal Creek	Headwaters to confluence with unnamed EDW wash (Globe WWTP) at 33°25'29"/110°48'18"				A&We			PBC				AgL
SR	Pinal Creek (EDW)	~~Below unnamed EDW wash to Radium~~ Globe WWTP outfall on unnamed wash at 33°25'46"/110°47'28" to confluence with Pinal Creek to Radium at 33°26'54"/110°49'02"					A&Wedw		PBC				
SR	Pinal Creek	Radium to ~~Setka Ranch~~ lower Pinal Creek water treatment plant discharge at 33°32'05"/110°52'17"				A&We			PBC				AgL
SR	Pinal Creek	~~Setka Ranch to Salt River~~ Lower Pinal Creek WTP outfall #1 at 33°31'56"/110°52'14" to See Ranch Crossing at 33°32'25"/110°52'28"			~~A&Ww~~		A&Wedw	~~FBC~~	PBC		~~FC~~		~~AgL~~
SR	Pinal Creek	See Ranch Crossing to 33°35'33"/110°54'33"			A&Ww			FBC					
SR	Pinal Creek	From 33°35'33"/110°54'33" to Salt River			A&Ww			FBC			FC		
SR	Pine Creek	Tributary to the Salt River at 33°36'04"/111°12'36"			A&Ww			FBC			FC		
SR	Pinto Creek	Headwaters to confluence with unnamed tributary at 33°19'27"/110°54'56"		A&Wc				FBC			FC	AgI	AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
SR	Pinto Creek	Below confluence with unnamed tributary to Roosevelt Lake at 33°39'11"/111°00'43"			A&Ww			FBC			FC	AgI	AgL
SR	Pueblo Canyon Creek	Headwaters to confluence with unnamed tributary at 33°50'30"/110°53'13"		A&Wc				FBC			FC		AgL
SR	Pueblo Canyon Creek	Below confluence with unnamed tributary to Cherry Creek at 33°52'30"/110°52'55"			A&Ww			FBC			FC		AgL
SR	Reevis Creek	Tributary to Pine Creek at 33°33'07"/ 111°09'40"			A&Ww			FBC			FC		
SR	Reservation Creek	Tributary to the Black River at 33°41'42"/ 109°28'26"		A&Wc				FBC			FC		AgL
SR	Reynolds Creek	Tributary to Workman Creek at 33°52'16"/ 111°00'14"		A&Wc				FBC			FC		AgL
SR	Roosevelt Lake	33°40'45"/111°09'15"	Deep		A&Ww			FBC		DWS	FC	AgI	AgL
SR	Russell Gulch	From headwaters to confluence with Miami Wash				A&We			PBC				
SR	Rye Creek	Tributary to Tonto Creek at 34°01'41"/ 111°17'06"			A&Ww			FBC			FC		AgL
SR	Saguaro Lake	33°34'00"/111°32'06"	Deep	~~A&Wc~~	A&Ww			FBC		DWS	FC	AgI	AgL
SR	Salome Creek	Tributary to the Salt River at 33°41'56"/ 111°05'46"			A&Ww			FBC			FC	AgI	AgL
SR	Salt River	~~Above Roosevelt Lake~~ Confluence of White River and Black River to Roosevelt Lake			A&Ww			FBC			FC	AgI	AgL
SR	Salt River	Theodore Roosevelt Dam to ~~the Verde River~~ 2 km below Granite Reef Dam		~~A&Wc~~	A&Ww			FBC		DWS	FC	AgI	AgL
~~SR~~	~~Salt River~~	~~Verde River to 2 km below Granite Reef Dam~~			~~A&Ww~~			~~FBC~~		~~DWS~~	~~FC~~	~~AgI~~	~~AgL~~
~~SR~~	~~Salt River~~	~~2 km below Granite Reef Dam to I-10 bridge~~				~~A&We~~			~~PBC~~				
~~SR~~	~~Salt River~~	~~I-10 bridge to the 23rd Ave WWTP~~				~~A&We~~			~~PBC~~				
~~SR~~	~~Salt River (EDW)~~	~~23rd Ave WWTP to confluence with Gila River~~					~~A&Wedw~~		~~PBC~~		~~FC~~	~~AgI~~	~~AgL~~
SR	Slate Creek	Tributary to Tonto Creek at 33°56'24"/ 111°18'25"			A&Ww			FBC			FC		AgL
SR	Snake Creek ~~(UW)~~ (OAW)	Tributary to the Black River at 33°40'30"/ 109°28'55"		A&Wc				FBC			FC		AgL
SR	Spring Creek	Tributary to Tonto Creek at 34°09'54"/ 111°10'08"			A&Ww			FBC			FC		AgL
SR	Stinky Creek ~~(UW)~~ (OAW)	Tributary to the Black River, West Fork at 33°51'22"/109°27'07"		A&Wc				FBC			FC		AgL
