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APR 11 3 42 PM '01

Agency Receipt

NOTICE OF RULEMAKING DOCKET OPENING

1. **Agency name:** Arizona Department of Environmental Quality

2. **Title and its heading:** Title 18. Environmental Quality

Chapter and its heading: Chapter 11. Water Quality Standards

Subchapter and its heading (if applicable): Not applicable

Article and its heading: Article 1. Water Quality Standards for Surface Waters

Sections Affected:	**Action**
R18-11-101	Amend
R18-11-102	Amend
R18-11-104	Amend
R18-11-105	Amend
R18-11-106	Amend
R18-11-107	Amend
R18-11-108	Amend
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	Repeal
R18-11-118	Amend
R18-11-120	Amend
R18-11-121	Amend
R18-11-122	Amend
R18-11-123	Amend
Appendix A	Amend
Appendix B	Amend

5-4-01 Register

R01-166

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   Chapter and its heading: Chapter 11. Water Quality Standards

   Subchapter and its heading (if applicable): Not applicable

   Part and its heading (if applicable): Not applicable

   Article and its heading: Article 1. Water Quality Standards for Surface Waters

   Section numbers: R18-11-101 through R18-11-123, Appendices A and B.

2. **The subject matter of the proposed rule:** A.R.S. §49-202(A) designates the Arizona Department of Environmental Quality [ADEQ] as the state agency for all purposes of the Clean Water Act. As the responsible state agency in Arizona, ADEQ must implement the requirements of §303(c) of the Clean Water Act. §303 of the Clean Water Act imposes a duty on ADEQ to conduct a triennial review of water quality standards, and, as appropriate, adopt or modify the standards. This rulemaking will satisfy the Clean Water Act requirement to conduct a triennial review. ADEQ is considering revisions to virtually every rule in Article 1, including changes to definitions, applicability, designated uses, the "tributary rule," antidegradation, numeric and narrative water quality standards, salinity standards for the Colorado River, unique waters, effluent dependent waters, mixing zones, nutrient waivers, enforcement, the numeric water quality criteria listed in Appendix A, and the list of surface waters and designated uses in Appendix B.

~~3.~~ **Agency docket number (if applicable):** ~~Not applicable~~

not necessary to include unless a docket number is referenced.

~~4.~~ 3. **A citation to all published notices relating to the proceeding:** None

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

4. Mr. Steven Pawlowski

Arizona Department of Environmental Quality

3033 N. Central Avenue

Phoenix, Arizona 85012

Telephone Number: (602) 207-4219

E-Mail: pawlowski.steven@ev.state.az.us

~~6.~~5. **The time during which the agency will accept written comments and the time and place where written comments may be made:** ADEQ will accept written comments on the proposed surface water quality standards rules. The time and place where written comments may be made will be specified in the Notice of Proposed Rulemaking.

~~7.~~6. **A timetable for agency decisions or other action on the proceeding, if known:** The tentative schedule for the rulemaking to amend the surface water quality standards rules is as follows:

Publication of Notice of Proposed Rulemaking: May, 2001

Oral proceedings: June, 2001

Close of public comment period: July 20, 2001

Consideration of final rules by Governor's Regulatory Review Council: December, 2001

Effective rules: January, 2002

NOTICE OF RULEMAKING DOCKET OPENING

Arizona Department of Environmental Quality

1. **Title and its heading:** Title 18. Environmental Quality

   Chapter and its heading: Chapter 11. Water Quality Standards

   Subchapter and its heading (if applicable): Not applicable

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   Section numbers: R18-11-101 through R18-11-123, Appendices A and B.

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3. **Agency docket number (if applicable):** Not applicable

4. **A citation to all published notices relating to the proceeding:** None

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Effective rules: January, 2002

4-14

RW-122 Reg

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MAR 21 2 03 PM '00

SECRETARY OF STATE

NOTICE OF RULEMAKING DOCKET OPENING

Arizona Department of Environmental Quality

1. **Title and its heading:** Title 18. Environmental Quality

   Chapter and its heading: Chapter 11. Water Quality Standards

   Subchapter and its heading (if applicable): Not applicable

   Part and its heading (if applicable): Not applicable

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3. **Agency docket number (if applicable):** Not applicable

4. **A citation to all published notices relating to the proceeding:** None

DEBORAH –

Here's the original Notice of Rulemaking Docket Opening for Ch. 11, Art. 1. It was filed w. / Sec. of State on 3/21/00.

Steve

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

Mr. Steven Pawlowski

Arizona Department of Environmental Quality

3033 N. Central Avenue

Phoenix, Arizona 85012

Telephone Number: (602) 207-4219

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RW-122 Reg

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   Article and its heading: Article 1. Water Quality Standards for Surface Waters

   Section numbers: R18-11-101 through R18-11-123, Appendices A and B.

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3. **Agency docket number (if applicable):** Not applicable

4. **A citation to all published notices relating to the proceeding:** None

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

Mr. Steven Pawlowski

Arizona Department of Environmental Quality

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Phoenix, Arizona 85012

Telephone Number: (602) 207-4219

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Oral proceedings: June, 2000

Close of public comment period: July, 2000

Consideration of final rules by Governor's Regulatory Review Council: December, 2000

Effective rules: January, 2001

R01-125

FILED

2001 MAR 16 P 2:52

SECRETARY OF STATE

NOTICE OF PROPOSED RULEMAKING

TITLE 18. ENVIRONMENTAL QUALITY

CHAPTER 11. DEPARTMENT OF ENVIRONMENTAL QUALITY

WATER QUALITY STANDARDS

PREAMBLE

1.

Sections Affected	Rulemaking Action
R18-11-101	Amend
R18-11-102	Amend
R18-11-104	Amend
R18-11-105	Amend
R18-11-106	Amend
R18-11-107	Amend
R18-11-108	Amend
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	Repeal
R18-11-118	Amend
R18-11-120	Amend
R18-11-121	Amend
R18-11-122	Amend
R18-11-123	Amend

Agency Certificate

1. **Agency Name:** Arizona Department of Environmental Quality

2. **Chapter Heading:** Chapter 11. Department of Environmental Quality

   Water Quality Standards

3. **Code citation for the Chapter:** 18 A.A.C. 11

4. **The Subchapters if applicable; the Articles; the Parts if applicable; and the Sections involved in the rulemaking; listed in alphabetical and numerical order:** Article 1. Surface Water Quality Standards

Subchapters, Articles, Parts and Sections	Action
R18-11-101	Amend
R18-11-102	Amend
R18-11-104	Amend
R18-11-105	Amend
R18-11-106	Amend
R18-11-107	Amend
R18-11-108	Amend
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	Repeal
R18-11-118	Amend
R18-11-120	Amend
R18-11-121	Amend
R18-11-122	Amend
R18-11-123	Amend

Appendix A	Amend
Appendix B	Amend

5. **The rules contained in this package are true and correct as proposed.**

6. _____ _____ 3/12/01

Signature of Agency Chief Executive Officer	**Date of signing**
Jacqueline E. Schafer	**Director**
Printed or typed name of signer	**Title of signer**

Agency Receipt

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2001 MAR 16 P 2:46

SECRETARY OF STATE

NOTICE OF PROPOSED RULEMAKING

1. **Agency name:** Arizona Department of Environmental Quality

2. **Title and its heading:** Title 18. Environmental Quality

Chapter and its heading: Chapter 11. Water Quality Standards

Subchapter and its heading (if applicable): Not applicable

Article and its heading: Article 1. Water Quality Standards for Surface Waters

Sections Affected:	**Action**
R18-11-101	Amend
R18-11-102	Amend
R18-11-104	Amend
R18-11-105	Amend
R18-11-106	Amend
R18-11-107	Amend
R18-11-108	Amend
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	Repeal
R18-11-118	Amend
R18-11-120	Amend
R18-11-121	Amend
R18-11-122	Amend
R18-11-123	Amend
Appendix A	Amend
Appendix B	Amend

A

5-4-01 Register
R01-125

FILED

2001 MAR 16 P 2:52

SECRETARY OF STATE

Agency Certificate

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2. **Chapter Heading:** Chapter 11. Department of Environmental Quality Water Quality Standards

3. **Code citation for the Chapter:** 18 A.A.C. 11

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R18-11-110	Amend
R18-11-111	Amend
R18-11-112	Amend
R18-11-113	Amend
R18-11-114	Amend
R18-11-115	Amend
R18-11-118	Repeal
R18-11-120	Amend
R18-11-121	Amend
R18-11-122	Amend
R18-11-123	Amend

AZ DEPT OF ENVIRONMENTTAL QUALITY
MAY 14 2001
WATER QUALITY DIVISION

Appendix A	Amend
Appendix B	Amend

5. **The rules contained in this package are true and correct as proposed.**

6. _____ _____ 3/12/01

Signature of Agency Chief Executive Officer	**Date of signing**
Jacqueline E. Schafer	**Director**
Printed or typed name of signer	**Title of signer**

NOTICE OF PROPOSED RULEMAKING

TITLE 18. ENVIRONMENTAL QUALITY

CHAPTER 11. DEPARTMENT OF ENVIRONMENTAL QUALITY

WATER QUALITY STANDARDS

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R18-11-110	Amend
R18-11-111	Amend
R18-11-112	Amend
R18-11-113	Amend
R18-11-114	Amend
R18-11-115	Repeal
R18-11-118	Amend
R18-11-120	Amend
R18-11-121	Amend
R18-11-122	Amend
R18-11-123	Amend

Appendix A	Amend
Appendix B	Amend

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

Authorizing statute:	§49-202(A), §49-203(A)(1), and §49-221
Implementing statute:	§49-222

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

Name:	Mr. Steven Pawlowski
Address:	3033 N. Central Avenue, MO 301C, Phoenix, Arizona 85012-2809
Telephone Number:	(602) 207-4219
Fax Number:	(602) 207-4528
E-Mail:	pawlowski.steven@ev.state.az.us

4. **An explanation of the rules, including the agency's reasons for initiating the rules:**

The Clean Water Act Requires That ADEQ Initiate a Water Quality Standards Rulemaking

Almost 30 years ago, Congress enacted landmark legislation to prevent water pollution in the nation's waters. This legislation was the Federal Water Pollution Control Act Amendments of 1972 (1972 FWPCA). The 1972 FWPCA and its subsequent amendments are commonly known as the Clean Water Act. In the Clean Water Act, Congress directed states to adopt water quality standards for "waters of the United States" located within the states' jurisdictions.

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

1. §303(c) defines a water quality standard as the designated uses of a surface water and the water quality criteria necessary to support those uses [*See* §303(c)(2)(A)].

2. A state must consider the use of surface waters for public water supply, propagation of fish and wildlife, recreation, agricultural uses, industrial uses, and navigation when it establishes water quality standards [*See* §303(c)(2)(A)].

3. State-adopted water quality standards must protect the public health and welfare, enhance the quality of water, and "serve the purposes of the Clean Water Act" [*See* §303(c)(2)(A)].

4. States must review their water quality standards at least once every 3 years using a process that includes public participation [*See* §303(c)(1)].

5. The U.S. Environmental Protection Agency (EPA) reviews state-adopted water quality standards. §303(c) provides authority for the federal promulgation of a water quality standard if EPA determines that a state-adopted water quality standard is inconsistent with applicable requirements of the Clean Water Act or EPA determines that a federal water quality standard is necessary to meet the requirements of the Clean Water Act [*See* §303(c)(2)(A), §303(c)(3) and §303(c)(4)].

6. States are required to adopt water quality criteria for toxic pollutants listed under §307(a)(1) of the Clean Water Act for which EPA has published national criteria guidance if the presence of a toxic pollutant in a surface water could reasonably be expected to interfere with the designated uses of a surface water. The 126 toxic pollutants listed under §307(a)(1) of the Clean Water Act are called the priority pollutants. Water quality criteria for priority pollutants must be numeric criteria (except where numeric criteria are unavailable). If numeric criteria for a priority pollutant are unavailable, then a state must adopt water quality criteria based on biological monitoring or assessment methods consistent with EPA guidance [*See* §303(c)(2)(B) and §304(A)(8)].

§303(c) of the Clean Water Act requires that Arizona establish surface water quality standards and review them every three years. This review process is known as the triennial review.

State Law Requires That ADEQ Initiate a Water Quality Standards Rulemaking

A.R.S. §49-202(A) designates the Arizona Department of Environmental Quality [ADEQ] as the state agency for all purposes of the Clean Water Act. As the responsible state agency in Arizona, ADEQ must implement the requirements of §303(c) of the Clean Water Act stated above. ADEQ has a duty to conduct the triennial review of surface water quality standards, and, as appropriate, adopt or modify the standards.

Arizona law requires that ADEQ adopt or modify water quality standards through a rulemaking process [*See* A.R.S. § 49-203 and § 49-221]. § 49-203(A)(1) states that ADEQ shall adopt, by rule, water quality standards in accordance with legislative guidelines prescribed by Title 49, Chapter 2, Article 2 of the Arizona Revised Statutes. Title 49, Chapter 2, Article 2 of the Arizona Revised Statutes addresses water quality standards. §49-221 addresses water quality standards generally and § 49-222 specifically addresses water quality standards for "navigable waters" [*See* discussion of the applicability of water quality standards to "waters of the United States," "navigable waters," and "surface waters" later in this preamble]. § 49-221(A) requires ADEQ to adopt water quality standards by rulemaking for all navigable waters to preserve and protect water quality for all present and reasonably foreseeable future uses. § 49-221(C) states that ADEQ must consider the following factors when the agency establishes water quality standards:

1. The protection of the public health and the environment;
2. The uses which have been made, are being made, or with reasonable probability may be made of surface waters;
3. The provisions and requirements of the Clean Water Act and Safe Drinking Water Act and the federal regulations adopted pursuant to those acts;
4. The degree to which standards for one category of waters [e.g., surface water] could cause violations of standards for other, hydrologically-connected water categories [e.g., groundwater];
5. Guidelines, action levels, or other numeric criteria adopted or recommended by EPA or any other federal agency; and
6. Any unique, physical, biological, or chemical properties of the waters.

Arizona law requires that surface water quality standards be expressed in terms of the uses to be protected. There is a statutory preference for numeric water quality standards if adequate information exists to establish a numeric standard. ADEQ also has authority to adopt any narrative water quality standard that ADEQ deems appropriate [*See* A.R.S. § 49-221(D)].

§ 49-222 prescribes legislative guidelines for the surface water quality standards program, restating some of the language in § 303(c)(2)(A) of the Clean Water Act. § 49-222(A) requires that surface water quality standards assure water quality, if attainable, that provides for protecting the public health and welfare. § 49-222(A), like § 303(c)(2)(A) of the Clean Water Act, says that the state's water quality standards shall enhance the quality of the water taking into consideration its use and value for public water supplies, the propagation of fish and wildlife, and for recreational, agricultural, industrial, and other purposes, including navigation.

§ 49-222(B) requires that ADEQ adopt numeric water quality standards for surface waters for each toxic pollutant listed by EPA pursuant to § 307 of the Clean Water Act [that is, for each of the 126 priority pollutants]. The law states that when ADEQ establishes numeric water quality standards, ADEQ may consider the effect of local water quality characteristics on the toxicity of specific pollutants, the varying sensitivities of local affected aquatic populations to toxic pollutants, and the extent to which the natural flow of the stream is intermittent or ephemeral resulting in a stream where the in-stream flow consists mostly of treated wastewater effluent. However, ADEQ may not establish a numeric water quality standard that is inconsistent with the Clean Water Act [*See* § 49-222(C)].

The purposes of the water quality standards program

Water quality standards are one of the cornerstones of the Clean Water Act and they play a central role in the successful implementation of Arizona's water quality management programs. Water quality standards define the water quality goals for surface waters in Arizona. They designate the uses to be protected in Arizona's surface waters and they prescribe the criteria that ADEQ determines are necessary to maintain and protect water quality for the designated uses. Water quality standards provide the regulatory basis for establishing water quality-based

discharge limitations and other discharge controls in NPDES permits for point source discharges to surface waters. These water quality-based discharge limitations may be more stringent than technology-based effluent limitations for point sources that EPA prescribes in federal effluent guidelines regulations that implement the Clean Water Act. The water quality standards also provide the regulatory basis for establishing wasteload allocations and load allocations in total maximum daily load (TMDL) analyses. Water quality standards provide the basis for the implementation of best management practices (BMPs) to control nonpoint sources of pollution and for measuring the effectiveness of the BMPs. Finally, water quality standards provide the "yardstick" by which ADEQ assesses the water quality status of Arizona's rivers, streams, and lakes.

Water quality standards are established to "serve the purposes" of the Clean Water Act. These purposes are set forth in § 101 of the Clean Water Act. The primary objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Congress articulated two ambitious goals in the Clean Water Act to achieve the primary objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. First, Congress set a goal of eliminating completely the discharge of pollutants into the waters of the United States. Second, Congress prohibited the discharge of toxic pollutants in toxic amounts to those waters [*See* § 101(a)(1) and (3)]. While great progress has been made in improving water quality in the nation's waters since the enactment of the Clean Water Act, neither of the two ambitious national goals set forth in § 101 have been achieved within the original deadlines prescribed in the Clean Water Act.

Congress also set forth an interim water quality goal to achieve, wherever attainable, a level of surface water quality that provides for: 1) the protection and propagation of fish, shellfish, and wildlife, and 2) recreation in and on the water. This interim water quality goal is known as the "fishable, swimmable" goal of the Clean Water Act [*See* § 101(a)(2)]. In 1972, Congress envisioned that all of the waters of the United States should be fishable and swimmable wherever that level of water quality was attainable. The "fishable, swimmable" goal of the Clean Water Act has had a significant impact on Arizona's surface water quality standards. It has had a major impact on the

types of designated uses that have been established for surface waters in Arizona and the stringency of the water quality criteria that are prescribed to maintain and protect water quality for the designated uses.

Summary of major issues for this triennial review

ADEQ considers revisions to the state's surface water quality standards in the triennial review. Water quality standards revisions may take many forms, including additions or modifications to designated uses, changes to water quality criteria, revisions to the state's antidegradation policy, new unique water or effluent dependent water classifications, and changes to general policies such as variances, nutrient waivers, and mixing zones. ADEQ has identified the following issues for consideration in this triennial review:

1. ADEQ proposes to revise the current definitions for "aquatic and wildlife (cold water fishery)," "aquatic and wildlife (warm water fishery)," "ephemeral water," and "effluent dependent water." ADEQ also proposes to add new definitions for "perennial surface water," "intermittent surface water," and "pollutant."
2. ADEQ proposes to revise the tributary rule at R18-11-105 as follows:
    a. ADEQ proposes to repeal references in R18-11-105(2) to unlisted tributaries that are effluent dependent waters (EDWs). Under current state law, an EDW can be classified only through the rulemaking process. Consequently, every EDW in Arizona is specifically listed in the surface water quality standards rules. ADEQ proposes to delete R18-11-105(2) because it is impossible to have an *unlisted* tributary that is classified as an EDW.
    b. ADEQ proposes to clarify how the tributary rule applies to perennial and intermittent streams that are above and below 5000 feet in elevation. The current tributary rule assigns designated uses to unlisted tributaries that are neither ephemeral waters nor effluent dependent waters and that have salmonids present [*See* R18-11-105(3)]. ADEQ proposes to repeal the language in R18-11-105(3) that refers to an "unlisted tributary that is not an ephemeral water or an effluent dependent water and which has salmonids present." ADEQ intends to revise this subsection of the tributary rule to clarify that it applies to unlisted tributaries that are perennial and intermittent surface waters. ADEQ proposes to conform the rule to proposed changes to the definitions of "aquatic and

wildlife (cold water)" and "aquatic and wildlife (warm water)." The proposed tributary rule reads: "The full body contact recreation, aquatic and wildlife (cold water), and fish consumption standards apply to a perennial or intermittent tributary that is above 5000 feet in elevation."

c. ADEQ proposes to make similar revisions to part of the tributary rule that assigns designated uses to unlisted tributaries that are neither ephemeral nor effluent dependent waters and that do not have salmonids present [*See* R18-11-105(4)]. Again, ADEQ proposes to repeal language that refers to an "unlisted tributary that is not an ephemeral water or an effluent dependent water and which does not have salmonids present" and clarify that R18-11-105(4) applies to unlisted tributaries that are perennial or intermittent surface waters. The proposed rule states: "The full body contact recreation, aquatic and wildlife (warm water), and fish consumption standards apply to a perennial or intermittent tributary that is below 5000 feet in elevation."

d. ADEQ proposes to repeal the part of the current tributary rule that applies the nearest downstream surface water quality standards to unlisted tributaries that are neither ephemeral waters or EDWs.

4. ADEQ proposes to repeal the part of the antidegradation rule at R18-11-107(D) that extends Tier 3 antidegradation protection to *proposed* unique waters. The new rule states at R18-11-107(D) that Tier 3 antidegradation protection applies only to surface waters that are actually classified as unique waters through the rulemaking process.

5. ADEQ proposes to amend R18-11-108 (A)(4), the narrative standard which states that a surface water shall be free from pollutants in amounts or combinations that cause off-flavor in aquatic organisms or waterfowl. ADEQ proposes to repeal the reference to "or waterfowl" in this narrative standard because of the lack of practical implementation procedures to determine compliance with that part of the narrative standard.

6. ADEQ proposes to amend the current narrative standard that addresses bottom deposits. ADEQ proposes to adopt language to clarify that the narrative standard is intended to prevent bottom deposits that impair aquatic life designated uses. ADEQ proposes to repeal language in the current standard that relates to the impairment of recreational uses because of the lack of objective criteria to determine when there is

impairment of a recreational use and the lack of practical procedures to implement that part of the narrative standard.

7. ADEQ proposes to adopt a new narrative standard to address excessive concentrations of suspended solids in a surface water that impair a domestic water source use.

8. ADEQ proposes to revise the current numeric water quality standards for bacteria as follows:

   a. ADEQ proposes to repeal the current fecal coliform criteria for the domestic water source (DWS), partial body contact (PBC), aquatic and wildlife uses (A&Wc, A&Ww, A&Wedw, and A&We), agricultural irrigation (AgI), and agricultural livestock watering (AgL) designated uses. ADEQ proposes to repeal the fecal coliform criteria because: 1) ADEQ questions the scientific basis of the current fecal coliform criteria for these designated uses, 2) microbiological water quality will be maintained and protected because *E. coli* criteria will apply to all surface waters through the FBC and PBC designated uses, and 3) the repeal of the fecal coliform criteria will eliminate unnecessary and redundant monitoring requirements.

   b. ADEQ proposes to adopt new *E. coli* criteria for the PBC designated use. The new *E. coli* criteria replace the current fecal coliform criteria for PBC.

   c. ADEQ proposes to establish the following *E. coli* criteria for the FBC and PBC designated uses: 1) A geometric mean of 126 cfu / 100 ml for both the FBC and PBC designated uses, and 2) a single sample maximum concentration of 235 cfu / 100 ml for the FBC designated use, and 3) a single sample maximum concentration of 576 cfu / 100 ml for the PBC designated use.

   d. ADEQ proposes to repeal the fecal coliform criteria for EDWs. EDWs will be protected by *E. coli* criteria that ADEQ proposes to apply to surface waters with the PBC designated use.

9. ADEQ proposes to revise the water quality standard for temperature at R18-9-109(E) to clarify that the criterion for "maximum change in temperature due to discharge" applies only to thermal discharges and it does not apply to storm water discharges. ADEQ proposes to revise footnote 4 at the end of R18-11-109 to state that the maximum temperature change criterion due to discharge does not apply to wastewater treatment plants that discharge to an EDW *or to storm water discharges*.

10. ADEQ proposes to repeal the numeric criteria for turbidity in R18-11-109(D) that are established to maintain and protect water quality for aquatic life designated uses. Instead ADEQ proposes to adopt a new numeric criterion for suspended sediment concentration (SSC) in R18-11-109(F) to protect aquatic life. The proposed SSC criterion is intended to apply at or near base flow and does not apply to a surface water at times when there is elevated flow that is in direct response to a precipitation event.

11. ADEQ proposes to add a subsection to R18-11-110 to incorporate by reference the Colorado River Salinity Control Forum plan of implementation.

12. ADEQ proposes to revise the unique waters rule at R18-11-112 to clarify the eligibility, nomination, and decision-making procedures and to include additional factors that ADEQ will consider when making decisions regarding unique water nominations and classifications. ADEQ received 37 nominations for unique waters classification in this triennial review. ADEQ is proposing 10 surface waters for classification as unique waters. The 10 surface waters proposed for classification as unique waters are:
1) Lee Valley Creek (above Lee Valley Lake) in the Little Colorado River watershed; 2) Bear Wallow Creek 3) North Fork of Bear Wallow Creek, 4) South Fork of Bear Wallow Creek, 5) Snake Creek, 6) Stinky Creek, 7) Hayground Creek, and 8) West Fork of the Black River in the Salt River watershed; 9) Upper Cienega Creek in the Santa Cruz River watershed; and 10) KP / Cienega Creek in the Upper Gila River watershed. ADEQ decided not to propose Pinto Creek, Lower Haunted Canyon Creek, and 25 other streams that were nominated for unique waters classification. Finally, ADEQ decided not to revise the current listing of Peeple's Canyon Creek as a unique water as requested by the Bureau of Land Management.

13. ADEQ proposes to revise the current definition of "effluent dependent water" by repealing the word, "primarily," in the current definition. ADEQ proposes to add Lake Cochise as an EDW and to revise the EDW description of Queen Creek in R18-11-113. Finally, ADEQ proposes to adopt a site-specific standard for dissolved copper of 36 μg / L for the Rio de Flag.

15. ADEQ proposes to revise the mixing zone rule at R18-11-114. The current mixing zone rule prohibits acute toxicity in a mixing zone [*See* R18-11-114(F)]. A complete prohibition of acute toxicity is inconsistent with current EPA guidance on mixing zones and the concept of a zone of passage that is currently allowed by

the state mixing zone rule at R18-11-114 (I). ADEQ also proposes to make changes to the administrative procedures that apply to requests for a mixing zone. The current rule states that mixing zones are established by order of the Director. ADEQ will clarify that mixing zones are established as part of a NPDES permit for a point source discharge to a surface water and not by administrative order. Finally, ADEQ proposes a prohibition against mixing zones for persistent, bioaccumulative pollutants, including : chlordane, DDD, DDE, DDT, dieldrin, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, mercury, PCBs, TCDD 2,3,7,8 (dioxin), and toxaphene. ADEQ also will prohibit mixing zones for cadmium.

15. ADEQ proposes to repeal the nutrient waiver rule at R18-11-115.

16. ADEQ proposes to repeal R18-11-118(B) that relates to dams and flood control structures. R18-11-118(B) states that nothing in the surface water quality standards rules "shall be construed to require a person who operates a dam or flood control structure to operate the structure to cure or mitigate an exceedance of a water quality standard caused by another person." This provision is an unnecessary restatement of R18-11-118(C). In ADEQ's opinion, the only way that an operator of a dam or flood control structure may cure or mitigate a water quality standard violation caused by another person is by releasing water. This is already covered by R18-11-118(C).

17. ADEQ proposes to amend R18-11-120(C). ADEQ proposes to revise language in the current rule that relates to the determination of compliance with chronic aquatic and wildlife criteria. The current rule states that compliance with chronic aquatic and wildlife criteria shall be determined from the arithmetic mean of the analytical results of grab samples collected over a period of 4 consecutive days at a minimum rate of one grab sample per day. It is impractical for ADEQ to determine compliance with chronic A&W criteria under the current rule because ADEQ staff cannot stay at a sampling site for 4 consecutive days to collect the requisite number of samples. The proposed rule states that ADEQ will determine compliance with chronic aquatic and wildlife criteria from the geometric mean of the analytical results of the last 4 samples taken provided the samples are taken at least 24 hours apart.

19. ADEQ proposes to amend the language in R18-11-121(B) that prohibits a schedule of compliance for a new point source. ADEQ proposes to authorize schedules of compliance for new and recommencing point

sources. The proposed rule is consistent with the federal NPDES permit regulation that addresses schedules of compliance for new and recommencing point source dischargers at 40 CFR §122.47. A schedule of compliance for a new point source is authorized only when one is necessary to allow a reasonable opportunity to attain compliance with a water quality standard that is issued after commencement of construction but less than 3 years before commencement of discharge. A schedule of compliance for a recommencing discharger is authorized when necessary to allow a reasonable opportunity to attain compliance with a water quality standard that has been issued or revised less than 3 years before recommencement of discharge.

19. ADEQ proposes to amend the variance rule at R18-11-122 to authorize a variance from a water quality standard on the ground that human-caused conditions or sources of pollution prevent attainment of a water quality standard and the conditions or sources cannot be remedied within 5 years or it would cause more environmental damage to correct the conditions or sources than to leave them in place. The proposed ground for a variance is based upon an assumption that attainment of the water quality standard can ultimately be achieved and that the human-caused conditions or sources of pollution can be remediated. The additional ground for a variance is consistent with EPA guidance on variances and is based on one of the grounds for use attainability analysis identified by EPA in 40 CFR §131.10(g)(3).

21. ADEQ proposes to amend R18-11-123 to prohibit the discharge of sewage from vessels to Lake Powell.

22. Proposed revisions to Appendix A:

    a. ADEQ proposes to clarify the current sulfide standards that are established to protect the aquatic and wildlife designated uses. The current sulfide criteria are found in Appendix A, Table 2 of the surface water quality standards rules. A sulfide criterion of 100 mg / L has been established to prevent acute toxicity to aquatic organisms. This criterion applies to all surface waters and it does not distinguish between lentic systems (lakes, reservoirs, and ponds) and lotic systems (rivers and streams). ADEQ proposes to clarify the sulfide standard for lakes by adding a footnote to explain that the sulfide water quality criterion of 100 mg/L applies only to water samples that are taken from the epilimnion, or the upper layer of a lake or reservoir.

b. ADEQ proposes to add tables to Appendix A for certain hardness-dependent and pH-dependent parameters. The current acute and chronic aquatic and wildlife criteria for cadmium, chromium III, copper, lead, nickel, pentachlorophenol, silver, and zinc are expressed as mathematical equations that factor in the hardness or pH of the receiving surface water to derive a numeric water quality criterion. The numeric criteria for these parameters are not presented in the current rules. The applicable numeric criterion must be calculated using mathematical equations that are difficult for the average person to understand or use. ADEQ proposes to calculate the criteria for a range of hardness and pH values and present the derived criteria in a series of tables to make the standards more understandable and "user-friendly."

c. ADEQ proposes to repeal the current aquatic and wildlife chronic toxicity criteria that are established for ephemeral waters.

d. ADEQ proposes to revise the numeric water quality criteria for the partial body contact designated use. ADEQ proposes to use a modified FBC methodology to derive criteria for PBC.

e. ADEQ proposes to update the human health and aquatic and wildlife criteria in Appendix A using current human health effects (i.e., updated reference doses and cancer potency slopes) and toxicity data.

f. ADEQ proposes to update the aquatic life criteria for ammonia for A&Wc and A&Ww to be consistent with EPA's 1999 Update of the Ambient Water Quality Criteria for Ammonia.

23. Proposed revisions to Appendix B:

a. ADEQ proposes to revise the aquatic and wildlife designated uses for A&W (cold water) and A&W (warm water) using the 5000 foot elevation as a predictive model for aquatic life use designation. Research conducted by ADEQ's biocriteria program shows that perennial streams above 5000 feet in elevation generally have cold water macroinvertebrate communities and those that are below 5000 feet in elevation generally have warm water macroinvertebrate communities. ADEQ proposes to use this information to refine the current A&Wc and A&Ww use designations for surface waters listed in Appendix B.

b. ADEQ proposes to add Tempe Town Lake and establish designated uses for it in Appendix B.

c. ADEQ proposes to revise the designated uses for Davidson Canyon. Davidson Canyon is incorrectly listed as an ephemeral water in Appendix B.

d. ADEQ proposes to add the domestic water source (DWS) designated use to Canyon Lake in the Salt River basin and Lake Pleasant in the Middle Gila River basin.

e. ADEQ will review surface waters with the partial body contact recreation (PBC) designated use to determine if there is any new information which indicates that the full body contact recreation (FBC) designated use is an attainable use.

Each of these issues is discussed in more detail in the following sections of the preamble. The discussion of issues in the preamble is organized by the numeric order of the surface water quality standards rules, starting with issues related to definitions in R18-11-101 and ending with issues related to the list of surface waters and their designated uses in Appendix B

Definitions [R18-11-101]

The terms that are used in the surface water quality standards rules are defined in R18-11-101. ADEQ proposes to revise the current definitions for "aquatic and wildlife (cold water fishery)," "aquatic and wildlife (warm water fishery)," "ephemeral water," and "effluent dependent water." ADEQ also proposes to add new definitions for "perennial surface water," "intermittent surface water," and "pollutant."

a. Revision of the definitions of aquatic and wildlife (cold water fishery) and aquatic and wildlife (warm water fishery)

ADEQ proposes to change the definitions of "aquatic and wildlife (cold water fishery)" ("A&Wc") and "aquatic and wildlife (warm water fishery)" ("A&Ww") to "aquatic and wildlife (cold water)" and "aquatic and wildlife (warm water)" respectively. The current definition of "aquatic and wildlife (cold water fishery) is:

> Aquatic and wildlife (cold water fishery) means the use of a surface water by animals, plants, or other organisms, including salmonids, for habitation, growth, or propagation [*See* R18-11-101(7)].

The current definition of "aquatic and wildlife (warm water fishery)" is similar:

> Aquatic and wildlife (warm water fishery) means the use of a surface water by animals, plants, or other organisms, excluding salmonids, for habitation, growth, or propagation [*See* R18-11-101 (10)].

Both aquatic life designated uses currently are defined by the presence or absence of salmonid species (e.g., trout). The use of the presence or absence of salmonids to define the A&Wc and A&Ww aquatic life designated uses is problematic for two reasons. First, not all cold surface waters contain salmonids but they do contain aquatic life and should be protected by A&Wc standards. Second, statewide data on the distribution of salmonid species in Arizona surface waters is lacking. ADEQ has relied on data supplied by the Arizona Game and Fish Department, the U.S. Fish and Wildlife Service, or anecdotal data to support the current A&Wc and A&Ww use designations. For many surface waters, it is not known whether salmonids are or are not present. Research conducted by the ADEQ Biocriteria Program on the distribution of bottom-dwelling aquatic invertebrates (i.e., benthic macroinvertebrates) in wadeable, perennial streams indicates that benthic macroinvertebrate communities are a better indicator of whether A&Wc or A&Ww water quality standards should apply to a surface water [*See* Spindler, Patti, "Macroinvertebrate Community Distribution Among Reference Sites in Arizona," Open File Report 00-05, Biocriteria Program, Arizona Department of Environmental Quality, October, 2000].

The findings of the report cited above are based on benthic macroinvertebrate data collected over 3 years at 89 reference sites statewide. 329 different taxa were collected in 240 bioassessments. Community patterns among the 89 reference sites were described using three multi-variate statistical methods: 1) de-trended correspondence analysis, 2) cluster analysis, and 3) discriminant function analysis. Statistical analyses of the bioassessment data resulted in the identification of two broad macroinvertebrate community types in Arizona. Elevation was consistently identified as the most important environmental variable explaining the two community types. ADEQ

found that a warm water macroinvertebrate community inhabits wadeable, perennial streams in Arizona that are at elevations of 5000 feet or less. A cold water macroinvertebrate community inhabits wadeable, perennial streams that are at elevations of 5000 feet or more. The warm water macroinvertebrate community is uniquely adapted to floods and droughts in Arizona's arid landscape and consists of a resilient community that is taxonomically poorer than the cold water community. The cold water macroinvertebrate community is taxonomically richer and resembles benthic macroinvertebrate communities found in Rocky Mountain streams of other western states. All small- to medium-sized perennial streams in the state are predicted to be one of these two general macroinvertebrate community types.

The macroinvertebrate community is a better indicator of the A&Wc and A&Ww designated uses because: 1) All perennial surface waters contain benthic macroinvertebrates, and 2) ADEQ has now collected data statewide on the distribution of benthic macroinvertebrates in wadeable, perennial steams. Statistical analyses of data collected by the ADEQ biocriteria program show that there are identifiable differences between the benthic macroinvertebrate communities of cold and warm water streams. The data also show that there is a transition from cold water to warm water macroinvertebrate communities at approximately the 5000 foot elevation. ADEQ proposes to use the results of this research to refine the A&Wc and A&Ww designated uses in the state. ADEQ believes that the use of macroinvertebrate communities is a more scientifically defensible way to assign the A&Wc and A&Ww designated uses than the presence or absence of salmonids.

ADEQ proposes to change the name of "aquatic and wildlife (cold water fishery)" to "aquatic and wildlife (cold water)." The purpose of this change is to clarify that the A&Wc designated use applies to surface waters that support fish populations and those that do not support fish populations. The proposed rule defines "aquatic and wildlife (cold water) as follows:

> "Aquatic and wildlife (cold water)" means the use of a surface water by animals, plants, or other cold water organisms, generally occurring at elevations greater than 5000 feet for habitation, growth, or propagation.

ADEQ proposes similar changes to the definition of the "aquatic and wildlife (warm water fishery) designated use. ADEQ proposes to change the name of the designated use to "aquatic and wildlife (warm water)" to clarify that the designated use is not limited to surface waters that support fisheries. The designated use also applies to surface waters that do not support fish populations. ADEQ proposes to define "aquatic and wildlife (warm water) as follows:

> "Aquatic and wildlife (warm water)" means the use of a surface water by animals, plants, or other warm water organisms, generally occurring at elevations less than 5000 feet for habitation, growth, or propagation.

b. Revision of the definition of "effluent dependent water"

ADEQ proposes to change the definition of "effluent dependent water" (EDW) at R18-11-101(21). The current definition states that an EDW is "a surface water that consists *primarily* of discharges of treated wastewater which has been classified as an effluent dependent water by the Director under R18-11-113." The word, "primarily," in this definition is vague. It is not clear from the definition whether a surface water can be classified as an EDW if more than 50% of the flow in a surface water consists of treated wastewater (that is, the flow consists *primarily* of discharges of treated wastewater). ADEQ proposes to revise the definition of "effluent dependent water" to clarify that an EDW is a surface water whose flow consists of treated wastewater and sometimes storm water. Under the proposed definition, an EDW is defined as an ephemeral water that contains flow because of the discharge of treated wastewater. An EDW also may contain flow from storm water runoff that is in direct response to precipitation.

ADEQ wants to clarify that a low flow perennial surface water with an existing A&Wc or A&Ww aquatic life designated use cannot be classified as A&Wedw through the EDW classification process. A wastewater treatment plant that discharges treated wastewater to a perennial surface water with an A&Wc or A&Ww designated use must comply with the applicable water quality standards that apply to the receiving water, even where the resulting flow in the receiving surface water consists "primarily" of treated wastewater. ADEQ wants to clarify that a surface water can be classified as an EDW only when the receiving surface water is an ephemeral water in the absence of the

discharge of treated wastewater. ADEQ proposes to define "effluent dependent water" as follows:

21. "Effluent dependent water" means a surface water that consists ~~primarily~~ of discharges of treated wastewater ~~which has been~~ 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 discharge of treated wastewater, would be an ephemeral water.

c. *Addition of definitions for "perennial surface water" and "intermittent surface water"*

ADEQ proposes to add definitions for "perennial surface water" and "intermittent surface water." ADEQ proposes to add new definitions for these terms to support proposed revisions to the tributary rule and to distinguish intermittent waters from ephemeral waters. As discussed elsewhere in this preamble, ADEQ is considering revisions to the tributary rule at R18-11-105 to establish water quality standards for unlisted tributaries depending on whether they are: 1) ephemeral waters, 2) perennial and intermittent surface waters that are above 5000 feet in elevation, or 3) perennial and intermittent surface waters that are below 5000 feet in elevation. New definitions for "perennial surface water" and "intermittent surface water" will clarify the scope of the proposed revisions to the tributary rule and make them more understandable.

ADEQ proposes to define "perennial surface water" as "a surface water that flows continuously throughout the year." This definition is based upon the generally accepted hydrologic definition of "perennial stream" found in standard references such as: Bates, Robert L. And Jackson, Julia A., Editors, Glossary of Geology, Third Edition, American Geological Institute, Alexandria, Virginia, 1987, p. 492 and W.B. Langbein and Kathleen T. Iseri, "General Introduction and Hydrologic Definitions," Manual of Hydrology: Part 1. General Surface-Water Techniques, Geological Survey Water Supply Paper 1541-A, United States Government Printing Office, Washington, D.C. (1960), p. 18.

ADEQ proposes to define "intermittent surface water" as a surface water that flows continuously for 30 days or more at times of the year when it receives water from springs or from a surface source such as melting snow. An

intermittent surface water is different from an ephemeral water. An ephemeral water flows only in direct response to precipitation (that is, direct storm water runoff) for short periods of time. An intermittent water may flow seasonally for longer periods of time (30 days or more). The distinction between ephemeral waters and intermittent waters is important because the proposed tributary rule assigns different aquatic life designated uses to ephemeral waters and intermittent surface waters. An intermittent surface water has either an A&Wc or A&Ww designated use with acute and chronic toxicity criteria to protect aquatic life. An intermittent water has the same aquatic life designated uses as a perennial surface water. Ephemeral waters are protected by a subcategory of the aquatic life designated use that is specifically tailored for ephemeral waters. The aquatic and wildlife (ephemeral) designated use does not include chronic toxicity criteria because of the short duration of flow in an ephemeral water.

d. Amendment of the definition of "ephemeral water"

The current surface water quality standards rules define "ephemeral water" as a "surface water that has a channel that is at all times above the water table, that flows only in direct response to precipitation, and that does not support a self-sustaining fish population" [*See* R18-11-101(22)]. This definition is inconsistent with generally accepted hydrological definitions of "ephemeral water" found in reference texts such as the Glossary of Geology and the USGS Manual of Hydrology cited above. The standard definitions of "ephemeral water" do not include a biological element that refers to the non-support of a self-sustaining fish population. The reference texts define "ephemeral water" as a surface water that flows only in direct response to precipitation and whose channel is at all times above the water table. The term is sometimes restricted to mean a stream that does not flow during periods of as much as 30 days. Ephemeral waters are distinguished from intermittent waters because an intermittent water is a surface water that flows continuously for 30 days or more at times of the year when it receives water from springs or from another surface source such as melting snow. ADEQ proposes to repeal the biological element in the current definition of "ephemeral water" that refers to fish populations to make the definition more concise and more consistent with the generally accepted hydrological definition of "ephemeral water." The amended definition of "ephemeral water" in the proposed rule states:

22. "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 ~~;and that does not support a self-sustaining fish population~~.

e. Addition of a definition for "pollutant."

The word, "pollutant," is used in several places in the current surface water quality standards rules but it is not defined in the rules. For example, the current antidegradation rule states at R18-11-107(A) that ADEQ shall determine whether there is degradation of surface water quality on a "pollutant by pollutant" basis. The narrative standards rule states at R18-11-108(A) that a surface water shall be free from pollutants in amounts or combinations that cause various effects [*See* R18-11-108(A)(1-8)]. A definition of "pollutant" will clarify the rules where "pollutant" is used and make the rules more understandable.

The statutory definition of "pollutant" at A.R.S. §49-201(26) is broadly inclusive and it goes beyond chemical pollutants. In particular, the statutory definition clearly includes rock, sand, and dirt as "pollutants." The inclusion of rock, sand, and dirt in the statutory definition of "pollutant" is important because it clarifies that sediment in a surface water is a pollutant. ADEQ proposes to include the definition of "pollutant" that is prescribed in Arizona's Water Quality Control statutes in the surface water quality standards rules. A.R.S. §49-201(26) defines "pollutant" as follows:

> "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.

Applicability [R18-11-102]

The water quality standards in Title 18, Chapter 11, Article 1 of the Arizona Administrative Code apply to surface waters in Arizona [*See* R18-11-102(A)]. In general, "surface water" includes Arizona's rivers, streams, and lakes. The term, "surface water," has a specific legal definition for purposes of the water quality standards program [*See* R18-11-101(40)]. "Surface water," as used in the surface water quality standards rules, has the same meaning as the terms, "navigable water" and "water of the United States," as those terms are used in the Clean Water Act and its implementing federal regulations.

§303(c) of the Clean Water Act requires states to adopt water quality standards for "navigable waters." The Clean Water Act defines "navigable waters" as the "waters of the United States" [*See* §502(7) of the Clean Water Act]. Congress did not define "waters of the United States" in the Clean Water Act. However, EPA defined "waters of the United States" in federal regulations that implement the Act, such as the federal regulations that govern the NPDES permit program [*See* 40 CFR §122.2].

Under 40 CFR §122.2, "waters of the United States" means:

a. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

b. All interstate waters, including interstate "wetlands;"

c. All other waters, such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, or playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including any such waters:

    1. Which are or could be used by interstate or foreign travelers for recreational or other purposes;

2. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

3. Which are used or could be used for industrial purposes by industries in interstate commerce;

d. All impoundments of waters otherwise defined as waters of the United States under this definition;

e. Tributaries of waters identified in paragraphs (a) through (d) of this definition;

f. The territorial sea; and

g. "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition [*See* 40 CFR §122.2].

ADEQ modeled the state's definition of "surface water" on the above definition. The federal definition of "waters of the United States" in 40 CFR § 122.2 is essentially the same as the state's definition of "surface water." ADEQ defines "surface water" at R18-11-101(40) as follows:

"Surface water" means a water of the United States and includes the following:

a. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce;

b. All interstate waters, including interstate wetlands;

c. All other waters, such as intrastate lakes, reservoirs, natural ponds, rivers, streams (including intermittent and ephemeral streams), creeks, washes, draws, mudflats, sandflats, wetlands, sloughs, backwaters, prairie potholes, wet meadows, or playa lakes, the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including any such waters:

i. Which are 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. Which are used or could be used for industrial purposes by industries in interstate commerce;

d. All impoundments of waters otherwise defined as surface waters under this definition;

e. Tributaries of surface waters identified in paragraphs (a) through (d) of this definition; and

f. Wetlands adjacent to surface waters identified in pargraphs (a) through (e) of this definition.

There are minor differences between the federal definition of "waters of the United States" and ADEQ's definition of "surface water" [*Compare* 40 CFR § 122.2 and R18-11-101(40) above]. First, ADEQ's definition of "surface water" does not include references to the territorial sea or to waters that are subject to the ebb and flow of the tide because Arizona is an inland state and such references are unnecessary. Second, ADEQ's definition of "surface water" includes examples of intrastate waters that are found in Arizona but are not included as examples in the federal definition of "waters of the United States." For example, the ADEQ definition of "surface water" includes reservoirs, creeks, ephemeral waters, washes, draws, and backwaters as examples of intrastate waters. These examples are not found in 40 CFR §122.2.

The applicability rule includes two exclusions. Surface water quality standards do not apply to waste treatment systems or to man-made surface impoundments and associated ditches and conveyances that are used in the extraction, beneficiation, and processing of metallic ores under certain conditions [*See* R18-11-102(B)]. ADEQ proposes no changes to either exclusion in this triennial review.

Designated uses [R18-11-104]

§303(c)(2)(A) of the Clean Water Act defines a water quality standard as the designated uses of a surface water and the water quality criteria necessary to support the designated uses. A designated use is one of the two essential elements of a water quality standard. Arizona's numeric surface water quality standards are expressed in terms of the maintenance and protection of designated uses.

As noted previously, §303 of the Clean Water Act requires states to adopt water quality standards to protect public health or welfare, enhance the quality of water, and "serve the purposes of the Clean Water Act." 40 CFR §131.2 and §2.1 of the *Water Quality Standards Handbook, 2nd Edition* (p. 2-1) provide guidance on what is meant by the phrase, "serve the purposes of the Clean Water Act." According to the *Water Quality Standards Handbook*, "serve the purposes of the Act" means that the surface water quality standards should:

- Provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water (to implement the "fishable / swimmable"goal of the Act), and
- Consider the use and value of state waters for public water supplies, propagation of fish and wildlife, recreation, agriculture, and industrial purposes, including navigation.

§303 of the Clean Water Act and a similar Arizona statute, §49-222(A), describe the types of uses of surface waters that must be protected by water quality standards. These uses are called "designated uses." The Clean Water Act requirements for designated uses are stated in the federal water quality standards regulations at 40 CFR §131.10 (a):

> Each state must specify appropriate water uses to be achieved and protected. The classification of the waters of the State must take into consideration the use and value of water for public water supplies, protection and propagation of fish, shellfish, and wildlife, recreation in and on the water, agricultural, industrial, and other purposes including navigation. In no case shall a State adopt waste transport or waste assimilation as a designated use for any waters of the United States.