~~SR~~	~~Tempe Town Lake~~	~~At Mill Avenue Bridge~~			~~A&Ww~~			~~FBC~~			~~FC~~		
SR	Thomas Creek	Tributary to Beaver Creek at 33°42'29"/109°15'11"		A&Wc				FBC			FC		AgL
SR	Thompson Creek	Tributary to the West Fork of the Black River~~, West Fork~~ at 33°53'24"/109°28'48"		A&Wc				FBC			FC		AgL
SR	Tonto Creek	Headwaters to confluence with unnamed tributary at 34°18'10"/111°04'14"		A&Wc				FBC			FC	AgI	AgL
SR	Tonto Creek	Below confluence with unnamed tributary to Roosevelt Lake at 33°45'14"/111°14'17"			A&Ww			FBC			FC	AgI	AgL
SR	Turkey Creek	Tributary to Rock Creek at 33°58'30"/ 111°06'47"		A&Wc				FBC			FC		
SR	Unnamed Wash (EDW)	~~Globe WWTP outfall to Pinal Creek~~ Cobre Valley Plaza WWTP at 33°24'56"/110°49'43" to confluence with Russell Gulch					A&Wedw		PBC				
SR	Wildcat Creek	Tributary to Centerfire Creek at 33°43'41"/ 109°26'28"		A&Wc				FBC			FC		AgL
SR	Willow Creek	Tributary to Beaver Creek at 33°43'52"/ 109°18'04"		A&Wc				FBC			FC		AgL
SR	Workman Creek	Headwaters to confluence with Reynolds Creek at 33°52'17"/111°00'14.5"		A&Wc				FBC			FC	AgI	AgL
SR	Workman Creek	Below confluence with Reynolds Creek to Salome Creek at 33°52'37"/111°02'20"			A&Ww			FBC			FC	AgI	AgL
UG	Apache Creek	Tributary to the Gila River at 32°52'08"/ 109°11'53"			A&Ww			FBC			FC		AgL
UG	Ash Creek	Headwaters to confluence with unnamed tributary at 32°45'37"/109°52'22"		A&Wc				FBC			FC		AgL
UG	Ash Creek	Below confluence with unnamed tributary to Gila River at 32°53'35"/109°47'34.8"			A&Ww			FBC			FC		AgL
UG	Bennett Wash (EDW)	ADOC-Safford WWTP outfall at 32°50'20"/ 109°34'44" to the Gila River					A&Wedw		PBC				
UG	Bitter Creek	Tributary to the Gila River at 32°50'17"/ 109°10'59"			A&Ww			FBC			FC		
UG	Blue River	Headwaters to confluence with Strayhorse Creek at 33°29'02"/110°12'12"		A&Wc				FBC			FC	AgI	AgL
UG	Blue River	Below confluence with Strayhorse Creek to San Francisco River at 33°12'36"/ 109°11'27.6"			A&Ww			FBC			FC	AgI	AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife A&Wc	A&Ww	A&We	A&Wedw	Human Health FBC	PBC	DWS	FC	Agricultural AgI	AgL
UG	Bonita Creek ~~(Unique Water)~~ (OAW)	San Carlos Indian Reservation to the Gila River at 32°53'35"/109°28'41"			A&Ww			FBC		DWS	FC		AgL
UG	Buckalou Creek	Tributary to Castle Creek at 33°43'34"/109°09'07"		A&Wc				FBC			FC		AgL
UG	Campbell Blue Creek	Tributary to the Blue River at 33°43'30"/109°02'46"		A&Wc				FBC			FC		AgL
UG	Castle Creek	Tributary to Campbell Blue Creek at 33°44'06"/109°08'10"		A&Wc				FBC			FC		AgL
UG	Cave Creek ~~(Unique Water)~~ (OAW)	Headwaters to confluence with South Fork Cave Creek at 31°53'04"/109°10'27"		A&Wc				FBC			FC	AgI	AgL
UG	Cave Creek ~~(Unique Water)~~ (OAW)	Below confluence with South Fork Cave Creek to Coronado ~~NF Boundary~~ National Forest boundary			A&Ww			FBC			FC	AgI	AgL
UG	Cave Creek	Below Coronado ~~NF Boundary~~ National Forest boundary to New Mexico border at 31°58'19"/109°03'00"			A&Ww			FBC			FC	AgI	AgL
UG	Cave Creek, South Fork	Tributary to Cave Creek at 31°53'04"/109°10'27"		A&Wc				FBC			FC	AgI	AgL
UG	Chase Creek	Headwaters to the Phelps-Dodge Morenci Mine			A&Ww			FBC			FC		AgL
UG	Chase Creek	Below the Phelps-Dodge Morenci Mine to San Francisco River				A&We			PBC				
UG	Chitty Canyon Creek	Tributary to Salt House Creek at 33°30'32"/109°24'04"		A&Wc				FBC			FC		AgL
UG	Cima Creek	Tributary to Cave Creek at 31°52'19"/109°14'02"		A&Wc				FBC			FC		AgL
UG	Cluff Ranch Pond #1	32°48'55"/109°49'15"	Sedimentary		A&Ww			FBC			FC	AgI	AgL
UG	Cluff Ranch Pond #2	32°49'15"/109°50'33"	Sedimentary		A&Ww			FBC			FC	AgI	AgL
UG	Cluff Ranch Pond #3	32°48'20"/109°51'43"	Sedimentary		A&Ww			FBC			FC	AgI	AgL
UG	Coleman Creek	Tributary to Campbell Blue Creek at 33°44'20"/109°09'32"		A&Wc				FBC			FC		AgL
UG	Dankworth Ponds	32°43'15"/109°42'15"	Sedimentary	A&Wc				FBC			FC		
UG	Deadman Canyon Creek	Headwaters to confluence with unnamed tributary at 32°43'50"/109°49'01"		A&Wc				FBC		DWS	FC		AgL
UG	Deadman Canyon Creek	Below confluence with unnamed tributary to confluence with Graveyard Wash at 32°46'48"/109°44'13"			A&Ww			FBC		DWS	FC		AgL
UG	Eagle Creek	Headwaters to confluence with unnamed tributary at 33°23'24"/109°29'35"		A&Wc				FBC		DWS	FC	AgI	AgL
UG	Eagle Creek	Below confluence with unnamed tributary to Eagle Creek at 32°57'36"/109°24'21.6"			A&Ww			FBC		DWS	FC	AgI	AgL
UG	East Eagle Creek	Tributary to Eagle Creek at 33°29'38"/109°28'05"		A&Wc				FBC			FC		AgL
UG	East Turkey Creek	Headwaters to confluence with unnamed tributary at 31°58'22"/109°12'17"		A&Wc				FBC			FC		AgL
UG	East Turkey Creek	Below confluence with unnamed tributary to terminus near San Simon River at 31°59'53"/109°07'37"			A&Ww			FBC			FC		AgL
UG	East Whitetail	Headwaters to terminus near San Simon River at 32°08'52"/109°09'25" in the Chiricahua Mountains			A&Ww			FBC			FC		AgL
UG	Emigrant Canyon	Headwaters to terminus near San Simon River at 32°17'02"/109°20'27.6" in the Chiricahua Mountains			A&Ww			FBC			FC		AgL
UG	Evans Pond	32°49'15"/109°51'15"	Sedimentary		A&Ww			FBC			FC		
UG	Fishhook Creek	Tributary to the Blue River at 33°35'13"/109°10'01"		A&Wc				FBC			FC		AgL
UG	Foote Creek	Tributary to the Blue River at 33°35'24"/109°08'49"		A&Wc				FBC			FC		AgL
UG	Frye Canyon Creek	Headwaters to Frye Mesa Reservoir at 32°45'09.5"/109°50'02"		A&Wc				FBC		DWS	FC		AgL
UG	Frye Canyon Creek	Below Frye Mesa Reservoir to Highline Canal Headwaters to terminus near San Simon River at 32°50'10"/109°45'43"			A&Ww			FBC			FC		AgL
UG	Frye Mesa Reservoir	32°45'13"/109°50'00"	Igneous	A&Wc				FBC		DWS	FC		
UG	Gibson Creek	Tributary to Marijilda Creek at 32°41'24"/109°48'11"		A&Wc				FBC			FC		AgL
UG	Gila River	New Mexico border to the San Carlos Indian Reservation at 33°05'37"/110°03'21"			A&Ww			FBC			FC	AgI	AgL
UG	Grant Creek	Tributary to the Blue River at 33°34'16"/109°10'37"		A&Wc				FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
UG	Judd Lake	33°51'15"/109°09'15"	Sedimentary	A&Wc				FBC			FC		
UG	K P Creek ~~(UW)~~ (OAW)	Tributary to the Blue River at 33°31'44"/109°12'04"		A&Wc				FBC			FC		AgL
UG	Lanphier Canyon Creek	Tributary to the Blue River at 33°35'42"/109°07'52"		A&Wc				FBC			FC		AgL
UG	Little Blue Creek	Headwaters to confluence with Dutch Blue Creek at 33°24'26.5"/109°09'18"		A&Wc				FBC			FC		AgL