ADEQ has discretion to adopt a designated use classification scheme appropriate for surface waters in Arizona. However, ADEQ must adopt designated uses that are consistent with the Clean Water Act and the statutory guidelines prescribed in A.R.S.§49-221 and §49-222. This means that ADEQ must establish water quality standards that provide water quality for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water where those uses are attainable to be consistent with the "fishable, swimmable" goal of the Clean Water Act. ADEQ also must consider the types of uses described in the Clean Water Act and the Arizona statutes when

establishing designated uses for surface waters in Arizona. ADEQ is free to add other designated uses to the state water quality standards except for waste assimilation or transport.

ADEQ has established the following designated uses for surface waters in Arizona:

- Domestic water source (DWS)
- Full body contact recreation (FBC)
- Partial body contact recreation (PBC)
- Fish consumption (FC)
- Agricultural irrigation (AgI)
- Agricultural livestock watering (AgL)
- Aquatic life and wildlife (cold water) (A&Wc)
- Aquatic life and wildlife (warm water) (A&Ww)
- Aquatic life and wildlife (effluent dependent water) (A&Wedw)
- Aquatic life and wildlife (ephemeral water) (A&We)

Arizona's "menu" of designated uses is listed in R18-11-104(B). Designated uses for specific surface waters are listed in Appendix B of the surface water quality standards rules. The state's current designated use classification system "serves the purposes of the Clean Water Act" because it provides for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water.

A state may adopt subcategories of a use and set appropriate criteria to meet the water quality requirements for each subcategory [*See* 40 CFR §131.10(c)]. ADEQ established 4 subcategories of designated uses to protect fish, shellfish, and wildlife (A&Wc, A&Ww, A&Wedw, and A&We). Every surface water in Arizona, with the exception of certain canals, has one of 4 designated uses to protect aquatic life and wildlife.

ADEQ protects water quality for "recreation in and on the water" with the full body contact recreation (FBC), partial body contact recreation (PBC), and fish consumption (FC) designated uses. These designated uses are intended to maintain and protect water quality for swimming, water-skiing, boating, wading, fishing, and other recreational uses. The FBC designated use is intended to protect public health when people engage in recreational activities that may involve full immersion in the water and potential ingestion of the water such as swimming . The PBC designated use is intended to protect public health when people engage in water-based recreational activities where full immersion and ingestion of the water are unlikely such as wading or boating. The FC designated use is intended to protect human health when fish or other aquatic organisms are taken from a surface water for human consumption.

ADEQ has considered the use and value of surface waters for public water supply by establishing the domestic water source (DWS) designated use. The DWS designated use applies to a surface water that is used as a raw water source for drinking water supply. The water quality criteria for the DWS designated use were developed assuming that treatment may be necessary to yield drinking water suitable for human consumption. The DWS designated use applies to a surface water that has a water treatment plant located along it which uses the surface water as a raw water source.

Finally, ADEQ recognizes the use and value of surface waters for agricultural purposes by establishing the agricultural irrigation (AgI) and agricultural livestock watering (AgL) designated uses. These uses are intended to maintain and protect surface water quality so water can be used for crop irrigation or to water cattle and other livestock.

Use attainability

In each triennial review, ADEQ considers appropriate revisions to the designated uses of the state's surface waters. The Clean Water Act and its implementing regulations require that ADEQ review the designated uses of the state's surface waters to determine whether the uses that are specified in §101(a)(2) of the Clean Water Act (that is, uses related to the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water) are

attainable. The *Water Quality Standards Handbook, 2nd Edition* and 40 CFR §131.10(d) both define "attainable uses" as uses that can be achieved by imposition of effluent limits required under §§ 301(b)(1)(A) and (B) and §306 on point source dischargers and implementation of cost-effective and reasonable best management practices for non-point source pollution control.

Federal law requires that ADEQ re-examine each surface water with surface water quality standards that do not include the uses specified in §101(a)(2) of the Clean Water Act each triennial review to determine if there is new information indicating that the uses specified in §101(a)(2) are attainable. If "fishable, swimmable" uses are attainable in a surface water, ADEQ must revise the state-adopted water quality standards accordingly [*See* 40 CFR §131.20(a)].

ADEQ interprets the uses that are specified in §101(a)(2) of the Clean Water Act to include one of the state's 4 aquatic life use subcategories (A&Wc, A&Ww, A&Wedw, or A&We), the full body contact recreation (FBC), and the fish consumption (FC) designated uses. Therefore, ADEQ must review each surface water listed in Appendix B of the surface water quality standards rules each triennial review and re-examine surface waters that do not include the FBC, FC, and an A&W designated use. Under 40 CFR §131.10(j), ADEQ must conduct a use attainability analysis (UAA) to justify the omission of one of these designated uses. EPA has stated in the preamble to the federal water quality standards regulations that a state need only conduct a UAA once for a given water body and a set of designated uses [48 Federal Register, 51,400, 51,409 (November 8, 1983)]. During subsequent triennial reviews, a state is required only to review the bases for not including a use that is specified in §101(a)(2) of the Clean Water Act to show that circumstances have not changed and that the FBC, FC, or A&W designated use remains unattainable.

There are 6 grounds that can be used to demonstrate that attaining a designated use is not feasible. The 6 grounds are prescribed in 40 CFR §131.10(g) and R18-11-104 (H)(1-6). They are:

1. Naturally occurring pollutant concentrations prevent the attainment of the use;
2. Natural, ephemeral, intermittent, or low flow conditions prevent the attainment of the use;
3. Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.
4. Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use;
5. Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life designated uses; or
6. Controls more stringent than those required by §301(b) and §306 of the Clean Water Act are necessary to attain the use and implementation of such controls would result in substantial and widespread economic and social impact.

When ADEQ conducts a triennial review of the state's surface water quality standards rules, ADEQ must evaluate what uses are being attained in surface waters. If a surface water is designated for a use that requires less stringent criteria than a use that is being attained, ADEQ must revise the designated uses to include the use that is actually being attained. For example, if a surface water has a PBC designated use but it is actually used for full body contact recreation or the existing water quality in the surface water meets FBC water quality standards, then ADEQ must revise the list of designated uses for that surface water to include the FBC designated use.

ADEQ Review of Surface Waters in Appendix B That Lack a Full Body Contact Recreation Designated Use.
Every surface water in Arizona, with the exception of certain canals, has either a full body contact recreation (FBC) or a partial body contact recreation (PBC) designated use. ADEQ interprets the Clean Water Act and the federal water quality standards regulations as requiring a review of each surface water with a PBC designated use to determine if the FBC designated use is attainable.

The large majority of surface waters with a PBC designated use are identified as ephemeral waters, effluent dependent waters, or municipal park lakes. In 1996, ADEQ prepared use attainability analyses [UAAs] to justify the omission of the FBC designated use for ephemeral and effluent dependent waters. These UAAs were approved by EPA. EPA has stated in the preamble to the federal water quality standards regulation that a state need only conduct a UAA once for a given water body and a set of designated uses [48 Federal Register, 51,400, 51,409 (November 8, 1983)]. During subsequent triennial reviews, a state is required only to review the bases for not including a use that is specified in §101(a)(2) of the Clean Water Act to show that circumstances have not changed and that the FBC designated use remains unattainable. ADEQ will rely on the previously submitted UAAs for ephemeral and effluent dependent waters to justify the omission of the FBC designated use because circumstances have not changed and the FBC designated use remains unattainable in both ephemeral and effluent dependent waters.

ADEQ will review the following surface waters in this triennial review to determine if there is any new information warranting a change in the water quality standards and which indicates that FBC is an attainable use:

1. Dry Lake in the Little Colorado River basin is currently classified as an EDW but it does not have a PBC or a FBC designated use.
2. Indian Bend Wash in the Middle Gila River basin has the A&Ww and PBC designated uses. The PBC designated use may be appropriate for Indian Bend Wash because it is an ephemeral water.
3. Mule Gulch in the Rios de Mexico basin, from the headwaters to the Bisbee WWTP outfall is identified as having the A&Ww and PBC designated uses. Again, the PBC designated use may be appropriate for portions of Mule Gulch because they may be ephemeral.
4. Salt River, in the Salt River basin, from the I-10 bridge to the 23rd Avenue WWTP outfall is identified as A&Ww with a PBC designated use. ADEQ will review the bases for both the A&Ww and PBC designated uses for this reach of the Salt River.
6. Bitter Creek, a tributary to the Gila River, has the A&Ww and PBC designated uses. ADEQ will review this surface water to determine whether the FBC designated use is an attainable use.

7. Bitter Creek, in the Verde River basin, from the headwaters to the Jerome WWTP outfall discharge has the A&Ww and PBC designated uses. ADEQ will review this surface water to determine whether the FBC designated use is an attainable use.

ADEQ Review of Surface Waters That Lack a Fish Consumption Designated Use

As noted above, ADEQ interprets the uses that are specified in §101(a)(2) of the Clean Water Act to include the fish consumption (FC) designated use. The FC designated use is one that ADEQ interprets to be within the meaning of the phrase, "recreation in and on the water." In each triennial review, ADEQ must review each surface water that does not include the FC designated use to determine whether the FC designated use is attainable. ADEQ must justify the omission of the FC designated use for a surface water with a use attainability analysis (UAA).

With one exception, the FC designated use has been established for every perennial surface water in Arizona that currently has either an aquatic and wildlife (cold water fishery) or aquatic and wildlife (warm water fishery) designated use. The one exception is Nogales Wash. Nogales Wash has an aquatic and wildlife (warm water fishery) designated use but it does not have a FC designated use. In 1996, ADEQ prepared a UAA to justify the omission of the FC designated use in Nogales Wash [*See* "Fish Consumption in Nogales Wash: Use Attainability Analysis (April 3, 1996)"]. This UAA was based on the following grounds: 1) natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the FC designated use, and 2) human-caused conditions or sources of pollutants prevent the attainment of FC designated use and cannot be remedied or would cause more environmental damage to correct than to leave in place. Circumstances have not changed in Nogales Wash and ADEQ will resubmit the 1996 UAA to justify the omission of the FC designated use in Nogales Wash in this triennial review.

Fish consumption has not been established as a designated use for surface waters that fall into two general categories: 1) ephemeral waters, and 2) effluent dependent waters. ADEQ prepared UAAs in the 1996 triennial review to justify the omission of the FC designated use in ephemeral waters and effluent dependent waters [*See*

"Use Attainability Analyses: Non-Attainment of Full Body Contact for Surface Waters and Non-Attainment of Fish Consumption for Ephemeral Waters" (March 17, 1997) and "Fish Consumption in Effluent-Dependent Waters: Use Attainability Analysis (April 3, 1996)"]. Again, circumstances have not changed for these categories of surface waters and ADEQ will resubmit the UAAs that were previously prepared to justify the omission of the FC designated use in ephemeral waters and EDWs.

Finally, fish consumption has not been established as a designated use for the canals that are listed in the surface water quality standards. The few canal systems that are listed in the surface water quality standards rules are manmade conveyances for the transportation of surface water for domestic water supply and agricultural uses. Fishing is prohibited on the listed canal systems. Consequently, fish consumption is not an existing use. ADEQ will not propose fish consumption as a designated use for canals in this triennial review.

ADEQ Review of Surface Waters That Lack an Aquatic and Wildlife Designated Use

Every surface water that is listed in Appendix B of the surface water quality standards rules, with the exception of certain canals, has an aquatic life designated use. Thus, the large majority of Arizona surface waters do not lack an aquatic life designated use and they do not have to be re-examined in this triennial review to determine if a designated use related to the protection and propagation of fish, shellfish, and wildlife is attainable.

ADEQ does not intend to propose an aquatic life designated use for canals in this triennial review. Again, as noted above, the few canal systems that are listed in the surface water quality standards rules are manmade conveyances for the transportation of surface water for domestic water supply and agricultural uses. Human-caused conditions prevent the attainment of an aquatic life use in the listed canals.

Proposed Revisions of the Aquatic and Wildlife (Cold Water Fishery) and Aquatic and Wildlife (Warm Water Fishery) Designated Uses

As discussed previously in the definition section of this preamble, ADEQ proposes to revise the current definitions of the aquatic and wildlife (cold water fishery) and aquatic and wildlife (warm water fishery) designated uses. Currently, these two designated uses are defined by references to the presence or absence of salmonid species in a surface water. "Aquatic and wildlife (cold water fishery)" means "the use of a surface water by animals, plants, or other organisms, *including salmonids*, for habitation, growth, or propagation" [*See* R18-11-101(7)]. "Aquatic and wildlife (warm water fishery)" means "the use of a surface water by animals, plants, or other organisms, *excluding salmonids*, for habitation, growth, or propagation [*See* R18-11-101(10)].

The references to "fishery"in the A&Wc and A&Ww designated uses are misnomers. The current names of the two designated uses suggest that the water quality standards are intended to apply only to surface waters that actually support fisheries. However, the current definitions of the A&Wc and A&Ww designated uses clearly indicate that the designated uses are intended to have broader application. The A&Wc and A&Ww designated uses are defined in terms of the protection of "animals, plants, or other organisms" and they are not limited to the protection of fish species. The A&Wc and A&Ww designated uses are meant to maintain and protect water quality for aquatic life. Both designated uses apply to surface waters that support fisheries and those that do not have fish. For example, there may be cold or warm water streams that support a diverse assemblage of macroinvertebrates, aquatic plants, and other organisms but they do not support fish species. The A&Wc and A&Ww designated uses are intended to apply to such surface waters. ADEQ proposes to revise the names of the two designated uses by deleting the reference to "fishery" in each one. The new names of the designated uses in the proposed rule are: "aquatic and wildlife (cold water) and "aquatic and wildlife (warm water)."

ADEQ also proposes to revise the current definitions of the A&Wc and A&Ww designated uses to repeal references to the presence or absence of salmonids. ADEQ proposes to define the A&Wc and A&Ww designated uses using the macroinvertebrate communities that each type of surface water supports. ADEQ research on the

distribution of macroinvertebrate communities in streams in Arizona indicates that macroinvertebrate communities are a better way to define the A&Wc and A&Ww designated uses. Macroinvertebrate communities are a better way to define the A&Wc and A&Ww designated uses for two reasons. First, virtually all surface waters contain macroinvertebrates. The problem with using the presence or absence of salmonids as the way to define the A&Wc and A&Ww designated uses is that some Arizona surface waters may not contain fish populations or there is little or no data on the presence or absence of salmonids in a surface water to make a reliable determination as to which designated use applies. The lack of data on the presence or absence of salmonids makes it difficult to determine which designated use should apply without conducting an actual field investigation of a surface water. Second, ADEQ has acquired data on the distribution of macroinvertebrates in surface waters statewide through its biocriteria program [*See* Spindler, Patti, "Macroinvertebrate Community Distribution Among Reference Sites in Arizona," Arizona Department of Environmental Quality, October, 2000]. The data from this study show that there are two broad macroinvertebrate community types in Arizona: cold water and warm water macroinvertebrate communities. ADEQ has found through statistical analyses of the macroinvertebrate data that elevation was consistently identified as the most important environmental variable explaining the distribution of the two community types. Cold water macroinvertebrate communities are generally found at elevations greater than 5000 feet and warm water macroinvertebrate communities are generally found at elevations less than 5000 feet. The data indicate that the 5000 foot elevation contour can be used as a predictive model to determine whether A&Wc or A&Ww should apply to a surface water. ADEQ believes that the use of macroinvertebrate community types and the 5000 foot contour is a more reliable and scientifically defensible way to determine which aquatic life designated use applies to a surface water.

ADEQ proposes to revise the listings of surface waters that are currently classified as A&Wc and A&Ww based upon whether a surface water is above or below 5000 feet in elevation. ADEQ proposes to classify reaches of perennial surface waters that are above 5000 feet as A&Wc and those that are below 5000 feet in elevation as A&Ww. The use of the 5000 foot elevation contour will result in changes to the current designated uses for some surface waters in each watershed. In some cases, ADEQ proposes to segment surface waters with upper reaches

that start above 5000 feet and lower reaches that terminate below 5000 feet in elevation. ADEQ recognizes that there may be exceptions to the use of the 5000 foot contour to assign A&Wc and A&Ww designated uses. For example, there may be streams located below 5000 feet that are affected by hypolimnetic releases of very cold water from dams (e.g., Colorado River below Glen Canyon Dam). Also, the use of the 5000 foot contour does not apply to the assignment of aquatic life uses to lakes and reservoirs. ADEQ does not propose to change the current aquatic life designated uses for lakes and reservoirs in this triennial review. A complete listing of proposed changes to the A&Wc and A&Ww designated uses is shown in Appendix B.

Changes to the tributary rule [R18-11-105]

R18-11-105 is commonly called "the tributary rule." The tributary rule establishes water quality standards for surface waters that are not listed in Appendix B of the surface water quality standards rules. The intent of the rule is to provide a minimum level of water quality protection for all surface waters in Arizona, including the surface waters that are not specifically identified in Appendix B of the rules. The tributary rule accomplishes this by prescribing designated uses and establishing default water quality standards for certain categories of surface waters.

The current tributary rule establishes water quality standards for 4 different types of tributaries: 1) ephemeral waters, 2) effluent dependent waters (EDWs), 3) tributaries that are neither ephemeral or EDWs and that have salmonids present, and 4) tributaries that are neither ephemeral or EDWs and that do not have salmonids present. Under the current rule, unlisted tributaries that are ephemeral waters are protected by the water quality standards for aquatic and wildlife (ephemeral) and partial body contact recreation. The aquatic and wildlife (edw) and partial body contact water quality standards apply to unlisted tributaries that are EDWs. Tributaries that are neither ephemeral waters or EDWs and that have salmonids present are protected by aquatic and wildlife (cold water fishery), fish consumption, and the water quality standards that apply to the nearest downstream surface water that is neither an ephemeral water or an EDW. Tributaries that are neither an ephemeral water or an EDW that do not have salmonids present are protected by aquatic and wildlife (warm water fishery) standards, fish consumption standards, and the

water quality standards that apply to the nearest downstream surface water listed in Appendix B that is neither an ephemeral water or an EDW.

The current tributary rule needs to be revised for several reasons. First, the rule includes a provision that assigns water quality standards to "an unlisted tributary that is an effluent dependent water."[*See* R18-11-105 (2)]. This part of the tributary rule is inconsistent with R18-11-113, the rule that specifically addresses EDWs. Under R18-11-113, the only way that a surface water can be recognized as an EDW is when ADEQ promulgates a rule to classify the surface water as an EDW. Consequently, all EDWs in Arizona are specifically listed in R18-11-113(D) and in Appendix B of the surface water quality standards rules. It is impossible for there to be an *unlisted* tributary that is an EDW. Thus, the part of the tributary rule that addresses unlisted tributaries that are EDWs has no practical application. ADEQ proposes to correct this problem by repealing R18-11-105 (2).

Second, the current tributary rule defines two categories of tributaries by the presence or absence of salmonid species [*See* R18-11-105 (3) and (4)]. These subsections of the tributary rule are consistent with the way that ADEQ currently defines the aquatic and wildlife (cold water fishery) and aquatic and wildlife (warm water fishery) designated uses in the surface water quality standards rules. As noted above, ADEQ proposes to revise the names and definitions of the A&Wc and A&Ww designated uses in this triennial review. ADEQ also proposes to revise the tributary rule to conform it to the proposed changes in the definitions of the A&Wc and A&Ww designated uses. The proposed tributary rule assigns designated uses to unlisted tributaries depending on whether they are ephemeral, intermittent, or perennial streams and whether they are above or below 5000 feet in elevation. The aquatic and wildlife (ephemeral) and partial body contact designated uses apply to unlisted tributaries that are ephemeral waters under the proposed rule. Unlisted tributaries that are intermittent or perennial and above 5000 feet in elevation are assigned the aquatic and wildlife (cold water), full body contact recreation, and fish consumption water quality standards. Unlisted tributaries that are intermittent or perennial and are below 5000 feet in elevation are assigned the aquatic and wildlife (warm water), full body contact recreation, and fish consumption standards. The proposed assignment of the FBC, FC, and the A&Wc or A&Ww designated uses to unlisted tributaries that are

perennial or intermittent is consistent with the way that designated uses are currently assigned to perennial and intermittent surface waters listed in Appendix B. Also, this approach is consistent with the "fishable / swimmable" goals of the Clean Water Act.

Finally, the current tributary rule assigns designated uses from the "...nearest downstream surface water listed in Appendix B that is not an ephemeral water or effluent dependent water" to unlisted tributaries that are neither ephemeral waters or EDWs [*See* R18-11-105(3) and (4)]. The intent of this rule is to ensure compliance with surface water quality standards that apply to the nearest downstream, perennial surface water. ADEQ is concerned that implementation of this part of the current tributary rule more frequently results in the establishment of inappropriate designated uses for upstream tributaries. In many cases, the nearest downstream, perennial surface water is separated from an unlisted tributary by long stream reaches that are ephemeral waters. Often, the assignment of designated uses such as the domestic water source, agricultural irrigation, or agricultural livestock watering to an unlisted tributary is inappropriate because they are not existing uses of the unlisted tributary. Also, the assignment of designated uses to an unlisted tributary is usually unnecessary to maintain and protect water quality in the downstream, perennial surface water because, in most cases, the unlisted tributary and the nearest downstream, perennial surface water are spatially interrupted. Finally, the assignment of "fishable, swimmable" designated uses to unlisted tributaries that are perennial or intermittent through the proposed tributary rule will: 1) provide a high level of water quality protection to the unlisted tributaries, and 2) ensure that water quality in a downstream perennial surface water is maintained and protected.

Revisions to the Antidegradation Rule [R18-11-107]

Arizona's surface water quality standards rules must include an antidegradation policy that is consistent with the federal antidegradation policy prescribed in 40 CFR § 131.12. Arizona's antidegradation rule is R18-11-107 and its language closely parallels the language of 40 CFR §131.12. The antidegradation requirement is based upon the primary objective of the Clean Water Act stated in §101(a)(2) to "...restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The degradation of surface water quality is antithetical to this primary

objective. The antidegradation concept was specifically included in the text of the Clean Water Act in 1987 in an amendment to §303(d)(4)(B). §303(d)(4)(B) requires satisfaction of antidegradation requirements before certain changes in NPDES permits can be made.

Under 40 CFR § 131.12(a), each state must develop and adopt a statewide antidegradation policy and identify methods for implementing that policy. At a minimum, the state's antidegradation policy must be consistent with the following:

- Existing instream water uses and the level of water quality necessary to protect existing uses must be maintained and protected [*See* 40 CFR § 131.12(a)(1)].
- Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the state finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the state's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the state shall assure water quality adequate to protect existing uses fully. Further, the state shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control [*See* 40 CFR §131.12(a)(2)].
- Where high quality waters constitute an outstanding national resource, such as waters of national and state parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected [*See* 40 CFR § 131.12(a)(3)].
- In those cases where potential water quality impairment associated with a thermal discharge is involved, the antidegradation policy and implementing method shall be consistent with §316 of the Clean Water Act [*See* 40 CFR §131.12(a)(4)].

The state's current antidegradation rule, R18-11-107, satisfies the federal requirement that ADEQ adopt a statewide antidegradation policy consistent with the federal antidegradation policy prescribed in 40 CFR §131.12. Both the federal and state antidegradation rules establish a three-tiered approach to maintaining and protecting levels of water quality and the uses of surface waters. Tier 1 establishes the "floor" of water quality protection for surface waters in Arizona. At a minimum, existing uses and the level of water quality necessary to protect existing uses must be maintained and protected. Tier 2 provides for the protection of existing water quality in high quality surface waters or, those surface waters where water quality is better than the levels necessary to support the propagation of fish, shellfish, and wildlife and recreation in an on the water. There are provisions in both the federal and state antidegradation rules that allow limited water quality degradation to occur in a Tier 2 surface water provided there is adequate public participation in the decision-making process and water quality is not degraded to a point where a surface water is no longer "fishable, swimmable." Tier 3 of the federal antidegradation rule provides special water quality protection to surface waters that are classified as outstanding national resource waters. In Arizona, outstanding national resource waters are called unique waters. The federal and state Tier 3 antidegradation rules both require the maintenance and protection of existing water quality in an outstanding national resource water or a unique water. Limited activities which result in short-term or temporary changes in water quality are allowable but long-term degradation of existing water quality in a unique water is prohibited. Finally, both the federal and state antidegradation rules have the same language addressing thermal discharges.

There are a few non-substantive differences between the language of 40 CFR §131.12 and the language of R18-11-107. First, the state antidegradation rule includes an introductory section that clarifies that ADEQ shall determine whether there is degradation of water quality in a surface water on a "pollutant by pollutant" basis [*See* R18-11-107(A)]. The "pollutant by pollutant" language is not found in the federal antidegradation policy . [*Compare* 40 CFR §131.12 and R18-11-107]. Its inclusion in the state rule reflects ADEQ's understanding of current EPA guidance on how the antidegradation policy should be implemented. ADEQ conducts antidegradation reviews on a pollutant-by-pollutant basis. Thus, a surface water may be considered a Tier 1 waterbody for one pollutant and a Tier 2 waterbody for another pollutant.

ADEQ's inclusion of the "pollutant by pollutant" language in R18-11-107(A) may have created some misunderstanding in the regulated community that antidegradation reviews are strictly limited to a review of whether degradation by chemical pollutants will occur. While ADEQ does not propose to change the language of R18-11-107(A) in this triennial review, ADEQ wants to clarify that antidegradation determinations are *not* strictly limited to degradation by chemical pollutants only. For example, degradation of water quality in a surface water may occur because of total suspended solids or bottom deposits [i.e. siltation or excessive sedimentation]. The degradation of surface water quality also may be demonstrated by an increase in toxicity as demonstrated by ambient toxicity tests upstream and downstream of a point source discharge. In the latter example, it may not be possible to identify a specific chemical pollutant causing the toxicity through toxicity identification procedures. However, the toxicity test results by themselves could be used to establish that degradation was occurring in a surface water.

Second, the state antidegradation rule includes specific references to surface water quality standards that are not found in 40 CFR §131.12. The federal Tier 1 antidegradation policy states at 40 CFR §131.12(a)(1) that "[e]xisting instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." Arizona's Tier 1 antidegradation policy is expressed differently, but it is intended to provide the same level of water quality protection as the federal Tier 1 regulation. Like the federal regulation, R18-11-107(B) states: "The level of water quality necessary to protect existing uses shall be maintained and protected." However, R18-11-107(B) goes on to clarify that this baseline level of water quality is defined by reference to the surface water quality standards. R18-11-107(B) states that "[n]o degradation of existing water quality is permitted in a surface water where the existing water quality does not meet the applicable water quality standard." In other words, the surface water quality standards define the level of water quality necessary to protect existing uses. This clarifying reference to the surface water quality standards is not found in the federal Tier 1antidegradation policy. Under the Tier 1 policy, existing water quality establishes the water quality "floor" that must be maintained in an impaired surface water when a surface water quality standard is not met. No further degradation of existing water quality with respect to that pollutant is allowed in an impaired surface water.

Third, Arizona's Tier 2 antidegradation rule uses different language from the Tier 2 language found in 40 CFR §131.12(a)(2). Again, both rules are intended to accomplish the same purpose. The federal Tier 2 antidegradation policy is intended to protect existing water quality in high quality surface waters. 40 CFR §131.12(a)(2) states that "[w]here the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected....." R18-11-107(C) prescribes Arizona's Tier 2 antidegradation policy for high quality surface waters. R18-11-107(C) provides the same level of antidegradation protection as the federal antidegradation policy, but the state rule expresses the Tier 2 antidegradation policy in terms of existing water quality that is better than applicable surface water quality standards. R18-11-107(C) states that "[w]here existing water quality in a surface water *is better than the applicable water quality standard,* the existing water quality shall be maintained and protected." In both the federal and state antidegradation policies, the existing high quality of a surface water must be maintained and protected. The existing high quality of the surface water provides the reference point for a Tier 2 antidegradation analysis.

40 CFR §131.12 and R18-11-107(C) both permit limited degradation of a high quality surface water if certain conditions are met. Under 40 CFR §131.12(a)(2), lower water quality may be allowed in a Tier 2 surface water provided: 1) lower water quality is necessary to accommodate important economic or social development in the area in which the water is located, 2) the state assures water quality adequate to protect existing uses fully, 3) the state assures that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources, 4) all cost-effective and reasonable best management practices for nonpoint source control are achieved, and 5) the intergovernmental coordination and public participation provisions of the state's Continuing Planning Process (CPP) are fully satisfied.

R18-11-107(C) closely parallels the language of 40 CFR §131.12(a)(2). The same conditions must be met under R18-11-107(C) before limited degradation of a high quality surface water is allowed in Arizona. The only difference between the federal and state Tier 2 antidegradation policies is that R18-11-107(C) specifically requires that a public hearing be held on whether limited degradation should be allowed in a Tier 2 surface water. In ADEQ's view, this

public hearing requirement is the equivalent of fully satisfying the intergovernmental coordination and public participation provisions of the state CPP.

Finally, the federal and state antidegradation policies provide special water quality protection for Tier 3 surface waters. Tier 3 surface waters are called "outstanding national resource waters" in the federal antidegradation policy and "unique waters" in the state rule. 40 CFR §131.12(a)(3) and R18-11-107(D) both require the maintenance and protection of existing water quality in a Tier 3 surface water. However, Arizona's Tier 3 antidegradation rule is broader than the federal antidegradation policy because R18-11-107(D) extends Tier 3 antidegradation protection to surface waters that are *proposed* for unique waters classification. The federal Tier 3 antidegradation policy requires the maintenance and protection of existing water quality "[w]here high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational and ecological significance...."

R18-11-107(D) requires that existing water quality be maintained and protected in surface waters that are classified as unique waters and in surface waters "that the Director has proposed for classification as a unique water pursuant to R18-11-112." ADEQ extended Tier 3 antidegradation protection to proposed unique waters in amendments to R18-11-112 that were made in 1992. At the time, ADEQ argued that it was important to extend Tier 3 antidegradation protection to proposed unique waters to assure maintenance and protection of existing water quality and to preserve resource values that led to the nomination of the surface water. By "proposed," ADEQ means surface waters that are formally proposed for unique waters classification in a Notice of Proposed Rulemaking. ADEQ made clear that Tier 3 antidegradation protection should be extended to proposed unique waters only after the formal rulemaking process to classify a navigable water as a unique water is initiated by the publication of a Notice of Proposed Rulemaking. Tier 3 antidegradation protection does not extend to surface waters that are nominated for unique waters classification.

ADEQ has reconsidered the extension of Tier 3 antidegradation protection to proposed unique waters. ADEQ proposes to conform Arizona's Tier 3 policy to be more consistent with the federal antidegradation policy. ADEQ proposes to repeal the language in the current rule that extends Tier 3 antidegradation protection to surface waters that are *proposed* for unique waters classification. ADEQ proposes to revise R18-11-107(D) as follows:

D. Tier 3: Existing water quality shall be maintained and protected in a surface water that is classified as a unique water ~~or that the Director has proposed for classification as a unique water~~ pursuant to R18-11-112. The Director shall not allow limited degradation of a unique water pursuant to subsection (C) of this Section.

ADEQ proposes the repeal of language indicated by strikeouts above for several reasons. First, as noted above, the repeal of the language that extends Tier 3 antidegradation protection to proposed unique waters will make the state rule more consistent with federal antidegradation policy.

Second, it is unclear how the extension of Tier 3 antidegradation protection to a proposed unique water can be practically implemented in the absence of data on existing water quality in a proposed unique water. In most cases, there is little or no data on existing water quality for surface waters that are proposed for unique waters classification. While R18-11-112(C)(4) states that a person who nominates a surface water for unique waters classification must submit *available* water quality data relevant to establishing baseline water quality in the proposed unique water, the rule does not make the collection of data on existing water quality a nomination requirement. ADEQ resource constraints usually preclude the collection of surface water quality data during the pendency of a formal rulemaking proposal.

Third, the extension of Tier 3 antidegradation protection to proposed unique waters only extends Tier 3 antidegradation protection for a short period of time. At most, Tier 3 antidegradation protection is extended six months to one year before it otherwise would apply. As ADEQ made clear in the concise explanatory statement for the surface water quality standards in the 1992 triennial review, Tier 3 antidegradation protection is extended to a

proposed unique water only when formal rulemaking to classify that surface water as a unique water is initiated by publication of a Notice of Proposed Rulemaking. Under the State Administrative Procedures Act, the formal rulemaking process usually takes 6 months to 1 year to complete after the publication of a Notice of Proposed Rulemaking in the Arizona Administrative Register.

Finally, ADEQ believes that the extension of Tier 3 antidegradation protection to proposed unique waters may create an incentive for persons to nominate surface waters for unique water classification in the hope that Tier 3 antidegradation protection can be obtained for the surface water during the pendency of formal rulemaking procedures. ADEQ is concerned that the extension of Tier 3 antidegradation to *proposed* unique waters encourages the nomination of surface waters that are believed to be threatened by mining, grazing, timber harvesting, growth and development, or other land uses but that cannot reasonably be considered to be outstanding state resource waters. The possibility of obtaining Tier 3 antidegradation protection for some interim period combined with the relative ease of nominating surface waters and the broad grounds for unique waters classification in the current rule may explain, at least in part, the large number of nominations in this triennial review (37). The large number of nominations has prompted ADEQ to conduct a complete review of the current unique waters nomination and classification processes in this triennial review. ADEQ proposes to make several changes to the rule that governs the unique waters program [*See* the discussion of R18-11-112 later in this preamble]. One of the proposed changes relates to R18-11-107(D). ADEQ has reconsidered the extension of Tier 3 antidegradation protection to *proposed* unique waters. ADEQ believes that Tier 3 antidegradation protection should be provided to a unique water only after the formal rulemaking process to classify a unique water is complete. The primary benefit of a unique waters classification is Tier 3 antidegradation protection. This benefit should not be afforded to a surface water prior to the development of a complete administrative record through the rulemaking process, including a cost / benefit analysis of a unique waters classification that is required for approval by the Governor's Regulatory Review Council.

The need for antidegradation implementation procedures

The federal antidegradation policy requires that each state identify methods for implementing its antidegradation policy [*See* 40 CFR §131.12(a)]. Antidegradation implementation is basically a set of procedures that are to be followed when evaluating activities that may impact surface water quality. Current EPA guidance on antidegradation in the *Water Quality Standards Handbook (2nd Edition)* states that antidegradation implementation procedures should specify how a state will determine, on a case-by-case basis, whether, and to what extent, surface water quality may be lowered.

Each state's antidegradation implementation procedures are subject to EPA review. However, EPA's review is limited to ensuring that adequate procedures are included that describe how the state will implement the required elements of an antidegradation review. EPA may disapprove and federally promulgate all or part of a state's antidegradation implementation procedures if the procedures can be implemented in a way that, in EPA's judgment, circumvents the basic intent of the federal antidegradation policy [*See Water Quality Standards Handbook, 2nd Edition*, § 4.3].

In 1994, EPA approved the state's antidegradation rule, R18-11-107, with certain conditions. In approving the state antidegradation rule, EPA noted that it had previously requested that Arizona develop antidegradation implementation procedures. EPA stated in an approval letter dated April 29, 1994 that the development of antidegradation implementation procedures was a condition of EPA's previous approval of the antidegradation rule in the 1986 triennial review and was overdue. EPA noted that the U.S. Fish & Wildlife Service determined in its biological opinion of the surface water quality standards rules conducted under § 7 of the Endangered Species Act (ESA) that an incidental take of endangered or threatened species could occur because of the lack of state antidegradation implementation procedures. The U.S. Fish & Wildlife Service further determined that the ESA required the state adoption of antidegradation implementation procedures. EPA conditionally approved the antidegradation rule and stated its expectation that ADEQ would develop and adopt antidegradation implementation procedures by 1995.

In 1994, ADEQ staff drafted "Implementation Guidelines for the State of Arizona Antidegradation Standard." This guidance document was based largely on antidegradation implementation procedures that were developed by EPA Region VIII. ADEQ used the Continuing Planning Process (CPP) public participation procedures to develop the antidegradation implementation guidelines because: 1) Each state is required to have a CPP by § 303(e) of the Clean Water Act, and 2) one of the 9 required elements of the CPP is a description of "the process for establishing and ensuring adequate implementation of revised or new water quality standards...under § 303(c) of the Act" [*See* §303(e)(3)(E) of the Clean Water Act and 40 CFR §130.5(b)(6)]. Since the antidegradation rule, R18-11-107, is included in the surface water quality standards rules and is a required element of the state's water quality standards submission to EPA, ADEQ thought it was appropriate to develop the antidegradation implementation procedures through the CPP process.

In 1995, ADEQ presented a draft of the state's antidegradation implementation guidelines to the Councils of Governments (COGs) and requested public comments. A few stakeholders provided comments to ADEQ and criticized the use of the CPP public participation process to develop the antidegradation implementation guidelines. In general, the stakeholders who submitted comments to ADEQ were concerned that the use of the CPP public participation process was inadequate because it did not reach major stakeholders in the regulated community who may be directly affected by the state's adoption of antidegradation implementation procedures. This concern was borne out by the relatively few comments that ADEQ received on the antidegradation implementation guidelines as a result of the public meetings held with the COGs. Several stakeholders argued that ADEQ should use the rulemaking process to adopt the antidegradation implementation procedures because rulemaking was, in their view, the only way that ADEQ could ensure that the antidegradation implementation procedures would receive adequate public review.

In the 1996 triennial review, EPA again reviewed and approved ADEQ's revisions to the surface water quality standards rules, including minor revisions to the antidegradation rule. In an EPA approval letter dated December 31, 1998, EPA addressed the issue of antidegradation implementation procedures again and requested that

ADEQ provide a schedule for their adoption in the 2000 triennial review. The relevant part of the December 31, 1998 approval letter from EPA states:

> The [U.S. Fish & Wildlife] Service has asked that ADEQ provide a schedule for adoption of antidegradation implementation in the Year 2000 triennial review of water quality standards. While the state is long overdue for adoption of antidegradation implementation, it is EPA's understanding that the State has been using the publicly reviewed draft *Implementation Guidelines for the State of Arizona Antidegradation Standard* since 1995. This guidance has been used to implement the antidegradation rule in over 40 permit reviews conducted by ADEQ. As such, the draft implementation document is the *de facto* policy of the State. In the interim, the State is developing a new antidegradation implementation guidance that would more comprehensively analyze water quality; incorporating physical integrity and biological measures to complement the existing approach which is largely based on measures of water chemistry. It is our expectation that the State will complete development and adopt this revised implementation policy for antidegradation during the Year 2000 triennial review. We request that the State provide a schedule for adoption of this implementation guidance.

ADEQ intends to revise the state's antidegradation implementation procedures in this triennial review. ADEQ is persuaded by the lack of public participation in the CPP process that the triennial review process is a better administrative process for obtaining adequate public review of this important element of the water quality standards program. ADEQ proposes to conduct public participation activities to review the current antidegradation implementation procedures concurrent with this triennial review. The review of the antidegradation implementation procedures will be on the same schedule as the proposed revisions to the surface water quality standards rules. ADEQ expects to complete the triennial review process by December 31, 2001. While ADEQ proposes to use a public participation process concurrent with the triennial review to ensure adequate public participation in the development of the antidegradation implementation guidelines, ADEQ does not, at this time, propose to incorporate the antidegradation implementation guidance into rule.

Narrative Water Quality Standards [R18-11-108]

There is a statutory preference in Arizona law for numeric water quality standards if adequate information exists to establish numeric standards [*See* §49-221(D)]. However, both federal and state law provide authority for ADEQ to establish narrative water quality standards. The federal water quality standards regulation says that states may establish narrative water quality criteria or criteria based upon biomonitoring methods where numeric criteria cannot be established or to supplement numeric water quality criteria [*See* 40 CFR §131.11(b)(2)]. Arizona law also provides authority for ADEQ to adopt narrative water quality standards that "the Director may deem appropriate" [*See* §49-221(D)].

ADEQ has used these authorities to promulgate the narrative water quality standards that are found in R18-11-108. Narrative water quality standards supplement the numeric water quality criteria that have been established to maintain and protect water quality for designated uses. Narrative water quality standards also describe the conditions that are necessary to maintain and protect the aesthetic qualities of Arizona's surface waters. Arizona's current narrative standards are expressed as 9 "free from" statements. R18-11-108 states that Arizona's surface waters shall 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 or that impair recreational uses;
- Cause objectionable odor in the area in which a surface water is located;
- Cause off-taste or odor in drinking water;
- Cause off-flavor in aquatic organisms or waterfowl;
- Are toxic to humans, animals, plants, or other organisms;
- 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;
- Cause or contribute to a violation of an aquifer water quality standard;
- Change the color of the a surface water from natural background levels of color.

- Float as debris, foam, or scum; or that cause a film or iridescent appearance on the surface of the water; or that cause a deposit on a shoreline, bank, or aquatic vegetation (The discharge of lubricating oil or gasoline associated with the normal operation of a recreational water craft is not considered to be a violation of this last narrative standard).

ADEQ proposes 3 revisions to the narrative water quality standards in this triennial review. First, ADEQ proposes to amend the bottom deposits narrative standard to focus it on the protection of aquatic life and to repeal the current reference to impairment of recreational uses. Second, ADEQ proposes to adopt a narrative standard to prevent excessive concentrations of suspended solids in a surface water that impair a domestic water source use. Third, ADEQ proposes to amend the narrative standard that addresses undesirable organoleptic effects in aquatic organisms and waterfowl by deleting the reference to "waterfowl."

Revised narrative standard to prevent siltation and excessive sedimentation

The current surface water quality standards rules include a narrative standard that is intended to prevent harmful effects of bottom deposits on aquatic life and the impairment of recreational uses. R18-11-108(A)(1) states:

> A surface water shall 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 or that impair recreational uses.

Bottom deposits, or settleable solids, are materials that settle out of suspension from the water column within a given period of time. Excessive sediment deposits can negatively affect aquatic life. Bottom deposits affect fish directly by smothering eggs in redds, choking spawning habitats, reducing over-wintering habitat for fry, and indirectly by altering invertebrate species composition thereby decreasing the abundance of preferred prey (Cordone and Kelley 1961). Deposited sediments also fill in rearing pools and interstitial spaces of riffles resulting in reduced habitat complexity in stream channels. Bottom deposits fill the interstitial spaces in gravel spawning beds interfering with inter-gravel permeability and transfer of dissolved oxygen thereby reducing the survival of fish eggs and juveniles.

Bottom deposits that blanket the stream bottom substrates affect benthic macroinvertebrate populations as well. Macroinvertebrates (aquatic insects) are affected by habitat reduction and change resulting in increased drift, lowered respiration capacity through blocking of gill surfaces or through lowered oxygen concentrations, and the reduced efficiency of feeding activities, especially filter feeding and visual predation (Lemly 1982, Waters 1995). Also, substrate size is important to aquatic insects because it is the primary factor influencing abundance and distribution (Minshall 1984). Adamus (1995) listed a reduction in species richness and a community shift from herbivorous and filter-feeding species to sediment burrowing species (worms) as impairments due to sedimentation in wetlands.

Though our recent understanding of fluvial geomorphology has been greatly enhanced by the work and methods of Dave Rosgen, quantitative approaches for assessing physical integrity and bottom deposits in all types of stream systems in Arizona are not well understood. Aggradation, degradation, and the transport of sediment in streams is influenced by many factors including land forms, slopes, soil erodibility, precipitation, runoff, vegetative cover, stream channel and bank erosion, and channel disturbances. The watershed processes that cause adverse sediment impacts are rarely simple and they cannot be reduced to instantaneous measurements of a single indicator such as turbidity. Although ADEQ and several other western states are developing a better understanding of fluvial geomorphic processes through regional curves and Rosgen's method for evaluating bank erodibility, easily implementable methods for distinguishing natural from human-caused sedimentation in our streams are not yet available. Through continued research, more quantitative approaches to documenting sedimentation processes may be developed. ADEQ rejects the use of numeric turbidity criteria as a surrogate indicator because it is inappropriate for use in desert ecosystems and we are not yet ready to implement physical integrity criteria. Therefore, ADEQ is pursuing a narrative approach for implementing the narrative bottom deposit standard.

ADEQ proposes to amend the current narrative "bottom deposits" standard to focus the standard on the protection of aquatic life. ADEQ proposes to repeal the language in the current rule that refers to the impairment of recreational uses as follows:

A surface water shall 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 ~~or that impair recreational uses.~~

ADEQ proposes to repeal the reference in the narrative standard to the impairment of recreational uses because of the lack of an objective way to determine impairments of recreational use. The national criteria document that EPA published on settleable solids provides no guidance on concentrations of settleable materials that cause impairment of recreational uses [*See* "Solids (Suspended, Settleable) and Turbidity," Quality Criteria for Water, 1986, United States Environmental Protection Agency, Office of Water, Regulations and Standards, Washington, D.C. (May 1, 1986)]. The EPA rationale for the recommended settleable solids criterion discusses adverse effects of settleable materials that damage invertebrate populations, block gravel spawning beds, and remove dissolved oxygen from surface waters. EPA also discusses imbalances in stream biota and reductions in biodiversity that are a result of the deposition of organic materials to bottom sediments. However, there is no discussion in the EPA criteria document for settleable solids that addresses the impairment of recreational uses.

The determination of whether there is an impairment of recreational use is too subjective and cannot be consistently implemented. ADEQ does not have practical implementation procedures for determining when bottom deposits cause an impairment of a recreational use of a surface water. This lack of practical implementation procedures is primarily due to the subjective nature of the recreational use impairment determination. Reasonable persons may differ over the amounts or concentrations of bottom deposits or settleable solids that negatively affect the aesthetic qualities of a surface water to the extent that there is an impairment of a recreational use. What amounts or concentrations of bottom deposits impair the use of a surface water for swimming, fishing, wading, or other water-based recreational activities? For this reason, ADEQ proposes to repeal the reference in the "bottom deposits" narrative standard to the impairment of recreational uses.

The narrative "bottom deposits" standard should be retained but its language should be amended to focus on preventing amounts or concentrations of bottom deposits that impair aquatic life designated uses. Adequate implementation procedures can be developed for a narrative standard that is more focused on the protection of aquatic life. Implementation procedures can be developed that describe how the bottom deposits narrative standard would be applied and how determinations of compliance will be made.

Implementation guidance for the revised narrative "bottom deposits" standard

The primary purpose of the proposed narrative "bottom deposits" standard is to prevent excessive sedimentation and siltation that adversely affect aquatic life in a surface water. For this reason, the proposed narrative standard specifically states that surface waters shall be free from pollutants in amounts and concentrations that settle to form bottom deposits *that impair aquatic life designated uses.* The language of the proposed narrative standard directly links bottom deposits to the impairment of aquatic life. This linkage provides a conceptual framework for the development of implementation procedures for determining compliance with the narrative "bottom deposits"standard. The conceptual framework has two basic elements: 1) bioassessment procedures for determining whether there is an impairment of aquatic life, and 2) habitat assessment procedures for determining that the cause of the impairment of aquatic life is due to excessive sedimentation or siltation.

ADEQ proposes to use biological integrity assessments, or bioassessments, to determine whether aquatic life is impaired in a surface water. ADEQ's bioassessments involve: 1) collection of benthic macroinvertebrate (i.e. bottom-dwelling aquatic insects and other invertebrates) samples from riffles in wadeable, perennial streams, 2) collection of relevant habitat and chemical stream measurements, 3) taxonomic identification of specimens in the sample, and 4) a comparison of the sample site species list with a composite reference species list using a multi-metric analysis tool to evaluate attainment of the aquatic and wildlife use. Since bioassessments are a direct measure of the condition of a biological community in a surface water, they are a better measure than surrogate chemical measurements for determining whether an impairment of aquatic life exists. ADEQ's bioassessment sampling protocols for use in wadeable, perennial streams in Arizona can be found in Meyerhoff and Spindler (1994). The

multi-metric tool measures structural, functional, tolerance and richness characteristics of the benthic macroinvertebrate community, is empirically derived in Arizona, and can be found in two documents, Gerritsen and Leppo (1998) and Gerritsen and Leppo (2000).