UG	Little Blue Creek	Below confluence with Dutch Blue Creek to Blue Creek at 32°22'30"/109°10'30"			A&Ww			FBC			FC		AgL
UG	Little Creek	Tributary to the San Francisco River at 33°49'41"/109°04'26"		A&Wc				FBC			FC		
UG	Lower George's Reservoir	33°51'23.5"/109°08'28"	Sedimentary	A&Wc				FBC			FC		AgL
UG	Luna Lake	33°49'45"/109°05'15"	Sedimentary	A&Wc				FBC			FC		AgL
UG	Marijilda Creek	Headwaters to confluence with Gibson Creek at 32°41'23"/109°48'13"		A&Wc				FBC			FC		AgL
UG	Marijilda Creek	Below confluence with Gibson Creek to Stockton Wash at 32°46'30"/109°40'51.6"			A&Ww			FBC			FC	AgI	AgL
UG	Markham Creek	Tributary to the Gila River at 32°56'17"/109°53'13"			A&Ww			FBC			FC		AgL
UG	Pigeon Creek	Tributary to the Blue River at 33°16'08"/109°11'42"			A&Ww			FBC			FC		AgL
UG	Raspberry Creek	Tributary to the Blue River at 33°30'07"/109°12'32"		A&Wc				FBC			FC		
UG	Roper Lake	32°45'20"/109°42'11"	Sedimentary		A&Ww			FBC			FC		
UG	San Francisco River	Headwaters to the New Mexico border at 33°49'24.5"/109°02'46"		A&Wc				FBC			FC	AgI	AgL
UG	San Francisco River	New Mexico border to the Gila River at 33°14'25"/109°02'49"			A&Ww			FBC			FC	AgI	AgL
UG	San Simon River	Tributary to the Gila River at 32°49'52"/109°38'53"				A&We			PBC				AgL
UG	Sheep Tank	32°46'15"/109°48'08"	Sedimentary		A&Ww			FBC			FC		AgL
UG	Smith Pond	32°49'09"/109°50'26"	Sedimentary		A&Ww			FBC			FC		
UG	Squaw Creek	Tributary to Thomas Creek at 33°23'38"/109°12'22"		A&Wc				FBC			FC		AgL
UG	Stone Creek	Tributary to the San Francisco River at 33°50'38"/109°02'46"		A&Wc				FBC			FC	AgI	AgL
UG	Strayhorse Creek	Tributary to the Blue River at 33°29'02"/109°12'11"		A&Wc				FBC			FC		
UG	Thomas Creek	Headwaters to confluence with Rousensock Creek at 33°23'45"/109°13'13"		A&Wc				FBC			FC		AgL
UG	Thomas Creek	Below confluence with Rousensock Creek to Blue River at 33°23'20"/109°11'20"			A&Ww			FBC			FC		AgL
UG	Tinny Pond	33°47'49"/109°04'23"	Sedimentary		A&Ww			FBC			FC		AgL
UG	Turkey Creek	Tributary to Campbell Blue Creek at 33°44'10"/109°04'05"		A&Wc				FBC			FC		AgL
UG	Unnamed Wash (EDW)	ADOC-Globe WWTP outfall at 33°24'55"/110°42'35" to the San Carlos Indian Reservation					A&Wedw		PBC				
VR	American Gulch	Headwaters to the Northern Gila County Sanitary District WWTP outfall (Payson) at 34°14'05"/111°22'18"			A&Ww			FBC			FC	AgI	AgL
VR	American Gulch (EDW)	Northern Gila County Sanitary District WWTP outfall (Payson) to the East Verde River at 34°14'42"/111°25'08"					A&Wedw		PBC				
VR	Apache Creek	Tributary to Walnut Creek at 34°55'12"/112°50'42"			A&Ww			FBC			FC		AgL
VR	Ashbrook Wash	Headwaters to the ~~Ft~~ Fort McDowell Reservation at 33°36'54"/111°42'06"				A&We			PBC				
VR	Aspen Creek	Tributary to Granite Creek at 34°31'55"/112°28'19"			A&Ww			FBC			FC		
VR	Bar Cross Tank	35°00'40"/112°05'34"			A&Ww			FBC			FC		AgL
VR	Barrata Tank	35°02'43"/112°24'17"			A&Ww			FBC			FC		AgL
VR	Bartlett Lake	33°49'00"/111°37'45"	Deep		A&Ww			FBC		DWS	FC	AgI	AgL
VR	Beaver Creek	Tributary to the Verde River at 34°34'26"/111°51'14"			A&Ww			FBC			FC		AgL
VR	Big Chino Wash	Tributary to Sullivan Lake at 34°52'37"/112°28'37"				A&We			PBC				AgL