There are 2 multi-metric tools, one developed for support of the aquatic and wildlife (cold water) designated use and one for the aquatic and wildlife (warm water) designated use. These tools, called Indexes of Biological Integrity (IBI), consist of a combination of metrics or key attributes of the benthic macroinvertebrate community which best discern impairment from the reference condition. The cold water IBI consists of 7 metrics selected for their ability to discriminate impairments in cold water streams located at >5000' of elevation. The 7 metrics are: total taxa richness, Diptera taxa richness, intolerant taxa richness, Hilsenhoff Biotic Index (HBI), percent composition by Plecoptera (stoneflies), percent composition by scrapers, and scraper taxa richness. The warm water IBI consists of 9 metrics which best discern impairment in warm water streams located at <5000' of elevation. The 9 metrics are: total taxa richness , Ephemeroptera taxa richness (mayflies), Trichoptera taxa richness (caddisflies), Diptera taxa richness, percent Ephemeroptera abundance, percent composition by the dominant taxon, scraper taxa richness, percent composition by scrapers, and the Hilsenhoff Biotic Index. These metrics are easily calculated from a list of species and their abundances. A total IBI score is calculated as an average of the individual metric scores. The IBI score is then categorized as being exceptional, good, fair, or poor using a 25th percentile of reference value scoring system. Streams with an IBI score that is less than the 25th percentile of reference are not attaining the aquatic life designated use.

Once an impairment of aquatic life is found using a bioassessment and the applicable IBI, habitat data and chemical stream data are used to diagnose the probable cause of the impairment as the next step for implementing the narrative bottom deposits standard. ADEQ proposes to use qualitative habitat assessment observations and associated quantitative measurements related to bottom deposits to determine if an impairment of aquatic life in a surface water is caused by excessive sedimentation or siltation. The proposed habitat assessment index consists of 4 substrate and one bank stability parameter adopted from USEPA's visual-based habitat assessment protocols

described in the Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition (July 1999).

There are two habitat assessment indexes, one for use in cold water habitats in streams located at >5000' and one for use in warm water habitats located at <5000' in elevation. Each habitat assessment index involves visual-based field observations of the in-stream and bank habitat parameters associated with bottom deposits on a ranking scale of 1 to 4. The 5 habitat parameters are riffle substrate, pool substrate, embeddedness, sediment deposition, and bank stability. To ensure consistency in the habitat assessment procedure, written descriptions of each habitat parameter and the visual-based evaluation criteria for each category are included on a standardized assessment form. The habitat scores are summed for a total habitat score ranging from 5 - 20. The habitat score is then categorized as being good, fair, or poor using the 25th percentile of reference value scoring system. If the habitat index score is less than the 25th percentile of reference, then a biological impairment is determined to be associated with bottom deposits and an exceedance of the narrative bottom deposit standard results.

ADEQ proposes to use IBI scores accompanied by habitat assessment index scores to implement the narrative bottom deposits standard. ADEQ acknowledges that the use of the proposed implementation procedures has some limitations. ADEQ's current bioassessment protocols and indexes of biological integrity do not apply to lakes, reservoirs, large rivers (i.e. non-wadeable), intermittent waters, ephemeral waters, or effluent dependent waters. Since the implementation of the bottom deposits narrative standard depends upon the use of bioassessment and the use of an applicable index of biological integrity to establish aquatic life impairment, the narrative standard for bottom deposits cannot be implemented for other categories of surface water until ADEQ develops bioassessment procedures and associated indexes of biological integrity for them. Consequently, the narrative bottom deposits standard will apply initially only to wadeable, perennial streams.

Narrative standard for suspended solids

ADEQ proposes to adopt a new narrative standard to address excessive concentrations of suspended solids in surface waters to prevent impairment of the domestic water source designated use. Excessively high suspended solids concentrations can negatively affect the use of a surface water as a raw water source for drinking water supply. Suspended solids and sediment can cause taste and odor problems in drinking water, block drinking water plant uptakes, foul drinking water treatment systems, and increase operation and maintenance costs at water treatment plants. Suspended solids can shield pathogenic microorganisms from the action of disinfectants and reduce disinfection efficiency at a water treatment plant.

The ability of a drinking water treatment plant to remove turbidity and suspended solids from a raw surface water source to achieve acceptable final turbidities required by Safe Drinking Water Act regulations is a function of the composition of the suspended material in a surface water source as well as its concentration. Very high sediment levels in a surface water may require that water supply intakes for drinking water treatment plants be shut down until a surface water source clears or they may result in increased system maintenance (e.g. more frequent back-flushing of filters). Because of the variability of water treatment plant removal efficiencies, it is not possible for ADEQ to prescribe a single numeric criterion for suspended solids to maintain and protect water quality for the domestic water source designated use. However, a narrative standard can be developed that prohibits suspended solids in amounts or concentrations that interfere with the ability of a water treatment plant to comply with Safe Drinking Water Act requirements. ADEQ proposes to add a new narrative standard to prohibit excessively high concentrations of suspended solids in a surface water that impair a domestic water source use in R18-11-108(A)(1). ADEQ will determine compliance with the proposed narrative standard directly from the operation of water treatment plants that rely on surface water sources. For example, if a water treatment plant must close its intakes because of excessively high suspended solids in a surface water source, the narrative standard would be violated. ADEQ proposes the following narrative standard:

A. A surface water shall be free from pollutants in amounts or combinations that:

1. Are suspended in the water column that impair a domestic water source use.

ADEQ considered the development of a narrative standard to prohibit excessively high concentrations of suspended solids that impair aquatic life uses but ADEQ was unable to develop practical implementation procedures for such a standard. Consequently, the proposed narrative "suspended solids" standard is limited in its application. The intent of the proposed narrative standard is to maintain and protect water quality so surface waters can be used as a raw drinking water sources. The narrative standard is violated only when suspended solids concentrations in a surface water directly interfere with the operation of a water treatment plant.

Revision of the narrative standard prohibiting off-flavor in aquatic organisms or waterfowl

ADEQ proposes to amend R18-11-108(A)(4) which states that surface waters shall be free from pollutants that cause off-flavor in aquatic organisms *or waterfowl.* ADEQ proposes to repeal the reference to "or waterfowl" because it is inconsistent with EPA's recommended national criteria for tainting substances and because ADEQ does not have practical implementation procedures to determine compliance with the "waterfowl" part of the current standard.

Implementation procedures exist for determining compliance with the part of the narrative standard that is intended to protect against undesirable organoleptic effects in edible portions of aquatic organisms. For example, EPA has published national criteria guidance on tainting substances in Quality Criteria for Water, 1986 (the "Gold Book"). EPA recommends the following narrative criterion for tainting substances:

> Materials should not be present in concentrations that individually or in combination produce undesirable flavors *which are detectable by organoleptic tests performed on the edible portions of aquatic organisms* [Emphasis added].

The rationale in the EPA criteria document for tainting substances is clearly focused on preventing abnormal or undesirable flavors in fish or shellfish. Obviously, abnormal flavors in fish and shellfish negatively affect product quality, marketability, and consumer acceptance of fish and shellfish that are sold in foreign or interstate commerce. Recreational fishing also is adversely affected by tainting substances in surface water that result in off-flavored fish. For most sport fishermen, the consumption of their catch is an important part of their recreation. An off-flavored catch may result in the diversion of fishermen and recreational fishing activity to surface waters that are not impacted by tainting substances.

The Gold Book contains a review of studies on tainting substances that impair the flavor of aquatic organisms. Earlier criteria documents, such as the Blue Book, contain discussions on tainting substances and the use of field exposure and organoleptic tests to determine the existence or the magnitude of a tainting problem in a surface water. Field exposure tests involve holding test species of fish or other edible aquatic life in cages at selected locations in a surface water where a tainting problem is suspected and subsequently conducting flavor tests on the edible portions of the fish or aquatic organisms. Field exposure tests are time-consuming and organoleptic tests require experienced judges who are trained in conducting flavor evaluations. While it would be difficult for ADEQ to conduct field exposure tests or the organoleptic tests to determine compliance with the current narrative standard, at least implementation procedures exist that ADEQ could use to determine compliance on a case-by-case basis where a tainting problem in a surface water is suspected. However, there is nothing in the discussion of tainting substances in the EPA criteria guidance documents that relates to undesirable organoleptic effects in waterfowl. Moreover, because waterfowl are migratory, it would be impossible to establish a cause-and-effect relationship between tainted flesh in waterfowl and pollution of Arizona surface waters. For these reasons, ADEQ proposes to repeal the reference to "or waterfowl" in R18-11-108(A)(4). ADEQ proposes to revise the narrative standard as follows:

A. A surface water shall be free from pollutants in amounts or combinations that:

4. Cause off-flavor in aquatic organisms ~~or waterfowl.~~

ADEQ will determine compliance with the proposed narrative standard by using field exposure tests and organoleptic tests conducted on the edible portions of aquatic organisms (e.g., fish) as described in the EPA criteria documents. ADEQ does not routinely monitor surface waters for the presence of pollutants that cause off-flavor in aquatic organisms. The field investigation of a surface water that is suspected of having a tainting problem may be initiated as part of a complaint investigation.

Narrative color standard [R18-11-108(A)(8)]

R18-11-108(A)(8) states that a surface water shall be free from pollutants in amounts or combinations that "change the color of the surface water from natural background levels of color." The intent of this narrative standard is to maintain and protect the aesthetic qualities of surface waters and to prohibit discharges of pollutants that cause unnatural and objectionable colors in a surface water.

Color in water results primarily from degradation processes in the natural environment. Although colloidal forms of iron and manganese occasionally are the cause of color in water, the most common causes of color change are complex organic compounds originating from the decomposition of naturally-occurring organic material. Sources of organic material include materials from soils such as tannins and humic acids, decaying plankton and other decaying aquatic plants; and wastewater discharges. Industrial discharges may contain color-changing organic compounds (e.g., discharges from pulp and paper industrial facilities). Other industrial discharges may contain brightly colored substances such as those from certain processes in the textile and chemical industries (e.g. dyes).

Surface waters also may appear colored because of the presence of suspended solids and turbidity. Color that is due to suspended matter and turbidity is commonly referred to as apparent color. Changes in the apparent color of a surface water due to turbidity and suspended solids are acceptable when the change is due to natural background. Turbidity and suspended solids that are present in a surface water because of naturally-occurring conditions and are not the result of a discharge or anthropogenic activity falls within the meaning of "natural background levels of color." For example, a surface water that normally flows clear may appear brown in color during a flood event

because of high concentrations of suspended solids and turbidity. In this example, the change in the color of the surface water during a flood event would be considered to be a part of the natural background. On the other hand, a surface water may change color because of the discharge of a highly colored industrial wastewater whose color is contributed principally by colloidal or suspended materials in the discharge. In the latter case, the change in the apparent color of the surface water would be a change from the natural background levels of color. Changes in the apparent color of a surface water from a highly colored point source discharge or other human activities are prohibited by the narrative color standard.

Apparent color is differentiated from true color. True color is the color of a surface water from which suspended matter and turbidity has been removed. ADEQ considers changes in the true color of a surface water that are caused by highly colored point source discharges or other human activities to violate the current narrative standard. However, changes in the true color of surface water due to naturally-occurring conditions (e.g., the decay of aquatic plants or the presence of tannins in the water) would not be considered a violation of the narrative color standard.

ADEQ prepared a preliminary draft set of revisions to the surface water quality standards rules and suggested a revision of the current color narrative standard. ADEQ suggested amending the narrative standard to state that surface waters shall be free from pollutants in amounts or concentrations that "produce objectionable color." ADEQ received public comments opposing the suggested revision on the ground that the word "objectionable" was a subjective term that would make consistent enforcement of the narrative standard more difficult. ADEQ agrees and is not proposing the suggested revision in this rule package. The comment was made that if any change to the narrative color standard was deemed necessary, then the standard should incorporate some definition of what "color" means. Citing Standard Methods for the Examination of Water and Wastewater, 20th Edition, one commenter suggested that the narrative standard should address only true color. The commenter suggested the following revision to the narrative standard: "A surface water shall be free from pollutants in amounts or combinations that.....produce a change in the true color of the navigable water from natural background levels of true color." For reasons given above, ADEQ disagrees with limiting the narrative standard to true color only. The narrative standard

should prohibit changes in true color or apparent color that are not due to naturally-occurring conditions. ADEQ has decided that the current narrative standard is preferable to ADEQ's suggested revision in the preliminary draft rules and the alternative language suggested in comments on the preliminary draft rules. ADEQ proposes to retain the current narrative standard without change in this triennial review.

Numeric Water Quality Criteria [R18-11-109]

Revision of the Current Bacterial Water Quality Standards in R18-11-109(B) and (C)

a. *Purpose of bacterial water quality standards*

Water quality standards for bacteria are concentrations of indicator organisms that should not be exceeded in order to protect human health from waterborne pathogens. Pathogens are disease-causing organisms that include viruses, parasites, and bacteria. Many waterborne pathogens cannot be measured directly. Surface waters may contain different pathogens, making individual measurement and quantification impractical even if analytical methods were available to detect all pathogens of concern. Consequently, indicator organisms are used to predict human health risks from pathogens that may be present in surface waters. EPA has conducted health effects studies which demonstrate that *Escherichia coli* (*E. coli*) and enterococci are best suited for predicting the presence of pathogens in freshwater that cause human gastrointestinal illness. EPA published these recommendations in Ambient Water Quality Criteria for Bacteria - 1986 , U.S. Environmental Protection Agency, EPA-440 / 5-84-002.

EPA has strongly encouraged states to adopt its national criteria document recommendations for *E.coli* or enterococci to replace surface water quality standards that are expressed as concentrations of total coliforms or fecal coliforms. In recent EPA implementation guidance for the ambient water quality criteria for bacteria, EPA stated that the transition to *E. Coli* and enterococci criteria is a high priority for EPA in its review of state-adopted water quality standards in triennial reviews occurring in 2000 - 2002. EPA has stated in its implementation guidance that if states fail to adopt bacteria standards that are consistent with its national criteria guidance, EPA intends to federally promulgate water quality standards to ensure that its national criteria guidance recommendations for bacteria apply in all states, territories, and authorized tribes by 2003. ADEQ adopted *E. coli* criteria for the state's full body contact

designated use in 1996. In this triennial review, ADEQ proposes to further amend the current bacterial standards in R18-11-109(B) and (C) to be more consistent with EPA ambient water quality criteria for bacteria.

b. *History of current water quality standards for bacteria*

Environmental protection and public health officials have been concerned for many years about the development of appropriate standards for protecting the microbiological quality of surface waters that are used for bathing and swimming. Microbiological water quality standards for surface waters were first considered in 1924 by the American Public Health Association's Committee on Bathing Places ("the APHA Committee"). At first, the APHA Committee did not recommend microbiological water quality standards because of the lack of epidemiological data to support standards and because the APHA Committee was reluctant to alarm the public about the dangers of outdoor bathing places without good evidence. The APHA Committee maintained this position until 1936 when it recommended a water quality standard that said that water quality was unacceptable for bathing if total coliform bacteria densities in water were greater than 1,000 per 100 ml. The APHA Committee's decision to recommend a water quality standard expressed as a total coliform concentration was based on the belief that coliform organisms were associated with fecal material from the gut of warm-blooded animals and that the presence of coliform organisms in water was an indicator of the potential presence of enteric pathogens.

In the late 1940's and 1950's, the U.S. Public Health Service conducted a series of epidemiological studies at bathing places in Chicago, Kentucky, and Long Island, New York to determine the human health effects associated with swimming in surface waters. The studies showed that there was a detectable human health effect (diarrhea) when total coliform densities in water were approximately 2,000 per 100 ml and greater. Based on this finding and a second finding that the subset of fecal coliform organisms was a better indicator of microbiological water quality in recreational waters than total coliforms, the National Technical Advisory Committee of the Federal Water Pollution Control Association (NTAC) recommended water quality standards for bacteria in surface waters. The recommended standards were published in the 1968 Report to the Committee on Water Quality Criteria (the "Green Book"). The NTAC recommended that fecal coliforms be used as indicator organisms for evaluating the

microbiological quality of surface waters that were used for recreation. The NTAC recommended that fecal coliform densities in a surface water should not exceed a log mean of 200 per 100 ml based upon a minimum of 5 samples taken within a 30-day period. The NTAC also recommended that not more than 10% of the samples collected during a 30-day period should exceed 400 per 100 ml, as determined by the either the multiple tube fermentation or the membrane filter procedure.

In 1972, EPA published Water Quality Criteria, 1972, A Report of the Committee on Water Quality Criteria, Environmental Studies Board, National Academy of Sciences and National Academy of Engineering, Washington, D. C. 1972 (the "Blue Book"). The NAS / NAE made no specific recommendations for bacterial water quality standards for recreational waters in the Blue Book because of a lack of valid epidemiological data. In the same year, EPA initiated a series of human health effects studies at marine and fresh water bathing beaches. These studies were designed to determine if swimming in sewage-contaminated water carried a health risk for bathers, and, if so, to what types of illnesses. EPA also wanted to determine which indicator organism was best correlated to swimming-associated health effects and if there was a strong enough relationship between any particular indicator and health effects to support the recommendation of a water quality criterion. EPA studied the differences in symptomatic illness between swimming and non-swimming beach goers at marine beaches between 1972-1978 and fresh water bathing beaches between 1978-1982. The health effects studies showed that: 1) swimmers who bathed in sewage-contaminated water were at greater risk of contracting gastroenteritis, and 2) as the microbiological quality of water degrades, the swimming-associated illness rate increases. From EPA's evaluation of the bacteriological data from the health effects studies, EPA estimated that there would be 8 illnesses per 1,000 swimmers if persons swam in fresh water with a maximum geometric mean of 200 fecal coliforms per 100 ml.

In the 1976 water quality criteria document (the "Red Book"), EPA recommended the fecal coliform criteria that NTAC had previously recommended in the Green Book (i.e., 5-sample mean of 200 / 100 ml) as the microbiological water quality standard for surface waters that were used for recreation. Many states, including Arizona, appear to

have adopted EPA's recommended fecal coliform criteria as surface water quality standards for primary contact recreation or the full body contact recreation designated use.

In 1986, EPA recommended new criteria to maintain and protect microbiological water quality in surface waters that were used for recreation. EPA recommended that states adopt either enterococci or *E. coli* water quality criteria for fresh waters that were used for recreation. EPA's fresh water health effects studies conducted between 1972-1982 confirmed that there was a strong correlation between *E. coli* densities and swimming-related gastrointestinal illness and that *E. coli* was a better indicator of swimming-associated gastrointestinal illness than fecal coliform [*See* Dufour, Alfred, Health Effects Criteria for Fresh Recreational Waters, EPA 600 / 1-84-004, Health Effects Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina (August, 1984)]. EPA recommended that the 30-day geometric mean concentration (5-sample minimum) of *E. coli* in fresh water should not exceed 126 cfu / 100 ml. This value was based on the same risk level of contracting gastrointestinal illness (no more than 8 illnesses per 1,000 swimmers) that previously was used for the recommended fecal coliform criteria. EPA also recommended single sample maximum concentrations of *E. coli* based upon anticipated levels of bathing use. The recommended single sample maximum concentrations were:

- Designated bathing beach: 235 cfu / 100 ml.
- Moderate use for bathing: 298 cfu / 100 ml.
- Light use for bathing: 276 cfu / 100 ml.
- Infrequent use for bathing: 576 cfu / 100 ml.

In 1996, ADEQ adopted *E. coli* criteria to maintain and protect surface water quality for the full body contact recreation designated use. The *E. coli* criteria were based upon EPA's national criteria guidance for bacteria. ADEQ adopted a 30-day geometric mean criterion (5-sample minimum) of 130 cfu / 100 ml. This criterion was based on EPA's recommended *E. coli* criterion of 126 cfu / 100 ml rounded to the nearest ten. ADEQ adopted a single sample maximum concentration of 580 cfu / 100 ml. The single sample maximum concentration was based upon EPA's least

stringent single sample maximum concentration for fresh waters that are infrequently used for bathing (i.e., 576 cfu / 100 ml rounded to the nearest ten).

EPA recently reaffirmed its recommended water quality for bacteria in a document called Draft Implementation Guidance for Ambient Water Quality Criteria for Bacteria -- 1986, U.S. Environmental Protection Agency, Office of Water, EPA-823-D-00-001 (January, 2000), § 2.0. EPA reviewed the original health effects studies supporting its recommended 1986 water quality criteria for bacteria and the literature on epidemiological studies conducted after EPA performed its initial marine and freshwater studies of swimming-associated health effects. As a result of these reviews, EPA concluded that when applied and implemented conservatively, EPA's recommended criteria for *E. coli* are more protective of human health for gastrointestinal illness than fecal coliform criteria. EPA concluded:

> The epidemiological studies conducted since 1984, which examined the relationships between water quality and swimming-associated health effects, have not established any new or unique principles that might significantly affect the current guidance EPA recommends for maintaining the microbiological safety of marine and freshwater bathing beaches. Many of the studies have, in fact, confirmed and validated the findings of the U.S. EPA studies. There would appear to be no good reason for modifying the Agency's current guidance for recreational waters at this time.

As a result of its review, EPA reaffirmed its 1986 water quality criteria for *E. coli* as representing the best available science and serving as a defensible foundation for protecting public health in surface waters that are used for recreation. ADEQ proposes to adopt these *E. coli* criteria to protect recreational uses of surface waters in Arizona.

a. More stringent E. coli criteria for the full body contact designated use

ADEQ proposes to revise the current *E. coli* criteria for the full body contact recreation designated use in this triennial review. ADEQ proposes to adopt a slightly more stringent geometric mean concentration of 126 cfu / 100 ml for the FBC designated use (the current geometric mean standard is 130 cfu / 100 ml). The proposed *E. coli* criterion of 126 cfu / 100 ml is the same as EPA's national criteria guidance recommendation for *E. coli*. ADEQ also intends to

propose a more stringent single sample maximum criterion for the FBC designated use. The current single sample maximum for FBC (580 cfu / 100 ml) is based on the least stringent microbiological quality criterion that EPA recommends for surface waters that are infrequently used for full body contact recreation. ADEQ's adoption of the least stringent criterion as a statewide standard results in its application to all surface waters in the state with the FBC designated use, regardless of the level of expected recreational use. Consequently, the least stringent single sample maximum criterion applies equally to surface waters with designated bathing beaches that are heavily used for recreation and surface waters that are infrequently used for recreation. While the least stringent *E. coli* criterion recommended by EPA may be appropriate for surface waters in Arizona that are infrequently used for swimming or bathing, it may not provide an adequate level of human health protection in surface waters that receive heavy recreational use [e.g., Slide Rock at Oak Creek, the area of the Lower Salt River used for tubing, designated bathing beaches along the Colorado River and at Saguaro and Canyon Lakes]. Consequently, ADEQ proposes to adopt the EPA-recommended single sample maximum criterion of 235 cfu / 100 ml that applies to designated bathing beaches as the statewide criterion for the FBC designated use. The adoption of a more stringent single sample maximum criterion ensures that heavily-used recreational waters in the state are protected by adequate microbiological water quality standards.

b. Adoption of E. coli criteria for the partial body contact recreation designated use

ADEQ proposes to adopt EPA's recommended *E. coli* criteria for the partial body contact (PBC) designated use. The current water quality criteria for the PBC designated use are expressed as fecal coliform concentrations. ADEQ recommends adoption of *E. coli* criteria for the PBC designated use for two reasons. First, the proposed *E. coli* criteria are more scientifically defensible. *E. coli* criteria are supported by the health effects studies that have been conducted to support EPA's national criteria guidance recommendations for bacteria. EPA recommends the use of *E. coli* as an indicator organism instead of fecal coliforms. Second, ADEQ questions the scientific defensibility of the current fecal coliform criteria for the PBC designated use. The current fecal coliform criteria for the PBC designated use are as follows:

30-day geometric mean (5-sample minimum):	1000 cfu / 100 ml
10% of all samples for a 30-day period:	2000 cfu / 100 ml
Single sample maximum	4000 cfu / 100 ml

ADEQ has been unable to find anything in the national criteria documents or health effects literature that supports the current fecal coliform densities for the PBC designated use. ADEQ has been unable to find anything in the literature that supports a quantifiable relationship between the fecal coliform densities prescribed in the current rule and human health risks associated with exposure to surface waters through partial body contact recreational activities.

EPA does not recommend water quality criteria for secondary or partial body contact recreation to protect human health. Water quality criteria for the PBC designated use might conceivably be based on human health effects of dermal contact, inhalation, or incidental ingestion of surface water. However, there is very little human health effects data for such exposures. EPA acknowledges that there is significant uncertainty in recreational water risk assessments regarding the actual exposure levels associated with ingestion, inhalation, and dermal contact with contaminated water and corresponding levels of illness [*See* "Action Plan for Beaches and Recreational Waters," U.S. Environmental Protection Agency, Office of Research and Development, Office of Water, EPA / 600 / R-98 / 079, March, 1999, p. 8]. In light of this uncertainty, ADEQ proposes to adopt the same geometric mean criterion for *E. coli* that EPA recommends for full body contact recreation as the water quality criterion for the PBC designated use [that is, 126 cfu / 100 ml]. ADEQ proposes to adopt the same *E. coli* criteria to maintain and protect water quality for FBC and PBC. EPA has stated that it considers this approach to be consistent with § 101 of the Clean Water Act. ADEQ believes that a conservative approach to public health protection is justified in the absence of definitive risk assessments or scientifically defensible *E. coli* criteria for the PBC designated use. In effect, ADEQ proposes to adopt microbiological water quality criteria for PBC that err on the side of protecting human health. Surface water quality that is acceptable for swimming should also be acceptable for recreational activities that do not involve swimming or full body contact recreation. ADEQ also proposes to adopt the least stringent *E. coli* single

sample maximum criterion of 576 cfu / 100 ml that applies to surface waters that are infrequently used for bathing as the most appropriate criterion for the PBC designated use.

The proposed rule states:

~~C~~ A. The following water quality standards for *Escherichia coli (E. coli)*, expressed in colony forming units per 100 milliliters of water (cfu / 100 ml), shall not be exceeded:

E. coli	FBC	PBC
~~30-day geometric mean (5-sample minimum)~~	~~130~~	
Geometric mean (4-sample minimum)	126	126
Single sample maximum	~~580~~ 235	576

c. *Repeal of fecal coliform criteria for effluent dependent waters*

ADEQ proposes to repeal the current fecal coliform criteria that have been established for effluent dependent waters (EDWs) that are prescribed in R18-11-109(B)(2). The current microbiological water quality standards for EDWs are the same fecal coliform criteria that previously applied to the FBC designated use prior to the adoption of *E. coli* criteria for FBC in 1996. The current fecal coliform criteria for EDWs appear to be based on the NTAC recommendations for microbiological water quality standards to protect recreational surface waters that date back to 1968. When ADEQ updated the criteria that applied to the FBC designated use and changed the microbiological indicator from fecal coliform to *E. coli* in the last triennial review, ADEQ did not revise the microbiological water quality criteria that applied to EDWs. ADEQ did not adopt *E. coli* criteria for EDWs because ADEQ did not want to suggest that water quality in EDWs was acceptable for the full body contact recreation use. However, the same rationale that supports revision of the FBC standards to *E. coli* applies equally to the revision of the current water quality standards for EDWs that currently are expressed in terms of fecal coliform concentrations. The microbiological water quality criteria for EDWs should be expressed as *E. coli* concentrations because *E. coli* is a better indicator of microbiological water quality and there is a stronger correlation between *E. coli* concentrations and swimming-related illness than with fecal coliform.

ADEQ made a policy decision prior to the last triennial review to maintain and protect microbiological water quality in EDWs at the same level as surface waters that are protected for full body contact recreation to protect human health and to provide a margin of safety. However, the state did not want to establish FBC as a designated use for the EDWs because it did not want to suggest that EDWs were suitable for swimming or other full body contact recreation activities. The proposed *E. coli* criteria to protect the FBC and PBC designated uses are the same (i.e., a 4-sample geometric mean of 126 cfu / 100 ml.). If the proposed criteria are adopted, then ADEQ can retain the PBC designated use for EDWs and also retain a level of microbiological water quality that is equivalent to FBC.

Finally, all EDWs that are listed in the surface water quality standards rules are protected by the PBC designated use. If ADEQ adopts the proposed *E. coli* criteria for the PBC designated use in this triennial review and does not repeal the current fecal coliform criteria that apply to EDWs, then EDWs will have microbiological water quality standards that are expressed as fecal coliforms and *E. coli*. Wastewater treatment plants that discharge to EDWs will be required to conduct discharge monitoring for fecal coliform and *E. coli*. Two different microbiological water quality standards to protect human health in EDWs are unnecessary. The current fecal coliform criteria for EDWs can and should be repealed to eliminate redundant monitoring requirements.

d. Repeal of fecal coliform for the domestic water source, aquatic and wildlife, agricultural irrigation, and agricultural livestock watering designated uses

ADEQ proposes to repeal the fecal coliform criteria that have been established to protect the domestic water source (DWS), aquatic and wildlife designated uses (A&W), agricultural irrigation (AgI), and agricultural livestock watering (AgL) designated uses. ADEQ proposes to repeal these criteria for several reasons.

First, the fecal coliform criteria for the DWS, A&W, AgI, and AgL designated uses will be superseded by more stringent *E. coli* criteria if the proposed criteria for the FBC and PBC designated uses are adopted. All surface waters in Arizona, with the exception of certain canals, have either a FBC or PBC designated use. Consequently,

almost every surface water will be protected by the proposed *E. coli* criteria. Less stringent bacterial water quality standards for the DWS, A&W, AgI, and AgL designated uses will no longer be necessary.

Second, the scientific defensibility of the current fecal coliform criteria for the DWS, A&W, AgI, and AgL designated uses are questionable. There are no national criteria guidance recommendations for bacteria for the DWS, A&W, AgI, or AgL designated uses in the Gold Book. EPA only makes criteria recommendations for bacteria for freshwater bathing, marine bathing, and shellfish harvesting.

Third, previous EPA recommendations for water quality criteria for bacteria are inconsistent with the state's current fecal coliform criteria prescribed in the surface water quality standards rules. For example, in Water Quality Criteria, 1972, EPA recommended that the geometric means of fecal coliform and total coliform densities not exceed 2000 / 100 ml and 20,000 / 100 ml respectively for surface waters that were used as public water supplies (i.e., for the DWS designated use) after taking into consideration the treatment capabilities of water treatment plants. To ADEQ's knowledge, EPA has never recommended water quality criteria for bacteria for livestock watering or to maintain and protect water quality for aquatic life. The only rationale that ADEQ has found in previous EPA criteria documents that supports the current bacteria criteria is for agricultural irrigation. In 1972, EPA stated in the Blue Book that irrigation waters with a fecal coliform density of 1,000 fecal coliform organisms / 100 ml should contain sufficiently low concentrations of pathogenic microorganisms that no hazards to animals or man should result from the use or from consumption of raw crops irrigated with such water [*See* Water Quality Criteria, 1972, p. 351]. EPA's recommended Blue Book criterion is consistent with the current fecal coliform criterion for agricultural irrigation. ADEQ proposes to repeal this criterion because ADEQ thinks it will no longer be necessary if all surface waters in Arizona are protected by the proposed *E. coli* criteria for the FBC and PBC designated uses.

Expression of the E. coli criteria as geometric means and as single sample maximum concentrations

The proposed bacteria standards for *E. coli* are expressed as single sample maximum concentrations and geometric mean values. Both criteria must be met to support the FBC and PBC designated uses. The use of a geometric mean

values in the proposed standards may cause some confusion regarding how compliance with the standards is determined. Confusion may arise because the proposed standard is expressed as a geometric mean (4 -sample minimum) and the current water quality standards for fecal coliform and *E. coli* bacteria are expressed as 30-day geometric means (5-sample minimum). That is, compliance with the current standard is based on a geometric mean of the sample results from a minimum of 5 samples taken within a 30-day period.

ADEQ did not include a reference to a 30-day averaging period in the proposed standards. EPA has explained in its Draft Implementation Guidance for the Ambient Water Quality Criteria for Bacteria-1986 that the reference to a minimum of 5 samples in a 30-day period in EPA's 1986 criteria recommendations for bacteria "is for accuracy purposes only" [*See* p. 21 of the Draft Implementation Guidance]. EPA and ADEQ agree that more frequent sampling for bacteria yields more accurate results when determining a geometric mean. However, EPA has clarified in its implementation guidance that it is the geometric mean *of the samples collected* in conjunction with the single sample maximum standard that determines attainment of the recommended *E. coli* criteria. In other words, the 30 - day averaging period is not a critical element of EPA's recommended criteria. For this reason, ADEQ amended the bacteria standards and removed the reference to a 30-day geometric mean. The proposed standard is simply expressed as a geometric mean (4 -sample minimum).

ADEQ and EPA both recommend that full body contact recreational areas be frequently monitored throughout the swimming season, particularly surface waters that are designated bathing areas, to ensure that human health is adequately protected. For example, there are some heavily used designated swimming areas in Arizona (such as Slide Rock State Park on Oak Creek) where frequent water quality monitoring for bacteria is recommended in the summer. Where frequent monitoring for bacteria occurs (e.g. daily), a geometric mean of the samples that are collected within a 30-day averaging period is appropriate. However, in surface waters that are infrequently used for full body contact recreation, less frequent water quality monitoring takes place and the use of a 30 -day averaging period is impractical. For example, ADEQ conducts monitoring of surface waters for bacteria as part of its ambient surface water quality monitoring program. ADEQ typically monitors quarterly for bacteria at sampling sites. Under

the current standards, ADEQ cannot determine compliance with the 30 -day geometric mean (5-sample minimum) bacterial water quality standard. ADEQ does not take 5 samples within 30 days at any site as part of its ambient surface water quality monitoring program.

Under the proposed rule, compliance with the *E. coli* standard is based on a 4 -sample minimum geometric mean. If the rule is changed as proposed, ADEQ will be able to determine compliance with the standard based on 4 quarterly samples that are taken over the water year. For this reason, ADEQ amended the expression of the geometric mean standard in the proposed rules. The proposed bacterial water quality standard is expressed as a geometric mean concentration calculated from a minimum of 4 samples. The expression of the *E. coli* standard in this way does not preclude more frequent water quality monitoring or the use of 30-day averaging periods in NPDES permits or at places like Slide Rock State Park. However, the proposed amendment will permit ADEQ to determine compliance with bacterial water quality standards in surface waters that are infrequently used for full body recreation. ADEQ will be able to determine compliance from quarterly samples that are collected as part of the ambient surface water quality monitoring program. It should be noted that compliance with the single sample maximum criteria for *E. coli* is determined from the analytical results of a single grab sample.

Temperature [R18-11-109(E)]

R18-11-109(E) prescribes limits on the maximum allowable increase in the temperature of a receiving surface water due to a discharge. The current water quality standard states that a maximum increase of 3.0° C from a thermal discharge is allowed in a receiving water with the A&Ww and A&Wedw designated uses. A maximum increase of 1.0° C due to discharge is allowed to a receiving surface water with the A&Wc designated use. The water quality standards for temperature are intended to apply to point source discharges to perennial waters where the thermal component of the discharge is controllable. The temperature criteria are not intended to apply to discharges to ephemeral waters because the flow in an ephemeral water consists entirely of point and nonpoint source discharges of storm water runoff. The temperature of a storm water discharge is highly variable and uncontrollable. ADEQ proposes to revise

footnote 4 to this water quality standard to clarify that the "maximum increase in temperature" standard does not apply to storm water discharges.

Repeal of the Current Numeric Turbidity Criteria [R18-11-109(F)]

ADEQ proposes to repeal the current turbidity criteria at R18-11-109(F). The current turbidity criteria are established to maintain and protect water quality for aquatic life designated uses (A&Wc, A&Ww, and A&Wedw). The current turbidity standards are as follows:

F. The following water quality standards for turbidity, expressed as a maximum concentration in nepholometric turbidity units (NTU) shall not be exceeded:

	A&Ww, A&Wedw	**A&Wc**
Rivers, streams, and other flowing waters	50	10
Lakes, reservoirs, tanks, and ponds	25	10

Turbidity is a qualitative measure of water clarity or opacity. Turbidity in water is caused by fine suspended particles such as clay, silt, organic and inorganic matter, plankton, and other microscopic organisms. Turbidity is an expression of the optical property that causes light to be scattered and adsorbed rather than transmitted in straight lines through a water sample. The measurement of turbidity, read in nepholometric turbidity units (NTUs), is an index of light refraction when light strikes suspended particles in the water. As a qualitative measurement, turbidity gives only a relative assessment of particulate loading in a surface water. Turbidity is a surrogate measurement for *estimating* the amount of suspended solids that are in water.

The source of the current turbidity criteria appears to date back to the first water quality standards adopted for surface waters in Arizona [*See* "Water Quality Standards for Surface Waters in Arizona," State Department of Health, Water Quality Control Council (July 18, 1968)]. On July 18, 1968, the Water Quality Control Council (WQCC)

adopted the following turbidity criteria to protect surface water quality for domestic and industrial water supply, recreation, and the protection of fish and wildlife:

> Turbidity of the water will be maintained at the lowest practicable values possible, but in no case shall:
>
> a. Turbidity in the receiving waters due to the discharge of wastes exceed 50 Jackson units in warm water streams or 10 Jackson units in cold water streams.
>
> b. Discharge to warm water lakes cause turbidities to exceed 25 Jackson units, and discharge to cold water or oligotrophic lakes cause turbidities to exceed 10 Jackson units.

The original water quality standards for turbidity cited above appear to have been based on recommendations made in Water Quality Criteria, Report of the National Technical Advisory Committee to the Secretary of the Interior (April 1, 1968) (the "Green Book"). The Green Book recommendations for turbidity were based on research studies dating back to the 1930's. (Ellis, 1937; Smith, 1940; Wallen, 1951; Buck, 1956; Tarzwell, 1957; Wagner 1959; Ziebell, 1960; Herbert and Merkens, 1961). One of the studies cited in the Green Book discussion of turbidity [Buck (1956)] actually supports the numeric criteria recommended by National Technical Advisory Committee. Buck investigated several farm ponds, hatchery ponds, and reservoirs over a 2-year period and observed that the maximum fish yield occurred in farm ponds where the average turbidity of the water was less than 25 Jackson units. Buck observed that fish yields decreased in farm ponds as turbidities increased to between 25 and 100 Jackson units and decreased again when turbidities exceeded 100 Jackson units.

Another possible source for the recommended 25 JTU turbidity criterion for warm water lakes may have been the precision of the method used for measuring turbidity at the time the Green Book recommendations were made. The instrument originally designed for the measurement of turbidity and in use in 1968 when the Green Book turbidity recommendations were made was the Jackson candle turbidimeter. The Jackson candle turbidimeter was a laboratory device that measured a combination of optical parameters such as light scatter, adsorption, and reflectance using the

human eye as the detector. The unit of measurement was called a Jackson candle unit, Jackson candle turbidity number, or Jackson turbidity unit (JTU). According to Standard Methods for the Examination of Water and Wastewater, the lowest turbidity value that could be measured by the Jackson candle turbidimeter was 25 JTUs. More precise instruments for measuring turbidity, including nephelometers, have since been developed. The newer instruments for measuring turbidity use incandescent light sources instead of a candle and they use automated photocell detectors instead of the human eye. Formazin suspensions were later accepted as the standard for calibration of turbidimeters and the unit of measurement became the formazin turbidity unit, or FTU. Currently, the nepholometric turbidity unit (NTU) is used as the unit of measurement. A NTU refers to the amount of light that is scattered at 90° when a turbidimeter is calibrated with formazin.

A comparison of the current turbidity criteria and the 1968 criteria shows that the numeric criteria have changed very little in over 30 years. Both sets of turbidity standards distinguish between streams and lakes and cold and warm surface waters. The only substantive change to the turbidity criteria in the last 30 years appears to be to the way that turbidity is measured. The units of measurement changed from Jackson turbidity units (JTUs) to nephelometric turbidity units (NTUs). However, the current numeric criteria for warm and cold water streams and lakes are the same as they were in 1968:

Comparison of 1968 and 1996 Turbidity Criteria

Type of surface water	1968	1996
Warm water streams	50 Jackson units	50 NTUs
Cold water streams	10 Jackson units	10 NTUs
Warm water lakes	25 Jackson units	25 NTUs
Cold water lakes	10 Jackson units	10 NTUs

ADEQ proposes to repeal the numeric water quality criteria for turbidity for several reasons:

1. The current numeric turbidity standards appear to be based based upon Green Book criteria recommendations that were made in 1968. The scientific defensibility of the current turbidity criteria is questionable.

2. The current turbidity criteria are expressed as single sample maximum concentrations. In Arizona, with its variable climate and hydrology, a single sample maximum measurement of turbidity is scientifically indefensible. A single sample maximum does not account for the spatial and temporal variability in Arizona surface waters. Many variables can affect the suspended and settleable solids concentrations in a surface water. These variables include watershed size, land uses, slopes, precipitation intensity and duration, soil types, channel morphology, stream stablility, and vegetative cover (to name just a few).

3. A single sample exceedance of the current turbidity standards is not correlated to impairment of aquatic life. There is no evidence that a one-time exceedance of the current turbidity criteria results in impairment of aquatic life designated uses.

4. Turbidity measurements are qualitative and they do not directly relate to the concentration of suspended solids in surface waters.

5. Turbidity data can be unreliable because of quality assurance / quality control problems associated with both field and laboratory measurements of turbidity. The laboratory measurement of turbidity in surface water may be unreliable because of exceedances of recommended sample holding times for turbidity analysis. Standard Methods recommends that water samples be analyzed in the laboratory on the same day that the sample is collected. Field measurements of turbidity are considered to be more reliable, but they may be affected by many variables including air bubbles; the sizes, shapes, and refractive characteristics of the particles that are suspended in the water; and differences in instrumentation. Standard Methods notes that variations of up to five times can result if different turbidimeters, all calibrated against the same standard, are used to measure the turbidity of a surface water.

6. According to Standard Methods, there is no direct relationship between the intensity of light scattered at a 90° angle (as measured in NTUs) and Jackson candle turbidity (JTUs). The absence of a direct relationship

calls the current turbidity criteria into question because it appears that the units of measurement changed from JTUs to NTUs while the same numeric criteria that were adopted in 1968 have been maintained. In other words, because of fundamental differences between modern turbidimeters and the Jackson candle turbidimeter, results that are expressed in JTUs may not be equivalent to results expressed in NTUs (i.e., 50 NTUs ≠ 50 JTUs).

For all of these reasons, ADEQ proposes to repeal the current numeric turbidity criteria. Instead, ADEQ will rely on 1) a numeric criterion for suspended sediment concentration to protect fish, 2) a narrative standard for suspended solids to protect water quality for domestic water source use, and 3) a narrative standard for bottom deposits to maintain and protect water quality for aquatic life.

Numeric suspended sediment concentration criteria to protect aquatic life

While ADEQ no longer supports the current turbidity criteria to protect aquatic life, ADEQ recognizes that the concentration of suspended solids in a surface water is an important water quality parameter because of the effect of suspended solids on light penetration, temperature, and on aquatic life. The importance of fluvial sediment to the quality of aquatic and riparian systems is well established. The U.S. Environmental Protection Agency identifies sediment as the single most widespread cause of impairment of the nation's rivers and streams, lakes, reservoirs, ponds and estuaries.

Suspended solids can affect several trophic levels and components of an aquatic ecosystem. For example, the EPA Water Quality Criteria 1986 document cites a report by the European Inland Fisheries Advisory Commission (EIFAC) which identifies 4 adverse effects of excessively high concentrations of suspended solids on fish. Excessively high concentrations of suspended solids:

- Act directly on fish swimming in the water in which solids are suspended, either by killing them or reducing their growth rate and resistance to disease;
- Prevent the successful development of fish eggs and larvae;

- Modify the natural movements and migrations of fish; and
- Reduce the abundance of food available to fish.

With regard to the effects of suspended solids on fisheries, EIFAC goes on to report that:

- There is no evidence that concentrations of suspended solids less than 25 mg / L have any harmful effects on fisheries;
- It should be possible to maintain good or moderate fisheries in surface waters that normally contain 25 to 80 mg / L suspended solids. However, the yield of fish from such waters may be lower than from those surface waters that have suspended solids less than 25 mg / L.
- Waters normally containing from 80 to 400 mg / L suspended solids are unlikely to support good fresh water fisheries, although fisheries may be found at the lower concentrations within this range.
- Only poor fisheries are likely to be found in waters that normally contain more than 400 mg / L suspended solids.

[*See* Water Quality Criteria 1972, A Report of the Committee on Water Quality Criteria, Environmental Studies Board, National Academy of Sciences and National Academy of Engineering, Washington, D.C., 1972]

Increases in suspended solids concentrations in a surface water may negatively affect fish populations in other ways. As noted above, high concentrations of suspended solids act directly on fish and cause stress reactions, behavioral modifications, reduce resistance to disease, and clog and abrade gill membranes. High concentrations of suspended solids reduce light penetration in a surface water and this can adversely affect fish reproductive processes. Some fish species have strong visual components to their reproductive behavior. For example, researchers have found that largemouth bass spawning was delayed by as much as 30 days in turbid surface waters as compared to clear surface waters. Studies have shown that smallmouth bass populations shun potential spawning areas that are highly turbid. Reproductive failure among many fish species can be attributed to the direct loss of spawning habitat due to siltation of formerly clean substrates and the loss of vegetation due to reductions in the size of the photic zone. Suspended solids also can impair the ability of sight feeding fish to locate their prey. It also can cause modifications in the natural movements and migrations of fish.

Suspended solids can reduce the size of the photic zone in a surface water and the amount of light available to aquatic plants. A decrease in light penetration reduces photosynthetic activity and can result in a reduction of primary production in a surface water. A decrease in light penetration may affect the depth distribution of vascular plants and algae. Greatly reduced light penetration may shift the algal composition of a surface water from green algae to blue-green algae since the latter are more tolerant of higher levels of ultraviolet light. Zooplankton populations also may be reduced because of decreases in primary productivity. Zooplankton are a major source of food for fish and a reduction in their population can have an adverse effect on fish populations. In 1974, a National Academy of Sciences (NAS) committee recommended that the depth of light penetration in a surface water not be reduced by more than 10 percent and EPA's current recommended criterion for suspended solids appears to be based on this NAS recommendation. EPA's recommended criterion in the Water Quality Criteria 1986 document states:

> Suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life.

ADEQ decided not to propose this recommended criterion as a surface water quality standard because ADEQ does not have reliable data on what the seasonal norms are for the depth of the compensation point for photosynthetic activity in Arizona surface waters. EPA's recommended criterion cannot be implemented without this baseline data. Instead, ADEQ proposes a numeric suspended sediment concentration criterion that is intended to protect fish in surface waters. The proposed standard is based upon earlier EPA criteria guidance for suspended solids recommended in the Water Quality Criteria, 1972 document and U.S. Geological Survey research recommending the use of analytical methods that measure the sedimented sediment concentration. In the criteria document, EPA states that aquatic communities should be protected if the following maximum concentrations of suspended solids exist:

- High level of protection 25 mg / L
- Moderate protection 80 mg / L
- Low level of protection 400 mg / L
- Very low level of protection 400 mg / L

The recommended maximum concentrations of suspended solids cited above apply to surface waters that *normally* contain those levels of suspended solids. The EPA guidance document states there is no evidence of harmful effects on fisheries if the concentration of suspended solids in a surface water is usually below 25 mg / L. If the concentration of suspended solids is usually below 80 mg/L, it is possible to maintain good or moderate fisheries. EPA's recommended criteria are intended to apply to rivers and streams at or near base flow (i.e., a stream's "normal" flow regime). The EPA criteria document also notes that temporary high concentrations of suspended solids should be prevented in streams where good fisheries are to be maintained but that fish can tolerate high concentrations of suspended solids for short periods of time. Citing a study by Wallen (1951), the criteria document states that short-term behavioral reactions in fish were not observed until concentrations of suspended solids neared 20,000 mg / L and in one species reactions did not occur until suspended solids concentrations reached 100,000 mg / L. Most fish species that were tested endured exposures of more than 100,000 mg / L for a week or longer, but these same fishes finally died at suspended solids concentrations of 175,000 to 200,000 mg / L. Lethal concentrations caused the death of fishes within 15 minutes to 2 hours. This research suggests an approach to expressing numeric criteria for suspended sediment in Arizona surface waters.

The proposed numeric standard for suspended sediment is intended to protect fish populations. Thus, the proposed criteria are derived for the protection of aquatic and wildlife designated uses only. Arizona has 4 subcategories of aquatic life designated uses: A&Wc, A&Ww, A&Wedw, and A&We. However, ADEQ proposes that the new suspended sediment concentration criteria apply only to the A&Wc and A&Ww designated uses.

The proposed suspended sediment criteria should not apply to ephemeral waters (A&We) for two reasons. First, the proposed criteria are intended to protect fish and ephemeral waters do not support fish populations. Second, the proposed criteria are intended to apply at or near base flow conditions. Ephemeral waters are defined as surface waters that flow only in direct response to precipitation. There is no base flow in an ephemeral water. The "normal" flow regime of an ephemeral water is either no flow or high intensity, short-term flows associated with direct runoff from a precipitation event. An ephemeral water is normally a dry watercourse. Since the proposed criteria are

intended to apply during a stream's "normal" flow regime, they do not apply to ephemeral waters that have no flow except in direct response to a precipitation event.

The proposed suspended sediment criteria should not apply to effluent dependent waters (EDWs) for two reasons. First, the primary purpose of the proposed suspended sediment criteria is to protect fish populations. In most cases, EDWs either do not have fish populations or they have limited fish populations (e.g., mosquito fish). Second, and more importantly, EDWs are created by the discharge of treated wastewater from a wastewater treatment plant to an ephemeral water. Point source discharges of treated wastewater from a wastewater treatment plant to an EDW are regulated under the federal secondary treatment regulation [See 40 CFR, Part 133]. The federal secondary treatment regulations establish technology-based effluent limits on the discharge of suspended solids from a wastewater treatment plant. Under 40 CFR § 133.102, the 30-day average of suspended solids cannot exceed 30 mg / L and the 7-day average cannot exceed 45 mg / L. In addition, federal secondary treatment regulations require a wastewater treatment plant to achieve a 30-day average percent removal of suspended solids of 85%. These technology-based requirements are more stringent than the proposed water quality criteria for suspended sediment. ADEQ will rely on the secondary treatment regulations to provide effective control over the discharge of suspended solids to EDWs.

It is clear from EPA's criteria recommendations for suspended solids in the Blue Book that criteria recommendations are intended to be chronic criteria. The recommended criteria are intended to protect fish from chronic or long-term exposures to suspended solids in surface waters. The rationale in the Blue Book supporting EPA's recommended criteria states that fish can withstand much higher acute or short-term exposures to suspended solids. For this reason, ADEQ proposes to express the suspended sediment criteria as an average value (4 -sample minimum) that must achieved in a stream at or near base flow conditions (i.e., the stream's "normal" flow regime). Water that flows in a surface water consists of a base flow fraction made up of ground water that infiltrates into a stream channel and a direct runoff fraction that enters the drainage system during and soon after a precipitation event. The proposed criterion is intended to apply only at or near base flow in a stream and not during storm events. Sample results

that are taken in a stream during or soon after a precipitation event should not be used to determine compliance with the proposed suspended sediment criterion.

Finally, the proposed criteria are expressed as a suspended sediment concentration (SSC). The SSC analytical method, ASTM D 3977-97, Standard Test Method for Determining Sediment Concentration in Water Samples, is the U. S. Geological Survey (USGS) standard method for determining concentrations of suspended material in surface water samples. The method is used by all USGS sediment laboratories and by cooperating laboratories certified to provide suspended sediment data to USGS. The SSC is the most accurate way to measure the total amount of suspended material in a water sample collected from a surface water. Recent studies on the accuracy of the SCC analytical method by ASTM and the U.S. Geological Survey Branch of Quality Systems (Gordon and others, 2000) have shown that the SCC analysis represents a more accurate and reliable measure of the concentration of suspended sediment in a surface water sample. Other measurements, such as total suspended solids and turbidity, may be less expensive to collect or analyze but they result in unacceptably large errors and are fundamentally unreliable.

Differences between total suspended solids (TSS) and suspended sediment concentration analyses were investigated recently by the U.S. Geological Survey [*See* Gray, John R. et. al, Comparability of Suspended Sediment Concentration and Total Suspended Solids Data, Water Resources Investigation Report 00-4191, U. S. Department of the 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 SCC technique is more reliable than data produced by TSS analysis. The conclusions of this USGS study can be summarized as follows:

- TSS analysis is normally performed on an aliquot of the original water sample. The difficulty in withdrawing an aliquot from a sample that truly represents suspended material concentration leads to inherent variability in the measurement. By contrast SCC analysis is performed on an entire water sample, thus measuring the

entire sediment mass in the sample. The analytical procedures for SCC and TSS differ and at times produce considerably different results, particularly when sand-size material composes a significant percentage of the sediment in a sample.

- TSS methods and equipment differ among various laboratories whereas SSC methods and equipment used by USGS sediment laboratories are consistent and are quality assured by the National Sediment Laboratory Quality Assurance Program.
- Results of the TSS analytical method tend to produce data that are negatively biased by 25 % to 34 % with respect to SCC analyses collected at the same time and can vary widely at different flows at a given site. The biased TSS data can result in errors in sediment load computations of several orders of magnitude.

For the reasons stated above, ADEQ proposes the following criterion expressed as a suspended sediment concentration:

D. The following water quality standard for suspended sediment concentration, expressed as an arithmetic mean (4 sample minimum), shall not be exceeded. The criterion applies to a surface water that is at or near base flow and does not apply during or soon after a precipitation event:

A&Wc, A&Ww

80 mg/ L

Nutrient criteria [R18-11-109(H)]

R18-11-109(H) prescribes water quality standards for total phosphorus and total nitrogen for a number of major rivers, their tributaries, and lakes in Arizona. The listed streams include the Verde River, Salt River, Little Colorado River, Colorado River, and the San Pedro River. The lakes include Roosevelt, Apache, Canyon, and Saguaro lakes. The current criteria for nutrients are expressed as annual means, 90th percentile values, and single sample maximum concentrations. ADEQ does not propose to change the current nutrient criteria in this triennial review. However, ADEQ expects that the development of revised nutrient criteria for streams and lakes will be a major issue in the next triennial review.

An initiative to address nutrient enrichment problems in the nation's waters was published in the Clean Water Action Plan in February, 1998. The Clean Water Action Plan states that EPA will establish numeric criteria recommendations for nutrients (i.e., nitrogen and phosphorus) in 2000. The federal nutrient criteria recommendations are to be tailored to reflect different types of water bodies (e.g., lakes, rivers, and estuaries) and different ecoregions of the country. The Clean Water Action Plan states that EPA will assist states to adopt numeric water quality standards for nutrients based on the EPA's criteria recommendations. EPA expects to develop numerical ranges for acceptable levels of nitrogen and phosphorus in surface waters based upon the water body type and the region of the country in which the surface water is located. EPA also expects the states to adopt numeric water quality standards for nutrients within 3 years of EPA issuance of recommendations for nutrient criteria. EPA has stated its intention to federally promulgate nutrient criteria if a state fails to adopt a water quality standard for nutrients appropriate to their region and water body types.

EPA recently published notice of the availability of 17 ecoregional nutrient criteria documents for lakes, streams and rivers, and wetlands in 8 ecoregions in the United States. In the notice of availability of the nutrient criteria documents, EPA restated its expectation that the states will use the ecoregional nutrient criteria recommendations as "starting points" to identify more accurate, site-specific nutrient criteria for surface waters located within the states. EPA expects states to develop a plan for the development of numeric nutrient criteria for its surface waters by the end of 2001 and to adopt or revise numeric nutrient criteria for surface waters by 2004.

Salinity of the Colorado River [R18-11-110]

R18-11-110 prescribes flow-weighted average annual salinity standards for three control points on the lower Colorado River. R18-11-110 requires that the flow-weighted average annual total dissolved solids concentration be maintained at or below 723 mg/L below Hoover Dam, 747 mg/L below Parker Dam, and 879 mg/L at Imperial Dam. ADEQ proposes to retain these salinity standards without change in this triennial review.

Arizona's numeric salinity standards are based upon water quality standards for salinity recommended by the Colorado River Basin Salinity Control Forum (Forum). The Forum conducts its own triennial review of the water quality standards for salinity. On May 27, 1999, the Forum approved the "Report on the 1999 Review, Water Quality Standards for Salinity, Colorado River System (June, 1999)." On October 27, 1999, the Forum approved a Supplemental Report to its 1999 Review. The 1999 Review and the Supplemental Report constitute the Forum's triennial review of the water quality standards for salinity of the Colorado River system. The Forum's final report and supplement were transmitted to Governor Hull by letter dated December 3, 1999 urging prompt state adoption of the Salinity Control Forum's salinity criteria and the plan of implementation by Arizona's water quality control agency.

The Forum recommended no change to the current numeric salinity criteria that have been established for the 3 control points on the Colorado River at Hoover, Parker, and Imperial dams. These criteria are incorporated into Arizona's surface water quality standards rules in R18-11-110. No change has been made to the numeric salinity criteria since their original adoption by the Forum in 1975. ADEQ reviewed the Forum's 1999 Review and concurs that there is no need to modify the numeric criteria for salinity that are in R18-11-110 in this triennial review.

The Forum's water quality standards for salinity consist of the numeric salinity criteria and a plan of implementation for salinity control for the Colorado River system. The plan of implementation is designed to meet the objective of maintaining the salinity concentrations at or below the numeric criteria at the three stations located on the lower mainstem of the Colorado River. The legal basis for the inclusion of a plan of implementation as an element of the Forum's water quality standards for salinity appears to date back to the Water Quality Act of 1965. Water quality standards initially appeared in §5 of that Act. Under the Water Quality Act of 1965, water quality standards consisted of 3 basic elements: 1) a designated use, 2) water quality criteria expressed in numeric or narrative form sufficiently stringent to protect the designated use, and 3) a plan of implementation and enforcement of the water quality criteria [*See* §10(c)(1), 79 Stat. 907, 33 U.S.C. §1160(c)(1) (1965)]. The inclusion of a plan of implementation as a required element of water quality standards was deleted in the Clean Water Act of 1972. §303(c) of the Clean

Water Act removed the plan of implementation as a required element of water quality standards [*See* EDF v. Costle, 657 F. 2nd 275 (D.C.Cir. 1981)].

While a plan of implementation is not a required element of a state water quality standards under §303(c), ADEQ proposes to amend R18-11-110 to incorporate by reference the Forum's plan of implementation for salinity control. The plan of implementation includes: 1) completion of Bureau of Reclamation, Bureau of Land Management (BLM), and U.S. Department of Agriculture salinity control measures to the extent that each unit remains viable and cost-effective, 2) implementation of the Forum's recommended policies for effluent limitations, principally under the NPDES permit program. These policies include the following: "Policy for Implementation of Colorado River Salinity Standards Through the NPDES Permit Program," "Policy for the Use of Brackish and / or Saline Waters for Industrial Purposes," "Policy for Implementation of the Colorado River Salinity Standards Through the NPDES Permit Program for Intercepted Ground Water," and "Policy for Implementation of the Colorado River Salinity Standards Through the NPDES Permit Program for Fish Hatcheries," and 3) implementation of nonpoint source management plans developed by the states and approved by EPA. These policies are designed to ensure compliance with the numeric criteria for salinity at the control points on the lower Colorado River. During each triennial review of the Forum's water quality standards for salinity, the numeric criteria for salinity are reviewed and the plan of implementation is updated as necessary to ensure compliance with the numeric criteria.

The Colorado River water quality standards for salinity and the approach taken by the basin states to salinity control are unique. Arizona strongly supports the efforts of the Forum and its salinity control activities in the Colorado River basin, including the plan of implementation. For this reason, ADEQ proposes to add a subsection (B) to R18-11-110 to adopt the plan of implementation for salinity control:

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 salinity set forth in subsection (A), the Department adopts the plan of implementation contained in the "1999 Review, Water Quality Standards for Salinity, Colorado River System," Colorado River Basin Salinity Control Forum

(June, 1999) which is incorporated by reference and on file with the Office of the Secretary of State and the Department.

Unique Waters [R18-11-112]

R18-11-112 prescribes the rules that govern the state's unique waters program. A unique water is a surface water that ADEQ has determined to be an outstanding state resource water. Currently, there are 10 unique waters in Arizona:

1. West Fork of the Little Colorado River above Government Springs
2. Oak Creek, including the West Fork of Oak Creek
3. Peeples Canyon Creek, a tributary to the Santa Maria River
4. Burro Creek, above its confluence with Boulder Creek
5. Francis Creek, in Mohave and Yavapai counties
6. Bonita Creek, a tributary to the upper Gila River
7. Cienega Creek, from I-10 to the Del Lago Dam in Pima County
8. Aravaipa Creek, from the confluence with Stowe Gulch to the downstream boundary of the Aravaipa Canyon Wilderness Area.
9. Cave Creek and the South Fork of Cave Creek, in the Chiricahua Mountains, and
10. Buehman Canyon Creek, a tributary to the San Pedro River.

Unique waters are given stringent surface water quality protections under R18-11-107(D), the state antidegradation rule. R18-11-107(D) states:

> Tier 3: Existing water quality shall be maintained and protected in a surface water that is classified as a unique water or that the Director has proposed for classification as a unique water pursuant to R18-11-112. The Director shall not allow limited degradation of a unique water pursuant to [R18-11-107(C)].

Under Arizona's current antidegradation implementation guidelines, any proposed activity that results in a new or expanded discharge of pollutants directly to a unique water is prohibited. For example, a new or expanded point source discharge of pollutants (e.g., a new wastewater treatment plant) directly to a unique water is prohibited by the state's Tier 3 antidegradation policy. The antidegradation implementation guidelines also prohibit a new or expanded discharge of pollutants to a tributary to a unique water if the discharge would cause degradation of existing water quality in the downstream unique water. A unique waters classification also can affect land use activities within a unique waters watershed. Land use activities that cause nonpoint source pollution are not exempt from the provisions of Arizona's Tier 3 antidegradation policy. For example, cattle grazing, mining, timber harvesting, agriculture, and other land uses that result in the nonpoint source discharge of pollutants to a surface water could be affected by a unique waters classification. Once a surface water is classified as a unique water, land use activities in the watershed have to be conducted in a way that prevents the degradation of existing water quality in the unique water. While Arizona does not have a regulatory program to directly control nonpoint sources of pollution, 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 a unique water.

ADEQ classifies surface waters as unique waters by rulemaking. To classify a surface water as a unique water, ADEQ must go through the rulemaking process to amend R18-11-112 to add a new unique water to the list of 10 unique waters in R18-11-112(E). The legal requirements for the rulemaking process are prescribed in the State Administrative Procedures Act. Those requirements must be followed to classify a surface water as a unique water [*See* R18-11-112(A)]. Rulemaking to classify a unique water usually takes place as part of the triennial review of the surface water quality standards rules.

Under R18-11-112, any person may nominate a surface water for classification as a unique water. The current rule outlines the nomination process in R18-11-112(B). A person who wants to nominate a surface water for unique waters classification must submit a nomination to ADEQ. The nomination must include: 1) a map and description of the candidate unique water, 2) a written statement in support of the nomination that includes a specific reference to

one of the two grounds for unique water classification, 3) supporting evidence that one or more of the grounds for classification is met, and 4) available water quality data relevant to establishing baseline water quality conditions for the proposed unique water.

ADEQ may classify a surface water as a unique water if it meets one of the following criteria:

1. The surface water is of exceptional recreational or ecological significance because of its unique attributes, including but not limited to attributes related to the geology, flora, fauna, water quality, aesthetic values, or wilderness characteristics of the surface water, or
2. Threatened or endangered species are known to be associated with the surface water and the existing water quality is essential to the maintenance and propagation of a threatened or endangered species, or the surface water provides critical habitat for a threatened or endangered species.

The Director has discretion to classify unique waters. R18-11-112(D) states that the Director *may* classify a surface water as a unique water if the Director finds that one or both of the grounds for classification are met. However, ADEQ is not required to classify a nominated surface water as a unique water even if it meets one of the 2 grounds for unique waters classification stated above. There are no guidelines in the current rule to guide the exercise of the agency's discretion in making this decision.

ADEQ proposes to prescribe more specific eligibility criteria for a unique waters classification. The current grounds for unique water classification are broad and general, especially the ground that provides for unique classification if a surface water is determined to be "of exceptional recreational or ecological significance because of its unique attributes."[*See* R18-11-112(D)(1)]. While the current rule provides examples of the types of unique attributes that may be considered by the ADEQ (i.e., geology, flora, fauna, water quality, aesthetic values, or wilderness characteristics), there are no criteria or guidelines in the rule for determining what constitutes *exceptional* recreational or ecological significance.

ADEQ proposes to establish new requirements for a surface water that must be satisfied before it can be considered eligible for a unique waters classification. The proposed eligibility requirements are modeled on the eligibility requirements for rivers under the federal Wild and Scenic Rivers Act (Pub. L 90-542 as amended, 16 U.S.C. 1271-1287). The Wild and Scenic Rivers Act appears to be one of the sources for the attributes listed in the "exceptional recreational or ecological significance" ground for unique waters classification. In fact, two of the attributes listed as examples in R18-11-112(D)(1), "wilderness characteristics " and "aesthetic values," are synonyms for "wild and scenic." The statement of intent in the preamble to the Wild and Scenic Rivers Act could serve as a mission statement for the state's current unique waters program. The preamble to the Wild and Scenic Rivers Act states:

> It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, *possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values,* shall be preserved in free flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations.

This language is similar to language used in "exceptional recreational and ecological significance" ground for unique waters classification at R18-11-112(D)(1). R18-11-112(D)(1) states that a surface water may be classified as a unique water if the Director finds:

> The surface water is of exceptional recreational or ecological significance because of its unique attributes including but not limited to, attributes related to geology, flora, fauna, water quality, aesthetic values, or the wilderness characteristics of the surface water.

ADEQ proposes to add several eligibility requirements to the unique waters rule that are based on the Wild and Scenic Rivers Act. First, the proposed rule clarifies that a surface water must be perennial to be eligible for a unique waters classification. That is, a surface water must flow continuously throughout the entire year. Ephemeral waters and intermittent surface waters are ineligible for unique waters classification under the proposed rule.

Second, a surface water must be "in a free-flowing condition" to be eligible for a unique waters classification. "Free-flowing" means that a nominated surface water does not have impoundments, diversions, channelization, rip-rapping, or other hydrological modifications within a nominated surface water reach. In applying this eligibility criterion, the fact that a nominated surface water flows between impoundments does not necessarily preclude its satisfying the "free-flowing condition" eligibility requirement. Surface waters that flow between impoundments may be considered to be "free-flowing " provided conditions within the nominated reach meet the requirements stated above. For example, the Colorado River flows between several large impoundments in Arizona and the flow of the river is regulated by dams. The Colorado River between Lake Powell and Lake Mead would be considered "free-flowing" and eligible for unique waters classification because there are no impoundments, diversions, channelization, or other hydrological modifications within the reach of the Colorado River between the two lakes. Even though the flow of the river is regulated, it still satisfies the "free-flowing" eligibility requirement. An effluent dependent water would be ineligible for unique waters classification because ADEQ does not consider an EDW to be "in a free-flowing condition" since it is entirely dependent on the point source discharge of treated wastewater.

Third, ADEQ proposes to require that a surface water have exceptional water quality in order to be eligible for a unique waters classification. Water quality must meet or exceed applicable water quality standards that have been established for recreation in and on the water and for the propagation of aquatic life to be eligible for unique waters classification. A surface water that is identified as an impaired surface water under §303(d) of the Clean Water Act would be ineligible for unique waters classification under the proposed rule. It should be noted that the adoption of this requirement will require the collection of water quality data at some point in the unique waters classification process to determine baseline water quality. The current rule requires a nominating party to submit *available* water quality data relevant to establishing baseline water quality of a proposed unique water. ADEQ proposes to retain this requirement and does not propose to require that nominating parties collect data on existing water quality and submit that data as part of a nomination. ADEQ recognizes that a requirement to collect water quality data would impose a significant cost on nominating parties. Nonetheless, the collection of data on existing water quality is critically important to providing Tier 3 antidegradation protection and to the practical implementation of the unique

waters program. The primary benefit of a unique water classification is the maintenance and protection of existing water quality and prohibition against degradation under Tier 3 of the antidegradation rule. Tier 3 antidegradation protection cannot be provided without data on existing water quality. If existing water quality data is unavailable for a nominated surface water, then it will have to be collected before a decision can be made on the proposal or the classification of a unique water.

Fourth, it must be shown in a nomination that at least one of the grounds for unique waters classification is satisfied. A nominating party must provide sufficient information in a nomination that demonstrates either: 1) a federally-listed threatened or endangered species is associated with the surface water and the surface water is essential to the maintenance and propagation of the species, or 2) the surface water provides critical habitat for a federally-listed threatened or endangered species, 3) the surface water is of "exceptional recreational ...significance" because of one or more outstanding attributes, or 4) the surface water is of "exceptional... ecological significance" because of one or more outstanding attributes.

Currently, R18-11-112(C) states that any person may nominate a surface water for consideration as a unique water by filing a petition for rule adoption with the Department. The current rule requires a person who nominates a surface water to submit a map and description of the surface water, a written statement in support of the nomination with specific reference to the applicable criteria for unique waters classification, supporting evidence demonstrating that 1 or more of the applicable criteria are met, and any available water quality data that is relevant to establishing baseline water quality of the proposed unique water. ADEQ sometimes receives nominations that do not provide enough information for ADEQ to make a decision on a unique waters classification, or the accuracy of the information provided in the nomination documents is uncertain or disputed, or the information provided is insufficient to provide a clear basis for findings of eligibility or classification.

ADEQ proposes to develop a substantive policy to provide specific guidance on the information requirements for unique waters nominations. A person who wants to nominate a surface water as a unique water will still have to

provide a map and a description of the nominated surface water. The description of the surface water must include information or data which demonstrates that a nominated surface water is perennial. Second, the description of the surface water must include information upon which ADEQ may find that the nominated surface water is "in a free-flowing condition." The description of the nominated surface water must describe any impoundments, diversions, channel modifications, flood control structures, bridges, road crossings, rip-rapping, or other hydrological modifications. Third, a nomination should include information on the current status of land ownership and existing land uses within 1/4 mile from each bank of the nominated surface water. ADEQ will require the submittal of information on land ownership and land uses in the riparian corridor to make a judgment regarding whether there is an ability to manage the nominated unique water for water quality purposes. Fourth, a nomination must include a description of the existing uses and the reasonably foreseeable potential uses of the land and water that may be enhanced by a unique waters classification and the existing and reasonably foreseeable potential uses that may be foreclosed or limited if a surface water is classified as a unique water. ADEQ will require the submittal of this information in order to make a judgment regarding the social and economic impact of a unique water nomination.

A nomination must include a detailed description of the characteristics that make the surface water a worthy addition to the unique waters program. If a surface water is nominated on the ground that threatened or endangered species are known to be associated with the surface water and existing water quality is essential to the maintenance and propagation of the threatened or endangered species, then the nomination must specifically identify the threatened or endangered species associated with the surface water and provide documentation that the species currently is listed as endangered or threatened by the Secretary of the Interior pursuant to §4 of the Endangered Species Act. The presence of candidate or sensitive species is insufficient to support a unique waters nomination. A nomination must include information upon which a finding can be made that a threatened or endangered species is known to occur in the specific area of the nominated surface water. A nomination must include citations to academic studies, scientific literature, or other references or sources of information that document the presence of a threatened or endangered species. If the presence of a threatened or endangered species is based upon a biological survey of a nominated surface water, the nomination must include a description of the survey methods that were used to

establish the presence of a threatened or endangered species. At a minimum, the description of the biological survey must include a description of the survey area, who conducted the survey and their qualifications, the date the survey was conducted, and whether individuals or populations of threatened or endangered species were actually observed to occur. The presence of suitable habitat for a threatened or endangered species is insufficient by itself to support a unique waters nomination. If a surface water is nominated on the ground that it provides critical habitat for a threatened or endangered species, the nomination must include documentation that the nominated surface water is located within a specific geographic area designated as critical habitat by the Secretary of the Interior pursuant to §4 of the Endangered Species Act.

If a nomination is based, in whole or in part, on the ground of exceptional recreational significance, the nomination must include information on the estimated level of recreational use and the quality of the recreation experience provided by the nominated surface water. ADEQ proposes to use an assessment methodology developed for the Arizona River Assessment Project to evaluate exceptional recreational significance for the unique waters program. The Arizona River Assessment Project was initiated at the recommendation of Arizona's 1989 Statewide Comprehensive Outdoor Recreation Plan (SCORP). The Arizona River Assessment Project includes a methodology for evaluating surface waters as recreation resources. The methodology assigns streams into one of 5 classes for recreation: outstanding, substantial, moderate, limited, or unknown. These ratings are based on an assessment of the surface water's statewide significance as a recreation resource. An outstanding rating means the surface water is an exceptional recreational resource within the state as compared to other surface waters. An outstanding surface water provides one of the highest quality recreational experiences available within the state due to its unique combination of attributes or one or more specific characteristics that create an exceptional recreation opportunity. A substantial rating means that a surface water is an important recreational resource that represents one of the finer examples in the state in terms of providing a quality recreational experience. A moderate rating means that the surface water may be considered average or standard when compared to the recreational experiences provided by other surface waters within the state. A surface water that is rated moderate for a recreational activity is similar to many other surface waters in the state. A limited rating means that the recreational value of the surface water is

limited. A surface water that is limited for a recreational activity either does not permit recreational activities or the surface water does not provide a quality recreational experience as compared to other surface waters in the state. An unknown rating means that information on the quality of the recreational opportunity provided by the surface water is unavailable.

ADEQ proposes to use the Arizona River Assessment Project methodology to make determinations of exceptional recreational significance. Surface waters that are assessed as being outstanding recreation resources using the Arizona River Assessment Project methodology will be considered for unique water designation. ADEQ proposes to require the submittal of information on the types, level of use, and the quality of water-dependent and stream corridor-related recreational activities, including fishing, motorized and non-motorized boating, water play (e.g. swimming, wading, tubing, and floating), camping, picnicking, hiking, nature study, motorized recreation, and visiting historic or cultural sites. ADEQ proposes to use standardized recreation assessment forms and the scoring system described in the Arizona Rivers Assessment Project methodology to determine if a surface water is of "exceptional recreational significance."

If a nomination is based, in whole or in part, on the ground that a surface water is of "exceptional ecological significance," the nomination must include information on the outstanding natural attributes that make the surface water "of exceptional ecological significance." ADEQ proposes to clarify the evaluation criteria that ADEQ will use to determine whether a surface water is of "exceptional ecological significance." Again, ADEQ proposes to use the Arizona Rivers Assessment Project evaluation system to assess whether surface waters are of exceptional ecological significance because of their riparian vegetation, fish, wildlife, stream hydrology, or geology.

A surface water may be of exceptional ecological significance because it has an outstanding riparian community associated with it. To make this determination ADEQ will require submittal of specific information about the plant species and plant communities associated with a surface water, the existing and potential extent or coverage of riparian vegetation, and a description of the ecological functions of the riparian corridor. ADEQ will use the

following criteria to assess whether a surface water has an outstanding riparian community: the presence of threatened, endangered, and candidate plant species; the estimated length, width, and acreage of the riparian area or riparian community; the dominant vegetation community; species diversity; species scarcity; successional stage of the riparian community; relative predominance of natural (native) and introduced vegetation, and whether the riparian community is in proper functioning condition. Again, ADEQ proposes to use the Arizona River Assessment Project methodology to assess riparian functions and values.

A surface water may be of exceptional ecological significance because it is an outstanding fishery. If the fishery resource is cited as one of the grounds for a unique waters nomination, ADEQ will require submittal of information to assess whether the resource is an outstanding fishery of statewide significance. To make this determination, ADEQ will require submittal of specific information about the fish species present; the relative significance of the fish species present; population origin (i.e., native, reintroduced native, introduced, stocked), population size and sustainability; and the overall condition of the fish habitat provided by a nominated surface water. ADEQ will evaluate two broad categories of fish species: native fish and sportfish. Both categories of fish have resource values and should be evaluated independently. ADEQ proposes to adopt a checklist of 74 fish species used by the Arizona Game and Fish Department to help nominating parties inventory the fish species that are present in a nominated surface water. Native fish species significance will be based on the presence or absence of threatened, endangered, or candidate fish species in a nominated surface water and the extent of native fish predominance in the overall fish population. Sport fish significance will be evaluated on whether a fish species is rated as preferred, average, or of no value for fishing. ADEQ will require the submittal of information on the present population size and population trends (increasing, stable, or decreasing). ADEQ will require submittal of information on whether populations of fish are naturally-reproducing or hatchery-subsidized and whether populations are at or below levels that the surface water can reasonably support. ADEQ will require the submittal of information to make a general assessment of fish habitat based on parameters such as habitat diversity, cover, water quality, and water quantity. ADEQ also will require information on any special or unique habitat characteristics of the surface water, such as critical spawning areas, critical rearing or nursery areas, flooding or low flow refugia areas, exceptional or unusual

habitat features such as oxbows, sloughs, backwaters, exceptional habitat diversity or a unique combination of habitat types, has a critical habitat designation, or is in a special research area.

A surface water may be of exceptional ecological significance because it is an outstanding wildlife resource. Again, ADEQ proposes to use the Arizona River Assessment Project methodology to assess whether a nominated surface water is of exceptional ecological significance. Wildlife habitat varies as much as do the animals themselves. It is impossible to do a detailed assessment of the habitat value of a nominated surface water for each species that may be present. However, a general assessment of a stream's overall habitat value to wildlife may be performed to determine whether a stream is of exceptional ecological significance.

Wildlife resource assessment criteria include two broad categories: species and habitat. As a first step in assessing species, ADEQ will require the submittal of information on the species for which the stream corridor segment provides significant habitat. ADEQ proposes to use the species list included in the Arizona River Assessment Project guidelines. A nominating party should focus on obligate and facultative riparian wildlife, especially the identification of species of special concern that are of statewide significance. For example, federal or state-listed threatened or endangered species, species proposed for listing, candidate species, species identified by state or federal agencies as species of special concern, and species that are of special local importance and uncommon throughout the state. Species significance is measured by rarity or perceived importance. Obviously, threatened or endangered species are given the highest statewide significance. Next in significance are species of special local importance and species that are uncommon throughout the rest of the state. Species that are common throughout the state would be considered less significant.

ADEQ will require submittal of information on habitat characteristics to make a determination whether a stream is of exceptional ecological significance. ADEQ will ask for information on special habitat characteristics, including: unique wildlife activity areas that are critical to some element of a species' life cycle; unusual or exceptional habitat features, designated critical habitat for federally-listed threatened or endangered species, other critical habitat for

threatened, endangered, sensitive, or other species of concern, presence of designated wildlife areas, and special research areas. ADEQ will ask a nominating party to provide information on whether the habitat characteristics are improving, stable, or declining and some assessment of the habitat's recovery potential (at or near potential, recovery through natural systems alone, recovery with reasonable management assistance, recovery with intensive assistance, and no recovery potential). ADEQ will ask for a overall habitat value assessment of different habitat types (aquatic, marshes / wetlands, scrub lands, forests and woodlands) and whether the stream contains habitat that is of excellent or high quality, moderate quality, limited or low quality, none, or unknown.

ADEQ also will ask for information on habitat uniqueness or rarity. Rare or unique habitat is defined as one of the 5 - 10 best examples of the type in the state. Uncommon habitat is defined as not unique, but its scarcity is a limiting factor for certain valued species. All other habitat will be considered common. ADEQ will ask for information on habitat diversity based on the plant communities and vegetative structure, stream configuration, and physical structure within the nominated stream reach. Finally, ADEQ will require information on the confidence level of the information provided in making the assessment. ADEQ will require information on the amount and quality of data upon which wildlife determinations were based (i.e. Was a field survey of the reach conducted? Was the wildlife assessment based on general field knowledge or extrapolation? Best guess?)

A surface water may be of exceptional ecological significance because of its stream hydrology. Most of Arizona's streams are ephemeral waters that flow in direct response to precipitation or they are intermittent waters that flow seasonally. The duration of flow in a stream is a primary concern because of the proposed eligibility requirement that a unique water be perennial. Ephemeral and intermittent waters are ineligible for unique waters classification. To be eligible for a unique waters classification, a nominating party must provide documentation that the nominated surface water flows continuously throughout the year. This can be shown in two ways in a nomination. If empirical data is available from a USGS gaging station or other discharge monitoring, the mean monthly flow in cubic feet per second for each month of the year and the mean annual flow in cubic feet per second can be calculated and provided to ADEQ. If empirical data are unavailable, a nominating party can provide other information that a stream flows

throughout the year. In the latter case, ADEQ will require information on the amount and quality of the data that supports an assertion that a stream is perennial (e.g. field observations over a period of record, modeling, best guess). Finally, ADEQ will require information on the existence of an in-stream flow right or applications for an in-stream flow right. Obviously, appropriations of surface water can have a significant effect on the volume of water flowing in a stream.

ADEQ will also require information on the flow regime and whether it is regulated or unregulated to determine whether the stream is "in a free-flowing condition." ADEQ will require submittal of information on the stream channel and the existence of hydrological modifications (e.g., dams, impoundments, diversions, canals, channel modifications, linings, armored banks, intakes and pumping stations, etc.)

ADEQ proposes to amend the part of the current rule which states that unique waters nominations are made by petitions for rule adoption [*See* R18-11-112(C)]. ADEQ believes that petitions for rule adoption unnecessarily accelerate the decision making process and short-circuits the careful study of surface waters nominated for unique waters classification. A unique waters rule should not impose unreasonably short time frames that result in ADEQ decisions on the eligibility and suitability of nominated surface waters on the basis of limited information. Rather, the nomination of a surface water for unique waters classification should start a careful review process that can be accomplished by ADEQ within agency resource and budget constraints and the larger time frame that applies to the triennial review of surface water quality standards.

Under the proposed rule, any person may still submit a nomination of a surface water for consideration as a unique water. However, the submittal of a nomination will not trigger the initiation of the rulemaking process in the triennial review. Instead, the nomination of a surface water will trigger an evaluation process by ADEQ that will take place outside of the triennial review of surface water quality standards. Nominations will be screened for completeness and ADEQ may solicit informal public comment on the nominations. The end product of this process will be a more

structured assessment of the eligibility and suitability of a nominated surface water by ADEQ and a recommendation for non-inclusion or inclusion in the unique waters program through a proposed revision to the unique waters rule.

The rule should be amended to clarify the public participation procedures that are to be used during the unique waters classification process. While the current rule does not require public participation beyond the public participation requirements that apply to rulemaking, it has been ADEQ practice to hold at least one informal public meeting in the area where a nominated unique water is located to present the unique waters nominations to persons in the local community who will be most directly affected by a nomination and to solicit public comment. ADEQ believes that this element of the informal public participation process for unique waters classification should be included in the rule.

ADEQ proposes to add language to the rule to clarify that unique waters classifications will be considered only as part of the triennial review of surface water quality standards. ADEQ is proposing this clarification to conserve agency administrative resources. Informal and formal rulemaking activities are resource-intensive and they can take a long time to complete, sometimes years. It is more efficient for ADEQ to consider unique waters classifications during the triennial review of the surface water quality rules rather than in a separate rulemaking. Therefore, ADEQ proposes to add language to the rule to clarify that ADEQ will consider unique water classifications only during a triennial review.

There is a need to amend the rule to require consideration of whether there is an ability to manage a proposed unique water and its watershed to maintain and protect existing water quality. ADEQ believes that a management capability to maintain and protect existing water quality is an important factor in the decision to classify a unique water. The ability to manage for water quality was one of 3 primary criteria for designation of unique waters under the original unique waters policy for Arizona. The 3 primary designation criteria for a unique waters designation in the original policy were: 1) water quality is consistently better than water quality standards, 2) preservation of existing water quality is not in conflict with the present or anticipated necessary or justifiable economic and social uses of the

watersheds consistent with appropriate planning such as §208 area wide water quality management plans or county and municipal plans, and 3) *the body of water and its watershed are capable of being managed to maintain the existing high water quality* [*See* "Arizona Water Quality Control Council Unique Waters Policy," April 8, 1981, p. 2]. ADEQ proposes to amend R18-11-112 to reinstate these 3 decision criteria.

There is a need to specifically describe the criteria that ADEQ will consider when making decisions on unique waters nominations. Additional decision criteria are needed to guide the exercise of agency discretion in the decision making process. The current rule states only that the Director *may* classify a unique water. At a minimum, a surface water that is nominated for unique waters classification must meet eligibility requirements and at least one of the prescribed grounds for unique waters classification. However, once one of these two criteria is met, what factors should the agency consider before making a decision on a nomination? What factors should inform the exercise of the agency's discretion on whether to classify a nominated surface water as a unique water? ADEQ believes that additional decision criteria are necessary to guide the exercise of ADEQ's discretion in the decision making process. Other decision criteria that the Director may consider include:

- *Social and economic impact of Tier 3 antidegradation protection*: The Director may take into consideration the potential social and economic impact of a unique water classification and the establishment of Tier 3 antidegradation protection, including:
    - a. Impact of a prohibition of new point source discharges and expansion of existing point source discharges, including possible limits on discharges to the tributaries of a proposed unique water and possible impacts on growth and development.
    - b. Impact of possible future restrictions on land use activities in a unique waters watershed, including cattle grazing, timber harvesting, mining, recreation, and agriculture.
    - c. The impact of stricter requirements for §401 certification of federal permits and licenses, including NPDES and §404 permits.
    - d. Impact on private property rights and the potential for regulatory "takings."
    - e. Ecosystem and preservation values.

ADEQ is required by law to classify unique waters by rule. One of the requirements of the rulemaking process is the preparation of an economic, small business, and consumer impact statement (EIS). Any rule establishing a new unique water is subject to review by the Governor's Regulatory Review Council (GRRC). The GRRC cannot approve a rule establishing a new unique water unless there is a complete EIS, the EIS is "generally accurate," and the probable benefits of a unique waters classification outweigh the probable costs of the rule. The Director may consider the availability of information to develop an adequate economic impact statement in making a decision on a unique waters nomination. Where information is available on the probable costs and benefits of a unique waters classification, the Director may take that information into account in making a decision whether to go forward with a unique waters proposal. Where probable costs of a unique waters classification outweigh the probable benefits, the Director may deny a nomination.

- *Public comments in support or opposition to a unique waters classification*: The Director will consider public comments and the degree of support or opposition to a unique waters classification. While a unique waters classification is not subject to a majority vote, ADEQ will carefully consider all of the public comments that are submitted on a proposed unique water. ADEQ will carefully consider the comments of the federal and state land management agencies that have primary responsibility for managing public lands where a proposed unique water is located. Such agencies may include the U.S. Forest Service, Bureau of Land Management (BLM), National Park Service, State Land Department, and Arizona State Parks. This decision criterion closely relates to the determination as to whether there is an ability to manage the proposed unique water and it recognizes the need for intergovernmental cooperation between ADEQ's unique water program and federal and state land managers and other natural resource management agencies [e.g., U.S. Fish & Wildlife Service and Arizona Game and Fish Department].
- *Location*: The Director may consider whether the proposed unique water is located within a National or State Park, National Monument, National Recreation Area, Wilderness Area, National Wildlife Refuge, Area of Critical Environmental Concern, Riparian National Conservation Area, or is designated or proposed for designation as a Wild and Scenic River.

- *Agency resource constraints*: A unique waters classification provides Tier 3 antidegradation protection [*See* R18-11-107(D)]. To make Tier 3 antidegradation protection meaningful, a water quality monitoring program must be implemented to determine existing water quality and whether degradation is occurring. The Director may consider whether there is an ability to monitor water quality in a proposed unique water before classifying it. ADEQ also will consider the potential for cooperative agreements with other agencies (USGS, USFS, BLM) and the availability of volunteer monitoring groups before making a decision to propose a surface water as a unique water.

Unique water nominations

ADEQ received nominations of 37 surface waters for consideration as unique waters in this triennial review. ADEQ held 6 public meetings in Alpine, Flagstaff, Cascabel, Phoenix, and Globe to discuss the nominations with persons in locally affected communities. All 37 surface waters that were nominated were included in a set of preliminary draft rules that ADEQ distributed for public comment. ADEQ held 4 additional public meetings to take public comments on the rules, including the unique waters nominations. ADEQ considered all of the public comments that were received on the nominations before making a decision of which surface waters to formally propose for unique waters classification in this Notice of Proposed Rulemaking. ADEQ proposes the following 10 surface waters for classification as unique waters:

Little Colorado River watershed

1. Lee Valley Creek (above Lee Valley Lake)

Salt River watershed

2. Bear Wallow Creek
3. North Fork of Bear Wallow Creek
4. South Fork of Bear Wallow Creek
5. Snake Creek
6. Stinky Creek
7. Hayground Creek

8. West Fork of the Black River

Santa Cruz River watershed

9. Upper Cienega Creek

Upper Gila River watershed

10. KP / Cienega Creek

ADEQ decided to **not** propose the following surface waters that were nominated for unique waters classification:

Little Colorado River watershed

1. Dry Lake

2. Coyote Creek

3. Mamie Creek

Salt River watershed

4. Reavis Creek (Superstition Wilderness)

5. Pine Creek (Superstition Wilderness)

6. Tortilla Creek (Superstition Wilderness)

7. Fish Creek (Superstition Wilderness)

8. La Barge Creek (Superstition Wilderness)

9. Pinto Creek

10. Lower Haunted Canyon

11. Conklin Creek (Black River watershed)

12. Corduroy Creek (Black River watershed)

13. Double Cienega Creek (Black River watershed)

14. Fish Creek (Black River watershed)

15. Hannagan Creek (Black River watershed)

16. Boggy Creek (Black River watershed)

17. Centerfire Creek (Black River watershed)

18. Wildcat Creek (Black River watershed)

19. Home Creek (Black River watershed)

20. Reservation Creek (Black River watershed)

21. Soldier Creek (Black River watershed)

Upper Gila watershed

22. Coleman Creek (Blue River watershed)

23. Grant Creek (Blue River watershed)

San Pedro River watershed

24. Hot Springs Canyon

25. Bass Canyon

26. Redfield Canyon

27. Wildcat Canyon Creek

Pinto Creek unique water nomination

In August, 1999, Mr. Tom Sonandres, on behalf of the Friends of Pinto Creek, nominated a 8.8 mile segment of Pinto Creek for unique waters classification. Pinto Creek is a small, perennial stream that flows through the Sonoran desert in Gila County near Globe, Arizona. The nominated segment of Pinto Creek is located primarily within the Tonto National Forest. Pinto Creek is ephemeral in its upper reaches but it flows perennially in several reaches between its headwaters in the Pinal Mountains and Roosevelt Lake. The nominated segment of Pinto Creek extends from approximately the Pinto Valley Mine weir to the lower end of an area called the Pinto Box.

The nominated segment of Pinto Creek is perennial. This description is supported by stream flow or stream discharge information provided by the U.S. Forest Service in a preliminary analysis of Pinto Creek that was done to determine its eligibility for potential inclusion in the Wild and Scenic River system and by USGS Water Resources Data. The U.S. Forest Service described the nominated segment as being "mostly perennial" with a median flow over 5-year period of record of 2.1 cubic feet per second (cfs). USGS discharge records from October, 1994 - 1999 obtained from the stream gaging station at the Pinto Valley weir also indicate that the nominated section of Pinto

Creek is perennial. The annual mean discharge in cubic feet per second ranges from .38 cfs to 27.3 cfs, the minimum discharge ranges from .01 cfs to 1.3 cfs, and the maximum discharge ranges from 19 cfs to 5010 cfs. Discharge data over the period of record indicate that the nominated segment of Pinto Creek is perennial even though there can be very low flow in the stream in dry years.

Pinto Creek was nominated for consideration as a unique water on the ground that the stream is of exceptional ecological significance because of the presence of perennial water in the Sonoran desert environment; the presence of more than 20 endangered, threatened, or sensitive species; its outstanding cottonwood-willow riparian corridor, and its geological features. Pinto Creek also was nominated for its outstanding scenic values. Pinto Creek supports a cottonwood-willow riparian community. The U.S. Forest Service identified Pinto Creek as having "outstandingly remarkable" ecological values because of its cottonwood-willow riparian community, described as the rarest riparian community on the Tonto National Forest. The U.S. Forest Service also identified Pinto Creek as having outstandingly remarkable riparian values based on a 1993 evaluation of the stream's riparian condition. The condition of the riparian community was described as "only fair" on the upstream half of the segment of Pinto Creek that was being evaluated for eligibility and classification as a Wild and Scenic River. The condition of the riparian community in the lower half of the segment was described as good where no livestock grazing had occurred in several years. The Tonto National Forest also noted that the riparian area had high value as a benchmark for documenting the recovery of the rare cottonwood-willow riparian community and that the trend for the riparian community was improving. More recent information on the status of the riparian community for Pinto Creek was not included in the nomination other than a brief note reporting personal observations of the nominator that he observed dense thickets of young cottonwoods during a June, 1999 hike.

Pinto Creek was nominated for unique waters classification in part because Pinto Creek provides moderate to good riparian habitat for a variety of threatened, endangered, or sensitive species that may be present in the nominated segment. The availability of suitable habitat and the assertion that threatened or endangered species *may* be present are insufficient to support a unique waters classification under R18-11-112(D)(2). There is insufficient information in

the nomination document for ADEQ to make a finding that threatened or endangered species are known to be associated with the surface water and the existing water quality is essential to the maintenance and propagation of a threatened or endangered species. The only federally-listed endangered or threatened species identified in the nomination are the bald eagle, southwestern willow flycatcher, the lesser long-nosed bat, and the Arizona hedgehog cactus (the other identified species are either candidate or Forest Service sensitive species). The 4 federally-listed species that are identified are only weakly associated with Pinto Creek and there is no showing that the maintenance and protection of existing water quality is essential to the maintenance and propagation of the species. For example, the nomination document states that neither bald eagles or the southwestern willow flycatcher have been observed along Pinto Creek but that bald eagles may fly over lower Pinto Creek in search of prey and the southwestern willow flycatcher may find suitable habitat if willows recover from flooding to form dense thickets. The only information provided in the nomination document regarding the lesser long-nosed bat is a statement that the U.S. Fish & Wildlife Service believes that the bat may be in the area. The Arizona hedgehog cactus is only weakly associated with the Pinto Creek riparian community. Its habitat is described as the ecotone between interior chapparal and madrean evergreen woodlands. It grows on open slopes, in narrow cracks between boulders, and in the understory of shrubs. It is difficult to conclude that a unique waters classification of Pinto Creek is essential to the maintenance and protection of the Arizona hedgehog cactus given these habitat requirements. Moreover, the presence of threatened or endangered species in Pinto Creek is contradicted by conclusions of the final environmental impact statement (EIS) for the Carlota Mine Project. Extensive studies on the presence of threatened or endangered species were done as part of the EIS. The final EIS document concludes that special status wildlife species or other wildlife species of concern "are not located in the vicinity of the Carlota project area and / or suitable habitat is not present" [*See* p. 3-189 of the EIS]. It also should be noted that Pinto Creek has *not* been designated as a critical habitat under the Endangered Species Act for any federally-listed threatened or endangered species. For all of these reasons, Pinto Creek does not qualify for unique water classification on the basis of the presence of threatened or endangered species.

ADEQ has determined that Pinto Creek does not qualify for unique waters classification on the ground that the stream is of exceptional recreational significance. Public access to the nominated reach of Pinto Creek is limited. There are no developed recreation facilities or trails within the nominated segment. Recreational activities are limited to dispersed recreation activities such as hiking, nature study, picnicking, and horseback riding. In 1993, the Tonto National Forest estimated that only 1,500 recreation visitor days occurred within the area of the nominated segment annually. This level of recreational use does not support a finding that Pinto Creek is one of Arizona's exceptional recreation resources.

The nomination document notes that Pinto Creek was included in a U.S. Forest Service study of rivers and streams potentially eligible for inclusion in the national Wild & Scenic Rivers System. In January, 1993, the U.S. Forest Service evaluated Pinto Creek in Preliminary Analysis of Eligibility and Classification for Wild / Scenic / Recreational River Designation Report. Resource information for Pinto Creek was published in a report entitled, Resource Information Report, Potential Wild / Scenic / Recreational River Designation, National Forests of Arizona, U.S. Department of Agriculture, U.S. Forest Service, Southwestern Region, September, 1993. Based on this preliminary analysis, the U.S. Forest Service found that Pinto Creek was eligible for inclusion in the national Wild & Scenic Rivers System as a scenic river and that it possessed outstandingly remarkable scenic, riparian, and ecological values. In fact, much of the information for the Friends of Pinto Creek nomination is taken from the resource information compiled by U.S. Forest Service. While a preliminary determination was made that Pinto Creek is eligible for inclusion in the Wild and Scenic Rivers system by the U.S. Forest Service, it has not been so designated.