VR	Bitter Creek	Headwaters to the Jerome WWTP outfall at 34°45'08"/112°06'25"				A&We			PBC				AgL
VR	Bitter Creek (EDW)	Jerome WWTP outfall to the Yavapai Apache Indian Reservation at 34°45'45.5"/112°04'44"					A&Wedw		PBC				AgL
VR	Bitter Creek	Below the Yavapai Apache Indian Reservation to the Verde River at 34°46'37"/112°02'53"			A&Ww			FBC			FC	AgI	AgL
VR	Black Canyon Creek	Headwaters to confluence with unnamed tributary at 34°39'20"/112°05'05"		A&Wc				FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
VR	Black Canyon Creek	Below confluence with unnamed tributary to the Verde River at 34°40'59"/111°57'28.8"			A&Ww			FBC			FC		AgL
VR	Bonita Creek	Tributary to Ellison Creek at 34°20'56"/ 111°14'20"		A&Wc				FBC			FC		
VR	Bray Creek	Tributary to Webber Creek at 34°22'37"/ 111°20'53"		A&Wc				FBC			FC		AgL
VR	Camp Creek	Tributary to the Verde River at 33°45'32"/ 111°30'14"			A&Ww			FBC			FC		AgL
VR	Carter Tank	34°52'27"/112°57'28"			A&Ww			FBC			FC		AgL
VR	Cereus Wash	Headwaters to the Fort McDowell Indian Reservation at 33°34'13"/111°42'28"				A&We			PBC				
VR	Chase Creek	Tributary to the East Verde River at 34°22'48"/111°16'59"		A&Wc				FBC		DWS	FC		
VR	Clover Creek	Tributary to headwaters of West Clear Creek at 34°33'04"/111°24'11"		A&Wc				FBC			FC		AgL
VR	~~Coffe~~ Coffee Creek	Tributary to Spring Creek at 34°48'18"/ 111°55'41"			A&Ww			FBC			FC		AgL
VR	Colony Wash	Headwaters to the Fort McDowell Indian Reservation at 33°35'42"/111°42'15"				A&We			PBC				
VR	Dead Horse Lake	34°45'00"/112°00'30"	Shallow	~~A&Wc~~	A&Ww			FBC			FC		
VR	Deadman Creek	Tributary to Horseshoe Reservoir at 34°00'00"/111°42'36"			A&Ww			FBC			FC		AgL
VR	Del Rio Dam Lake	34°48'55"/112°28'00"	Sedimentary		A&Ww			FBC			FC		AgL
VR	Dry Beaver Creek	Tributary to Beaver Creek at 34°37'59"/ 111°49'34"			A&Ww			FBC			FC	AgI	AgL
VR	Dry Creek (EDW)	Sedona Ventures WWTP outfall at 34°50'45"/ 111°52'15" to confluence with Dry Creek at 34°50'31"/111°52'39"					A&Wedw		PBC				
VR	Dude Creek	Tributary to the East Verde River at 34°23'06"/111°16'26"		A&Wc				FBC			FC	AgI	AgL
VR	East Verde River	Headwaters to confluence with Ellison Creek at 34°21'10"/111°16'47.5"		A&Wc				FBC		DWS	FC	AgI	AgL
VR	East Verde River	Below confluence with Ellison Creek to the Verde River at 34°17'02"/111°40'19"			A&Ww			FBC		DWS	FC	AgI	AgL
VR	Ellison Creek	Tributary to the East Verde River at 34°21'11"/111°16'48"		A&Wc				FBC			FC		AgL
VR	Fossil Creek	Tributary to the Verde River at 34°18'22"/ 111°40'30"			A&Ww			FBC			FC		AgL
VR	Fossil Springs (OAW)	34°25'24"/111°34'25"			A&Ww			FBC		DWS	FC		
VR	Foxboro Lake (OAW)	34°53'48"/111°40'00"			A&Ww			FBC			FC		AgL
VR	Fry Lake	35°03'45"/111°48'02"			A&Ww			FBC			FC		AgL
VR	Gap Creek	Headwaters to Government Spring at 34°23'23"/111°50'53.5"		A&Wc				FBC			FC		AgL
VR	Gap Creek	Below Government Spring to the Verde River at 34°24'50"/111°46'51.6"			A&Ww			FBC			FC		AgL
VR	Garrett Tank	35°18'57"/112°42'16"			A&Ww			FBC			FC		AgL
VR	Goldwater Lake, Lower	34°29'55"/112°27'18"	Sedimentary	A&Wc				FBC		DWS	FC		
VR	Goldwater Lake, Upper	34°29'51"/112°26'55"	Igneous	A&Wc				FBC		DWS	FC		
VR	Granite Basin Lake	34°37'01"/112°42'16"	Igneous	A&Wc	~~A&Ww~~			FBC			FC	AgI	AgL
VR	Granite Creek	Headwaters to ~~confluence with Willow Creek~~ Watson Lake at ~~34°36'55"/112°25'05"~~ 34°35'15"/112°25'05"		A&Wc				FBC			FC	AgI	AgL
VR	Granite Creek	Below ~~confluence with Willow Creek~~ Watson Lake to the Verde River at 34°52'54"/ 112°25'05"			A&Ww			FBC			FC	AgI	AgL
VR	Heifer Tank	35°20'28"/112°32'56"			A&Ww			FBC			FC		AgL
VR	Hell Canyon Tank	35°05'00"/112°24'06"	Igneous		A&Ww			FBC			FC		AgL
VR	Homestead Tank	35°21'23"/112°41'32"	Igneous		A&Ww			FBC			FC		AgL
VR	Horse Park Tank	34°58'15"/111°36'29"			A&Ww			FBC			FC		AgL
VR	Horseshoe Res-ervoir	33°59'00"/111°42'30"	Sedimentary		A&Ww			FBC			FC	AgI	AgL
VR	Houston Creek	Tributary to the Verde River at 34°16'55"/ 111°41'06"			A&Ww			FBC			FC		AgL
VR	J.D. Dam Lake	35°04'01"/112°01'40"	Shallow	A&Wc				FBC			FC	AgI	AgL
VR	Jacks Canyon Wash	Headwaters to Big Park WWTP outfall at 34°45'32"/111°45'10"				A&We			PBC				
VR	Jacks Canyon Wash (EDW)	Big Park WWTP outfall to Dry Beaver Creek at 34°44'28"/111°46'01"					A&Wedw		PBC				
VR	Lime Creek	Tributary to Horseshoe Reservoir at 33°59'20"/111°44'13"			A&Ww			FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES

~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
VR	McLellan Reservoir	35°13'15"/112°17'05"	Igneous		A&Ww			FBC			FC	AgI	AgL
VR	Meath Dam Tank	35°07'46"/112°27'35"			A&Ww			FBC			FC		AgL
VR	Mullican Place Tank	34°44'16"/111°36'08"	Igneous		A&Ww			FBC			FC		AgL
VR	Oak Creek ~~(Unique Water)~~ (OAW)	Headwaters to confluence with unnamed tributary at 34°57'08.5"/111°45'13"		A&Wc				FBC		DWS	FC	AgI	AgL
VR	Oak Creek ~~(Unique Water)~~ (OAW)	Below confluence with unnamed tributary at 34°57'08.5"/111°45'13" to Verde River			A&Ww			FBC		DWS	FC	AgI	AgL
VR	Oak Creek, West Fork ~~(Unique Water)~~ (OAW)	Tributary to Oak Creek at 34°59'13"/ 111°44'46"		A&Wc				FBC			FC		AgL
VR	Odell Lake	34°56'02"/111°37'52"	Igneous	A&Wc				FBC			FC		
VR	Peck's Lake	34°47'07"/112°02'30"	Shallow	~~A&Wc~~	A&Ww			FBC			FC	AgI	AgL
VR	Perkins Tank	35°06'42"/112°04'08"	Shallow	A&Wc				FBC			FC		AgL
VR	Pine Creek	Headwaters to confluence with unnamed tributary at 34°21'51"/111°26'46"		A&Wc				FBC		DWS	FC	AgI	AgL
VR	Pine Creek	Below confluence with unnamed tributary to East Verde River at 34°13'19"/111°29'27.6"			A&Ww			FBC		DWS	FC	AgI	AgL
VR	Red Creek	Tributary to the Verde River at 34°09'47"/ 111°43'12"			A&Ww			FBC			FC		AgL
VR	Red Lake	35°12'19"/113°03'55"	Sedimentary		A&Ww			FBC			FC		AgL
VR	Reservoir #1	35°13'05"/111°50'07"	Igneous		A&Ww			FBC			FC		
VR	Reservoir #2	35°13'16"/111°50'36"	Igneous		A&Ww			FBC			FC		
VR	Roundtree Canyon Creek	Tributary to Tangle Creek at 34°09'04"/ 111°48'18"			A&Ww			FBC			FC		AgL
VR	Scholze Lake	35°11'53"/112°00'31"	Igneous	A&Wc	~~A&Ww~~			FBC			FC		AgL
VR	Spring Creek	Headwaters to confluence with unnamed tributary at 34°57'23.5"/111°57'19"		A&Wc				FBC			FC	AgI	AgL
VR	Spring Creek	Below confluence with unnamed tributary at 34°44'38"/111°54'19" to Oak Creek			A&Ww			FBC			FC	AgI	AgL
VR	Steel Dam Lake	35°13'36"/112°24'51"	Igneous	A&Wc				FBC			FC		AgL
VR	Stehr Lake	34°21'59"/111°40'00"	Sedimentary		A&Ww			FBC			FC		AgL
VR	Stone Dam Lake	35°13'36"/112°24'16"		A&Wc				FBC			FC	AgI	AgL