The Pinto Creek watershed contains areas of known natural copper mineralization that have been exploited by past and present mining activities. Pinto Creek flows across the western margin of the historic Globe-Miami mining district, one of the major porphyry copper districts in the Southwest. Mining activities in the Pinto Creek watershed have created point and nonpoint source pollution sources that have contributed copper to Pinto Creek and its tributaries. These mining activities include open pit copper operations, several historic open-pit and underground operations, and hundreds of smaller adits, shafts, and prospects. Pinto Creek has been affected by numerous spills

from the Pinto Valley Mine over the past 25 years, the latest resulting from a massive tailings failure in 1998. A remedial action under CERCLA was initiated against BHP Copper to clean up Pinto Creek.

Pinto Creek is listed by ADEQ under §303(d) of the Clean Water Act as a water quality-limited surface water for non-attainment of the surface water quality standard for dissolved copper. Under §303(d), a total maximum daily load (TMDL) analysis must be developed for all impaired surface waters on the §303(d) list. A draft TMDL for copper in Pinto Creek has been completed [*See* Total Maximum Daily Load for Copper in Pinto Creek, Arizona, Environmental Protection Agency and Arizona Department of Environmental Quality, Public Review Draft, July,2000]. The geographic scope of the TMDL includes the entire Pinto Creek watershed from its headwaters to Roosevelt Lake, including the reach of Pinto Creek nominated for classification as a unique water.

ADEQ agrees with the nominators that Pinto Creek has important natural resource values because of the presence of perennial water and the relatively rare cottonwood-willow riparian community that the stream supports. However, ADEQ has decided not to propose Pinto Creek for unique waters classification. ADEQ decided not to propose Pinto Creek for unique waters classification primarily because the stream is water quality-limited for dissolved copper and the stream is listed on Arizona's §303(d) list. ADEQ believes that the current §303(d) listing is inconsistent with a unique waters classification. The unique waters program recognizes the state's outstanding state resource waters. By contrast, the TMDL program is intended to restore water quality in degraded surface waters to levels that achieve compliance with applicable water quality standards.

Lower Haunted Canyon unique water nomination

Mr. Tim Flood, on behalf of the Friends of Arizona Rivers, nominated a 0.7 mile segment of Lower Haunted Canyon for classification as a unique water in August, 1999. The nomination states that Lower Haunted Canyon is an outstanding state resource water of exceptional ecological and recreational significance because of its unique attributes, including its regional importance as a perennial stream in the Sonoran desert, its relatively good water quality, its biological uniqueness (particularly its high quality riparian vegetation and the presence of numerous

species of insects, amphibians, fish, reptiles, birds and mammals), the stream's geomorphology (especially its relatively high percentage of pool habitat), and its scenic and aesthetic values.

ADEQ agrees that Lower Haunted Canyon is a valuable surface water resource that is ecologically significant as a perennial desert stream. However, ADEQ does not agree that the stream possesses the outstandingly remarkable and unique attributes that qualify it as one of Arizona's outstanding state resource waters of exceptional ecological significance. Lower Haunted Canyon may be a significant surface water resource on a local or even a regional scale, in ADEQ's best professional judgment, Lower Haunted Canyon does not possess outstanding attributes to set it apart as a surface water of statewide significance. No federally-listed threatened or endangered species are documented to occur in Lower Haunted Canyon, nor is it designated as a critical habitat for a threatened or endangered species. The nomination document notes that both exotic fish species and native fish species are present in Lower Haunted Canyon. The absence of threatened or endangered species and the presence of non-native fish species in Lower Haunted Canyon (e.g., green sunfish) suggests that the stream is representative of other small, desert streams. The nomination of Lower Haunted Canyon states that the stream provides suitable habitat for the Gila topminnow and Gila chub, two federally-listed endangered species. However, a finding that a surface water may provide suitable habitat is not, by itself, sufficient to support a unique waters classification. The presence of green sunfish in Lower Haunted Canyon suggests that active fishery management by the Arizona Game and Fish Department (AGFD) may be necessary for Lower Haunted Canyon to achieve its potential as a native fishery for the Gila topminnow or Gila chub. AGFD provided comments to ADEQ on the unique waters nominations and stated their concern that a unique waters designation may impair the AGFD's ability to manage the fishery resource. The AGFD notes in their comments that it is sometimes necessary to alter stream morphology to improve fish habitat (e.g., construction of fish barriers, stream bank stabilization, installation of check dams, etc.) or apply piscicides such as rotenone or antimycin to remove non-native fish to aid in the recovery of threatened and endangered species (e.g., eradication of green sunfish). While a unique waters classification does not necessarily preclude such activities, it may limit AGFD's fishery management options.

Lower Haunted Canyon does not qualify for unique waters classification on the ground that it is of exceptional recreational significance. Public use and access to the stream are limited. The nomination document itself notes that Lower Haunted Canyon is only a "lightly used recreational area." Moreover, an independent evaluation of Lower Haunted Canyon conducted as part of the Arizona Rivers Assessment Project described Haunted Canyon as being only a limited recreation resource that does not offer a high quality or unique recreational experience within the state when compared to other surface waters in the state.

Finally, ADEQ considered the comments of the U.S. Forest Service, the primary federal land management agency for the Tonto National Forest where Lower Haunted Canyon is located. The Tonto National Forest opposed the unique waters classification for Lower Haunted Canyon because it may interfere with mitigation measures agreed to by the U.S. Forest Service, the Carlotta Copper Company, U.S. Environmental Protection Agency, Arizona Department of Water Resources, U.S. Army Corps of Engineers, and ADEQ in the final Environmental Impact Statement (EIS) for the Carlotta Mine Project. One of the mitigation measures (WR-3 in the final EIS) developed by the Tonto National Forest and agreed to by the Carlotta Copper Company is a measure to maintain stream flow in Haunted Canyon. The mitigation measure calls for diverting water from a water supply well field and discharging it to Haunted Canyon. Water quality data provided from the water supply well field indicates that the groundwater has a similar water chemistry to surface water in Haunted Canyon. However, some differences in water quality exist that could make it difficult to comply with Tier 3 antidegradation requirements. The classification of Lower Haunted Canyon as a unique water could be counterproductive because it could impair the ability to implement the wellfield mitigation program to preserve existing stream flow in Lower Haunted Canyon. The principal ground for the nomination of Lower Haunted Canyon as a unique water is its outstanding riparian vegetation and stream hydrology. The maintenance of flow in Lower Haunted Canyon is essential to maintaining this riparian community. A unique waters classification that interferes with the implementation of a strategy to preserve in-stream flows in Haunted Canyon may do more harm than good. For this reason, ADEQ chose not to propose Lower Haunted Canyon for unique water classification.

Forest Guardians Nominations

The Forest Guardians White Mountain Conservation League ["Forest Guardians"] nominated all of the Apache trout streams in the Black River, Blue River, and Little Colorado River watersheds for unique waters classification. Forest Guardians nominated 22 streams in 3 watersheds primarily on the ground that the streams support populations of threatened, endangered, and sensitive wildlife species, particularly the Apache trout. Forest Guardians also recommended the 22 streams on the ground that the surface waters provide important recreational opportunities such as hiking, birding, nature study, camping, hunting, fishing, and horseback riding.

ADEQ does not disagree that nominated surface waters have important recreational values, but the nominations provide insufficient information upon which ADEQ could find that the nominated surface waters represent surface waters that present exceptional recreational opportunities of statewide recreational significance.

Forest Guardians recommended the 22 surface waters primarily because of the presence of a number of endangered, threatened, and sensitive species. Many of the species listed in the nomination documents are identified as sensitive bird, terrestrial, or plant species and there is no information to show that the maintenance of existing water quality in the nominated surface waters is essential to the maintenance and propagation of the endangered, threatened, or sensitive species.

ADEQ considered public comments that were made in support and in opposition to the Forest Guardians nominations. In particular, ADEQ carefully considered the comments of the Apache Sitgreaves National Forest [ASNF], the federal agency with management authority over the public lands where the nominated surface waters are located. In 1994, the U.S. Forest Service conducted biological assessments and evaluations for an Apache Trout Habitat Improvement Project within the ASNF. The biological assessments provided information used to develop the current Apache Trout Recovery Plan for the ASNF. These assessments appear to be a principal source of information used by Forest Guardians in the nominations.

The ASNF does not support the nominations of Conklin Creek, Corduroy Creek, Double Cienega Creek, Fish Creek, Hannagan Creek, Boggy Creek, Centerfire Creek, Wildcat Creek, Home Creek, Reservation Creek, or Soldier Creek in the Black River watershed. The ASNF does not support the nominations of Coleman Creek and Grant Creek in the Blue River watershed. Finally, the ASNF does not support the nominations of Coyote Creek and Mamie Creek in the Little Colorado River watershed. The reasons ASNF provided for not supporting an individual nomination are various, but they include the following: 1) The stream does not provide exceptional Apache trout habitat or it only provides limited Apache trout; 2) the stream is an intermittent stream; 3) The stream is impacted by roads or other nonpoint sources of pollution, and 4) the stream is partly on the Fort Apache Indian Reservation and the state and ASNF have no regulatory or management authority on tribal lands.

The ASNF supports the nominations of the following surface waters for unique waters classification:

1. Bear Wallow Creek (including the North and South Forks) - because it is located within the Bear Wallow Wilderness area and the stream provides high quality Apache trout habitat.
2. Snake Creek - because the stream is currently in good condition and provides exceptional Apache trout habitat.
3. West Fork of the Black River - (headwaters to West Fork campground) because the headwaters are considered to be in an unaltered watershed condition and it provides high quality Apache trout habitat within the ASNF.
4. Hayground Creek - because the stream is currently in good condition and has the potential of becoming exceptional Apache trout habitat. Much of the stream falls within the Hayground Research Natural Area.
5. Stinky Creek - because road closures and exclusionary fencing have improved this stream to good condition.
6. KP / Cienega Creek - because the stream is currently in good condition and has the potential of becoming exceptional habitat for Apache trout. Also. the stream has been designated to be a Gila trout recovery stream.

7. Lee Valley Creek - because it currently is in good condition and has the potential of becoming exceptional habitat for Apache trout. Its headwaters are in the Mt. Baldy Wilderness Area and cattle grazing has been eliminated from the reach.

ADEQ did not propose any surface water for unique waters classification that was not supported by the ASNF. ADEQ proposes to classify the surface waters listed above as unique waters in this triennial review because of the presence of the endangered Apache trout or the streams provide exceptional habitat for the Apache trout. Also, each of the above nominations are supported by the ANSF and the Arizona Game and Fish Department. Moreover, the nominated surface waters are capable of being managed to maintain existing water quality.

Forest Guardians Superstition Wilderness Nominations

Forest Guardians nominated 5 streams in the Superstition Wilderness Area for classification as unique waters. The 5 streams are Reavis Creek, Pine Creek, Tortilla Creek, Fish Creek, and LaBarge Creek. Forest Guardians nominated the 5 streams because they provide habitat for a variety of wildlife species and because most of the riparian corridors are in a healthy, proper functioning condition. The nomination document does state that some of the riparian areas along these streams show impacts from past overgrazing. For example, Tortilla Creek is described as having been subjected to heavy livestock concentrations in the past. The nomination states that threatened, endangered, and sensitive wildlife are associated with the 5 streams and that they "rely on the wooded areas supported by the creeks or the creeks themselves, and therefore water quality is crucial for their survival and propagation." While the nomination document states that the 5 streams provide critical habitat for threatened, endangered and sensitive species, there is no documentation that critical habitat designations under §4 of the Endangered Species Act include any of the 5 nominated streams. Also, the only federally-listed threatened and endangered species identified in the nomination document associated with the nominated streams are bird species that are weakly dependent on existing water quality in the nominated streams for their maintenance and survival.

ADEQ does not believe that an adequate case for unique waters classification has been made for the 5 streams in the Superstition Wilderness Area. This conclusion is shared by the Tonto National Forest, the primary federal land management agency with jurisdiction over the public lands where the 5 streams are located. Furthermore, as the Tonto National Forest notes in their public comments to ADEQ, unique waters designations are largely unnecessary because of the location of the streams within an established wilderness area which already provides an adequate level of protection for the ecological and recreational values of the nominated streams.

Dry Lake

The Friends of Dry Lake nominated Dry Lake for unique waters classification in July, 1999. Dry Lake is an intermittent wetland in an extinct caldera located west of the city limits of Flagstaff, Arizona. The U.S. Army Corps of Engineers designated approximately 45 acres of Dry Lake as jurisdictional wetland, although the size of the wetland fluctuates considerably with seasonal and precipitation cycles. The wetland lies within the San Francisco Volcanic Field. The only source of water for Dry Lake is drainage from the slopes of the caldera. From the 1940's to the early 1970's, a dairy farm operated within the caldera and a dike was constructed through the bed of Dry Lake. Evidence of this dike and the old dairy farm operations are visible today. At the time of the nomination, Dry Lake and a large part of the caldera were owned by the Flagstaff Ranch Golf Club. At the time the Dry Lake nomination was submitted to ADEQ, a private developer had plans to construct a residential development and golf course within the caldera.

The nomination document states that Dry Lake is an outstanding state resource water because of its rarity. The nomination document states that there are over 600 cinder cones in the San Francisco Volcanic Field and Dry Lake is 1of the 6 cinder cones that contain a wetlands. The nomination states that a natural wetlands like Dry Lake, a scarce water resource in northern Arizona, is of exceptional ecological significance because of its local importance to wildlife. The nomination cites the presence of three federally-listed or state-listed endangered or threatened bird species, including the bald eagle, peregrine falcon, and the Mexican spotted owl as qualifying Dry Lake for unique water status under R18-11-112(D)(2). Finally, the Friends of Dry Lake state in their nomination that Dry Lake is an outstanding state resource water because of its recreational significance and aesthetic appeal.

ADEQ disagrees that Dry Lake qualifies as one Arizona's outstanding state resource waters when compared to other surface waters statewide. While ADEQ agrees that a wetland within a caldera is relatively rare, ADEQ does not believe that Dry Lake is of exceptional recreational or ecological significance. Dry Lake's recreational significance is limited. At the time of the nomination, most of the caldera was privately-owned and public access to the caldera and Dry Lake was restricted. No water-based recreation is possible at Dry Lake. Recreational activities are limited to nature study, wildlife viewing, and hiking on adjacent public lands.

ADEQ disagrees that Dry Lake is a surface water of exceptional ecological significance for several reasons. First, Dry Lake is an intermittent wetland. Moreover, the Dry Lake bed has been hydrologically modified by the construction of a dike through and dredging activities when the dairy farm operated within the caldera. The caldera and Dry Lake do not exhibit wilderness characteristics because of these hydrologic modifications. The possible presence of the bald eagle, peregrine falcon, and Mexican spotted owl are insufficient to support a unique waters classification for Dry Lake. These bird species are only weakly associated with Dry Lake and the wetland cannot be characterized as *essential* to their maintenance and propagation. Dry Lake has not been designated as critical habitat for any federally-listed threatened or endangered species.

ADEQ also takes note that the Grand Canyon Trust has purchased the caldera basin and Dry Lake from the Flagstaff Ranch Country Club and will preserve the area as open space. This purchase will effectively prevent the development of the golf course and residential housing within the caldera. This purchase effectively removes the threat of development and will preserve the aesthetic and recreational values of Dry Lake and the surrounding caldera. For all of these reasons, ADEQ decided not to propose Dry Lake as a unique water.

Forest Guardians Santa Pedro River Watershed Nominations

Forest Guardians nominated 4 streams in the San Pedro River watershed for unique waters classification. Hot Springs Canyon, Bass Canyon, Redfield Canyon and Wildcat Canyon. These streams are located in Muleshoe Ecosystem located in the Galiuro Mountains in southeastern Arizona. The nomination document states that this

ecosystem encompasses the Muleshoe Cooperative Management Area which is jointly managed by Bureau of Land Management, the U.S. Forest Service, and the Nature Conservancy.

Forest Guardians nominated the 4 streams for consideration as outstanding state resource waters because of the existence of perennial flow in each stream and because each one provides important recreational opportunities and wildlife resources. The nomination cites the presence of 29 endangered, threatened, candidate and sensitive species of concern known to be associated with the proposed surface waters, including 5 native fish species.

ADEQ agrees that the nominated surface waters possess outstanding natural attributes that qualify them for unique waters classification. ADEQ has recognized their ecological significance by establishing biocriteria reference sites at 3 of the 4 nominated streams. ADEQ disagrees that the level of recreational use (1,700 - 1,800 visitors a year) supports a finding that the streams are of exceptional recreational significance. None of the nominated streams were rated as outstanding recreation resources by the Arizona River Assessment Project.

While the 4 streams may qualify as outstanding state resources on the ground that they are of exceptional ecological significance, ADEQ has decided not to propose them for unique waters classification. The nominated streams are located in remote areas almost entirely within the boundaries of the Muleshoe Preserve. They are already being well managed to protect existing water quality and the outstanding natural attributes of their riparian corridors. A Muleshoe Ecosystem Management Plan is already in place to improve the nominated watersheds. The Muleshoe Ecosystem Management Plan was created in a joint effort with the cooperation of the Nature Conservancy, Bureau of Land Management, U.S. Forest Service, Arizona Game and Fish Department, neighboring ranchers, and private property owners. These parties, including the Nature Conservancy which is principally responsible for preserving the natural resources and ecological values of the Muleshoe Preserve, oppose unique waters classification for the 4 nominated streams. The nominations also are opposed by the Redington Natural Resource Conservation District. ADEQ has decided that a unique waters classification of the 4 streams is unnecessary and may limit implementation of some of the management tools that have been shown to be effective in watershed improvement under the

Muleshoe Ecosystem Management Plan. In the absence of support for these nominations from the principal land management agencies, ADEQ decided not to propose the nominated streams for unique waters classification.

Peeples Canyon Creek

ADEQ received a request from the Arizona Office of the Bureau of Land Management (BLM) to review the existing classification of Peeples Canyon Creek as a unique water. The current unique waters listing of Peeples Canyon Creek is from its headwaters to its confluence with the Santa Maria River. BLM requested that ADEQ revised the current listing because it is inconsistent with the reach of Peeples Canyon Creek that BLM nominated for unique waters classification in 1985. BLM has requested that ADEQ change the unique water listing to be consistent with the original nomination of a 1/4 mile segment of Peeples Canyon Creek associated with South Peeples Spring. This request is strongly opposed by a coalition of 10 environmental organizations who argue that the entire reach of Peeples Canyon Creek, including the headwaters of the creek around Sycamore Spring, deserves protection as a unique water. ADEQ included the BLM request in the preliminary draft rules and the agency solicited public comments on the request to amend the current listing of Peeples Canyon Creek to include only the 1/4 mile segment associated with South Peeples Spring.

ADEQ decided not to propose any changes to the current listing of Peeples Canyon Creek in the proposed rules for the following reasons:

1. Peeples Canyon Creek, from its headwaters to its confluence with the Santa Maria River, is currently listed as a unique water in R18-11-112. The revision of the listing to include only a 1/4 mile segment of the creek around South Peeples Spring would result in the removal of Tier 3 antidegradation protection for most of the stream that currently is protected as a unique water. ADEQ has never "declassified" a unique water and does not believe that a delisting action is consistent with the intent of the state's antidegradation rule. Moreover, ADEQ believes that the declassification of a unique water establishes a bad precedent for the unique waters program as a whole which could lead to additional requests to declassify and remove Tier 3 water quality protection from other established unique waters. As a general policy, unique waters should

be maintained and protected for future generations. Once a unique water is established by rule, there should be no possibility of "delisting" it and removing its special status.

2. Restricting the unique waters classification to the area around South Peeples Spring would remove Tier 3 antidegradation protection from the Sycamore Spring area in the headwaters of Peeples Canyon Creek located in the Arrastra Mountain Wilderness Area. The practical result of this action would be to facilitate the use of the Sycamore Spring area of Peeples Canyon Creek as a livestock watering area. ADEQ believes that this would lead to significant degradation of existing water quality in the Sycamore Spring area. This result can and should be avoided by retaining the unique waters classification on the entire stream.

3. The Sycamore Spring area of Peeples Canyon Creek is perennial, has exceptional wilderness values, and meets the criteria for unique waters classification. While the Bureau of Land Management may be technically correct that the current listing of Peeples Canyon Creek is inconsistent with the original nomination documents submitted by BLM in 1985, the entire stream from its headwaters to its confluence with the Santa Maria River has been afforded Tier 3 antidegradation protection since 1992. ADEQ sees no compelling reasons to change the unique waters classification now and provide Tier 3 water quality protection in Peeples Canyon Creek on a limited and piecemeal basis.

Effluent dependent waters [R18-11-113]

As noted in the preamble discussion of the definition of "effluent dependent water," ADEQ proposes to amend the the definition of EDW to clarify that an EDW is a surface water that consists of wastewater discharges. Under the proposed definition, an EDW is a surface water that, in the absence of the discharge of treated wastewater, is an ephemeral water. ADEQ proposes to amend the information requirement in R18-11-113(C)(2) to conform it to the proposed amendment to the EDW definition as follows:

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 ~~primarily~~ of discharges of treated wastewater.

3. Information that demonstrates that the receiving surface water is an ephemeral water.

ADEQ is considering 3 requests related to EDWs in this triennial review. First, the City of Willcox has filed a petition for rule adoption requesting that Lake Cochise be classified as an effluent dependent water. The City of Willcox has been treating municipal wastewater and reusing treated effluent on a local golf course. Excess treated effluent is stored in a playa depression that is known locally as Lake Cochise. The only source of water for Lake Cochise is treated wastewater. ADEQ proposes to add Lake Cochise as an effluent dependent water and list it in R18-11-113.

Second, BHP Copper filed a petition for rule adoption requesting that a segment of Queen Creek from the Superior Mining Division discharge point downstream to the Town of Superior wastewater treatment plant be changed from an effluent dependent water to an ephemeral water. BHP Copper has provided information to ADEQ in support of this request to demonstrate that the segment of Queen Creek that is the subject of this request is an ephemeral water. ADEQ proposes to amend R18-11-113(D)(3)(e) as follows:

D. The following surface waters are classified as effluent dependent waters:

3. In the Middle Gila River Basin:

e. Queen Creek from ~~Superior Mining Division~~ Town of Superior WWTP discharge outfall to confluence with Potts Canyon

ADEQ also proposes to amend the listing of Queen Creek in Appendix B to indicate that it is an ephemeral water from its headwaters to the Town of Superior WWTP discharge outfall.

Third, ADEQ proposes to adopt a site-specific standard of 36 μg / L for the reach of the Rio de Flag from the Rio de Flag wastewater treatment plant discharge point to the confluence of Wildcat Canyon. The site-specific standard

addresses high copper concentrations in the influent to the wastewater treatment plant due to naturally elevated copper concentrations in well water. A water effect ratio (WER) study was performed with effluent from the EDW portion of the Rio de Flag in Flagstaff, Arizona. The WER procedure is an EPA-approved procedure for developing site-specific standards for metals. The scientific basis for the WER procedure is as follows. EPA's ambient water quality criteria for metals are derived from the results of acute and chronic laboratory toxicity tests done in clean laboratory water. Laboratory water contains very low concentrations of substances, such as dissolved organic carbon and suspended solids, or other substances that may sorb or form complexes with metals and reduce their bioavailability or toxicity. Also, EPA's water quality criteria for metals were all based on measurements of total recoverable metal, which EPA acknowledges overestimates the toxicity of metals to aquatic life. The WER procedure was developed to modify criteria for metals to adjust for site-specific effects on metal toxicity in surface waters.

In the WER procedure, two sets of acute or chronic toxicity tests with a metal are done side-by-side. One is done in laboratory water and the other is performed using water taken from the surface water being evaluated. Toxicity endpoints from the two sets of toxicity tests and the ratio between toxicity endpoints are calculated. This is the water effects ratio. To develop a site-specific standard for the surface water, the national or state water quality criterion for the metal is multiplied by the water effects ratio. Two studies for the Rio de Flag were done to develop a site-specific standard for copper. A screening level study was done in June, 1996 and a definitive study done in August, 1996. These WER studies were done by ENSR Toxicology of Fort Collins, Colorado.

The results from the WER studies indicate that copper in the Rio de Flag is at least 6.9 times less toxic than in laboratory water used to derive EPA's ambient water quality criterion for copper. Based on these results, the current chronic water quality standard for copper could be increased 6.9 times without compromising the protection of sensitive aquatic species in the Rio de Flag. Although the results of the WER studies support such an increase, the City of Flagstaff requested that the copper standard be increased only by a factor of 2 to 36 μg/L. The proposed site-specific standard for copper in the Rio de Flag incorporates this additional margin of safety.

ADEQ proposes to adopt the following site-specific standard for dissolved copper in the Rio de Flag:

E. The following site-specific water quality standards apply to the listed effluent dependent waters:

1. Rio de Flag

a. Copper: 36 $\mu g/L$ (D)

Revision of the mixing zone rule [R18-11-114]

States may, at their discretion, adopt policies in their rules that affect the application and implementation of water quality standards, such as a mixing zone policy. State mixing zone policies are subject to EPA review and approval [*See* 40 CFR §131.13]. EPA recommends that states have a definitive statement in their water quality standards regulations on whether or not mixing zones are allowed. Arizona has a definitive statement in R18-11-114, the rule that authorizes mixing zones.

A mixing zone is a limited area or volume of water where initial dilution of a discharge takes place and where numeric water quality criteria may be exceeded in a receiving surface water. Mixing zones are based on the understanding that it is not always necessary to meet all water quality criteria at the point of discharge to protect the biological, chemical, and physical integrity of a surface water as a whole. Sometimes it is appropriate to allow a pollutant to be discharged in a concentration that exceeds the applicable water quality standard in the immediate area of an outfall. These areas are called mixing zones. Mixing zones may be allowed provided: 1) the mixing zone does not impair the integrity of the surface water as a whole, 2) there is no lethality to organisms passing through a mixing zone, and 3) there are no significant human health risks, considering the likely exposure pathways. Fundamental to the theory of using mixing zones is the belief that by mixing with the receiving water within the zone, the discharge will become sufficiently diluted to meet applicable water quality criteria beyond the borders of the mixing zone.

Mixing zone chararacteristics are defined on a case-by-case basis after it is determined that there is assimilative capacity in a receiving surface water to safely accomodate the discharge of a pollutant. A mixing zone analysis should take into consideration the physical, chemical, and biological characteristics of the receiving surface water

and the discharge, the potential impacts on the aquatic ecosystem, the protection of human health, and the designated uses of the receiving water.

EPA has provided extensive guidance on mixing zones in the *Water Quality Standards Handbook, 2nd Edition* and the *Technical Support Document for Water Quality-Based Toxics Control* (USEPA, 1991, §§ 2.2, 4.3, and 4.4). These EPA guidance documents discuss mixing zone methodologies; the location, size and shape of mixing zones; in-zone water quality, the prevention of lethality to organisms passing through a mixing zone; mixing zone analyses; outfall designs that maximize initial dilution in a mixing zone; critical design periods for mixing zone analyses, and methods to analyze and model near field and far field mixing. ADEQ proposes to amend R18-11-114 to be more consistent with current EPA guidance on mixing zones and to clarify the administrative procedures that apply to establishment of a mixing zone.

R18-11-114 should specifically prescribe water quality requirements within mixing zones. Since a mixing zone is an allocated impact zone where dilution of a discharge is in progress, ADEQ understands that acute and chronic water quality criteria may be exceeded within different boundaries in a mixing zone. ADEQ wants to clarify statements in the current rule at R18-11-114(F) which states that "the Director shall deny the request to establish a mixing zone...if concentrations of pollutants within the proposed mixing zone will cause acute toxicity to aquatic life." This statement incorrectly suggests that acute toxicity criteria to protect aquatic life always must be met at the "end-of-the-pipe" and that ADEQ cannot establish a mixing zone for an acute toxicity criterion. ADEQ wants to amend the statement in R18-11-114(F) to clarify that ADEQ may establish a zone of initial dilution (ZID) in a mixing zone where it is permissible to exceed an acute toxicity criterion provided certain conditions are met. In a ZID immediately surrounding an outfall, neither acute or chronic toxicity criteria are met. The acute criterion must be met at the boundary of the ZID. In the outer mixing zone, the acute criterion, but not the chronic criterion must be met. The chronic criterion must be met at the boundary of the outer mixing zone. This amendment is consistent with current EPA guidance on mixing zones [*See Water Quality Standards Handbook, Second Edition*, Figure 5-1, p. 5-4, and *Technical Support Document for Water Quality-based Toxics Control*, §2.2.2, p. 33]. Current EPA guidance does

not completely prohibit mixing zones for acute toxicity criteria. Rather, EPA guidance prohibits concentrations of pollutants in a mixing zone that are acutely lethal to aquatic organisms passing through a mixing zone. The zone of initial dilution in the mixing zone is sized to prevent lethality to passing organisms.

Lethality is a function of the magnitude of pollutant concentrations and the duration an organism is exposed to those concentrations. An acute toxicity criterion describes the condition under which lethality will not occur if the duration of exposure at the acute toxicity concentration is less than 1 hour. Thus, the areal extent and concentration isopleths of a mixing zone must be such that the 1-hour average exposure of organisms passing through the mixing zone is less than the acute toxicity criterion. An organism must be able to pass through a zone of initial dilution or escape the high concentration area. Lethality to passing organisms can be prevented in a mixing zone in several ways. First, ADEQ can continue the approach articulated in the current rule, prohibit ZIDs, and require that acute toxicity criteria be met at the "end-of-the-pipe." This conservative approach ensures the prevention of acute toxicity in a receiving water. The second approach is to require that an acute toxicity criterion be met at the boundary of an appropriately-sized ZID that is designed to prevent lethality to passing organisms. In the second approach, an acute toxicity criterion may be exceeded within a ZID. Hydraulic investigations and calculations would have to be provided to ADEQ to demonstrate that the acute toxicity criterion will be met at the boundary of the ZID during critical design flow conditions. *The Water Quality Standards Handbook, Second Edition*, §5.1.2, provides specific guidance on methods that can be used to prevent lethality.

Mixing zones should be denied for persistent, bioaccumulative pollutants of concern (BCCs). The potential for a pollutant to bioaccumulate in living organisms is a function of the bioaccumulation factor (BAF) or bioconcentration factor (BCF) for the pollutant, the duration of exposure, and the concentration of the pollutant. While any BCF greater than 1 indicates that bioaccumulation potential exists, bioaccumulation potential is generally not considered to be of concern unless the BAF or BCF exceeds 1000 or more. The proposed mixing zone prohibition is limited to the following persistent BCCs: chlordane, DDD, DDE, DDT, dieldrin, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, lindane, mercury, PCBs, dioxin, and toxaphene. ADEQ also proposes to prohibit mixing zones for cadmium.

Mixing zones for persistent BCCs should be prohibited to the greatest extent technically and economically possible. This is because BCCs, due to their persistent and bioaccumulative nature, are incompatible with mixing zones. By definition, BCCs are chemicals that do not degrade over time. These chemicals accumulate in organisms living in surface waters and they become more concentrated as they move up the food chain - from biota to fish and wildlife to humans. Because the effects of these chemicals are not mitigated by dilution, using a mixing zone to dilute the discharge of a BCC is inappropriate. Dilution and dispersion are not appropriate control strategies for BCCs and a mixing zone is an inadequate substitute to the removal and treatment of a BCC at the source before it is discharged to a surface water.

Finally, ADEQ proposes to make procedural changes to R18-11-114 on how mixing zones are established. R18-11-114(A) states that the Director may establish a mixing zone by order. ADEQ proposes to amend R18-11-114(A) to clarify that a mixing zone is established as part of the NPDES permit issuance process and not by administrative order.

Nutrient Waivers [R18-11-115]

R18-11-115 authorizes a waiver from water quality standards for total phosphorus and total nitrogen that apply to ephemeral waters by operation of the tributary rule. Nutrient waivers are available on a discharger-specific basis. Typically, they are issued to the operators of wastewater treatment plants that discharge to ephemeral tributaries to surface waters to which numeric nutrient standards apply. Under R18-11-115, a discharger must apply for a nutrient waiver. A discharger may obtain a nutrient waiver by demonstrating that the discharge of wastewater to an ephemeral tributary will not cause a violation of the nutrient standards that apply to the downstream surface water.

Currently, both the nutrient waiver rule at R18-11-115 and the variance rule at R18-11-122 provide mechanisms for a point source discharger to discharge wastewater containing concentrations of nitrogen or phosphorus that exceed surface water quality standards. In effect, a nutrient waiver is a type of variance from water quality standards. While

different information requirements and conditions apply to nutrient waivers and variances, they are similar in many respects. Nutrient waivers and variances have the following similarities:

- Both authorize a temporary exceedance of a water quality standard.
- Both are discharger-specific.
- Both are pollutant-specific (e.g., total nitrogen and total phosphorus)
- Both have 5-year terms.
- Both are re-evaluated upon the issuance, reissuance, or modification of the NPDES permit for the discharge.
- The same public participation processes apply to variances and nutrient waivers.
- The same administrative appeal processes apply to both.
- Variances and nutrient waivers are both subject to EPA review and approval.

There are 3 major differences between a variance and a nutrient waiver. First, the grounds for obtaining a variance are different from the grounds for obtaining a nutrient waiver. To obtain a variance, a discharger must demonstrate that treatment more advanced than applicable technology-based requirements of the Clean Water Act are necessary to comply with a water quality standard and either: 1) it is not technically feasible to achieve compliance within 5 years, or 2) the cost of treatment to achieve compliance would result in "substantial and widespread economic and social impact." For example, a wastewater treatment plant operator who wants to obtain a variance from a nutrient standard would have to demonstrate: 1) that treatment beyond secondary treatment requirements is necessary to achieve compliance with the nutrient standard, and 2) that it is either not technically feasible to install nutrient control treatment technology at the wastewater treatment plant within 5 years or the cost of installing the treatment technology would have a substantial and widespread economic and social impact in the community. These technology requirements do not apply to nutrient waivers. To obtain a nutrient waiver, the operator of the wastewater treatment plant must demonstrate that the receiving water is an ephemeral water and that the discharge of wastewater to the ephemeral water will not cause a violation of applicable nutrient standards in the nearest downstream surface water. There are no requirements to demonstrate that it is technically or economically infeasible to install nutrient control technology at the wastewater treatment plant to obtain a nutrient waiver.

Second, to renew a variance a discharger must demonstrate that a discharging facility is making "reasonable progress" towards achieving compliance with the applicable standard over the term of the variance [*See* R18-11-122(D)]. In effect, R18-11-122(D) is a technology-forcing provision that requires a periodic review to see if it is feasible to achieve compliance with water quality standards. In the example provided in the previous paragraph, R18-11-122(D) would require that the wastewater treatment plant operator control the discharge of nutrients to the maximum extent practicable with existing treatment technology. Eventually, the rule would require a wastewater treatment plant operator to install a treatment upgrade to control the excessive concentration of nutrients in a discharge. The "reasonable progress" requirement is not found in the current nutrient waiver provision. There is nothing in the current nutrient waiver rule that requires a discharger to take any steps at all to control the discharge of nutrients once a nutrient waiver is obtained. Wastewater treatment plant operators who have obtained nutrient waivers for their facilities typically reapply and renew them every 5 years. There is nothing in the rule that requires a review to determine whether it is feasible to install nutrient control technologies. Consequently, the rule permits wastewater treatment plants to continue operation over consecutive 5-year nutrient waiver cycles without ever having to address the excessive discharge of nutrients to the receiving water.

Finally, the current variance provision requires the proposal of interim discharge limitations that represent the highest level of treatment that is achievable by a point source discharge during the term of the variance. A nutrient waiver does not require the proposal of interim discharge limitations to control the discharge of nutrients. Instead, the nutrient waiver provision waives the applicable surface water quality standards for total nitrogen or total phosphorus. In doing so, a nutrient waiver removes the legal basis for the establishment of any water quality-based discharge limitations in an NPDES permit to control the discharge of nutrients to the receiving water. There are no regulatory requirements to improve the performance of the wastewater treatment plant.

ADEQ proposes to repeal the nutrient waiver provision at R18-11-115 for two reasons. First, the variance provision serves the same function as the nutrient waiver provision. A variance can be obtained from water quality standards for total phosphorus or total nitrogen. Second, ADEQ believes that the surface water quality standards rules should

require a discharger to take steps to upgrade treatment to control the discharge of nutrients if it is technically and economically feasible to do so. At a minimum, the rule should require the implementation of measures to control the discharge of nutrients to the maximum extent practicable (i.e., through imposition of interim discharge limitations). Unlike the variance rule, the nutrient waiver rule has no requirements to take corrective action to control the discharge of nutrients even if treatment upgrades are technically and economically feasible. The nutrient waiver rule authorizes the continued discharge of wastewater that exceeds applicable nutrient standards without any consideration of available treatment alternatives to control nutrients in that discharge.

The proposed repeal of the nutrient waiver provision is opposed by some members of the regulated community who are concerned that the current variance provision is so restricted that it is effectively unavailable to dischargers. The regulated community has argued that the nutrient waiver provision should be retained because it is limited in its scope. They argue that the nutrient waiver rule is limited in scope because: 1) it applies only to two pollutants, nitrogen and phosphorus, neither of which are toxic pollutants, and 2) it applies only to discharges to ephemeral waters that are tributary to surface waters for which nutrient standards have been established. Finally, it is argued that the nutrient wavier provision should be retained because it provides a significant benefit to small wastewater treatment plants that may not have the financial capability to upgrade treatment processes without resulting in documented nutrient problems in downstream surface waters. ADEQ disagrees that a variance will be effectively unavailable to dischargers. A variance for nutrients could be obtained on grounds that it is economically infeasible to install nutrient control technologies at the wastewater treatment plant. Second, ADEQ disagrees that wastewater treatment plants should not be required to control nutrients in discharges to ephemeral tributaries of surface waters for which nutrient standards have been established. The discharge of treated wastewater to an ephemeral water creates an effluent dependent water. The effective control of nutrients in the treated wastewater that creates the EDW will improve water quality in the EDW and help to prevent accelerated eutrophication and the nuisance growth of algae. Finally, less than 10 wastewater treatment plants in the state currently operate under nutrient waivers. Small wastewater treatment plants that are financially incapable of upgrading treatment processes to control the discharge of nutrients should be able to obtain a variance.

Dams and flood control structures [R18-11-118]

ADEQ proposes to repeal R18-11-118(B). R18-11-118(B) states that nothing in the surface water quality standards rules shall be construed to require a person who operates a dam or flood control structure to operate the structure to cure or mitigate an exceedance of a water quality standard caused by another person. This provision is confusing. The original intent of R18-11-118(B) is not clear, especially since R18-11-118(C) already states that nothing in the surface water quality standards rules shall require the release of water from a dam. It is not clear how a person could operate a dam or flood control structure to cure or mitigate an exceedance of a water quality standard caused by another person except by releasing of water. R18-11-118(B) is unnecessary.

Enforcement [R18-11-120]

ADEQ proposes to amend R18-11-120(C). R18-11-120 (C) states that ADEQ shall determine compliance with chronic aquatic and wildlife (A&W) criteria from the arithmetic mean of the analytical results of samples collected over a period of 4 consecutive days at a minimum rate of 1 grab sample per day. The current rule effectively makes the state's chronic A&W criteria unenforceable.

ADEQ staff in the Surface Water Quality Monitoring and Standards Unit are responsible for conducting ongoing monitoring of the surface waters in the state. Each water year, ADEQ staff conduct water quality monitoring at Fixed Station Network sites statewide to determine long-term water quality trends and compliance with surface water quality standards. Also, ADEQ staff also have implemented a targeted watershed approach to surface water quality monitoring and assessment. Arizona is divided into 10 watersheds for monitoring purposes. ADEQ staff conduct monitoring at sites located in 2 watersheds each year. A 5-year rotating schedule has been established so all 10 watersheds will be monitored over a 5-year period. ADEQ staff conduct monitoring at each sampling site 4 times a year. Because of budget, time, and other resource constraints, ADEQ staff cannot stay at a single sampling site for 4 consecutive days to take water quality samples at the rate of 1 grab sample per day. Consequently, ADEQ does not meet the minimum data requirements to determine compliance with chronic A&W water quality standards.

ADEQ proposes to amend R18-11-120(C) to make it possible to assess compliance with chronic A&W water quality standards. ADEQ proposes to amend the rule as follows:

C. The Department shall determine compliance with acute aquatic and wildlife criteria from the analytical result of a grab sample. Compliance with chronic aquatic and wildlife criteria shall be determined from the ~~arithmetic~~ geometric mean of the analytical results of ~~grab samples collected over a period of 4 consecutive days at a minimum rate of 1 grab sample per day~~ the last 4 samples taken at least 24 hours apart.

Schedules of compliance [R18-11-121]

ADEQ proposes to amend the schedule of compliance provision at R18-11-121 to allow compliance schedules for new and recommencing sources, similar to EPA's schedule of compliance provision for NPDES permits at 40 CFR §122.47.

R18-11-121(B) states that a schedule of compliance shall not be established in a NPDES permit for a new point source. The rule defines a new point source as follows:

> [A] new point source means a point source, the construction of which commences after the effective date of a water quality standard. 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. On-site physical construction program 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% of the total cost incurred for physical construction.

The federal NPDES permit rules include a schedule of compliance provision for new sources at 40 CFR §122.47(a)(2). The federal NPDES permit regulations do not prohibit schedules of compliance for new sources or new dischargers. The federal rule permits a schedule of compliance for a new source, but only when necessary to allow a reasonable opportunity to attain compliance with requirements that are issued or revised after commencement of construction but less than three years before commencement of the relevant discharge. The federal rule also permits schedules of compliance for recommencing dischargers to allow a reasonable opportunity to attain compliance with requirements issued or revised less than 3 years before recommencement of a discharge. ADEQ proposes to amend R18-11-121(B) to make it consistent with the federal regulation that addresses schedules of compliance for new and recommencing dischargers.

Variances [R18-11-122]

In the last triennial review, ADEQ adopted R18-11-122 which establishes a procedure for granting a variance from a water quality standard. The adoption of R18-11-122 is consistent with EPA guidance which states that variances from state-adopted water quality standards are allowed [*See Water Quality Standards Handbook, 2nd Edition,* § 5.3 (August, 1994)].

According to EPA guidance, a variance from water quality standards involves the same substantive and procedural requirements that apply to the removal of a designated use through the use attainability process, except that variances are discharger-specific, pollutant-specific, limited in duration, and do not result in a change to a designated use. A variance is viewed as an alternative to a permanent downgrade of a water quality standard. A variance is typically used where a state believes that a water quality standard can ultimately be attained. By maintaining the water quality standard and granting a variance, the state can assure that reasonable progress is made in improving water quality. With a variance, a NPDES permit may be written to ensure that reasonable progress is made toward attaining the water quality standard without violating §402(a)(1) of the Clean Water Act which requires that NPDES permits ensure compliance with water quality standards.

R18-11-122 authorizes a variance where a point source discharger demonstrates that it is not technologically feasible to immediately comply with an applicable water quality standard or where compliance with a water quality standard will cause substantial and widespread economic and social impact. The variance procedure allows temporary non-compliance with a water quality standard while maintaining that standard as a water quality goal for a surface water.

In the 1992 triennial review, Arizona adopted a comprehensive set of numeric water quality standards for toxic pollutants. The numeric water quality criteria were derived using methodologies that did not take the economic or technical feasibility of achieving compliance into consideration. The water quality criteria were established at concentrations deemed necessary to protect the various designated uses. In the last triennial review, ADEQ acknowledged that a variance procedure should be included in the water quality standards rules to provide regulatory flexibility when it is not technically or economically feasible for a point source discharger to achieve compliance with a water quality standard. Situations can and do arise where a point source discharger cannot comply with a water quality standard because the treatment technology is unavailable or the cost of treatment is too high. In such cases, a variance procedure provides a mechanism for maintaining the water quality standard as the ultimate water quality goal for a surface water while providing short-term relief from the water quality standard for a specific discharge. The grant of a variance does not modify a water quality standard, but does provide the legal basis for the establishment of alternative discharge limitations in an NPDES permit. The allowance of a variance on a discharger-specific, pollutant-specific, short-term basis is preferable to a permanent downgrade of the water quality standards for a surface water through the use attainability process.

Under R18-11-122, a variance may be granted on a discharger-specific basis for a period of up to five years. A variance is implemented through an NPDES permit for a specific point source discharge. A point source discharger must document that treatment more advanced than that required by technology-based effluent limitations prescribed by the Clean Water Act is necessary to achieve compliance with the water quality standard and that alternative discharge control strategies to achieve compliance with the water quality standard have been evaluated. The point source discharger must document 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 or that the installation and operation of the treatment technology would cause substantial and widespread social and economic impact. An applicant for a variance also must demonstrate that the discharge of the pollutant for which a variance is sought is reduced to the maximum extent practicable through implementation of a local pretreatment program, source reduction, or waste minimization. Finally, an applicant for a variance must propose interim discharge limitations which represent the highest level of treatment achievable by the point source discharge during the term of the variance.

A variance may be renewed, but a point source discharger who seeks renewal must demonstrate that reasonable progress towards achieving compliance with the water quality has been made during the term of the variance. R18-11-122 includes public participation procedures and provides a right of appeal to any person who may be adversely affected by a decision to grant or deny a variance from a water quality standard. The rule also clarifies that all variances are subject to EPA review and approval.

ADEQ has received a request that ADEQ reconsider a number of issues related to variances that were raised in the last triennial review. These variance issues include: 1) the suggestion to modify the variance procedure to permit temporary suspensions of a water quality standard while one or more dischargers work under ADEQ supervision to correct a water quality problem, 2) a request to amend the variance procedure to include all 6 factors identified by EPA in 40 CFR §131.10(g), 3) a request to extend the variance provision to cover nonpoint source discharges, and 4) a request to allow variances for specific surface waters or segments of surface waters. ADEQ specifically responded to several of these issues in the last triennial review and the comment responses reflect ADEQ current thinking on these issues.

ADEQ disagrees that R18-11-122 should be amended to authorize variances for nonpoint source discharges. While EPA has approved variance procedures for nonpoint source discharges in a few states like Colorado, such states are in the minority. In the National Assessment of State Variance Procedures published in November, 1990, EPA reported that 32 of the 57 states and territories have authority to grant variances from water quality standards. Of

these states, 22 allowed variances from water quality standards for individual dischargers and only 7 states specifically authorized variances for nonpoint source runoff. A significant concern with authorizing variances from water quality standards for nonpoint sources is that the grant of a variance may undermine the implementation of best management practices [BMPs] through nonpoint source management control programs. A nonpoint source discharger may seek a variance rather than identifying and implementing BMPs which could be used to achieve compliance with water quality standards.

ADEQ also is concerned about how to administer and implement a variance for a nonpoint source discharge. As proposed, a variance from a water quality standard may be issued only on a discharger-specific basis. Under the proposed rule, the granting of the variance does not modify a water quality standard in a surface water. Other point source discharges to the surface water are required to comply with applicable water quality standards, including the water quality standard for which a variance has been granted to a specific discharger. A variance for a nonpoint source discharge would be fundamentally different. It would not be possible to grant a variance for a nonpoint source discharge on a discharger-specific basis. The only way to grant a variance for a nonpoint source discharge would be to temporarily modify the water quality standard for the surface water. A temporary modification of a water quality standard would affect all point source and nonpoint source discharges to the surface water. Moreover, under Arizona law, rulemaking would be required to modify a water quality standard in this way.

As proposed by ADEQ, a variance is clearly tied to the NPDES permitting program. Variances are for terms of up to five years and they are reevaluated when the NPDES permit for a point source discharge is reissued. There is no similar regulatory program through which a variance for a nonpoint source discharge could be administered.

Finally, the intent of the proposed variance provision is to ensure the highest level of water quality achievable while a variance is in effect. The proposed rule achieves this by requiring a demonstration by a point source discharger that the discharger has reduced, to the maximum extent practicable, the discharge of the pollutant for which a variance is sought. The discharger also is required to propose interim discharge limitations which represent the

highest level of treatment achievable during the term of the variance. It is not clear how to ensure the highest level of water quality achievable when a variance is requested for a nonpoint source discharge.

ADEQ also disagrees that the variances should be permitted for all of the grounds that support a use attainability analysis. While EPA guidance on variances indicates that a variance from a water quality standard may be based upon any of the grounds for removing a designated use prescribed in 40 CFR §131.10(g), ADEQ does not believe that most of the grounds cited in 40 CFR §131.10(g) are appropriate for a discharger-specific variance. The five grounds are:

1. Naturally occurring pollutant concentrations prevent the attainment of the water quality standard;
2. Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the water quality standard, unless these conditions may be compensated by the discharge of a sufficient volume of effluent to enable the water quality standard to be met without violating state water conservation requirements;
3. Human-caused conditions or sources of pollution prevent the attainment of the water quality standard and cannot be remedied, or would cause more environmental damage to correct than leave in place;
4. Dams, diversions or other types of hydrologic modifications preclude the attainment of the water quality standard, and it is not feasible to restore the waterbody to its original condition or to operate such modification in a way that would result in the attainment of the water quality standard; and
5. Physical conditions related to the natural features of the waterbody such as the lack of a proper substrate, cover, flow, depth, pools, riffles and the like, unrelated to chemical water quality, preclude the attainment of the water quality standard.