VR	Stoneman Lake	34°46'44"/111°31'05"	Shallow	A&Wc				FBC			FC	AgI	AgL
VR	Sullivan Lake	34°51'46"/112°27'41"			A&Ww			FBC			FC	AgI	AgL
VR	Sycamore Creek	Headwaters to confluence with unnamed tributary at 35°03'40"/111°57'28"		A&Wc				FBC			FC	AgI	AgL
VR	Sycamore Creek	Below confluence with unnamed tributary to Verde River at 34°51'47"/112°04'41"			A&Ww			FBC			FC	AgI	AgL
VR	Sycamore Creek	Tributary to Verde River at 33°37'55"/ 111°39'58"			A&Ww			FBC			FC	AgI	AgL
VR	Sycamore Creek	Tributary to Verde River at 34°04'42"/ 111°42'14"			A&Ww			FBC			FC		AgL
VR	Tangle Creek	Tributary to ~~the~~ Verde River at 34°05'06"/ 111°42'36"			A&Ww			FBC			FC	AgI	AgL
VR	Trinity Tank	35°27'44"/112°47'56"			A&Ww			FBC			FC		AgL
VR	Unnamed Wash	Flagstaff Meadows WWTP outfall at 36°14'17"/111°49'28" to Volunteer Wash at 35°11'55"/111°49'42"					A&Wedw		PBC				
VR	Verde River	Above Bartlett Dam from confluence of Chino Wash and Granite Creek to Bartlett Lake			A&Ww			FBC			FC	AgI	AgL
VR	Verde River	Below Bartlett Lake Dam to Salt River			A&Ww			FBC		DWS	FC	AgI	AgL
VR	Walnut Creek	Tributary to Big Chino Wash at 34°58'12"/ 112°34'55"			A&Ww			FBC			FC		AgL
VR	Watson Lake	34°35'15"/112°25'05"	Igneous		A&Ww			FBC			FC	AgI	AgL
VR	Webber Creek	Tributary to the East Verde River at 34°18'50"/111°19'55"		A&Wc				FBC			FC		AgL
VR	West Clear Creek	Headwaters to confluence with Meadow Canyon at 34°33'40"/111°31'30"		A&Wc				FBC			FC		AgL
VR	West Clear Creek	Below confluence with Meadow Canyon to the Verde River at 34°30'14"/111°49'41"			A&Ww			FBC			FC	AgI	AgL
VR	Wet Beaver Creek	Headwaters to unnamed springs at 34°41'17"/ 111°34'34"		A&Wc				FBC			FC	AgI	AgL
VR	Wet Beaver Creek	Below unnamed springs to Dry Beaver Creek at 34°37'59"/111°49'33.6"			A&Ww			FBC			FC	AgI	AgL
VR	Whitehorse Lake	35°07'00"/112°00'47"	Igneous	A&Wc				FBC		DWS	FC	AgI	AgL
VR	Williamson Valley Wash	Headwaters to confluence with Mint Wash at 34°49'05"/112°37'55"				A&We			PBC				AgL
VR	Williamson alley Wash	Confluence of Mint Wash to 10.5 km ~~dwnstm~~ downstream at 34°49'05"/111°37'55"			A&Ww			FBC			FC		AgL

APPENDIX B. SURFACE WATERS AND DESIGNATED USES													
~~BASIN~~ Watershed	~~SEGMENT~~ Surface Waters	~~LOCATION~~ Segment Description and Location (Latitude and Longitudes are in NAD 27)	Lake Category	Aquatic and Wildlife				Human Health				Agricultural	
				A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	AgL
VR	Williamson Valley Wash	Below 10.5 km downstream of Mint Wash confluence to Big Chino Wash at 32°52'52"/ 112°28'48"				A&We			PBC				AgL
VR	Williscraft Tank	35°11'23"/112°35'38"			A&Ww			FBC			FC		AgL
VR	Willow Creek	~~Tributary to Granite Creek at 34°51'47"/ 112°25'52"~~ Above Willow Creek Reservoir	Shallow	A&Wc				FBC			FC		AgL
VR	Willow Creek	Below Willow Creek Reservoir to confluence with Granite Creek			A&Ww			FBC			FC		AgL
VR	Willow Creek Reservoir	34°36'17"/112°26'19"	Shallow		A&Ww			FBC			FC	AgI	AgL
VR	Willow Valley Lake	34°41'08"/111°19'57"	Sedimentary		A&Ww			FBC			FC		AgL
~~WP~~	~~Big Creek~~	~~Tributary to Pitchfork Canyon at 32°35'24"/ 109°57'07"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~Goudy Canyon Creek~~	~~Pinaleno Mountains~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~Grant Creek~~	~~Headwaters to confluence with unnamed tributary at 32°38'09.5"/109°56'35"~~		~~A&Wc~~				~~FBC~~		~~DWS~~	~~FC~~		~~AgL~~
~~WP~~	~~Grant Creek~~	~~Below confluence with unnamed tributary~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~High Creek~~	~~Headwaters to confluence with unnamed tributary at 32°33'07"/110°14'40"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~High Creek~~	~~Below confluence with unnamed tributary~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~Lake Cochise~~	~~South of Twin Lakes Municipal Golf Course at 32°14' N / 109°11' W~~					~~A&Wedw~~		~~PBC~~				
~~WP~~	~~Moonshine Creek~~	~~Tributary to Post Creek at 32°40'52"/ 109°54'25"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~Pinery Creek~~	~~Headwaters to State Highway 181 at 32°00'24"/109°25'16"~~		~~A&Wc~~				~~FBC~~		~~DWS~~	~~FC~~		~~AgL~~
~~WP~~	~~Pinery Creek~~	~~Below State Highway 181~~			~~A&Ww~~			~~FBC~~		~~DWS~~	~~FC~~		~~AgL~~
~~WP~~	~~Post Creek~~	~~Tributary to Grant Creek at 32°40'05"/ 109°54'58"~~		~~A&Wc~~				~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~WP~~	~~Riggs Flat Lake~~	~~32°42'27"/109°57'51"~~		~~A&Wc~~				~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~WP~~	~~Rock Creek~~	~~Tributary to Turkey Creek at 31°53'20"/ 109°30'00"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~Snow Flat Lake~~	~~32°39'09"/109°51'52"~~		~~A&Wc~~				~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~WP~~	~~Soldier Creek~~	~~Tributary to Post Creek at 32°40'52"/ 109°54'40"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~Turkey Creek~~	~~Headwaters to confluence with Rock Creek at 31°53'20"/109°30'00"~~		~~A&Wc~~				~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~WP~~	~~Turkey Creek~~	~~Below confluence with Rock Creek~~			~~A&Ww~~			~~FBC~~			~~FC~~	~~AgI~~	~~AgL~~
~~WP~~	~~Ward Canyon Creek~~	~~Tributary to Turkey Creek at 31°51'47"/ 109°20'13"~~		~~A&Wc~~				~~FBC~~			~~FC~~		~~AgL~~
~~WP~~	~~Willcox Playa~~	~~Sulphur Springs Valley~~			~~A&Ww~~			~~FBC~~			~~FC~~		~~AgL~~

Watersheds
BW = Bill Williams
CG = Colorado – Grand Canyon
CL = Colorado – Lower Gila
LC = Little Colorado
MG = Middle Gila
SC = Santa Cruz – Rio Magdelena – Rio Sonoyta
SP = San Pedro – Willcox Playa – Rio Yaqui
SR = Salt River
UG = Upper Gila
VR = Verde River

Other Abbreviations
WWTP = Wastewater Treatment Plant
Km = kilometers

Appendix C. ~~Repealed~~ Site-specific Standards

APPENDIX C. SITE-SPECIFIC STANDARDS				
Watershed	**Surface Water**	**Surface Water Description & Location**	**Parameter**	**Site-Specific Criterion**
LC	Rio de Flag (EDW)	Flagstaff WWTP outfall to the confluence with San Francisco Wash at 35°14'04"/111°28'02.5"	Copper (D)	36 µg/L

APPENDIX C. SITE-SPECIFIC STANDARDS

Watershed	**Surface Water**	**Surface Water Description & Location**	**Parameter**	**Site-Specific Criterion**
CL	Yuma East Wetlands	From inlet culvert from Colorado River into restored channel to Ocean bridge	Selenium (T) Total residual chlorine	2.2 mg/L 33 µg/L (A&Ww acute) 20 µg/L (A&Ww chronic)