While the five grounds may support the removal or downgrade of a designated use of a surface water, 4 of the 5 grounds do not support a variance for a specific point source discharger. For example, it is not clear how "naturally occurring pollutant concentrations which prevent attainment of the water quality standard" may be applied to support a variance for an individual point source discharger. While there may be situations where it is not possible

to comply with a water quality standard because of naturally occurring pollutant concentrations in a surface water , it is difficult to see why a point source discharger should be granted a variance from a water quality standard on this ground. If it is impossible to attain compliance with a water quality standard because of naturally occurring pollutant concentrations, then the appropriate response is to conduct a use attainability analysis to modify the water quality standard for the surface water. A variance is premised on the belief that the conditions which prevent attainment of a water quality standard are temporary in nature and that compliance with the water quality standard ultimately can be achieved. When a naturally occurring concentration of a pollutant prevents attainment of a water quality standard, it is unlikely that compliance with the water quality standard will ever be achieved. Naturally-occurring pollutant concentrations in a surface water are permanent in nature. Similarly, when natural, ephemeral, intermittent or low flow conditions prevent attainment, or dams, diversion, or other types of hydrologic modifications prevent attainment; or physical conditions related to the natural features of a surface water prevent attainment of a water quality standard, then the appropriate regulatory response is a UAA, not a variance. When such conditions exist, they are permanent in nature and it is unlikely that such conditions will change in the future.

When ADEQ adopted the variance provision in 1996, ADEQ stated its position that only one element in 40 CFR §131.10(g) may be applied on a discharger-specific basis because it was related to a discharger's capability to install and operate discharge control technology to attain designated uses. 40 CFR §131.10(g)(6) allows the removal of a designated use if it can be demonstrated that attaining the designated use is not feasible because "controls more stringent than those required by §301(b) and §306 of the Act would result in substantial and widespread economic and social impact."

When EPA first indicated the allowability of state water quality variance provisions in the federal Water Quality Standards Regulations at 40 CFR §131.13, EPA stated in the preamble that state-adopted variances could be approved if they were based upon a demonstration that meeting a water quality standard would cause "substantial and widespread economic and social impact" [See 48 Federal Register 51403]. This conclusion was based upon Decision of the General Counsel No. 58 [44 FR 39508 (March 29, 1977)]. In that decision, EPA stated:

> [V]ariances can be granted by States only when achieving the standard is unattainable. In demonstrating that meeting the standard is unattainable, the State must demonstrate that treatment in excess of that required by §301(b)(2)(A) and (B) of the CWA is necessary to meet the standard and also must demonstrate that requiring such treatment will result in substantial and widespread economic and social impact....

Subsequent EPA guidance has elaborated federal variance policy. On March 15, 1985, EPA issued a memorandum reinterpreting the factors that could be considered when granting variances. The memorandum explained that variances could be based on any of the grounds outlined in 40 CFR §131.10(g) for removing a designated use. This interpretation was based on EPA's reading of §510 of the Clean Water Act which states have the right to establish more stringent standards than those suggested by EPA. EPA concluded that as long as any temporary water quality standards variance conformed to the requirements established in 40 CR §131.10(g) for removal of a designated use, it would be more stringent than the federal requirements since it would be a temporary rather than a permanent downgrade in use.

EPA has stated in guidance that although the March 15, 1985 memorandum broadened the factors that could be considered for granting a variance, *it continued to interpret variances as being limited to individual dischargers.* EPA has acknowledged that while the legal rationale for broadening the factors may seem reasonable, the practical impact of limiting variances to individual dischargers is that the only factor that can be actually used is the "substantial and widespread economic and social impact" factor.

The variance provision at R18-11-122 is intended to apply on a discharger-specific basis. ADEQ recognizes that situations can and do arise where technological limitations or substantial economic hardship for a specific discharger make short-term compliance with standards impossible. In such cases, a variance from the water quality standard

may be justified. In ADEQ's view in 1996, the only ground that could be practically applied to support a request for a variance in such situations was the "widespread and substantial economic and social impact" factor.

In comments on preliminary draft surface water quality standards rules, the Arizona Mining Association has renewed a request to expand the grounds for variances and to allow variances for specific surface waters or segments of surface waters. ADEQ continues to disagree that variances should be allowed for specific surface waters. Variances should be allowed on a discharger-specific basis only. This is consistent with current EPA policy that variances are discharger and pollutant-specific and limited in duration. A "waterbody variance" is essentially a modification of a water quality standard that can only be done in Arizona through the rulemaking process.

The suggestion by the Arizona Mining Association to allow for "waterbody variance" is consistent with an approach to variances that EPA is solicited comment on in the Advanced Notice of Proposed Rulemaking (ANPR) on the water quality standards regulation. EPA stated in the ANPR that it was considering the approach of dividing variances into two categories: waterbody variances [to which the first five designated use removal elements in 40 CFR §131.10(g) would apply] and discharger-specific variances [to which the "substantial and widespread economic and social impact" factor would apply]. While ADEQ recognition of a "waterbody variance" would be consistent with EPA's approach, ADEQ does not believe that the grounds which support a "waterbody variance" are distinguishable from the factors that support the downgrade or removal of a designated use through the use attainability process. For example, if naturally occurring pollutant concentrations in a surface water prevent the attainment of a designated use, then the appropriate regulatory response is the removal of the designated use, not the issuance of a variance that is limited in duration. In general, variances should be used only where the state believes that a water quality standard can ultimately be attained. ADEQ believes that four of the five grounds in 40 CFR §131.10(g) [other than "widespread and substantial economic and social impact" and "human-caused sources of pollution"] that are cited by EPA as supporting a "waterbody variance" are essentially permanent in character. It is unlikely that where such conditions exist in a surface water, that the conditions will change so that the water quality standard ultimately may be attained. Where a water quality standard cannot be attained because of naturally

occurring pollutant concentrations; low flow conditions; the existence of dams, diversions or other hydrological modifications; or physical conditions related to the natural features of a surface water, it is unlikely that the water quality will ever be attained, even in the long term. Where such conditions exist, a UAA should be conducted to remove or permanently downgrade the designated use. Finally, it should be noted that while EPA stated that it was considering waterbody variances in the ANPR, EPA has not proposed this type of variance in any revisions to the federal water quality regulations.

ADEQ has reconsidered one of the grounds for a UAA that ADEQ believes may be used to support a variance. One of the grounds for a UAA is "...human-caused conditions or sources of pollution prevent the attainment of the water quality standard and cannot be remedied, or would cause more environmental damage to correct than leave in place." ADEQ acknowledges that there may be situations where human-caused conditions or sources of pollution prevent the attainment of a water quality standard and cannot be remedied in the short-term (i.e. within 5 years), but the water quality standard may be ultimately attainable. For example, a TMDL strategy may be implemented that is designed to achieve compliance with a water quality standard. However, the time line for achieving compliance with the water quality standard may be more than 5 years out. Under such circumstances, it may be appropriate to grant a variance to a point source discharger.

Prohibitions against discharge [R18-11-123]

§312(f)(1)(B)(3) of the Clean Water Act addresses the regulation of marine sanitation devices. It states, in relevant part:

> [I]f any State determines that the protection and enhancement of the quality of some or all of the waters within such State require greater environmental protection, such State may completely prohibit the discharge from all vessels of any sewage, whether treated or not, into such waters, except that no such prohibition shall apply until the Administrator determines that adequate facilities for the safe and sanitary removal and treatment of sewage from all vessels are reasonably available for such water to which such prohibition would apply.

The States of Utah and Arizona are applying to EPA to prohibit the discharge of sewage to Lake Powell. Arizona has determined that the protection and enhancement of Lake Powell water quality requires greater environmental protection by prohibiting discharges of sewage from vessels. Moreover, Arizona believes that adequate facilities for the safe and sanitary removal and treatment of sewage from all vessels are reasonably available at Lake Powell. Consequently, ADEQ proposes to include such a prohibition against the discharge of sewage from vessels to Lake Powell in R18-11-123.

Appendix A. Numeric Water Quality Criteria

A water quality standard is defined as a provision of state law that consists of designated uses *and water quality criteria based upon such uses* [*See* §303(c)(2)(A) of the Clean Water Act]. Water quality criteria are specifically defined as "elements of state water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use. When the criteria are met, water quality will generally protect the designated use" [*See* 40 CFR §131.3].

40 CFR §131.11(a)(1) requires that states adopt water quality criteria to maintain and protect water quality for designated uses. State-adopted water quality criteria must be based on a sound scientific rationale and they must contain sufficient parameters or constituents to protect the designated uses. In establishing numeric water quality criteria for designated uses, states may establish numeric values based upon the following: 1) EPA recommendations contained in national criteria guidance documents published under §304(a) of the Clean Water Act, 2) §304(a) guidance modified to reflect site-specific conditions, or 3) other scientifically defensible methods. §304(a) of the Clean Water Act requires EPA to develop and publish, and from time to time revise, criteria for water quality accurately reflecting the latest scientific knowledge. Water quality criteria developed under §304(a) are based solely on data and scientific judgments on the relationship between pollutant concentrations and environmental and human health effects. EPA's §304(a) criteria do not reflect consideration of economic impacts or technological feasibility of meeting the chemical concentrations in ambient water. EPA's §304(a) criteria recommendations provide guidance to the states in adopting numeric water quality standards. While EPA's national

criteria recommendations are not regulations and they do not impose legally binding requirements on states, once EPA publishes new or revised §304(a) criteria guidance, EPA expects the state to adopt new or revised criteria into their water quality standards. On December 10, 1998, EPA published a compilation of recommended water quality criteria in the Federal Register [See 63 Federal Register 68354 (December 10, 1998)]. ADEQ reviewed the EPA's national criteria recommendations to determine whether current state-adopted criteria are consistent.

Arizona law also provides guidelines for the state adoption of numeric water quality criteria for designated uses. A.R.S. §49-22(C)(5) states that ADEQ shall consider the guidelines, action levels or numerical criteria adopted or recommended by EPA or any other federal agency when setting water quality standards. As noted earlier, there is a preference in Arizona law for numeric water quality criteria if adequate information exists to support the establishment of numeric standards [*See* §49-221(D)]. Finally, §49-222(C) sets forth legislative guidelines for setting numeric standards for surface waters:

> In setting numeric standards for the quality of navigable waters, the director 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 such pollutants, and the extent to which the natural flow of the stream is intermittent or ephemeral, as a result of which the instream flow consists mostly of treated wastewater effluent, except that such standards shall not, in any event, be inconsistent with the Clean Water Act.

ADEQ proposes to amend the water quality criteria for many pollutants and designated uses in this triennial review. For some designated uses, ADEQ proposes to revise the methodology that was used to derive the numeric criteria. For example, ADEQ proposes to revise the methodology that is used to derive water quality criteria for the partial body contact recreation designated use. For other designated uses, ADEQ proposes to use the same methodologies but update the criteria using health effects and toxicity data that has become available since the last triennial review of water quality standards.

Revising the numeric water quality criteria in Appendix A for the protection of human health

Appendix A contains numeric water quality criteria for 4 designated uses that are established at concentrations which are intended to protect human health. The 4 designated uses are: domestic water supply (DWS), fish consumption (FC), full body contact recreation (FBC), and partial body contact recreation (PBC). Water quality criteria for these designated uses are established at concentrations that are intended to protect against long-term, or chronic, human health effects.

ADEQ uses EPA-recommended methodologies to derive water quality criteria for the DWS, FBC, and FC designated uses. Separate criteria derivation methodologies were used to calculate criteria for pollutants depending on whether a pollutant is a carcinogen or non-carcinogen. The carcinogen procedure was used to derive criteria for pollutants that EPA identifies as known, probable, or possible human carcinogens. The carcinogen procedure employs the use of cancer potency slopes (q1*) in the calculation to derive a criterion. The non-carcinogen procedure uses reference doses (RFDs) to calculate a criterion.

Revising criteria for the domestic water source designated use

ADEQ derived criteria to maintain and protect water quality for use as a raw water source for drinking water (i.e., the domestic water source or DWS) in two ways. First, ADEQ uses maximum contaminant levels (MCLs) that have been promulgated for drinking water under the Safe Drinking Water Act as numeric criteria for the DWS designated use where MCLs were available. ADEQ revised the DWS criteria to include the following MCLs:

Dalapon	200 ug / L
Di (2-ethylhexyl) adipate	400 ug / L
Dinoseb	7 ug / L
Diquat	20 ug / L
Endothall	100 ug / L
Endrin	2 ug / L
Glyphosate	700 ug / L

Oxamyl	200 ug / L
Picloram	500 ug / L
Simazine	4 ug / L

Second, ADEQ proposes to establish a criterion of 100 μg / L for individual trihalomethanes, including bromodichloromethane, bromoform, chloroform, and dibromochloromethane. This criterion is the same as the MCL for total trihalomethanes. The MCL for total trihalomethanes represents the maximum allowable limit for any individual trihalomethane. ADEQ revised the numeric criteria for the individual trihalomethanes by adding 100 μg / L after "TTHM" in Appendix A, Table 1.

Third, ADEQ derived numeric criteria for the DWS designated use using the following methodologies when MCLs were not available:

For carcinogens: $$\frac{70 \times 10^{-6}}{q1^* \times 2}$$

In this equation, 70 represents the average weight of a human male in kilograms (kg); 10^{-6} (1 in 1,000,000) is the excess cancer risk level, q1* is the cancer potency slope, and 2 is the national average water consumption rate in liters / day.

For non-carcinogens: $$\frac{Rfd \times 70 \times 0.2}{2}$$

In this equation, Rfd is the oral reference dose in milligrams / kilogram / day; 70 is the average weight of a human male in kilograms (kg); 0.2 is the allowable water source contribution factor; and 2 is the national average water consumption rate in liters / day. The use of an allowable water source contribution factor is a way of recognizing that a person's exposure to a pollutant may come from other sources, such as dietary intake, and from other exposure pathways such as inhalation and dermal contact. There is little information available to assess the amount of

exposure to a chemical that may be attributed to various exposure pathways. EPA uses an allowable water source contribution factor of 0.2 in the Safe Drinking Water Act program to calculate MCLs. This means that EPA estimates that 20% of a person's exposure to a pollutant is estimated to be through ingestion of drinking water. EPA considers this value to be reasonably conservative and protective when developing standards for drinking water. ADEQ used the same allowable water source contribution value of 20% to derive criteria for non-carcinogens for the DWS designated use when there are no MCLs.

ADEQ proposes to update the DWS criteria for parameters using current q1*s and Rfds from the Integrated Risk Information System database. ADEQ has new human health effects data to derive DWS criteria for the following pollutants that currently do not have numeric criteria:

Chlorine (total residual)	NNS to 700 μg / L
Chromium III	NNS to 10,500 μg / L
Chromium VI	NNS to 21 μg / L
2,6 - Dinitrotoluene	NNS to 0.051 μg / L
Di-n-octyl phthalate	NNS to 2800 μg / L
Napthalene	NNS to 140 μg / L
Silver	NNS to 35 μg / L

ADEQ updated the DWS criteria for the following parameters using new or revised q1*s, Rfds, or Minimum Risk Levels (MRLs). In some cases, criteria were changed to NNS because Rfds or q1*s have been withdrawn and are now unavailable. Finally, some criteria were found to be incorrect because of decimal misplacement or were revised because a different rounding convention was used.

Acrolein	110 μg / L to 3.50 μg / L
Acrylonitrile	0.06 μg / L to 0.065 μg / L
Benz (a) anthracene	0.003 μg / L to NNS
Benzo (k) fluoranthene	0.003 μg / L to NNS

3, 4 - Benzofluoranthene	0.003 μg / L to NNS
Bis (2-chloroethyl) ether	0.03 μg / L to 0.032 μg / L
Chrysene	0.003 μg / L to NNS
Copper	1000 μg / L to 1300 μg / L
Dibenz (ah) anthracene	0.003 μg / L to NNS
1,3-Dichlorobenzene	94 μg / L to NNS
3, 3'-Dichlorobenzidine	0.08 μg / L to 0.078 μg / L
p,p'Dichlorodiphenyldichloroethane (DDD)	0.15 μg / L to 0.146 μg / L
p,p'Dichlorodiphenyldichloroethylene (DDE)	0.1 μg / L to 0.103 μg / L
p,p'Dichlorodiphenyltrichloroethane (DDT)	0.1 μg / L to 0.103
1, 3-Dichloropropene	0.2 μg / L to 2.1 μg / L
Dimethyl phthalate	70,000 μg / L to NNS
4, 6 -Dinitro-o-cresol	2.7 μg / L to 28 μg / L
Endosulfan sulfate	0.35 μg / L to NNS
Endrin aldehyde	2.1 μg / L to NNS
Indeno (1,2,3 - cd) pyrene	0.003 μg / L to NNS
Lead	50 μg / L to 15 μg / L
Manganese	4900 μg / L to 980 μg / L
Nickel	100 μg / L to 140 μg / L
N-nitrosodimethyamine	0.0007 μg / L to 0.001 μg / L
N-nitrosodiphenylamine	7.1 μg / L to 7.14 μg / L
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.0000003 μg / L to 0.00003 μg / L
1,1,2,2-Tetrachloroethane	0.17 μg / L to 0.175 μg / L
2,4,6-Trichlorophenol	3.2 μg / L to 3.18 μg / L

Update fish consumption criteria in Appendix A.

In the last triennial review, ADEQ derived water quality criteria for the fish consumption designated use using the following equation for carcinogens:

$$\frac{70 \times 10^{-6}}{q_1^* \times 0.0065 \times BCF}$$

ADEQ derived water quality criteria for the FC designated use for non-carcinogens using the following equation:

$$\frac{RfD \times 70}{0.0065 \times BCF}$$

In these equations, 70 is the average weight of the human male in kilograms, 10^{-6} is the excess cancer risk level, 0.0065 is the national average fish consumption rate in kilograms per day, BCF is the bioconcentration factor in L / kg, q_1^* is the cancer potency slope in mg / kg / day, and Rfd is the reference dose in mg / kg / day.

The fish consumption value of 6.5 grams per day used in the above equations is based upon the national average fish consumption value that EPA used to calculate its §304(a) national criteria recommendations in 1980. Since the state's adoption of fish consumption criteria based on a 6.5 grams / day fish consumption rate, EPA has issued new guidance on how to derive fish consumption criteria entitled Ambient Water Quality Criteria Derivation Methodology Human Health, Technical Support Document, Final Draft (U.S. Environmental Protection Agency, Office of Water, EPA-822-B-98-005 (July 1998). EPA now recommends a hierarchy of preferences for developing fish consumption rates that states can use to derive appropriate water quality criteria. First, EPA recommends that states look to site-specific information on fish consumption rates to develop appropriate fish consumption criteria, with priority given to identifying fish consumption rates of highly exposed populations within a state, particularly sport and subsistence fishermen. Unfortunately, ADEQ does not have reliable data regarding fish consumption rates by sport or subsistence fishermen in Arizona that can be used to develop a revised and more site-specific fish consumption rate for Arizona. Second, EPA recommends that states use data from fish consumption surveys conducted in similar geographic areas and population groups. The EPA technical support document includes descriptions of a number of such surveys, but none of the cited studies were conducted in geographic areas similar

to Arizona. Third, EPA recommends that states use information on the intake of fish from national food consumption surveys. EPA recommends that states use national data from the combined 1989, 1990, 1991 Continuing Survey of Food Intake by Individuals survey conducted by the U.S. Department of Agriculture (CSFII). EPA presents a detailed set of fish consumption tables from the CSFII in its technical guidance document. The tables indicate various fish consumption rates for adults, children under 14, and women of child-bearing age (considered to be ages 15 - 44). Based on the national CSFII data, EPA now recommends revised default fish consumption rates of 17.80 grams / day for the general adult population and sport fishermen and 86.30 grams /day for subsistence fishermen. These default consumption rates include consumption of both store-bought and sport-caught fish.

ADEQ considered whether the current methodology to derive the fish consumption criteria should be revised to incorporate a higher fish consumption rate of 17.80 grams / day as recommended by EPA for the general adult population and for sport fishermen. ADEQ decided not to revise the state's current fish consumption criteria using the national fish consumption rate derived from the CSFII because of uncertainty regarding whether the national fish consumption rate, which includes consumption of both sport-caught and store-bought fish, was appropriate for the protection of the health of persons who consume fish taken from Arizona surface waters. Uncertainty over the applicability of the national fish consumption rate exists for two reasons. First, the EPA technical guidance document states that data on national distributions of fish intake by sport fishers and subsistence fishers are unavailable. EPA states in the technical guidance that because of a lack of information on national estimates for fish consumption by sport fishermen, the 17.80 grams / day rate, which approximates the 90th percentile fish intake rate from the CSFII, was *assumed* to represent the average non-marine fish consumption rate of the sport fishermen population. Second, EPA's presentation of information on regional break-outs of the national data set for the CSFII in its technical guidance document calls the national 17.80 grams / day rate into question. The following table is taken from EPA's technical guidance document and it presents regional fish consumption data for the Mountain West states, including Arizona:

Distribution of Finfish and Shellfish Consumption: Mountain

Fresh / Estuarine Fish

Statistic	Estimate (g/day)
Mean	3.23
50th Percentile	0.00
90th Percentile	0.48
95th Percentile	20.90
99th Percentile	78.60
All Fish (including marine fish)	
Mean	11.20
50th Percentile	0.00
90th Percentile	39.32
95th Percentile	58.55
99th Percentile	95.84

Source: Ambient Water Quality Criteria Derivation Methodology Human Health, Technical Support Document, Final Draft, U.S. Environmental Protection Agency, Office of Water, EPA-822-B-98-005, July 1998, p. 116.

The mean estimated fish consumption rate in grams / day for fresh water fish in the Mountain West region is 3.23 grams / day and the estimated 90th percentile fish consumption rate is only 0.48 gram / day. These Mountain West fish consumption rates are considerably below the 17.80 grams / day that EPA assumes to be representative of fish consumption rates by sport fishermen and the general adult population nationally. Because of the lack of reliable fish consumption data for Arizona and uncertainty regarding the appropriateness of using the national fish consumption rate of 17.80 grams / day, ADEQ chose to maintain the current methodology for deriving water quality criteria for the fish consumption designated use. The water quality criteria for the fish consumption designated use in the proposed rules is calculated using the 6.5 grams / day fish consumption rate. This fish consumption rate is twice the mean fish consumption rate and more than 13 times the estimated 90th percentile fresh water fish

consumption rate for the Mountain West Region. ADEQ decided not to change its current methodology for deriving fish consumption criteria in this triennial review because of the lack of reliable fish consumption data for Arizona.

Bioaccumulation and bioconcentration factors

Some pollutants have the capacity to bioconcentrate in the tissues of aquatic organisms. When this occurs there is a net increase in the amount of the pollutant within the organism. Thus, the concentration of a pollutant in an organism can exceed the concentration of the pollutant in the water column. The ratio of the pollutant concentration in the organism to the pollutant concentration in the water is called the bioconcentration factor, or BCF. In addition to bioconcentration, some pollutants accumulate in aquatic organisms by being passed up the food chain. Examples of pollutants that bioaccumulate include PCBs, DDT, and methyl mercury.

Bioconcentration and bioaccumulation are important factors to consider when developing water quality criteria for the fish consumption (FC) designated use. Humans are at the top of the food chain and they can ingest pollutants that have accumulated in the tissues of the aquatic organisms they harvest and consume. To protect human health, the water quality criteria for the FC designated use must be established at concentrations that are not harmful to human consumers. The criteria must take the bioaccumulation of pollutants in aquatic organisms into account. ADEQ used BCFs that are both chemical-specific and Arizona-specific to derive FC criteria in previous triennial reviews. A complete discussion of the derivation of the BCFs that were used to derive FC water quality criteria is contained in the 1992 and 1996 human health rationale documents. ADEQ does not propose to change the use of BCFs to derive water quality criteria for the FC designated use in this triennial review.

EPA recently proposed to use bioaccumulation factors (BAFs) to derive water quality criteria to protect human health [*See* Ambient Water Quality Criteria Derivation Methodology - Human Health, Technical Support Document, Final Draft, §2.4.1, pp. 165-166]. A BAF is the ratio of a pollutant concentration in tissue to the concentration in water and it takes into account the uptake of pollutants through contaminated food, sediment, and water. Chemicals

with larger BAFs reflect greater bioaccumulation in fish tissues compared to chemicals with lower BAFs. EPA now recommends that states use BAFs instead of BCFs to derive water quality criteria. This contrasts with EPA's 1980 AWQC National Guidelines for deriving human health criteria. EPA previously relied on BCFs to derive human health criteria. In contrast to the BAF, the BCF measures the uptake of chemicals into fish that have been exposed only through water, not food or sediment. EPA recommends the use of BAFs as being superior to BCFs for deriving water quality criteria to protect human health because BAFs account for uptake from all sources of waterborne exposure of a pollutant to an organism.

ADEQ reviewed EPA's technical recommendations and is considering revisions to the methodology for deriving the water quality criteria for the FC designated use. ADEQ invites public comment on whether ADEQ should revise the current methodology for deriving fish consumption criteria to include BAFs instead of BCFs. For purposes of the proposed rules, ADEQ did not change methodologies and used the same BCFs to calculate the FC criteria.

ADEQ proposes to adopt new criteria for the following pollutants for the FC designated use.

Dalapon	161,538 μg / L
Dinoseb	158 μg / L
Diquat	23, 692 μg / L
Endothall	215,385 μg / L
Glyphosate	1,076,923 μg / L
Picloram	24,318 μg / L
Simazine	10,769 μg / L

ADEQ proposes to revise the criteria for the following pollutants for the FC designated use based upon revised q1*s or Rfds, the withdrawal or unavailability of q1*s or Rfds, or changes in rounding conventions:

Acenapthene	2600 μg / L to 2568 μg / L
Acrolein	750 μg / L to 23.9 μg / L

Anthracene	6300 μg / L to 6343 μg / L
Antimony (T)	140 μg / L to 154 μg / L
Benzene	120 μg / L to 239 μg / L
Benz(a)anthracene	0.00008 μg / L to NNS
Benzo(k)fluoranthene	0.00001 μg / L to NNS
3,4 - Benzofluoranthene	0.00004 μg / L to NNS
Beryllium (T)	0.21 μg / L to 1,795 μg / L
Bis (2-chloroisopropyl) ether	15,000 μg / L to 35,897 μg / L
Bromodichloromethane	22 μg / L to 11.6 μg / L
Bromoform	80 μg / L to 341 μg / L
Bromomethane	7500 μg / L to 5026 μg / L
Butyl benzyl phthalate	5000 μg / L to 5008 μg / L
Cadmium (T)	41 μg / L to 41.4 μg / L
Carbon tetrachloride	5.5 μg / L to 5.52 μg / L
Chlordane	0.001 μg / L to 0.005 μg / L
Chlorobenzene	500 μg / L to 514 μg / L
Chloroform	590 μg / L to 588 μg / L
Chloronapthalene beta	13,000 μg / L to 13,295 μg / L
2-Chlorophenol	2100 μg / L to 2154 μg / L
Chromium III	67,000 μg / L to 1,009,615 μg / L
Chromium VI	3,400 μg / L to 2,019 μg / L
Chrysene	.0001 μg / L to NNS
Cyanide	210,000 μg / L to 215,385 μg / L
Dibenz (ah) anthracene	0.00003 μg / L to NNS
Dibromochloromethane	12 μg / L to 8.55 μg / L
Dibutyl phthalate	2300 μg / L to 159 μg / L

1,2 - Dichlorobenzene	2800 μg / L to 2761 μg / L
1,3 - Dichlorobenzene	2000 μg / L to NNS
1,4 - Dichlorobenzene	1200 μg / L to 35,601 μg / L
3,3'-Dichlorobenzidine	0.09 μg / L to 0.091 μg / L
p,p'-Dichlorodiphenyldichloroethane (DDD)	0.0009 μg / L to 0.001 μg / L
p,p'-Dichlorodiphenyldichloroethylene (DDE)	0.0006 μg / L to 0.012 μg / L
p,p'-Dichlorodiphenyltrichloroethane (DDT)	0.0005 μg / L to 0.0004 μg / L
1,2 - Dichloroethane	120 μg / L to 118 μg / L
1,2 - trans- Dichloroethylene	13,000 μg / L to 13,462 μg / L
1,1- Dichloroethylene	4.5 μg / L to 321 μg / L
Dichloromethane	480 μg / L to 479 μg / L
2,4 - Dichlorophenol	810 μg / L to 808 μg / L
1,2 - Dichloropropane	NNS to 161,538 μg / L
1,3 - Dichloropropene	6.6 μg / L to 646 μg / L
Diethyl phthalate	110,000 μg / L to 113,360 μg / L
2,4 - Dimethylphenol	2200 μg / L to 2198 μg / L
Dimethyl phthalate	2,800,000 μg / L to NNS
4,6 - Dinitro -o-cresol	120 μg / L to 3077 μg / L
2,4 - Dinitrophenol	5400 μg / L to 3590 μg / L
2,6 - Dinitrotoluene	NNS to 1.98 μg / L
Di -n-octyl phthalate	NNS to 3084 μg / L
Endosulfan sulfate	0.78 μg / L to NNS
Endrin	1.1 μg / L to 1.15 μg / L
Endrin aldehyde	0.81 μg / L to NNS
Ethylbenzene	110,000 μg / L to 107,692 μg / L
Fluoranthene	130 μg / L to 15,569 μg / L

Fluorene	580 μg / L to 33,946 μg / L
Heptachlor	0.0002 μg / L to 0.0004 μg / L
Hexachloroccyclohexane gamma	0.02 μg / L to 6.37 μg / L
Indeno (1,2,3-cd) pyrene	0.000003 μg / L to NNS
Isophorone	2300 μg / L to 2267 μg / L
Mercury	0.6 μg / L to 1.66 μg / L
Napthalene	NNS to 71,795 μg / L
Nickel	730 μg / L to 733 μg / L
Nitrobenzene	600 μg / L to 598 μg / L
N-nitrosodimethylamine	2.1 μg / L to 0.88 μg / L
N-nitrosodi-n-propylamine	0.51 μg / L to 0.385 μg / L
Pentachlorophenol	8.2 μg / L to 1.13 μg / L
Phenol	6,500,000 μg / L to 6,461,538 μg / L
PCBs	0.00009 μg / L to 0.013 μg / L
Pyrene	1100 μg / L to 1090 μg / L
Selenium	9000 μg / L to 8964 μg / L
Silver	NNS to 5983 μg / L
2,3,7,8-TCDD (Dioxin)	0.000000004 μg / L to 0.002 μg / L
Tetrachloroethylene	11 μg / L to 4487 μg / L
Thallium	41 μg / L to 39.2 μg / L
Toluene	90,000 μg / L to 89,744 μg / L
Toxaphene	0.0008 μg / L to 0.001 μg / L
1,2,4-Trichlorobenzene	155 μg / L to 156 μg / L
Trichloroethylene	NNS to 195,804 μg / L
2,4,6 - Trichlorophenol	4.9 μg / L to 4.89 μg / L

Vinyl chloride	620 μg / L to 15 μg / L
Zinc	22,000 μg / L to 21,830 μg / L

Update full body contact recreation criteria in Appendix A

The criteria for the full body contact recreation (FBC) designated use are intended to protect people from exposure to pollutants when they are swimming. To develop FBC criteria, ADEQ made assumptions regarding possible human exposure to pollutants while swimming. Ingestion and dermal contact are two common exposure pathways to pollutants while swimming. However, there is little reliable data to support the derivation of FBC criteria based on dermal contact exposures to pollutants. Consequently, ADEQ developed the current FBC criteria based on assumptions regarding oral ingestion of water while swimming.

An individual may incidentally ingest some water when he or she swims in a surface water. ADEQ derived the current water quality criteria for FBC assuming an incidental water ingestion rate of 50 ml / day. This value is based upon EPA Superfund risk assessment guidelines which suggest that an average mouthful of water may be 50 ml. ADEQ derived the current FBC criteria assuming an exposure from ingesting 50 ml of water during an estimated average of 1 hour of swimming per day. The following equation was used to derive criteria for carcinogens:

$$\frac{70 \times 10^{-6}}{q_1^* \times 0.05 \text{ L / day}}$$

ADEQ derived water quality for noncarcinogens using the following equation:

$$\frac{\text{RfD} \times 70}{0.05 \text{ L / day}}$$

In these equations, 70 is the average weight of a human male in kilograms, 10^{-6} is the excess cancer risk level, 0.05 is the estimated water consumption rate due to swimming in liters / day, q_1^* is cancer potency slope in mg / kg / day, and Rfd is the reference dose in mg / kg / day.

The available literature on recreational exposures to pollutants combined with assumptions about the average mouthful of water ingested for every hour of total body contact recreation can be used to determine an alternative incidental ingestion rate. EPA now recommends an incidental water ingestion rate of 10 ml / day in the Ambient Water Quality Criteria Derivation Methodology Human Health, Technical Support Document, Final Draft, § 2.3.2.4, p. 123. This estimate is based on an assumption that an individual may be in total contact with surface water for 123 hours a year (i.e., an hour of swimming per day throughout 4 summer months) and may ingest 30 ml of water per hour of total contact. EPA's recommended ingestion rate of 10 ml / day may be appropriate for situations where exposure to pollutants while swimming occurs for one hour daily for about 4 months. However, EPA recognizes that states in warmer climates may wish to use higher incidental water ingestion rates to protect individuals who may swim in lakes or rivers for a greater portion of the year. ADEQ considered revising the current incidental ingestion rate of 50 ml / day to EPA's recommended incidental ingestion rate of 10 ml / day for the FBC designated use. However, ADEQ decided to retain the higher incidental water ingestion rate of 50 ml / day because of Arizona's warmer climate and the potential for greater exposure to pollutants by swimming.

ADEQ proposes to revise some FBC criteria that are artificially low because of a policy decision that was made in a previous triennial review that relates to the derivation of criteria for the partial body contact recreation (PBC) designated use. After ADEQ derived numeric criteria for the FBC and PBC designated uses in the 1992 triennial review, ADEQ found that for some pollutants, the numeric criterion for the FBC designated use was less stringent than the numeric criterion calculated to protect the PBC designated use. For other pollutants the FBC criterion was more stringent than the water quality criterion for the DWS designated use. Based on assumptions regarding relative exposures to pollutants in surface water, one would expect that the FBC criteria would be more stringent than the criteria for the PBC designated use and less stringent than the DWS criteria. However, the numeric criteria for the DWS, FBC, and PBC designated uses did not always reflect this logic because different methodologies were used to derive the criteria for each designated use. Consequently, ADEQ made two policy decisions regarding the FBC criteria in the 1992 triennial review. First, whenever a calculated numeric criterion for the FBC designated use was less stringent than the numeric criterion to protect the PBC designated use, ADEQ "defaulted" to the more

stringent criterion PBC criterion. Second, whenever a FBC criterion was calculated to be more stringent than a DWS criterion, the DWS criterion was used to maintain and protect water quality for the FBC designated use. In the latter case, this occurred for 4 pollutants that had a less stringent DWS criterion based on MCLs with an excess cancer risk level higher than 10^{-6}. ADEQ believes that the use of Safe Drinking Water Act MCLs to protect the FBC designated use is reasonable, even when the MCL is less stringent than a criterion calculated using the FBC methodology.

ADEQ proposes to abandon the EBASCO methodology that was used to calculate the PBC criteria in previous triennial reviews and does not believe it makes sense to "default" to more stringent criteria for the PBC designated use that were calculated using that methodology. ADEQ proposes to revise the criteria derivation methodology for the PBC designated use [*See* discussion below]. The PBC criteria calculated using the EBASCO methodology assume an incidental water ingestion rate that is 10 times higher than the exposure assumption used to derive the FBC criteria. ADEQ used a PBC criteria derivation methodology suggested by the regulated community during the 1992 triennial review and published in Proposed Human Health Ambient Water Quality Standards for Arizona, (EBASCO Environmental, 1990). ADEQ has reconsidered the exposure assumptions used in the EBASCO methodology for calculating the PBC criteria. An incidental water ingestion rate for the PBC designated use that is 10 times higher than that used for the FBC designated use is unreasonable. Given the lack of data on incidental ingestion or dermal exposure to pollutants through PBC recreation, ADEQ continues to rely on an assumed incidental water ingestion rate as a surrogate measure to derive criteria for the PBC designated use. However, ADEQ rejects the use of an incidental water ingestion rate for PBC that is 10 times higher than the one used for the FBC designated use. ADEQ proposes to use essentially the same methodology to derive water quality criteria for both the FBC and PBC designated uses. The result of this proposed approach is that ADEQ will no longer "default" to more stringent PBC criteria. The practical result of this approach is that many FBC criteria become less stringent by a factor of 10. Also, ADEQ proposes to update the criteria for FBC and PBC designated uses using current q1*s and Rfds from IRIS. ADEQ proposes to revise the following numeric criteria for the FBC designated use:

Acenapthene	8400 μg / L to 84,000 μg / L
Acrolein	2200 μg / L to 700 μg / L
Acrylonitrile	2.6 μg / L to 2.59 μg / L
Alachlor	1400 μg / L to 14,000 μg / L
Anthracene	42,000 μg / L to 420,000 μg / L
Antimony	56 μg / L to 560 μg / L
Atrazine	4900 μg / L to 49,000 μg / L
Barium	9800 μg / L to 98,000 μg / L
Benzene	48 μg / L to 93.3 μg / L
Benzidine	0.006 μg / L to 0.01 μg / L
Benz(ah)anthracene	0.12 μg / L to NNS
Benzo(a)pyrene	0.2 μg / L to 0.19 μg / L
Benzo(k)fluoranthene	0.12 μg / L to NNS
3,4-Benzofluoranthene	0.12 μg / L to NNS
Beryllium	4 μg / L to 2800 μg / L
Bis (2-chloroethyl) ether	1.3 μg / L to 1.27 μg / L
Bis (2-chloroisopropyl) ether	5600 μg / L to 56,000 μg / L
Boron	12,600 μg / L to 126,000 μg / L
Bromoform	180 μg / L to 177 μg / L
Bromomethane	200 μg / L to 1,960 μg / L
Butyl benzyl phthalate	28,000 μg / L to 280,000 μg / L
Cadmium	70 μg / L to 700 μg / L
Carbofuran	700 μg / L to 7,000 μg / L
Carbon tetrachloride	11 μg / L to 10.8 μg / L
Chlordane	2 μg / L to 4 μg / L
Chlorine (total residual)	14,000 μg / L to 140,000 μg / L

Chlorobenzene	2800 μg / L to 28,000 μg / L
Chloronapthalene beta	11,000 μg / L to 112,000 μg / L
2-Chlorophenol	700 μg / L to 7,000 μg / L
Chromium III	140,000 μg / L to 2,100,000 μg / L
Chromium VI	700 μg / L to 4,200 μg / L
Chromium (total)	NNS to 100 μg / L
Chrysene	0.12 μg / L to NNS
Copper	5200 μg / L to 1,300 μg / L
Cyanide	2800 μg / L to 28,000 μg / L
Dalapon	NNS to 42,000 μg / L
Di (2-ethylhexyl) adipate	NNS to 1,167 μg / L
Di (2-ethylhexyl) phthalate	NNS to 100 μg / L
Dibenz (ah) anthracene	0.12 μg / L to NNS
Dibromochloromethane	17 μg / L to 100 μg / L (TTHM)
1,2-Dibromo-3-chloropropane (DBCP)	NNS to 2,800 μg / L
1,2-Dibromoethane (EDB)	1.6 μg / L to 0.05 μg / L
Dibutyl phthalate	14,000 μg / L to 140,000 μg / L
1,2-Dichlorobenzene	13,000 μg / L to 126,000 μg / L
1,3-Dichlorobenzene	1880 μg / L to NNS
1,4-Dichlorobenzene	1880 μg / L to 560,000 μg / L
3,3'-Dichlorobenzidine	3.1 μg / L to 3.11 μg / L
p,p'-Dichlorodiphenyldichloroethane (DDD)	5.8 μg / L to 5.83 μg / L
p,p'-Dichlorodiphenyldichloroethylene (DDE)	4.1 μg / L to 4.12 μg / L
p,p'-Dichlorodiphenyltrichloroethane (DDT)	4.1 μg / L to 4.12 μg / L
1,2-Dichloroethane	15 μg / L to 15.4 μg / L
1,1-Dichloroethylene	7 μg / L to 233 μg / L

1,2-cis-Dichloroethylene	NNS to 70 μg / L
1,2-trans-Dichloroethylene	2800 μg / L to 28,000 μg / L
Dichloromethane	190 μg / L to 187 μg / L
2,4-Dichlorophenol	420 μg / L to 4,200 μg / L
2,4-Dichlorophenoxyacetic acid (2,4-D)	1400 μg / L to 14,000 μg / L
1,2-Dichloropropane	NNS to 126,000 μg / L
1,3-Dichloropropene	7.8 μg / L to 420 μg / L
Diethyl phthalate	110,000 μg / L to 1,120,000 μg / L
2,4-Dimethylphenol	2800 μg / L to 28,000 μg / L
Dimethyl phthalate	1,400,000 μg / L to NNS
4,6-Dinitro-o-cresol	55 μg / L to 5,600 μg / L
2,4-Dinitrophenol	280 μg / L to 2,800 μg / L
2,4-Dinitrotoluene	280 μg / L to 2,800 μg / L
2,6-Dinitrotoluene	NNS to 2.06 μg / L
Di-n-octyl-phthalate	NNS to 560,000 μg / L
Dinoseb	NNS to 1,400 μg / L
1,2-Diphenylhydrazine	1.8 μg / L to 1.75 μg / L
Diquat	NNS to 3,080 μg / L
Endosulfan sulfate	7 μg / L to NNS
Endosulfan (total)	840 μg / L to 8,400 μg / L
Endothall	NNS to 28,000 μg / L
Endrin	40 μg / L to 420 μg / L
Endrin aldehyde	420 μg / L to NNS
Ethylbenzene	14,000 μg / L to 140,000 μg / L
Fluoranthene	5600 μg / L to 56,000 μg / L
Fluorene	5600 μg / L to 56,000 μg / L

Fluoride	8400 μg / L to 84,000 μg / L
Glyphosate	NNS to 140,000 μg / L
Hexachlorocyclohexane gamma (lindane)	1 μg / L to 420 μg / L
Hexachlorocyclopentadiene	1000 μg / L to 9,800 μg / L
Indeno (1,2,3-cd) pyrene	0.12 μg / L to NNS
Isophorone	1500 μg / L to 1,474 μg / L
Lead	NNS to 15 μg / L
Manganese	19,600 μg / L to 196,000 μg / L
Mercury	42 μg / L to 420 μg / L
Methoxychlor	700 μg / L to 7,000 μg / L
Napthalene	NNS to 28,000 μg / L
Nickel	2,800 μg / L to 28,000 μg / L
Nitrate	224,000 μg / L to 2,240,000 μg / L
Nitrite	14,000 μg / L to 140,000 μg / L
Nitrobenzene	70 μg / L to 700 μg / L
N-Nitrosodiphenylamine	290 μg / L to 286 μg / L
Oxamyl	NNS to 35,000 μg / L
Phenol	84,400 μg / L to 840,000 μg / L
Picloram	NNS to 98,000 μg / L
Polychlorinated biphenyls (PCBs)	0.5 μg / L to 28 μg / L
Pyrene	4,200 μg / L to 42,000 μg / L
Radium 226, 228	NNS to 5 pCi / L
Selenium	700 μg / L to 7,000 μg / L
Silver	NNS to 7,000 μg / L
Simazine	NNS to 7,000 μg / L
Styrene	28,000 μg / L to 280,000 μg / L

2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.00009 μg / L to 1.40 μg / L
Tetrachloroethylene	35 μg / L to 14,000 μg / L
Thallium	12 μg / L to 112 μg / L
Toluene	28,000 μg / L to 280,000 μg / L
Toxaphene	3 μg / L to 1.27 μg / L
1,2,4-Trichlorobenzene	1400 μg / L to 14,000 μg / L
1,1,1-Trichloroethane	NNS to 200 μg / L
1,1,2-Trichloroethane	25 μg / L to 24.6 μg / L
Trichloroethylene	NNS to 280,000 μg / L
2,4,6-Trichlorophenol	130 μg / L to 127.3 μg / L
2-(2,4,5-Trichlorophenoxy) propionic acid	1120 μg / L to 11,200 μg / L
2,4,5-Trichlorophenoxyacetic acid	NNS to 14,000 μg / L
Vinyl chloride	80 μg / L to 2 μg / L
Xylenes	280,000 μg / L to 2,800,000 μg / L
Zinc	42,000 μg / L to 420,000 μg / L

Recalculation of the partial body contact recreation (PBC) water quality criteria

In the 1992 triennial review of surface water quality standards, ADEQ originally proposed that no water quality criteria be adopted for the PBC designated use because of the lack of an accepted methodology to derive the criteria and a lack of data regarding incidental ingestion of water or dermal exposures to pollutants. During the 1992 triennial review, a methodology to derive water quality criteria for the PBC designated use was recommended by members of the regulated community. The recommendations were published in Proposed Human Health Ambient Water Quality Standards for Arizona (EBASCO Environmental, et. al., 1990). The EBASCO recommendations for deriving criteria for the PBC designated use included the following:

1. The PBC designated use would be applied to ephemeral waters and effluent dominated waters whose primary use is aesthetic and whose flow characteristics limit the likelihood of exposure. It is proposed that

the definition of PBC relate to the frequency and duration of incidental exposure based on the expected use of these waters. PBC should be defined in a toxicologically relevant manner that permits a dose estimate to be made. Because exposure through ingestion or exposure to sensitive body organs is unlikely to occur, then those instances of exposure can be assumed to be infrequent and to occur at sporadic intervals.

2. The relevant human health concern for purposes of establishing water quality standards for PBC is from acutely toxic effects and not from effects that cause chronic toxicity.

3. If acutely toxic health effects are possible, then consideration of a "maximally exposed individual" is appropriate instead of the most likely exposed individual.

4. The maximally exposed individual could be postulated to be one who may have consumed as much as 0.5 liter (about 1 pint) of water during a single day or who incidentally consumed an equal amount as a result of several exposures. The most likely exposure would be a person who immersed part of his or her body (e.g., waded) in the water.

5. It is recommended that the short term health advisory value be used to establish the permissible water limits for chemical contaminants and that this should be corrected for the consumption of 0.5 liter instead of 2 liters.

6. If health advisory levels are unavailable, then it is proposed that reference dose (Rfd) based on chronic oral administration be used and, if appropriate, adjusted upward to reflect the need to protect against acute toxicity. It is proposed that the dose for a 70 kg adult be calculated and an allowable water concentration based on a 0.5 liter consumption.

7. If health advisory levels are unavailable, it is proposed that a non-carcinogenic risk assessment be used based on No Observed Efflects Levels (NOAEL) determined from short term toxicity data and the numbers be adjusted with safety factors based on EPA protocols used to produce health advisory levels. If insufficient toxicological data are available for a particular compound, then data for analagous compounds should be used. This may be appropriate for certain polynuclear aromatic hydrocarbons, phenols, and phthalate esters.

ADEQ followed the EBASCO recommendations to derive water quality criteria for the PBC designated use. The EBASCO approach was admittedly conservative and probably more stringent than what was necessary to protect human health from the types of exposures to pollutants normally expected during partial body contact recreation. The exposure assumption of 0.5 liter of water ingested incidentally or accidentally during a single day of partial body contact recreation was used to derive the PBC criteria. ADEQ used the following decision hierarchy to derive criteria for PBC:

1. Use one-day children's health advisories to protect the PBC designated use where available,
2. Use the EBASCO method to derive PBC criteria and assume that the "maximally exposed individual" will ingest 0.5 liters of water during partial body contact recreation.
3. If an MCL is less stringent than the PBC criterion that results from using either the one-day children's health advisory or the EBASCO method, then use the MCL.

As noted earlier, a common sense approach based on expected exposures to pollutants in surface water should result in water quality criteria for PBC that are less stringent than FBC criteria and FBC criteria that are less stringent than the DWS criteria. However, as noted earlier, the human health criteria in Table 1 of Appendix A did not always reflect this logic because of differences in the methodologies that were used to derive the criteria for each designated use. Sometimes, a PBC criterion was calculated using the EBASCO methodology that was more stringent than the FBC criterion for the same pollutant. Whenever this happened, ADEQ "defaulted" to the more stringent PBC criterion and the more stringent PBC criterion was adopted for both the FBC and PBC designated uses.

ADEQ has reconsidered the use of the EBASCO methodology to derive water quality for the PBC designated use. ADEQ believes that the use of the EBASCO methodology drives FBC and PBC human health criteria to overly stringent levels. ADEQ proposes to abandon the EBASCO methodology for deriving criteria for the PBC designated use because the methodology uses an unreasonable incidental water ingestion exposure assumption. The EBASCO incidental ingestion rate for PBC (i.e., 0.5 liter or 500 ug/L) is 10 times the incidental ingestion rate used to derive the FBC criteria (0.05 mg / L or 50 ug/L). Common sense tells us that the incidental water ingestion rates for the two

designated uses should be reversed. That is, the incidental water ingestion rate assumed for FBC should be higher than the assumed incidental water ingestion rate for PBC. ADEQ believes that the incidental ingestion rate of 0.05 mg/L for the FBC designated use is a more reasonable exposure assumption for the PBC designated use. In the absence of reliable data to derive PBC criteria based on dermal exposures or another incidental water ingestion rate, ADEQ proposes to rely on the exposure assumptions in the FBC methodology to derive criteria for *both* the FBC and PBC designated uses. A FBC criterion should be adequately protective of water quality for the PBC designated use. If one can safely swim in a surface water, it should be adequately protected for partial body contact recreation.

Finally, ADEQ proposes to employ only noncarcinogenic endpoints to derive criteria for PBC. This approach is consistent with the EBASCO methodology recommendation to use a reference dose (Rfd) based on oral ingestion. Carcinogenic endpoints are not appropriate for the derivation of PBC criteria because they are based upon chronic exposures to pollutants. ADEQ proposes to use the following methodology to derive PBC criteria:

$$\frac{RfD \times 70}{0.05}$$

Where Rfd is the reference dose, 70 is the average weight of the human male in kilograms, and 0.05 is estimated incidental water ingestion rate in liters per day. This is the same methodology used to derive FBC criteria for noncarcinogens. ADEQ revised the current numeric water quality criteria for the PBC designated use using this criteria derivation methodology.

Where an Rfd for a pollutant is unavailable, ADEQ proposes to use Minimum Risk Levels (MRLs) for hazardous substances developed by the Agency for Toxic Substances and Disease Registry (ATSDR) to derive PBC criteria. ASTDR's development of MRLs is a response to a mandate found in the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act. Federal Superfund law requires ATSDR, in cooperation with EPA, to develop a list of hazardous substances commonly found at Superfund sites, prepare toxicological profiles for each substance included on the list of

hazardous substances, and ascertain significant human exposure levels for hazardous substances in the environment and the associated acute, subacute, and chronic human health effects.

An ATSDR minimum risk level (MRL) is similar to an EPA reference dose (Rfd). An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of an adverse noncancer health effect over a specified duration of exposure. MRLs are derived for acute (1 to 14 days), intermediate (15 to 364 days), and chronic exposures (365 days or longer) and for oral and inhalation routes of exposure. Currently, MRLs for the dermal route of exposure are not derived because ATSDR has not yet identified a method suitable for this route of exposure. ADEQ proposes to use oral MRLs to derive PBC criteria when an Rfd is not available. ADEQ proposes to use chronic oral exposure MRLs first, intermediate exposure MRLs if chronic exposure MRLs are unavailable, and acute oral exposure MRLs if both chronic and intermediate oral exposure MRLs are unavailable. The MRL will be substituted in the above equation for the Rfd.

MRLs are intended to serve as screening levels to identify contaminants with potential health effects of concern. MRLs are derived only when ATSDR determines that reliable and sufficient data exist to identify target organs or the most sensitive health effect for a specific duration for a given route of exposure to a hazardous substance. Like Rfds, MRLs are based on noncancer health effects only. Oral MRLs are expressed as daily human doses in units of milligrams per kilogram per day (mg / kg / day).

ATSDR uses the no observed adverse effect level / uncertainty factor approach to derive MRLs for hazardous substances. The MRLs are set below levels that, based on current information, might cause adverse health effects in people who are most sensitive to a substance-induced health effect. The MRLs are generally based on the most sensitive substance-induced end point that ATSDR considers to be of relevance to humans. MRLs contain uncertainty because of the lack of precise toxicological information on vulnerable populations who may be most sensitive to the effects of hazardous substances (e.g., infants, elderly, and immunologically compromised people). For this reason, ATSDR uses a conservative approach to address these uncertainties consistent with the public

health principle of prevention. Although human health effects data are preferred, MRLs often are based on animal studies because relevant human health effects studies are lacking. In the absence of evidence to the contrary, ATSDR assumes that humans are more sensitive than animals to the effects of hazardous substances and that certain persons may be particularly sensitive to exposure to hazardous substances [e.g. immunologically compromised persons]. Thus, an MRL may be set at a level below that which is shown to be nontoxic in animals.

MRLs undergo a rigorous review process. They are reviewed by the Health Effects / MRL Workgroup within the ATSDR Division of Toxicology; an expert panel of external peer reviewers, an agency-wide MRL Workgroup with participation from other federal agencies, including EPA. MRLs also are submitted for public comment through the toxicological profile public comment period. Each MRL is subject to change as new information becomes available and the toxicological profile for a hazardous substance is updated. ADEQ derived PBC criteria using MRLs for 17 pollutants. They are: acrolein, acrylonitrile, hexachlorocyclohexane-alpha, hexachlorocyclohexane-beta, 1,4-Dichlorobenzene, 1,2-Dibromo-3-chloropropane, 1,2-Dichloroethane, 1,2-Dichloropropane, 4,6-Dinitro-o-cresol, 2,6-Dinitrotoluene, Di-n-octyl phthalate, Hexachlorobutadiene, N-Nitrosodi-n-propylamine, 2,3,7,8-Tetrachlorodibenzo-p-dioxin, 1,1,2,2-Tetrachloroethane, Toxaphene, and Trichloroethylene.

For pollutants identified as carcinogens with q1*s, but that do not have a Rfd or MRL available, ADEQ proposes to use the full body contact criterion to protect the partial body contact designated use. This situation occurs for 8 pollutants, including benzene, benzo(a)pyrene, bis (chloroethyl) ether, 1,2-diphenylhyrdazine, n-nitrosodimethylamine, n-nitrosodiphenylamine, 1,1,1-trichloroethane, and 2,4,6-trichlorophenol. For pollutants for which there is no q1*, Rfd, or MRL but there is an MCL or an action level [e.g. lead and copper], ADEQ proposes to use the MCL or action level to protect the partial body contact designated use. This situation occurs for 7 pollutants, including total chromium, copper, 1,2-dibromoethane, 1,2-cis-dichloroethylene, lead, and radium- 226, and radium-228.

ADEQ proposes to revise the numeric criteria for the PBC designated use as follows:

Acenapthene	8400 μg / L to 84,000 μg / L
Acrolein	2200 μg / L to 700 μg / L
Acrylonitrile	NNS to 56,000 μg / L
Alachlor	1400 μg / L to 14,000 μg / L
Aldrin	4.2 μg / L to 42 μg / L
Anthracene	42,000 μg / L to 420,000 μg / L
Antimony	56 μg / L to 560 μg / L
Arsenic	50 μg / L to 420 μg / L
Atrazine	4900 μg / L to 49,000 μg / L
Barium	9800 μg / L to 98,000 μg / L
Benzene	NNS to 93.3 μg / L
Benzidine	420 μg / L to 4,200 μg / L
Benzo(a)pyrene	NNS to 0.19 μg / L
Beryllium	700 μg / L to 2,800 μg / L
Bis (2-chloroethyl) ether	NNS to 1.27 μg / L
Bis (2-chloroisopropyl) ether	5600 μg / L to 56,000 μg / L
Boron	12,600 μg / L to 126,000 μg / L
Bromodichloromethane	2,800 μg / L to 28,000 μg / L
Bromoform	2,800 μg / L to 28,000 μg / L
Bromomethane	200 μg / L to 1,960 μg / L
Butyl benzyl phthalate	28,000 μg / L to 280,000 μg / L
Cadmium	70 μg / L to 700 μg / L
Carbofuran	700 μg / L to 7,000 μg / L
Carbon tetrachloride	98 μg / L to 980 μg / L
Chlordane	8.4 μg / L to 700 μg / L

Chlorine (total residual)	14,000 μg / L to 140,000 μg / L
Chlorobenzene	2800 μg / L to 28,000 μg / L
Chloroform	1400 μg / L to 14,000 μg / L
Chloronapthalene beta	11,000 μg / L to 112,000 μg / L
2-Chlorophenol	700 μg / L to 7000 μg / L
Chromium III	140,000 μg / L to 2,100,000 μg / L
Chromium VI	700 μg / L to 4,200 μg / L
Chromium (total)	NNS to 100 μg / L
Copper	5200 μg / L to 1,300 μg / L
Cyanide	2800 μg / L to 28,000 μg / L
Dalapon	NNS to 42,000 μg / L
Di (2-ethylhexyl) adipate	NNS to 1,167 μg / L
Di (2-ethylhexyl) phthalate	NNS to 100 μg / L
Dibromochloromethane	2800 μg / L to 28,000 μg / L
1,2-Dibromo-3-chloropropane (DBCP)	NNS to 2,800 μg / L
1,2-Dibromoethane (EDB)	NNS to 0.05 μg / L
Dibutyl phthalate	14,000 μg / L to 140,000 μg / L
1,2-Dichlorobenzene	13,000 μg / L to 126,000 μg / L
1,3-Dichlorobenzene	1880 μg / L to NNS
1,4-Dichlorobenzene	1880 μg / L to 560,000 μg / L
3,3'-Dichlorobenzidine	NNS to 3.11 μg / L
p,p'-Dichlorodiphenyldichloroethane (DDD)	NNS to 5.83 μg / L
p,p'-Dichlorodiphenyldichloroethylene (DDE)	NNS to 4.12 μg / L
p,p'-Dichlorodiphenyltrichloroethane (DDT)	70 μg / L to 700 μg / L
1,2-Dichloroethane	NNS to 280,000 μg / L
1,1-Dichloroethylene	1300 μg / L to 12,600 μg / L

1,2-cis-Dichloroethylene	NNS to 70 μg / L
1,2-trans-Dichloroethylene	2800 μg / L to 28,000 μg / L
Dichloromethane	8400 μg / L to 84,000 μg / L
2,4-Dichlorophenol	420 μg / L to 4,200 μg / L
2,4-Dichlorophenoxyacetic acid (2,4-D)	1400 μg / L to 14,000 μg / L
1,2-Dichloropropane	NNS to 126,000 μg / L
1,3-Dichloropropene	42 μg / L to 420 μg / L
Dieldrin	70 μg / L to 700 μg / L
Diethyl phthalate	110,000 μg / L to 1,120,000 μg / L
Di (2-ethylhexyl) adipate	NNS to 840,000 μg / L
Di (2-ethylhexyl) phthalate	2800 μg / L to 28,000 μg / L
2,4-Dimethylphenol	2800 μg / L to 28,000 μg / L
Dimethyl phthalate	1,400,000 μg / L to NNS
4,6-Dinitro-o-cresol	55 μg / L to 5,600 μg / L
2,4-Dinitrophenol	280 μg / L to 2,800 μg / L
2,4-Dinitrotoluene	280 μg / L to 2,800 μg / L
2,6-Dinitrotoluene	NNS to 5,600 μg / L
Di-n-octyl-phthalate	NNS to 560,000 μg / L
Dinoseb	NNS to 1,400 μg / L
1,2-Diphenylhydrazine	NNS to 1.75 μg / L
Diquat	NNS to 3,080 μg / L
Endosulfan sulfate	7 μg / L to NNS
Endosulfan (total)	840 μg / L to 8,400 μg / L
Endothall	NNS to 28,000 μg / L
Endrin	40 μg / L to 420 μg / L
Endrin aldehyde	420 μg / L to NNS

Ethylbenzene	14,000 μg / L to 140,000 μg / L
Fluoranthene	5600 μg / L to 56,000 μg / L
Fluorene	5600 μg / L to 56,000 μg / L
Fluoride	8400 μg / L to 84,000 μg / L
Glyphosate	NNS to 140,000 μg / L
Heptachlor	70 μg / L to 700 μg / L
Heptachlor epoxide	2 μg / L to 18.2 μg / L
Hexachlorobenzene	280 μg / L to 1,120 μg / L
Hexachlorobutadiene	NNS to 280 μg / L
Hexachlorocyclohexane alpha	NNS to 11,200 μg / L
Hexachlorocyclohexane beta	NNS to 840 μg / L
Hexachlorocyclohexane gamma (lindane)	42 μg / L to 420 μg / L
Hexachlorocyclopentadiene	1000 μg / L to 9,800 μg / L
Hexachloroethane	140 μg / L to 1,400 μg / L
Isophorone	28,000 μg / L to 280,000 μg / L
Lead	NNS to 15 μg / L
Manganese	19,600 μg / L to 196,000 μg / L
Mercury	42 μg / L to 420 μg / L
Methoxychlor	700 μg / L to 7,000 μg / L
Napthalene	NNS to 28,000 μg / L
Nickel	2,800 μg / L to 28,000 μg / L
Nitrate	224,000 μg / L to 2,240,000 μg / L
Nitrite	14,000 μg / L to 140,000 μg / L
Nitrobenzene	70 μg / L to 700 μg / L
N-Nitrosomethylamine	NNS to 0.03 μg / L
N-Nitrosodiphenylamine	NNS to 286 μg / L

N-Nitrosodi-n-propylamine	NNS to 133,000 μg / L
Oxamyl	NNS to 35,000 μg / L
Pentachlorophenol	2000 μg / L to 42,000 μg / L
Phenol	84,000 μg / L to 840,000 μg / L
Picloram	NNS to 98,000 μg / L
Polychlorinated biphenyls (PCBs)	NNS to 28 μg / L
Pyrene	4,200 μg / L to 42,000 μg / L
Radium 226, 228	NNS to 5 pCi / L
Selenium	700 μg / L to 7,000 μg / L
Silver	NNS to 7,000 μg / L
Simazine	NNS to 7,000 μg / L
Styrene	28,000 μg / L to 280,000 μg / L
2,3,7,8-Tetrachlorodibenzo-p-dioxin	NNS to 1.40 μg / L
1,1,2,2-Tetrachloroethane	NNS to 56,000 μg / L
Tetrachloroethylene	1400 μg / L to 14,000 μg / L
Thallium	12 μg / L to 112 μg / L
Toluene	28,000 μg / L to 280,000 μg / L
Toxaphene	NNS to 1,400 μg / L
1,2,4-Trichlorobenzene	1400 μg / L to 14,000 μg / L
1,1,1-Trichloroethane	NNS to 200 μg / L
1,1,2-Trichloroethane	560 μg / L to 5,600 μg / L
Trichloroethylene	NNS to 280,000 μg / L
2,4,6-Trichlorophenol	NNS to 127.3 μg / L
2-(2,4,5-Trichlorophenoxy) propionic acid	1120 μg / L to 11,200 μg / L
2,4,5-Trichlorophenoxyacetic acid	NNS to 14,000 μg / L
Vinyl chloride	NNS to 4,200 μg / L

Xylenes	280,000 μg / L to 2,800,000 μg / L
Zinc	42,000 μg / L to 420,000 μg / L

Add Hardness / pH tables to Appendix A

Currently, there are 4 categories of aquatic life designated uses: aquatic and wildlife (cold water fishery), aquatic and wildlife (warm water fishery), aquatic and wildlife (effluent dependent water) and aquatic and wildlife (ephemeral water). Each aquatic life subcategory has water quality criteria to protect organisms from acute and chronic toxicity. The toxicity of several pollutants is dependent upon either the hardness or the pH of the surface water. For example, the toxicity of cadmium, chromium III, copper, lead, nickel, silver, and zinc is a function of the hardness of a surface water. The toxicity of pentachlorophenol is dependent on the pH of a surface water. The current water quality criteria for these pollutants are expressed as mathematical equations with hardness or pH variables. These mathematical equations are "user-unfriendly." It is difficult for the average person to understand what the water quality standards are for hardness and pH-dependent pollutants when the standards are expressed as mathematical equations. ADEQ proposes to add tables to Appendix A for these parameters and calculate the acute and chronic criteria for a range of hardness and pH values. ADEQ does not propose to revise the acute and chronic toxicity criteria for hardness and pH-dependent pollutants. Rather, ADEQ proposes to revise how the water quality criteria for those parameters are presented in the surface water quality standards rules. ADEQ hopes that tables with a range of hardness and pH values and corresponding acute and chronic aquatic life criteria will be more understandable than the mathematical equations that are in the current rules.

Update A&W criteria using recent toxicity data

ADEQ has adopted numeric water quality criteria to protect 4 aquatic life designated uses. They are: aquatic and wildlife-cold water (A&Wc), aquatic and wildlife-warm water (A&Ww), aquatic and wildlife - effluent dependent water (A&Wedw), and aquatic and wildlife - ephemeral water (A&We). Two methods were used to calculate acute and chronic criteria for the A&W designated uses where toxicity data was available. Both methods are described in

detail in "Rationale for the Development of Toxic Pollutant Criteria to Protect Aquatic and Wildlife Designated Uses," Arizona Department of Environmental Quality, Water Quality Assessment Unit, March 13, 1996.

The first method is the method that EPA uses to derive national water quality criteria for freshwater under §304(a) of the Clean Water Act (the "Guidelines procedure"). The Guidelines procedure is a statistically-based methodology designed to protect 95% of all species nationwide. The Guidelines procedure requires a minimum dataset of eight toxicity tests representing a variety of aquatic vertebrates and invertebrates. Species mean and genus mean values are calculated from the results of the toxicity tests and final acute or chronic values are calculated from the 4 lowest genus mean values.

The second method that ADEQ used to derive A&W criteria is called the LC_{50} method. The LC_{50} method was used to calculate criteria when insufficient data existed to apply the Guidelines procedure. Even with this methodology, ADEQ could not develop criteria for all of the priority pollutants because of a lack of toxicity data. Two primary factors distinguish the LC_{50} method from the Guidelines procedure: 1) there are no minimum data set requirements for the LC_{50} method, and 2) the LC_{50} method is not a statistically-based method designed to provide aquatic life protection at a specific confidence level.

Toxicity data and bioconcentration factors used to calculate the criteria were obtained from EPA criteria documents. Toxicity data to derive criteria are intended to be representative of the respective aquatic life designated use. For example, the dataset used to calculate criteria for the A&Wc designated use includes cold water species (e.g. trout). The dataset used to calculate criteria for the A&Ww designated use excludes cold water species. For the A&Wedw designated use, only toxicity data corresponding to species that have been found in EDWs were used to calculate criteria. Best professional judgment was used to compile a species list for ephemeral waters because of the lack of toxicity data on organisms inhabiting ephemeral waters in Arizona.

The use of different methodologies and modified datasets to derive criteria for the A&W designated uses sometimes resulted in the calculation of anomalous criteria. For example, ADEQ expected that water quality criteria derived using the Guidelines method would be the most stringent because they were designed to protect 95% of all species nationally. However, in some cases, criteria derived for other aquatic life designated uses were more stringent. Consequently, ADEQ developed the following 5-step decision guideline for the A&W criteria to address anomalies:

- A&W criteria are developed for each A&W designated use using the best available science and data.
- A&W criteria will not be designed to protect more than 95% of species nationally (except where site-specific criteria are proposed).
- If an A&Ww criterion is more stringent than an A&Wc criterion, the proposed A&Ww criterion will default to the proposed A&Wc criterion.
- If an A&Wedw criterion is more stringent than an A&Ww criterion, the proposed A&Wedw criterion will default to the A&Ww criterion
- If an A&We criterion is more stringent than an A&Ww criterion, the proposed A&We criterion shall default to the A&Ww criterion.

The application of these decision guidelines results in A&Wc criteria that are always more stringent or equal to A&Ww criteria and A&Ww criteria that are always more stringent or equal to A&Wedw or A&We criteria.

ADEQ updated the aquatic and wildlife criteria for the pollutants listed in Appendix B using toxicity data from ECOTOX, an ecotoxicology database maintained by the U. S. Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory. ADEQ proposes to adopt new aquatic life criteria for the following pollutants:

Alachlor: A&Wc (acute), A&Ww (acute), and A&Wedw (acute): 2,500 μg / L

A&Wc (chronic), A&Ww (chronic) and A&W (edw)(chronic): 170 μg / L

Carbofuran:	A&Wc (acute), A&Ww (acute), and A&Wedw (acute): 650 μg / L
	A&Wc (chronic), A&Ww (chronic) and A&W (edw)(chronic): 50 μg / L
Chlorobenzene:	A&Wedw (acute): NNS to 3,800 μg / L
	A&Wedw (chronic): NNS to 260 μg / L
Styrene:	A&Wc (acute), A&Ww (acute) and A&Wedw (acute): 5600 μg / L
	A&Wc (chronic), A&Ww (chronic) and A&Wedw (chronic): 370 μg / L

ADEQ proposes to revise the current aquatic life criteria and adopt more stringent criteria for the following pollutants and subcategories of aquatic life use:

Benzene:	A&Wedw (acute): 11,000 μg / L to 8,800 μg / L
	A&Wedw (chronic) 700 μg / L to 560 μg / L
Chlorobenzene:	A&Wc (acute), A&Ww (acute): 9,800 μg / L to 3,800 μg / L
	A&Wc (chronic), A&Ww (chronic): 620 μg / L to 260 μg / L
2,4-Dinitrotoluene:	A&Wc (acute), A&Ww (acute), and A&Wedw (acute):
	15,000 μg / L to 14,000 μg / L
	A&Wc (chronic), A&Ww (chronic) and A&W (edw)(chronic):
	970 μg / L to 860 μg / L
Napthalene	A&Ww (acute), A&Wedw (acute): 3,300 μg / L to 3,200 μg / L
	A&Ww (chronic), A&Wedw (chronic): 600 μg / L to 580 μg / L

Numeric ammonia criteria for aquatic life protection

Ammonia is a pollutant that is routinely found in wastewater treatment plant effluents, landfill leachates, and agricultural runoff from fields where commercial fertilizers and animal manure are applied. The control of the discharge of ammonia is necessary to protect aquatic life in Arizona's surface waters because ammonia has known toxic effects to aquatic life [*See 1999 Update of Ambient Water Quality Criteria for Ammonia* , U.S. Environmental Protection Agency, Office of Water, EPA-822-R-99-014, December, 1999].

In 1985, EPA published the first Ambient Water Quality Criteria for Ammonia document. This national criteria document contained ammonia criteria concentrations for the protection of freshwater aquatic life. The Criterion Maximum Concentration (CMC) applied to acute exposures, and the Criterion Continuous Concentration (CCC) applied to chronic or long-term exposures. The CMC and CCC varied according to pH and the type of fishery involved. EPA amended this criteria document in 1992.

In 1998, EPA published another update to the national criteria document for ammonia. The updated criteria document assessed the aquatic toxicity data for ammonia in freshwater and presented revised criteria to protect aquatic life. The revised ammonia criteria superseded EPA's previous criteria guidance for ammonia published in d 1992. The 1998 criteria guidance for ammonia revised the acute and chronic ammonia criteria and the chronic averaging period. The acute and chronic criteria were expressed in terms of milligrams of ammonia nitrogen per liter and they varied with pH. The ammonia criteria for acute toxicity differed depending on whether salmonid species were present or not. For the chronic ammonia criteria, no substantial differences between salmonid and non-salmonid sensitivity were apparent and the chronic criteria did not vary according to the species of fish present (i.e., presence or absence of salmonids).

In 1999, EPA updated the national water quality criteria for ammonia again. EPA's 1999 Update reflects recent research and data on ammonia toxicity collected since 1984. The 1999 Update includes several revisions of elements of the previous criteria documents, including revisions to take into account newer data, better models, and improved statistical methods to address the temperature and pH-dependence of ammonia toxicity in freshwater. EPA's recommended criteria are expressed as concentrations of total ammonia nitrogen (in mg / L). The recommended acute criteria for ammonia are dependent on pH and the presence or absence of salmonids. The acute criteria values vary as a continuous function of pH and they are not dependent on temperature. EPA's recommended chronic criteria are dependent on pH and temperature. However, the recommended chronic criteria are not species-sensitive. The chronic criteria do not vary depending on the presence or absence of salmonids. However, at lower temperatures, the chronic criteria are dependent on the presence or absence of early life stages of fish. EPA's recommended

chronic criteria gradually increase as temperature decreases. The chronic criteria are more stringent at temperatures below 15° C when early life stages of fish are expected to be present. EPA's 1999 Update differs from the 1998 Update primarily in the handling of the temperature-dependency of the chronic toxicity criteria for ammonia.

EPA recommends that states adopt numeric ammonia criteria applicable at all times of the year for all surface waters designated for the protection of aquatic life. Numeric ammonia criteria may be adopted based on EPA's national criteria recommendations for ammonia, national criteria modified to reflect site-specific conditions, or other scientifically defensible methods. EPA takes the position that numeric ammonia criteria can be adopted by states because EPA has published §304(a) criteria for ammonia. There is a voluminous amount of data on ammonia toxicity to support the development of numeric criteria. EPA has stated in the Federal Register that the adoption of numeric criteria for ammonia is a high priority for triennial reviews of water quality standards that will occur in FY 2001 through FY 2003. EPA has stated its intention to federally promulgate numeric ammonia criteria where a state does not amend its water quality standards to include water quality criteria for ammonia that ensure protection of aquatic life designated uses.

Arizona currently has acute criteria for ammonia for the A&Wc and A&W designated uses in the surface water quality standards rules, but these acute criteria are based upon earlier versions of EPA's national criteria guidance. As noted above, EPA's previous ammonia criteria recommendations have been superseded by the 1999 Update. Therefore, in the proposed rule, ADEQ proposes to revise the numeric criteria for total ammonia to be consistent with EPA's recommendations in the 1999 Update.

ADEQ proposes the following acute criteria for total ammonia (in mg N / L):

Acute Criteria for Total Ammonia (in mg N / L)		
pH	A&Wc	A&Ww
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
	0.885	1.32

ADEQ currently does not have numeric criteria for chronic ammonia toxicity in the surface water quality standard rules. ADEQ proposes to adopt the temperature and pH-dependent chronic values recommended by EPA for waters with early life stages of fish present as the state's criteria to prevent chronic ammonia toxicity. ADEQ proposes that the numeric criteria be applied to surface waters in Arizona with the A&Wc, and A&Ww designated uses.

Chronic Criteria for Total Ammonia in mg N / L for A&Wc and A&Ww Designated Uses										
pH	Temperature, °C									
	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
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

Proposed repeal of the chronic A&We criteria

Water quality criteria to protect aquatic life contain two expressions of allowable magnitude. Acute criteria are established to protect against short-term effects and chronic criteria are established to protect against long-term effects of pollutants. In general, EPA derives chronic criteria from longer term toxicity tests (often greater than 28-days) that measure survival, growth, and reproduction of test organisms. The term of these toxicity tests is often greater than the length of time that ephemeral waters typically flow in Arizona.

The surface water quality standard rules currently include an aquatic and wildlife designated use that applies to ephemeral waters (A&We). The A&We designated use has both acute and chronic criteria to protect aquatic life and wildlife. However, ADEQ has determined that chronic A&We criteria are unnecessary to protect the designated use. ADEQ defines an ephemeral water as a surface water that flows only in direct response to precipitation and that is at all times above the water table. Surface waters that flow continuously for 30 days or more are considered to be intermittent waters that are protected by A&Wc or A&Ww designated uses. The A&Wc and A&Ww designated uses have both acute and chronic criteria. ADEQ has determined that chronic criteria are unnecessary for ephemeral waters because they flow for less than 30 days at a time and the duration of exposure of organisms to pollutants is short-term. ADEQ therefore proposes to repeal the current chronic criteria for the A&We designated use.

Revised sulfide standard for lakes.

Arizona's lakes, reservoirs, and ponds are surface waters that are commonly referred to as lentic (still or slow water). They are the opposite of a lotic system, such as a stream or river, where water is continually moving and circulating. In most surface waters, the addition of oxygen occurs at the water's surface. In a stream or river, oxygen is circulated throughout the water column because the water is continually moving. In lakes and reservoirs, differences in chemical, physical, and biological characteristics can cause layers of water to form on top of one another. This process is called stratification. The layers of water can become fixed for long periods of time, preventing the circulation of oxygen into the deeper layers. This can cause the deeper areas of a lake or reservoir to become oxygen deficient or anaerobic. In anaerobic conditions, sulfide levels can sometimes be quite high. At times, the sulfide concentrations in the hypolimnion, or deepest layer of a lake or reservoir, can violate the current standards established to protect aquatic life designated uses. ADEQ proposes to clarify that the current sulfide standards apply only to water samples taken from the epilimnion, or the upper layer of a lake or reservoir.

The triennial review process

§303(c)(1) of the Clean Water Act requires that a state shall, from time to time, but at least once every 3 years, hold public hearings to review state-adopted water quality standards and, as appropriate, modify and adopt standards.

The beginning of each triennial review cycle is measured from the date of the transmittal letter that ADEQ sends to EPA informing EPA that revised or new standards have been adopted and are being submitted to EPA for their review. Arizona's water quality standards rules were last revised on April 26, 1996.

ADEQ identifies new water quality standards or revisions that need to made to existing water quality standards rules in each triennial review. Recommendations for changes to existing water quality standards or suggestions for adoption of new standards come from many sources, including ADEQ and EPA Region IX staff, water quality advisory groups, persons in the regulated community, and citizens who are interested in surface water quality issues.

Public participation

A required element of the triennial review process is public participation. The active and meaningful involvement of persons who are or may be affected by water quality standards decisions is critical to the successful implementation of ADEQ's water quality standards program. At a minimum, §303(c) of the Clean Water Act requires that states hold one public hearing to review and discuss revisions to the water quality standards. In recent triennial reviews, ADEQ has gone far beyond the minimum public participation requirements prescribed in the Clean Water Act. ADEQ has sponsored a variety of public participation activities. ADEQ has held public meetings, roundtable discussions, and met with advisory groups to discuss water quality standards issues and proposed revisions to the water quality standards rules.

Prior to the publication of the Notice of Proposed Rulemaking, ADEQ conducted a number of informal public participation activities to identify water quality standards issues, solicit comments and suggestions for additions or revisions to the current water quality standards rules, and to discuss proposed unique waters nominations. ADEQ has discussed water quality standards issues at several monthly meetings of the Water Quality Policy Coordinating Committee, a water quality advisory group. In late January and early February, 1999, ADEQ held a series of 3 public meetings in Flagstaff, Phoenix, and Tucson to take informal public comments on water quality standards issues that

should be considered in this triennial review. In 1999 and in 2000, ADEQ staff held a series of informal public meetings in Cascabel, Flagstaff, Alpine, Phoenix, and Globe to solicit comments on nominations of surface waters for classification as unique waters.

ADEQ published a preliminary draft set of revisions to the surface water quality standards rules and conducted a series of public meetings to take public comments on surface water quality issues raised in the preliminary draft. ADEQ considered the comments that were made on the preliminary draft rules. The general framework for public participation in Arizona's triennial review process is notice and comment rulemaking. The process includes both informal and formal rulemaking activities. The publication of this Notice of Proposed Rulemaking initiates the formal rulemaking process. ADEQ will hold oral proceedings to take formal public comments on the proposed rules. Persons can submit oral and written comments at the oral proceedings or submit written comments to ADEQ. After the close of the public comment period, ADEQ will consider all of the public comments received, make appropriate revisions to the proposed rules, and develop a formal responsiveness summary. Within 120 days of the close of the public comment period, ADEQ must either adopt the revisions to the surface water quality standards rules or terminate the rulemaking. ADEQ must prepare a Notice of Final Rulemaking which includes the revised rules, explanation of the changes to the rules, agency responses to comments, and an economic impact statement. The Notice of Final Rulemaking is then submitted to the Governor's Regulatory Review Council [GRRC]. The GRRC reviews the agency's Notice of Final Rulemaking at a public meeting and either approves or disapproves the rules. If the rules are approved, they are filed with the Office of the Secretary of State and they become effective. The GRRC may disapprove the rules and return them to the agency for supplemental rulemaking activities.

EPA Review of State-Adopted Water Quality Standards

After final administrative action at the state level, ADEQ will submit the water quality standards revisions and an Attorney General certification that the revisions were duly adopted according to state law to EPA Region IX for review and approval or disapproval. 40 CFR §131.20(c) of the federal water quality standards regulation requires ADEQ to submit the standards package to EPA within 30 days of final state action (i.e., the date of filing with the

Office of the Secretary of State). EPA reviews and either approves or disapproves the standards based on whether they meet the requirements of the Clean Water Act and the federal water quality standards regulations.

In general, three outcomes are possible: 1) EPA approval, in whole or in part, of the state's water quality standards, 2) EPA disapproval, in whole or in part, of the submitted standards, or 3) EPA conditional approval. EPA must, within 60 days of submittal by the state, notify ADEQ by letter of any approvals of the state's water quality standards. If EPA determines that the state-adopted water quality standards do not meet the requirements of the Clean Water Act, EPA Region IX must disapprove the standards within 90 days. A letter of disapproval must state why the standards do not meet the requirements of the Act and specify the revisions that must be made to obtain full EPA approval. State-adopted water quality standards do not become effective for Clean Water Act purposes until they are approved by EPA [*See* Alaska Clean Water Alliance v. Clark, No. C96-1762R (W.D. Wash. July 8, 1997)

5. **A showing of good cause why the rule is necessary to promote a statewide interest if the rule will diminish a previous grant of authority of a political subdivision of this state:** Not applicable

6. **The preliminary summary of the economic, small business, and consumer impact:**

ADEQ must prepare a preliminary summary of the economic, small business, and consumer impact because it is is a required element of a Notice of Proposed Rulemaking [*See* R1-1-502]. Later in the formal rulemaking process, ADEQ will have to prepare a final economic impact statement to accompany the final rules that ADEQ submits to the Governor's Regulatory Review Council.

ADEQ solicits comments on the economic impact of the rules from persons who will be directly affected by, bear the costs of, or directly benefit from proposed surface water quality standards rules. ADEQ is interested in receiving comments that relate to the following:

a. The probable costs and benefits to ADEQ and other agencies that will be directly affected by the implementation and enforcement of the surface water quality standards rules.

b. The probable costs and benefits to a political subdivision of Arizona that will be directly affected by the implementation and enforcement of the surface water quality standards rules.

c. The probable costs and benefits to businesses directly affected by the proposed rulemaking, including any anticipated effects on revenues or payroll expenditures of employers who may be affected by the rules.

d. The probable impacts on private and public employment.

e. The probable impacts on small businesses, including probable compliance costs and whether there are any methods that ADEQ may use to reduce the impact on small businesses (e.g., less costly compliance requirements, schedules of compliance, and exemptions).

f. The probable effects on state revenues.

g. The probable costs and benefits to private persons and consumers who are directly affected by the rulemaking.

h. Descriptions of any less intrusive or less costly alternative methods of achieving the purpose of the proposed rulemaking.

ADEQ is particularly interested in obtaining public comments on the economic impact of the proposed adoption of numeric criteria to protect aquatic life from chronic toxicity of ammonia, the proposed repeal of the nutrient waiver provision, and the proposal of 10 surface waters for unique waters classification.

In general, ADEQ does not believe that the proposed revisions to the surface water quality standards rules will have a significant economic, small business, or consumer impact. Many of the proposed revisions to the water quality standards are editorial in nature or clarifications of the current rules that will have no economic impact.

The proposed revisions to the rules may affect political subdivisions of Arizona that operate wastewater treatment plants that discharge to surface waters regulated by surface water quality standards. In particular, the adoption of stringent water quality criteria to control chronic ammonia toxicity in surface waters with the A&Wc and A&Ww designated uses may result in new water quality-based discharge limitations in NPDES permits for wastewater

treatment plants that discharge to perennial streams with these designated uses. Wastewater treatment plants and other point source dischargers may be required to upgrade treatment to control ammonia toxicity in discharges to surface waters. ADEQ received no comments on preliminary draft ammonia standards and cannot predict the extent of the economic impact to political subdivisions from the proposed rule change (if any).

Similarly, the repeal of the nutrient waiver rule may affect approximately 10 operators who currently operate wastewater treatment plants under nutrient waivers. Again, the proposed revision may require these wastewater treatment plants to upgrade wastewater treatment processes to control the discharge of nutrients to surface waters. If the nutrient waiver rule is repealed, ADEQ may establish schedules of compliance to provide time for the wastewater treatment plants to come into compliance with applicable nutrient standards. In the alternative, operators of the affected wastewater treatment plants may apply for a variance.

The proposed revisions to the surface water quality standards are expected to have no impact on private and public employment.

The proposal to classify 10 surface waters as unique waters may affect some persons (e.g., ranchers who have grazing allotments in the watersheds where the proposed unique waters are located). In general, the proposed unique waters are located in remote areas of the state, in National Forests, or in wilderness areas. A unique waters classification may result in changes in forest management plans for the Apache Sitgreaves National Forest and new requirements for best management practices. Unique waters classifications may affect the uses of public lands within the proposed unique waters watersheds such as grazing, timber harvesting, and mining activity. ADEQ is interested in receiving comments from persons who have economic interests who may be affected by the proposed unique waters classifications.

The proposed revisions to the surface water quality standards rules are anticipated to have little or no economic impact on other state agencies, other than ADEQ. The revisions to the rules are expected to have no effect on state revenues.

7. **The name and address of agency personnel with whom persons may communicate regarding the economic, small business, and consumer impact statement:**

Mr. Steven Pawlowski

Arizona Department of Environmental Quality

3033 N. Central Avenue

Phoenix, Arizona 85012-2809

Telephone Number: (602) 207-4219 Fax Number: (602) 207-4528

E-mail: sep@ev.state.az.us

8. **The date, time and place of public meetings to discuss the proposed rules:**

June 6, 2001 at 7:00 p.m.

Room 1709

Arizona Department of Environmental Quality

3033 N. Central Avenue

Phoenix, Arizona

June 12, 2001

7:00 p.m. to 10:00 p.m.

Arizona Corporation Commission Hearing Room 222

Arizona State Office Complex

400 W. Congress Street

Tucson, Arizona

June 14, 2001

7:00 p.m to 10:00 p.m.

City of Flagstaff City Council Chambers

211 W. Aspen Avenue

Flagstaff, Arizona

June 26, 2001

7:00 p.m. to 10:00 p.m.

Gila County Board of Supervisors Meeting Room

1400 East Ash Street

Globe, Arizona

June 27, 2001

7:00 p.m. to 10:00 p.m.

Town of Springerville City Hall

418 Main Street

Springerville, Arizona

The public comment period on the proposed rules will close on July 20, 2001. Written comments may be submitted by letter or e-mail to Mr. Steve Pawlowski at the address stated above. Written comment letters must be postmarked by July 20, 2001.

9. **Any other matters prescribed by statute that are applicable to the specific agency or to any specific rule or class of rules:** Not applicable

10. **Incorporations by reference and their location in the rules:**

In R18-11-110(B) ADEQ incorporates by reference the "1999 Review, Water Quality Standards for Salinity, Colorado River System," Colorado River Basin Salinity Control Forum (June, 1999).

11. **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

R18-11-103. Repealed

R18-11-104. Designated Uses

R18-11-105. Tributaries; Designated Uses

R18-11-106. Net Ecological Benefit

R18-11-107. Antidegradation

R18-11-108. Narrative Water Quality Standards

R18-11-109. Numeric Water Quality Standards

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

R18-11-111. Analytical Methods

R18-11-112. Unique Waters

R18-11-113. Effluent Dependent Waters

R18-11-114. Mixing Zones

~~R18-11-115. Nutrient Waivers~~

R18-11-116. Resource Management Agencies

R18-11-117. Canals and Municipal Park Lakes

R18-11-118. Dams and Flood Control Structures

R18-11-119. Natural Background

R18-11-120. Enforcement

R18-11-121. Schedules of Compliance

R18-11-122. Variances

R18-11-123. Prohibition Against Discharge~~; Sabino Creek~~

Appendix A. Numeric Water Quality Criteria

Appendix B. List of Surface Waters and Designated Uses

Appendix C. Repealed

ARTICLE 1. WATER QUALITY STANDARDS FOR SURFACE WATERS

R18-11-101. Definitions

The terms of this Article shall have the following meanings:

1. "Acute toxicity" means toxicity involving a stimulus severe enough to rapidly induce a response. 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. "Agricultural irrigation" means the use of a surface water for the irrigation of crops.
5. "Agricultural livestock watering" means the use of a surface water as a supply of water for consumption by livestock.
6. "Annual mean" means the arithmetic mean of monthly values determined over a consecutive 12-month period, provided that monthly values are determined for at least 3 months. The monthly value is the arithmetic mean of all values determined in a calendar month.
7. "Aquatic and wildlife" (cold water~~ fishery~~)" means the use of a surface water by animals, plants, or other cold water organisms~~, including salmonids~~, generally occurring at elevations greater than 5000 feet, for habitation, growth, or propagation.
8. "Aquatic and wildlife (effluent dependent water)" means the use of an effluent dependent water by animals, plants, or other organisms for habitation, growth, or propagation.
9. "Aquatic and wildlife (ephemeral) means the use of an ephemeral water by animals, plants, or other organisms, excluding fish, for habitation, growth, or propagation.
10. "Aquatic and wildlife (warm water~~ fishery~~) means the use of a surface water by animals, plants or other warm water organisms~~, excluding salmonids~~, generally occurring at elevations less than 5000 feet, for habitation, growth, or propagation.
11. "A&Wc" means aquatic and wildlife (cold water ~~fishery~~).
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~~ fishery~~).

15. "Clean Water Act" means the Federal Water Pollution Control Act, as amended by the Water Quality Act of 1987.

16. "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.

17. "Designated use" means a use specified in Appendix B of this Article for a surface water.

18. "Domestic water source" means the use of a surface water as a potable water supply. Coagulation, sedimentation, filtration, disinfection, or other treatments 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. "Effluent dependent water" means a surface water that consists ~~primarily~~ of discharges of treated wastewater~~ which has been~~ 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 discharge of treated wastewater, would be an ephemeral water.

22. "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~~, and that does not support a self-sustaining fish population~~).

23. "Existing use" means a use that~~ has actually occurred~~ actually occurs in a surface water ~~on or after November 28, 1975~~ or a use that the existing water quality of a surface water will allow.

24. "FBC" means full body contact.

25. "FC" means fish consumption.

26. "Fish consumption" 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. "Full body contact" means the use of a surface water ~~which~~ 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 to occur and certain sensitive body organs, such as the eyes, ears, or nose may be exposed to direct contact with the water.

28. "Geometric mean" mean the nth root of the product of n items or values. The geometric mean is calculated using the following formula:

$$G.M._y = \sqrt[n]{(y_1)(y_2)(y_3)\ldots(y_n)}$$

29. "Hardness" means the sum of the calcium and magnesium concentrations, expressed as calcium carbonate ($CaCO_3$) in milligrams per liter.

30. "Intermittent surface water" means a surface water that flows continuously for 30 days or more at times of the year when it receives water from springs or from a surface water source such as melting snow.

~~30~~ 31. "Mixing zone" means a prescribed area or volume of a surface water that is contiguous to a point source discharge where initial dilution of the discharge takes place.

~~31~~ 32. "National Pollutant Discharge Elimination System" means the point source discharge permit program established by §402 of the Clean Water Act.

~~33~~ 34. "NNS" means no numeric standard.

~~34~~ 35. "Oil" means petroleum in any form, including but not limited to crude oil, gasoline, fuel oil, diesel oil, lubricating oil, or sludge.

~~35~~ 36. "Partial body contact" means the recreational use of a surface water ~~which~~ that may cause the human body to come into direct contact with the water , but normally not to the point of complete submergence (e.g. wading or boating). The use is such that ingestion of the water is not likely, nor will sensitive body organs such as the eyes, ears, or nose normally be exposed to direct contact with the water.

~~36~~ 37. "PBC" means partial body contact.

38. "Perennial surface water" means a surface water that flows continuously throughout the year.

39. "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.

~~37~~ 40. "Practical quantitation limit" means the lowest level of quantitative measurement that can be reliably achieved during routine laboratory operations.

~~38~~ 41. "Recreational uses" means the full body contact and partial body contact designated uses.

~~39~~ 42. "Regional administrator" means the regional administrator of Region 9 of the U.S. Environmental Protection Agency.

~~40~~ 43. "Surface water" means a water of the United States and includes the following:

a. All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce;

b. All interstate waters, including interstate wetlands;

c. All other waters, such as intrastate lakes, reservoirs, natural ponds, rivers, streams (including intermittent and ephemeral streams), creeks, washes, draws, mudflats, sandflats, wetlands, sloughs, backwaters, prairie potholes, wet meadows, or playa lakes, the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce, including any such waters:

i. Which are 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. Which are used or could be used for industrial purposes by industries in interstate or foreign commerce;

d. All impoundments of waters otherwise defined as surface waters under this definition;

e. Tributaries of surface waters identified in paragraphs (a) through (d) of this definition; and

f. Wetlands adjacent to surface waters identified in paragraphs (a) through (e) of this this definition.

~~41~~ 44. "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.

~~42~~ 45. "Total phosphorus" means all of the phosphorus present in ~~the~~ a sample, regardless of form, as measured by a persulfate digestion procedure.

~~43~~ 46. "Toxic" means those pollutants, or combination of pollutants, which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations in such organisms or their offspring.

~~44~~ 47. "Unique water" means a surface water that has been classified as an outstanding state resource water by the Director under R18-11-112.

~~45~~ 48. "Use attainability analysis" means a structured scientific assessment of the factors affecting the attainment of a designated use ~~which may include~~, including physical, chemical, biological, and economic factors.

~~46~~ 49. "Wetlands" means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, cienegas, tinajas, and similar areas.

~~47~~ 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 ~~all~~ surface waters.

B. The water quality standards prescribed in this Article do not apply to the following:

1. Waste treatment systems, including impoundments, ponds, lagoons, and constructed wetlands that are a part of such waste treatment systems.

2. Man-made surface impoundments and associated ditches and conveyances used in the extraction, beneficiation, and processing of metallic ores, including pits, pregnant leach solution ponds, raffinate ponds, tailing impoundments, decant ponds, ponds and sumps in mine pits associated with dewatering activity, ponds holding water that has come into contact with process or product and that is being held for recycling, spill or upset catchment ponds, or ponds used for on-site remediation that are not surface waters or are located in areas that once were surface waters but no longer remain surface waters because they have and remain legally converted.

R18-11-104. Designated uses

A. The director shall adopt or remove designated uses and subcategories of designated uses by rule.

B. Designated uses of a surface water may include full body contact, partial body contact, domestic water source, fish consumption, aquatic and wildlife (cold water ~~fishery~~), aquatic and wildlife (warm water ~~fishery~~), aquatic and wildlife (ephemeral), aquatic and wildlife (effluent dependent water), agricultural irrigation, and agricultural livestock watering. The designated uses for specific surface waters are listed in Appendix B of this Article.

C. Numeric water quality criteria to maintain and protect water quality for the designated uses are prescribed in Appendix A, R18-11-109, R18-11-110, and R18-11-112. Narrative standards to protect all surface waters are prescribed in R18-11-108.

D. If a surface water has more than 1 designated use listed in Appendix B, then the most stringent water quality criterion applies.

E. The Director shall revise the designated uses of a surface water if water quality improvements result in a level of water quality ~~which~~ that permits a use that is not currently listed as a designated use in Appendix B.

F. In designating uses of a surface water and in establishing water quality criteria to protect ~~those~~ the designated uses, the Director shall take into consideration the applicable water quality standards for downstream surface waters and shall ensure that the water quality standards that are established for an upstream surface water also provide for the attainment and maintenance of the water quality standards of downstream surface waters.

G. A use attainability analysis shall be conducted prior to removal of a designated use or adoption of a subcategory of a designated use that requires less stringent water quality criteria.

H. The Director may remove a designated use or adopt a subcategory of a designated use that requires less stringent water quality criteria, provided the designated use is not an existing use and it is demonstrated through a use attainability analysis that attaining the designated use in not feasible for any of the following reasons:

1. Naturally occurring pollutant concentrations prevent the attainment of the use;
2. Natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the use;
3. Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;
4. Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the surface water to its original condition or to operate such modification in a way that would result in attainment of the use;
5. Physical conditions related to the natural features of the surface water, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality preclude attainment of aquatic life designated uses; or

6. Controls more stringent than those required by § 301 (b) and § 306 of the Clean Water Act are necessary to attain the use and implementation of such controls would result in substantial and widespread economic and social impact.

R18-11-105. Tributaries, Designated Uses

The following water quality standards apply to a surface water that is not listed in Appendix B but that is tributary to a listed surface water.

1. For an unlisted tributary that is an ephemeral water, the aquatic and wildlife (ephemeral) and partial body contact standards apply.

~~2. For an unlisted tributary that is an effluent dependent water, the aquatic and wildlife (effluent dependent water) and partial body contact standards apply.~~

~~3~~ 2. ~~For an unlisted tributary that is not an ephemeral water or an effluent dependent water and which has salmonids present, the aquatic and wildlife (cold water fishery) and fish consumption standards apply as well as the water quality standards that have been established for nearest downstream surface water listed in Appendix B that is not an ephemeral water or an effluent dependent water.~~ The aquatic and wildlife (cold water), full body contact, and fish consumption standards apply to an unlisted tributary that is a perennial or intermittent surface water and is above 5000 feet in elevation,.

~~4~~ 3. ~~.For an unlisted tributary that is not an ephemeral water or an effluent dependent water and which does not have salmonids present, the aquatic and wildlife (warm water fishery) and fish consumption standards apply as well as the water quality standards which have been established for the nearest downstream surface water listed in Appendix B that is not an ephemeral water or effluent dependent water.~~ The aquatic and wildlife (warm water), full body contact, and fish consumption standards apply to an unlisted tributary that is a perennial or intermittent surface water and is below 5000 feet in elevation.

R18-11-106. Net Ecological Benefit

A. The director may, by rule, modify a water quality standard on the ground 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 such water resources are limited. The director may modify a water quality for a pollutant if it is demonstrated that:

1. The discharge of effluent creates or supports an ecologically valuable aquatic, wetland, or riparian ecosystem in an area where such resources are limited;
2. The ecological benefits associated with the discharge of effluent under a modified water quality standard exceed the environmental costs associated with the elimination of the discharge of effluent.
3. The cost of treatment to achieve compliance with a water quality standard is so high that it is more cost effective to eliminate the discharge of effluent to the surface water. The discharger shall demonstrate that it is feasible to eliminate the discharge of effluent ~~which~~ that creates or supports the ecologically valuable aquatic, wetland, or riparian ecosystem and that a plan to eliminate the discharge is under active consideration.
4. The discharge of effluent to the surface water will not cause or contribute to a violation of a water quality standard that has been established for a downstream surface water.
5. All practicable point source discharge control programs, including local pretreatment, waste minimization, and source reduction programs are implemented; and
6. The discharge of effluent does not produce or contribute to the concentration of a pollutant in the tissues of aquatic organisms or wildlife that is likely to be harmful to humans or wildlife through food chain concentration.

B. The Director shall not modify a water quality criterion for a pollutant to be less stringent than a technology-based effluent limitation ~~which~~ that applies to the discharge of that effluent. The discharge of effluent ~~which creates or supports an ecologically valuable aquatic, riparian, or wetland ecosystem~~ shall, at a minimum, comply with applicable technology-based effluent limitations.

R18-11-107. Antidegradation

A. The Director shall determine whether there is any degradation of existing water quality in a surface water on a pollutant by pollutant basis.

B. Tier 1: The level of water quality necessary to protect existing uses 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 standard.

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 has held a public hearing on whether degradation should be allowed pursuant to the general public hearing procedures prescribed at R18-1-401 and R18-1-402 and the Director makes all of the following findings:

1. The level of water quality necessary to protect existing uses is fully protected. Water quality shall 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 as set forth in the Clean Water Act are achieved.

3. All cost-effective and reasonable best management practices for nonpoint source pollution control are implemented.

4. Allowing lower water quality is necessary to accommodate important economic or social development in the area ~~in which~~ 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 ~~or that the Director has proposed for classification as a unique water pursuant to~~ under R18-11-112. The Director shall not allow limited degradation of a unique water pursuant to subsection (C) of this Section.

E. The Department shall implement this Section in a manner consistent with § 316 of the Clean Water Act where a potential water quality impairment associated with a thermal discharge is involved.

R18-11-108. Narrative Water Quality Standards

A. A surface water shall be free from pollutants in amounts or combinations that:

1. Are suspended in the water column and that impair a domestic water source use.

~~1~~2. Settle to form bottom deposits that inhibit or prohibit the habitation, growth, or propagation of aquatic life ~~or that impair recreational uses~~;

~~2~~3. Cause objectionable odor in the area in which the surface water is located;

~~3~~4. Cause off-taste or odor in drinking water;

~~4~~5. Cause off-flavor in aquatic organisms~~ or waterfowl~~;

~~5~~6. Are toxic to humans, animals, plants, or other organisms;

~~6~~7. 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~~8. Cause or contribute to a violation of an aquifer water quality standard prescribed in R18-11-405 or R18-11-406; or

~~8~~9. Change the color of the surface water from natural background levels of color.

B. A surface water shall be free from oil, grease, and other pollutants that float as debris, foam, or scum; or that cause a film or iridescent appearance on the surface of the water; or that cause a deposit on a shoreline, bank, or aquatic vegetation. The discharge of lubricating oil or gasoline associated with the normal operation of a recreational water craft shall not be considered a violation of this narrative standard.

R18-11-109. Numeric Water Quality Standards

~~A. The water quality standards prescribed in this Section and in Appendix A apply to surface waters listed in Appendix B and their tributaries. Additional numeric water quality standards for unique waters are prescribed in R18-11-112.~~

~~B. The following water quality standards for fecal coliform, expressed in colony forming units per 100 milliliters of water (cfu / 100 ml), shall not be exceeded:~~

~~1. Fecal coliform DWS, PBC, A&W[1], AgI, AgL~~

~~30-day geometric mean~~

~~(5-sample minimum) 1000~~

~~10% if samples for a~~

~~30-day period 2000~~

~~Single sample maximum 4000~~

~~2. Fecal coliform in effluent dependent waters All designated uses~~

~~30-day geometric mean~~

~~(5-sample minimum) 200~~

~~10% if samples for a~~

~~30-day period 400~~

~~Single sample maximum 800~~

~~C~~ A. The following water quality standards for *Escherichia coli (E. coli)*, expressed in colony forming units per 100 milliliters of water (cfu / 100 ml), shall not be exceeded:

E. coli	FBC	PBC
~~30-day geometric mean (5 sample minimum)~~	~~130~~	
Geometric mean (4 -sample minimum)	126	126
Single sample maximum	~~580~~ 235	576

~~D~~ B. The following water quality standards for pH, expressed in standard units, shall not be violated:

pH	DWS	FBC, PBC, A&W[2]	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

~~E~~C. The following maximum allowable increase in ambient water temperature, expressed in degrees Celsius, shall not be exceeded:

Temperature	**A&Ww, A&Wedw**	**A&Wc**
Maximum increase due to a thermal discharge[3,4]	3.0	1.0

~~F. The following water quality standards for turbidity, expressed as a maximum concentration in nepholometric turbidity units (NTU) shall not be exceeded:~~

~~**Turbidity**~~	~~**A&Ww, A&Wedw**~~	~~**A&Wc**~~
~~Rivers, streams, and other flowing waters~~	~~50~~	~~10~~
~~Lakes, reservoirs, tanks, and ponds~~	~~25~~	~~10~~

D. The following water quality standards for suspended sediment concentration, expressed as an arithmetic mean (4 - sample minimum) in mg / L, shall not be exceeded. The following criteria apply to a surface water that is at or near base flow and do not apply to a surface water during or soon after precipitation event:

A&Wc, A&Ww
80

~~G~~E. The following are the water quality standards for dissolved oxygen, 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[5]	6.0	7.0

2. **Dissolved oxygen in effluent**

dependent waters (Single sample minimum):	**A&W edw**
3 hours after sunrise to sunset	3.0
Sunset to 3 hours after sunrise	1.0

3. If the dissolved oxygen (mg/L) of a surface water is less than the water quality standard for dissolved oxygen, but the percent saturation of oxygen is equal to or greater than 90%, then the surface water shall be deemed to be in compliance with the water quality standard for dissolved oxygen.

~~H~~F. The following water quality standards for total phosphorus and total nitrogen, expressed in milligrams per liter (mg/L), shall not be exceeded:

	Annual mean	**90th percentile**	**Single Sample Maximum**
1. Verde River and its tributaries from 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, except Pinal Creek, above Theodore Roosevelt Lake that are not located on tribal lands:			
Total phosphorus:	0.12	0.30	1.00
Total nitrogen:	0.60	1.20	2.00
4. Theodore Roosevelt, Apache, Canyon, and Saguaro Lakes:			
Total phosphorus:	0.03[a]	NNS	0.60[b]
Total nitrogen:	0.30[a]	NNS	1.00[b]

5. Salt River below Stewart Mountain Dam to confluence with the Verde River

Total phosphorus:	0.05	NNS	0.20
Total nitrogen	0.60	NNS	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:	0.08	0.10	0.75
Total nitrogen:	0.60	0.75	1.10

7. Little Colorado River at crossing of Apache County Road No. 124

Total phosphorus:	NNS	NNS	0.75
Total nitrogen:	NNS	NNS	1.10

8. Little Colorado River above Layman Lake to above 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

9. Colorado River, at Northern International Boundary near Morellos Dam:

Total phosphorus:	NNS	0.33	NNS
Total nitrogen:	NNS	2.50	NNS

10. San Pedro River, from Curtis to Benson:

Total phosphorus:	NNS	NNS	NNS
Total nitrate as N	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.

~~H~~ G The following water quality standards for radiochemicals shall not be exceeded:

1. In all surface waters, the concentration of radio chemicals shall not exceed the limits established by the Arizona Radiation Regulatory Agency in 12 A.A.C. 1, Article 4, Appendix A, Table II, Column 2 (effective June 30, 1977 and no future amendments), which is incorporated by reference and on file with the Office of the Secretary of State and with the Department.

2. In surface waters that are designated as domestic water sources, the following water quality standards for radiochemicals shall not be exceeded:

   a. The concentration of gross alpha particle activity, including radium-226, but excluding radon and uranium, shall not exceed 15 picocuries per liter of water.

   b. The concentration of combined radium-226 and radium-228 shall not exceed 5 picocuries per liter of water.

   c. The concentration of strontium-90 shall not exceed 8 picocuries per liter of water.

   d. The concentration of tritium shall not exceed 20,000 picocuries per liter of water.

   e. 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 4 millirems per year.

Footnotes:

[1] Includes A&Wc, A&Ww, and A&We

[2] Includes A&Wc, A&Ww, A&Wedw, and A&We.

[3] Does not apply to Cholla Lake

[4] Does not apply to a wastewater treatment plant discharge to a dry watercourse that creates an effluent dependent water <u>or to a stormwater discharge</u>.

[5] The dissolved oxygen water quality standard for a lake shall apply below the surface but not at a depth greater than 1 meter.

a Means the annual mean of representative composite samples taken from the surface and at 2 and 5 meter depths.

b Means maximum for any set of representative composite samples taken from the surface and at 2 and 5 meter depths.

R18-11-110. Salinity ~~of~~ 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 the following concentrations:

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 salinity set forth in subsection (A), the Department adopts the plan of implementation contained in the "1999 Review, Water Quality Standards for Salinity, Colorado River System," Colorado River Basin Salinity Control Forum (June, 1999) which is incorporated by reference and on file with the Office of the Secretary of State and the Department.

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, or an alternative analytical method that is approved by the Director of the Arizona Department of Health Services under R9-14-607(B).

B. A test result from a sample taken to determine compliance with a water quality standard is valid only if the sample has been analyzed by a laboratory that is licensed by the Arizona Department of Health Services for the analysis performed.

R18-11-112. Unique Waters

D. The Director shall ~~use rulemaking to~~ classify a surface water as a unique water 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.

E. The Director may adopt, by rule, site-specific water quality standards to maintain and protect existing water quality in a unique water.

F. Any person may nominate a surface water for classification as a unique water by filing a ~~petition for rule adoption~~ nomination with the Department. A ~~petition for rule adoption~~ nomination to classify 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 waters classification as prescribed in subsection (D) of this Section;
3. Supporting evidence demonstrating that 1 ~~or more~~ of the applicable unique waters criteria prescribed in subsection (D) of this Section ~~has been~~ is met; and
4. Available water quality data relevant to establishing baseline water quality of the proposed unique water.

D. The Director may classify a surface water as a unique water upon finding that the surface water is an outstanding state resource water based upon ~~1 of~~ the following criteria:

1. The surface water is a perennial 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 impoundments, diversions, channelization, rip-rapping or other bank armor, or other hydrological modifications within the reach nominated for unique waters classification.
3. A 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 applicable surface water quality standards. A surface water that is listed as impaired pursuant to §303(d) of the Clean

Water Act is ineligible for unique waters classification.

4. The surface water meets one or both of the following conditions:

~~1~~ a. The surface water is of exceptional recreational or ecological significance because of its unique attributes, including but not limited to, attributes related to the ~~geology, flora, fauna, water quality, aesthetic~~ riparian vegetation, fish, wildlife, hydrology, geology, scenic values, or the wilderness characteristics of the surface water.

~~2~~ b. Threatened or endangered species are known to be associated with the surface water and the existing water quality is essential to the maintenance and propagation of a threatened or endangered species or the surface water provides critical habitat for a threatened or endangered species. Endangered or threatened species are identified on the following lists which are hereby incorporated by reference and on file with the Office of the Secretary of State and the Department:

~~a~~ i. Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12 (revised as of ~~October 1, 1994~~ (July 1, 2000).

~~b. "Threatened Native Wildlife of Arizona," Arizona Game and Fish Department (July 21, 1988);~~

~~c. List of highly safeguarded protected native plants in 3 A.A.C. 4, Article 6, Appendix A(A) (December 20, 1994);~~

~~d.~~ ii. Federally Listed Threatened and Endangered Species of Arizona," U.S. Fish & Wildlife Service ~~(June 6, 1995)~~ (February, 1999) .

E. The following surface waters are classified as unique waters:

1. The West Fork of the Little Colorado River, above Government Springs;
2. Oak Creek, including the West Fork of Oak Creek;
3. Peeples Canyon Creek, tributary to Santa Maria River;
4. Burro Creek, above its confluence with Boulder Creek;
5. Francis Creek, Mohave and Yavapai counties;

6. Bonita Creek, tributary to the upper Gila River;

7. Cienega Creek, from ~~I-10 bridge~~ confluence with Gardner Canyon and Spring Water Canyon @ R18E T17S to Del Lago Dam, Pima County;

8. Aravaipa Creek, from confluence of Stowe Gulch to the downstream boundary of Aravaipa Canyon Wilderness Area;

9. Cave Creek and South Fork of Cave Creek (Chircahua Mountains), from headwaters to the Coronado National Forest boundary; and

10. Buehman Canyon Creek, from headwaters (Lat. 32°24'55.5" N, Long. 110°39'43.5"W) to approximately 9.8 miles downstream

11. Lee Valley Creek - Headwaters to Lee Valley Reservoir

12. Bear Wallow Creek - Headwaters to boundary of the San Carlos Indian Reservation

13. North Fork Bear Wallow Creek - Headwaters to Bear Wallow Creek

14. South Fork Bear Wallow Creek - Headwaters to Bear Wallow Creek

15. Snake Creek - Headwaters to confluence with Black River

17. Hayground Creek - Headwaters to confluence with West Fork Black River

18. Stinky Creek - Fort Apache Indian Reservation boundary to confluence with West Fork Black River

19. West Fork Black River - Fort Apache Indian Reservation boundary to T4N R27E Section 27

20. KP / Cienega Creek - Headwaters to confluence with the Blue River

F. The Department will 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 propose or classify a nominated surface water as a unique water:

1. Ability to manage the unique water and its watershed to maintain and protect existing water quality,

2. Social and economic impact of Tier 3 antidegradation protection,

3. Public comments in support or opposition to a unique waters classification,

4. Support or opposition of federal and state land management and natural resources agencies to a nomination,

5. Agency resource constraints,

6. Completeness of a unique waters nomination,

7. Timing of a unique waters nomination relative to the triennial review of surface water quality standards,

8. Consistency with applicable water quality management plans (e.g. §208 plans, U. S. Forest Service management plans),

9. Location within a national or state park, national monument, national recreation area, wilderness area, riparian conservation area, area of critical environmental concern, or other special use designation.

~~F.~~ 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 ~~pursuant to~~ under R18-11-109.

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 Creek:

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. Peeples Canyon Creek, tributary to the Santa Maria River:

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, Mohave and Yavapai counties:

Parameter	Standard
Manganese (T)	500 μg/L

6. Cienega Creek, from I-10 bridge to Del Lago Dam, 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

NTU means nephelometric turbidity unit

mg/L means milligrams per liter

μg/L means micrograms per liter

R18-11-113. Effluent Dependent Waters

K. The Director shall ~~use rulemaking to~~ classify a surface water as an effluent dependent water by rule.

B. The Director may adopt, by rule, site-specific water quality standards 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 ~~primarily~~ of discharges of treated wastewater.

3. Information that demonstrates that 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 South Rim Grand Canyon WWTP outfall to confluence with Coconino Wash.

   b. Cataract Creek from Williams WWTP outfall to 1 kilometer downstream from the outfall.

   c. Holy Moses Wash from Kingman WWTP outfall to 3 kilometers downstream from outfall.

   d. Transept Canyon from North Rim Grand Canyon WWTP outfall to 1 kilometer downstream.

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 City of Flagstaff WWTP outfall to confluence with San Francisco Wash.

   h. Whale Lake

3. In the Middle Gila River Basin:

a. Unnamed wash from the Town of Prescott Valley WWTP outfall to the confluence with the Agua Fria River, and the Agua Fria River below the confluence with the unnamed wash receiving treated wastewater from the Prescott Valley WWTP to State Route 169.

b. Agua Fria river from El Mirage WWTP outfall to 2 kilometers downstream from the outfall.

c. Gila River from Florence WWTP outfall to Felix Road.

d. Gila River from confluence with the Salt River to Gillespie Dam

e. Queen Creek from ~~Superior Mining Division discharge~~ Superior WWTP outfall to confluence with Potts Canyon.

f. Unnamed wash from Gila Bend WWTP outfall to confluence with Gila River.

g. Unnamed wash from Luke AFB WWTP outfall to the confluence with Agua Fria River.

h. Unnamed wash from the Queen Valley WWTP outfall to confluence with Queen Creek.

4. In the Rios de Mexico Basin:

a. Mule Gulch, from Bisbee WWTP outfall to confluence with Whitewater Draw.

b. Unnamed wash from Bisbee-Douglas International Airport WWTP outfall to Whitewater Draw.

5. In the Salt River Basin:

a. Unnamed wash from Globe WWTP outfall to confluence with Pinal Creek and from confluence of unnamed wash and Pinal Creek to Radium.

b. Salt River from 23rd Avenue WWTP outfall to confluence with the Gila River.

6. In the San Pedro River Basin:

a. Unnamed wash from Mt. Lemmon WWTP outfall to 0.25 kilometers downstream.

b. Walnut Gulch from Tombstone WWTP outfall to confluence with Tombstone Gulch.

7. In the Santa Cruz Basin:

a. Santa Cruz River from Nogales International WWTP outfall to Tubac Bridge.

b. Santa Cruz River from Roger Road WWTP outfall to Baumgartner Road crossing.

c. Unnamed wash from Oracle WWTP outfall to 5 kilometers downstream.

d. Sonoita Crekk from Town of Patagonia WWTP outfall to 750 feet downstream.

8. In the Upper Gila River Basin:

a. Bennett Wash from Arizona Department of Corrections-Safford WWTP outfall to Gila River.

b. Unnamed wash from 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 Northern Gila County Sanitary District WWTP outfall to the East Verde River.

b. Bitter Creek from Jerome WWTP outfall to 2.5 kilometers downstream from the outfall.

c. Jacks Canyon Wash from Big Park WWTP outfall to confluence with Dry Beaver Creek.

10. Willcox Playa Basin:

a. Lake Cochise

E. The following site-specific standards apply to the listed effluent dependent waters:

1. Rio de Flag

a. Copper (D): 36 $\mu g / L$

R18-11-114. Mixing Zones

A. The Director may~~, by order,~~ establish a mixing zone~~ in~~ for a point source discharge to a surface water as a condition of a NPDES permit. Mixing zones are prohibited in ephemeral waters 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. The application shall include:

1. 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%.

4. A complete and detailed description of the existing physical, biological, and chemical conditions of the receiving water and the predicted impact on such conditions from the proposed mixing zone.

~~5. Information which demonstrates that there will be no acute toxicity in the proposed mixing zone.~~

C. The Department shall review the application for a mixing zone to determine whether the application is complete. If the application is incomplete, the Department shall identify in writing the additional information that must be submitted to the Department ~~before the Department can take administrative action on the application for a mixing zone~~ to complete the mixing zone application.

~~D. When the application for a mixing zone is complete, the Department shall make a preliminary determination of whether to establish the mixing zone. The Department shall give public notice and provide an opportunity for a public hearing on whether to establish a mixing zone pursuant to the administrative procedures prescribed in R18-1-401 and R18-1-402.~~

~~E.~~D. In making the determination of whether to grant or deny the request for the establishment of a mixing zone, the Director shall consider the following factors: assimilative capacity of the receiving water, sediment deposition; bioaccumulation; bioconcentration; predicted exposure of biota and the likelihood that resident biota will be adversely affected; whether there will be acute toxicity in the mixing zone and the size of the area where there will be acute toxicity; the known or predicted safe exposure levels for the pollutant of concern; the likelihood of adverse human health effects; the size of the mixing zone; location of the mixing zone relative to biologically sensitive areas in the surface water; drinking water treatment plant intakes, and public swimming areas, concentration gradient within the mixing zone, the physical habitat, the potential for attraction of aquatic life to the mixing zone, and the cumulative impacts of other mixing zones and other discharges to the surface water.

~~F.~~E. The Director shall deny the request to establish a mixing zone if water quality standards outside the boundaries of the proposed mixing zone will be violated ~~or if concentrations of pollutants within the proposed mixing zone will cause acute toxicity to aquatic life~~. Denials of applications for a mixing zone shall be in writing and shall state the reasons for the denial. If the Director determines that a mixing zone should be established, he shall ~~issue an order to~~ establish a mixing zone as a condition of a NPDES permit. The Director may include mixing zone conditions in the ~~order~~ NPDES permit that the Director deems necessary to protect human health and the designated uses of the surface water. ~~A copy of the Director's decision and order shall be sent by certified mail to the applicant~~.

~~G.~~F. Any person who is adversely affected by ~~an order of the Director pertaining to~~ the establishment of a mixing zone may appeal the director's decision to an administrative law judge pursuant to A.R.S. §49-321.

~~H.~~G. The Department shall reevaluate a mixing zone upon issuance, reissuance, or modification of the National Pollutant Discharge Elimination System permit for the point source or modification of the outfall structure.

~~I.~~ H. The length of the mixing zone shall not exceed 500 meters in flowing streams. 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 of the individual mixing zones.

~~J.~~ 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.

~~K.~~ J. The discharge outfall shall be designed to maximize initial dilution of the treated wastewater in a surface water.

K. A mixing zone is prohibited for the following persistent, bioaccumulative pollutants:

1. Cadmium
2. Chlordane
3. DDT and its metabolites (DDD and DDE)
4. Dieldrin
5. Dioxin

6. Endrin

7. Endrin aldehyde

8. Heptachlor

9. Heptachlor epoxide

10. Lindane

11. Mercury

12. PCBs

13. Toxaphene

~~R18-11-115. Nutrient Waivers~~

~~A. The Department may waive the water quality standards for total phosphorus or total nitrogen on a discharger-specific basis for a discharge to an ephemeral water which is tributary to a surface water for which water quality standards for total nitrogen or total phosphorus are prescribed in R18-11-109(H).~~

~~B. A discharger who seeks a nutrient waiver shall submit an application to the Department on a standard form that is available from the Department. The application shall include:~~

~~1. Idnetification of the applicant.~~

~~2. Information on the discharging facility, including:~~

~~a. Date the facility was placed in service;~~

~~b. Location of the facility;~~

~~c. Location of the discharge point;~~

~~d. Wastewater treatment method; and~~

~~e. Discharge flow.~~

~~3. Information on the receiving surface water, including:~~

~~a. Name of the receiving water;~~

~~b. Distance in river miles to the nearest downstream surface water; and~~

~~c. Distance from the point of discharge to the point where the flow goes subsurface during~~

~~an average dry season.~~

~~4. Information which demonstrates that the nearest downstream surface water is free from pollutants in amounts or combinations which 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.~~

~~5. Water quality data, including:~~

~~a. Monthly average, 90th percentile, and single sample maximum concentrations of total phosphorus and total nitrogen as measured at the point of discharge.~~

~~b. Monthly average, 90th percentile, and single sample maximum concentrations of total phosphorus and total nitrogen as measured at a downstream control point established by the Department; and~~

~~c. Discharge flow at the time of sampling.~~

~~C. The Department shall review the application for completeness and shall notify the applicant in writing whether the application is complete or whether additional information needs to be submitted to the Department.~~

~~D. Once an application for a nutrient waiver is complete, the Department shall make a preliminary determination of whether to grant or deny the nutrient waiver. The Department shall issue public notice and provide an opportunity for a public hearing on whether the request for a nutrient waiver should be granted pursuant to procedures prescribed in A.A.C. R18-1-401 and R18-1-402.~~

~~E. The Director may, by order, grant a nutrient waiver provided the discharge will not cause a violation of a water quality standard for total phosphorus or total nitrogen in any downstream surface water or cause a violation of narrative standards prescribed in R18-11-108. A copy of the Director's decision and order shall be sent by certified mail to the applicant.~~

~~F. Any person who is adversely affected by an order granting or denying a nutrient waiver may appeal the decision to an administrative law judge pursuant to A.R.S. §49-321.~~

~~G. A nutrient waiver expires after a fixed term not to exceed 5 years. The Department shall reevaluate a nutrient waiver upon issuance, reissuance, or modification of the National Pollutant Discharge Elimination System permit for the point source.~~

R18-11-116. Resource Management Agencies

No proposed changes

R18-11-117. Canals and Municipal Park Lakes

No proposed changes

R18-11-118. Dams and Flood Control Structures

A. Increases in turbidity that result from the routine physical or mechanical maintenance of dams and flood control structures are not violations of this Article.

~~B. Nothing in this Article shall be construed to require a person who operates a dam or flood control structure to operate the structure to cure or mitigate an exceedance of a water quality standard caused by another person.~~

~~C~~ B. Nothing in this Article shall be construed to require the ~~releases of water from dams~~ release of water from a dam or a flood control structure.

R18-11-120. Enforcement

A. Any person who causes a violation of a water quality standard or any provision of this Article is subject to the enforcement provisions prescribed in A.R.S. Titel 49, Chapter 2, Article 4.

B. The Department may establish a numeric water quality standard at a concentration that is below the practical quantitation limit. In such cases, the water quality standard is enforceable at the practical quantitation limit.

C. The Department shall determine compliance with acute aquatic and wildlife criteria from the analytical result of a grab sample. Compliance with chronic aquatic and wildlife criteria shall be determined from the ~~arithmetic~~ geometric mean of the analytical results of ~~grab samples collected over a period of 4 consecutive days at a minimum rate of 1 grab sample per day~~ the last 4 samples taken at least 24 hours apart.

D. A person is not subject to penalties for violation of a water quality standard provided that the person is in compliance with the provisions of a compliance schedule issued pursuant to R18-11-121.

R18-11-121. Schedules of Compliance

A. A schedule 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 for an existing point source, other than a storm water discharge, shall require compliance with a discharge limitation based upon a new or revised water quality standard no later than 3 years after the effective date of the National Pollutant Discharge Elimination System permit. In order for a schedule of compliance to be granted, the owner or operator of the existing point source shall demonstrate that all requirements under §301(b) and §306 of the Clean Water Act have been 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 schedule of compliance ~~shall not~~ may be established in a National Pollutant Discharge Elimination System permit for a new point source. The first National Pollutant Discharge Elimination System permit issued to a new point source 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 is effective after commencement of construction but less than 3 years before commencement of the discharge. For purposes of this subsection, ~~a new point source means a point source, the construction of which commences after the effective date of a water quality standard. Commencement~~ 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. On-site 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% of the total cost incurred for physical construction.

C. A schedule of compliance may be established in a National Pollutant Discharge Elimination System permit for a recommencing point source discharge. The first National Pollutant Discharge Elimination System permit issued to a recommencing point source discharge 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 effective less than 3 years before recommencement of discharge.

~~C~~D. A schedule to bring a point source discharge of storm water into compliance with a water quality standard may be established in a National Pollutant Discharge Elimination System permit. A compliance schedule for a storm water discharge shall require implementation of all reasonable and cost-effective best management practices to control the discharge of pollutants in storm water.

R18-11-122. Variances

A. The Director may grant a variance from a water quality standard for a point source discharge provided 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 5 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 5 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.

D. A variance is for a fixed term not to exceed 5 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. In order for a variance to be renewed, the applicant shall demonstrate reasonable progress towards compliance with the water quality standard during the term of the variance.

E. The Department shall reevaluate a variance upon the issuance, reissuance, or modification of the National Pollutant Discharge Elimination System permit for the point source discharge.

F. A person who seeks a variance from a water quality standard shall submit a letter to the Department requesting a variance. 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; ~~or~~

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 5 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 which represent the highest level of treatment achievable by the point source discharge during the term of the variance. Interim discharge limitations shall not be less stringent than technology-based effluent limitations.

G. In making a decision on whether to grant or deny the request for a variance, the Director shall consider the following factors: bioaccumulation, bioconcentration, predicted exposure of biota and the likelihood that resident biota will be adversely affected, the known or predicted safe exposure levels for the pollutant of concern, and the likelihood of adverse human health effects.

H. The Department shall issue public notice and shall provide an opportunity for a public hearing on whether the request for a variance should be granted or denied pursuant to procedures prescribed in A.A.C. R18-1-401 and R18-1-402.

I. Any person who is adversely affected by a decision of the Director to grant or deny a variance may appeal the decision to an administrative law judge pursuant to A.R.S. §49-321.

J. The Department shall not grant a variance for a point source discharge to a unique water listed in R18-11-112.

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~~, Sabino Creek~~

A. The discharge of treated wastewater to Sabino Creek is prohibited.

B. The discharge of human body wastes and the wastes from toilets and other receptacles intended to receiveor retain such wastes from a vessel to Lake Powell is prohibited.

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Acenaphthene	83-32-9	420	~~2600~~ 2568	~~8400~~ 84,000	~~8400~~ 84,000	NNS	NNS
Acenaphthylene	208-96-8	NNS	NNS	NNS	NNS	NNS	NNS
Acrolein	107-02-8	~~110~~ 3.50	~~750~~ 23.9	~~2200~~ 700	~~2200~~ 700	NNS	NNS
Acrylonitrile	107-13-1	~~0.06~~ 0.065	0.64	~~3~~ 2.59	~~NNS~~ 56,000	NNS	NNS
Alachlor	15972-60-8	2	NNS	~~1400~~ 14,000	~~1400~~ 14,000	NNS	NNS
Aldrin	309-00-2	0.002	0.0003	0.08	~~4.2~~ 42	k	k
Ammonia	7664-41-7	NNS	NNS	NNS	NNS	NNS	NNS
Anthracene	120-12-7	2100	~~6300~~ 6343	~~42000~~ 420,000	~~42000~~ 420,000	NNS	NNS
Antimony (as Sb)	7440-36-0	6 T	~~140~~ T 154 T	~~56~~ 560 T	~~56~~ 560 T	NNS	NNS
Arsenic (as As)	7440-38-2	50 T	1450 T	50 T	~~50~~ 420 T	2000 T	200 T
Asbestos	1332-21-4	a	NNS	NNS	NNS	NNS	NNS
Atrazine	1912-24-9	3	NNS	~~4900~~ 49,000	~~4900~~ 49,000	NNS	NNS
Barium (as Ba)	7440-39-3	2000 T	NNS	~~9800 D~~ 98,000	~~9800 D~~ 98,000	NNS	NNS
Benzene	71-43-2	5	~~120~~ 239	~~48~~ 93.3	~~NNS~~ 93.3	NNS	NNS
Benzidine	92-87-5	0.0002	0.002	~~0.006~~ 0.01	~~420~~ 4,200	0.01	0.01

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Benz (a) anthracene	56-55-3	~~0.003~~ NNS	~~0.00008~~ NNS	~~0.12~~ NNS	NNS	NNS	NNS
Benzo (a) pyrene	50-32-8	0.2	0.002	~~0.2~~ 0.19	~~NNS~~ 0.19	NNS	NNS
Benzo (ghi) perylene	191-24-2	NNS	NNS	NNS	NNS	NNS	NNS
Benzo (k) fluoranthene	207-08-9	~~0.003~~ NNS	~~0.00001~~ NNS	~~0.12~~ NNS	NNS	NNS	NNS
3,4-Benzofluoranthene	205-99-2	~~0.003~~ NNS	~~0.00004~~ NNS	~~0.12~~ NNS	NNS	NNS	NNS
Beryllium (as Be)	7440-41-7	4 T	~~0.21~~ 1.795 T	~~4~~ 2.800 T	~~700~~ 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~~ 0.032	1.4	~~1.3~~ 1.27	~~NNS~~ 1.27	NNS	NNS
Bis (2-chloroisopropyl) ether	108-60-1	280	~~15000~~ 35,897	~~5600~~ 56,000	~~5600~~ 56,000	NNS	NNS
Boron (as B)	7440-42-8	630	NNS	~~12600~~ 126,000	~~12600~~ 126,000	1000 T	NNS
Bromodichloromethane	75-27-4	TTHM 100	~~22~~ 11.6	100	~~2800~~ 28,000	NNS	NNS
p-Bromodiphenyl ether	101-55-3	NNS	NNS	NNS	NNS	NNS	NNS
Bromoform	75-25-2	TTHM 100	~~80~~ 341	~~180~~ 177	28,000	NNS	NNS
Bromomethane	74-83-9	9.8	~~7500~~ 5026	~~200~~ 1,960	~~200~~ 1,960	NNS	NNS
Butyl benzyl phthalate	85-68-7	1400	~~5000~~ 5008	~~28000~~ 280,000	~~28000~~ 280,000	NNS	NNS
Cadmium (as Cd)	7440-43-9	5 T	~~41 T~~ 41.4 T	~~70~~ 700 T	~~70~~ 700 T	50 T	50 T

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Carbofuran	1563-66-2	40	NNS	~~700~~ 7,000	~~700~~ 7,000	NNS	NNS
Carbon tetrachloride	56-23-5	5	~~5.5~~ 5.52	~~11~~ 10.8	~~98~~ 980	NNS	NNS
Chlordane	57-74-9	2	~~0.001~~ 0.005	~~2~~ 4	~~8.4~~ 700	NNS	NNS
Chlorine (total residual)	7782-50-5	~~NNS~~ 700	NNS	~~14000~~ 140,000	~~14000~~ 140,000	NNS	NNS
Chlorobenzene	108-90-7	100	~~500~~ 514	~~2800~~ 28,000	~~2800~~ 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 100	~~590~~ 588	230	~~1400~~ 14,000	NNS	NNS
Chloromethane	74-87-3	NNS	NNS	NNS	NNS	NNS	NNS
Chloronapthalene beta	91-58-7	560	~~13000~~ 13,295	~~11000~~ 112,000	~~11000~~ 112,000	NNS	NNS
2-Chlorophenol	95-57-8	35	~~2100~~ 2154	~~700~~ 7,000	~~700~~ 7,000	NNS	NNS
4-Chlorophenyl phenyl ether	7005-72-3	NNS	NNS	NNS	NNS	NNS	NNS
Chromium (as Cr III)	16065-83-1	~~NNS~~ 10,500 T	~~67000 T~~ 1,009,615 T	~~140000 T~~ 2,100,000 T	~~140000 T~~ 2,100,000 T	NNS	NNS
Chromium (as Cr VI)	18540-29-9	~~NNS~~ 21 T	~~3400~~ 2,019T	~~700~~ 4,200 T	~~700~~ 4,200 T	NNS	NNS
Chromium (Total as Cr)	7440-47-3	100 T	NNS	~~NNS~~ 100 T	~~NNS~~ 100 T	1000 T	1000 T
Chrysene	218-01-9	~~0.003~~ NNS	~~.0001~~ NNS	~~0.12~~ NNS	NNS	NNS	NNS

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Copper (as Cu)	7440-50-8	~~1000 D~~ 1,300 T	NNS	~~5200 D~~ 1,300 T	~~5200 D~~ 1,300 T	5000 T	500 T
Cyanide	57-12-5	200 T	210000 T 215,385 T	~~2800 T~~ 28,000 T	~~2800 T~~ 28,000 T	NNS	200 T
Dalapon	75-99-0	200	161,538	42,000	42,000	NNS	NNS
Dibenz (ah) anthracene	53-70-3	~~0.003~~ NNS	~~0.00003~~ NNS	~~0.12~~ NNS	NNS	NNS	NNS
Dibromochloromethane	124-48-1	TTHM 100	~~12~~ 8.55	~~17~~ 100	~~2,800~~ 28,000	NNS	NNS
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	0.2	NNS	~~NNS~~ 2,800	~~NNS~~ 2,800	NNS	NNS
1,2-Dibromoethane (EDB)	106-93-4	0.05	NNS	~~1.6~~ 0.05	~~NNS~~ 0.05	NNS	NNS
Dibutyl phthalate	84-74-2	700	~~2300~~ 159	~~14000~~ 140,000	~~14000~~ 140,000	NNS	NNS
1,2-Dichlorobenzene	95-50-1	600	2800 2761	~~13000~~ 126,000	~~13000~~ 126,000	NNS	NNS
1,3-Dichlorobenzene	541-73-1	~~94~~ NNS	~~2000~~ NNS	~~1880~~ NNS	~~1880~~ NNS	NNS	NNS
1,4-Dichlorobenzene	106-46-7	75	1200 35,601	~~1880~~ 560,000	~~1880~~ 560,000	NNS	NNS
3,3'-Dichlorobenzidine	91-94-1	~~0.08~~ 0.078	~~0.09~~ 0.091	~~3.1~~ 3.11	~~NNS~~ 3.11	NNS	NNS
p,p'-Dichlorodiphenyldichloroethane (DDD)	72-54-8	~~0.15~~ 0.146	~~0.0009~~ 0.001	~~5.8~~ 5.83	~~NNS~~ 5.83	0.001	0.001
p,p'-Dichlorodiphenyldichloroethylene (DDE)	72-55-9	~~0.1~~ 0.103	~~0.0006~~ 0.012	~~4.1~~ 4.12	~~NNS~~ 4.12	0.001	0.001

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
p,p'-Dichlorodiphenyltrichloroethane (DDT)	50-29-3	~~0.1~~ 0.103	~~0.0005~~ 0.0004	~~4.1~~ 4.12	~~70~~ 700	0.001	0.001
1,1-Dichloroethane	75-34-3	NNS	NNS	NNS	NNS	NNS	NNS
1,2-Dichloroethane	107-06-2	5	~~120~~ 118	~~15~~ 15.4	~~NNS~~ 280,000	NNS	NNS
1,1-Dichloroethylene	75-35-4	7	~~4.5~~ 321	~~7~~ 233	~~1300~~ 12,600	NNS	NNS
1,2-cis-Dichloroethylene	156-59-2	70	NNS	~~NNS~~ 70	~~NNS~~ 70	NNS	NNS
1,2-trans-Dichloroethylene	156-60-5	100	~~13000~~ 13,462	~~2800~~ 28,000	~~2800~~ 28,000	NNS	NNS
Dichloromethane	75-09-2	5	~~480~~ 479	~~190~~ 187	~~8400~~ 84,000	NNS	NNS
2,4-Dichlorophenol	120-83-2	21	~~810~~ 808	~~420~~ 4,200	~~420~~ 4,200	NNS	NNS
2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	70	NNS	~~1400~~ 14,000	~~1400~~ 14,000	NNS	NNS
1,2-Dichloropropane	78-87-5	5	~~NNS~~ 161,538	NNS 126,000	NNS 126,000	NNS	NNS
1,3-Dichloropropene	542-75-6	~~0.2~~ 2.1	~~6.6~~ 646	~~7.8~~ 420	~~42~~ 420	NNS	NNS
Dieldrin	60-57-1	0.002	0.0002	0.09	~~7~~ 70	k	k
Diethyl phthalate	84-66-2	5600	~~110000~~ 113,360	~~110000~~ 1,120,000	~~110000~~ 1,120,000	NNS	NNS
Di (2-ethylhexyl) adipate	103-23-1	400	NNS	1167	840,000	NNS	NNS

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Di (2-ethylhexyl) phthalate	117-81-7	6	7.4	100	~~2800~~ 28,000	NNS	NNS
2,4-Dimethylphenol	105-67-9	140	~~2200~~ 2198	~~2800~~ 28,000	~~2800~~ 28,000	NNS	NNS
Dimethyl phthalate	131-11-3	~~70000~~ NNS	2,800,000 NNS	~~1400000~~ NNS	~~1400000~~ NNS	NNS	NNS
4,6-Dinitro-o-cresol	534-52-1	~~2.7~~ 28	~~120~~ 3077	~~55~~ 5,600	~~55~~ 5,600	NNS	NNS
2,4-Dinitrophenol	51-28-5	14	~~5400~~ 3590	~~280~~ 2,800	~~280~~ 2,800	NNS	NNS
2,4-Dinitrotoluene	121-14-2	14	163	~~280~~ 2,800	~~280~~ 2,800	NNS	NNS
2,6-Dinitrotoluene	606-20-2	~~NNS~~ 0.051	~~NNS~~ 1.98	~~NNS~~ 2.06	~~NNS~~ 5,600	NNS	NNS
Di-n-octyl phthalate	117-84-0	~~NNS~~ 2800	~~NNS~~ 3084	~~NNS~~ 560,000	~~NNS~~ 560,000	NNS	NNS
Dinoseb	88-85-7	7	158	1,400	1,400	NNS	NNS
1,2-Diphenylhydrazine	122-66-7	0.04	0.25	~~1.8~~ 1.75	~~NNS~~ 1.75	NNS	NNS
Diquat	85-00-7	20	23,692	3,080	3,080	NNS	NNS
Endosulfan sulfate	1031-07-8	~~0.35~~ NNS	~~0.78~~ NNS	~~7~~ NNS	~~7~~ NNS	NNS	NNS
Endosulfan (Total)	115-29-7	42	110	~~840~~ 8,400	~~840~~ 8,400	NNS	NNS
Endothall	145-73-3	100	215,385	28,000	28,000	NNS	NNS
Endrin	72-20-8	~~0.2~~ 2	~~1.1~~ 1.15	~~40~~ 420	~~40~~ 420	0.004	0.004
Endrin aldehyde	7421-93-3	~~2.1~~ NNS	~~0.81~~ NNS	~~420~~ NNS	~~420~~ NNS	NNS	NNS

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Ethylbenzene	100-41-4	700	~~110000~~ 107,692	~~14000~~ 140,000	~~14000~~ 140,000	NNS	NNS
Ethyl chloride	75-00-3	NNS	NNS	NNS	NNS	NNS	NNS
Fluoranthene	206-44-0	280	~~130~~ 15,569	~~5600~~ 56,000	~~5600~~ 56,000	NNS	NNS
Fluorene	86-73-7	280	~~580~~ 33,946	~~5600~~ 56,000	~~5600~~ 56,000	NNS	NNS
~~Fluorine~~ Fluoride	7782-41-4	4000	NNS	~~8400~~ 84,000	~~8400~~ 84,000	NNS	NNS
Glyphosate	1071-83-6	700	1,076,923	140,000	140,000	NNS	NNS
Heptachlor	76-44-8	0.4	~~0.0002~~ 0.0004	0.4	~~70~~ 700	NNS	NNS
Heptachlor epoxide	1024-57-3	0.2	0.0001	0.2	~~2~~ 18.2	NNS	NNS
Hexachlorobenzene	118-74-1	1	0.002	1	~~280~~ 1,120	NNS	NNS
Hexachlorobutadiene	87-68-3	0.45	0.52	18	~~NNS~~ 280	NNS	NNS
Hexachlorocyclohexane alpha	319-84-6	0.006	0.03	0.22	~~NNS~~ 11,200	NNS	NNS
Hexachlorocyclohexane beta	319-85-7	0.02	0.02	0.78	~~NNS~~ 840	NNS	NNS
Hexachlorocyclohexane delta	319-86-8	NNS	NNS	NNS	NNS	NNS	NNS
Hexachlorocyclohexane gamma (lindane)	58-89-9	0.2	~~0.02~~ 6.37	~~1~~ 420	~~42~~ 420	NNS	NNS
Hexachlorocyclopentadiene	77-47-4	50	550	~~1000~~ 9,800	~~1000~~ 9,800	NNS	NNS
Hexachloroethane	67-72-1	2.5	4.8	100	~~140~~ 1,400	NNS	NNS

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Indeno (1,2,3-cd) pyrene	193-39-5	~~0.003~~ NNS	~~0.000003~~ NNS	~~0.12~~ NNS	NNS	NNS	NNS
Isophorone	78-59-1	36.8	~~2300~~ 2,267	~~1500~~ 1,474	~~28000~~ 280,000	NNS	NNS
Lead (as Pb)	7439-97-1	~~50 T~~ 15 T	NNS	~~NNS~~ 15	~~NNS~~ 15	10000 T	100 T
Manganese (as Mn)	7439-96-5	~~4900~~ 980 T	NNS	~~19600 T~~ 196,000 T	~~19600 T~~ 196,000 T	10000	NNS
Mercury (as Hg)	7439-97-6	2 T	~~0.6 T~~ 1.66 T	~~42~~ 420 T	~~42~~ 420 T	NNS	10 T
Methoxychlor	72-43-5	40	NNS	~~700~~ 7,000	~~700~~ 7,000	NNS	NNS
Naphthalene	91-20-3	~~NNS~~ 140	~~NNS~~ 71,795	~~NNS~~ 28,000	~~NNS~~ 28,000	NNS	NNS
Nickel (as Ni)	7440-02-0	~~100 T~~ 140 T	~~730 T~~ 733 T	~~2800~~ 28,000 T	~~2800~~ 28,000 T	NNS	NNS
Nitrate (as N)	14797-55-8	10000	NNS	~~224000~~ 2,240,000	~~224000~~ 2,240,000	NNS	NNS
Nitrite (as N)	14797-65-0	1000	NNS	~~14000~~ 140,000	~~14000~~ 140,000	NNS	NNS
Nitrate/Nitrite (as Total N)		10000	NNS	NNS	NNS	NNS	NNS
Nitrobenzene	98-95-3	3.5	600	~~70~~ 700	~~70~~ 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	~~0.0007~~ 0.001	~~2.1~~ 0.88	0.03	~~NNS~~ 0.03	NNS	NNS

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
N-nitrosodiphenylamine	86-30-6	~~7.1~~ 7.14	14	~~290~~ 286	~~NNS~~ 286	NNS	NNS
N-nitrosodi-n-propylamine	621-64-7	0.005	~~0.51~~ 0.385	0.2	~~NNS~~ 133,000	NNS	NNS
Oxamyl	23135-22-0	200	NNS	35,000	35,000	NNS	NNS
Pentachlorophenol	87-86-5	1	~~8.2~~ 1.13	11.7	~~2000~~ 42,000	NNS	NNS
Phenanthrene	85-01-8	NNS	NNS	NNS	NNS	NNS	NNS
Phenol	108-95-2	4200	~~6,500,000~~ 6,461,538	~~84000~~ 840,000	~~84000~~ 840,000	NNS	NNS
Picloram	1918-02-1	500	24,318	98,000	98,000	NNS	NNS
Polychlorinatedbiphenyls (PCBs)	1336-36-3	0.5	~~0.00009~~ 0.013	~~0.5~~ 28	~~NNS~~ 28	0.001	0.001
Pyrene	129-00-0	210	~~1100~~ 1090	~~4200~~ 42,000	~~4200~~ 42,000	NNS	NNS
Selenium (as Se)	7782-49-2	50 T	~~9000 T~~ 8964 T	~~700~~ 7,000 T	~~700~~ 7,000 T	20 T	50 T
Silver (as Ag)	7440-22-4	~~NNS~~ 35	~~NNS~~ 5983	~~NNS~~ 7,000 T	~~NNS~~ 7,000 T	NNS	NNS
Simazine	112-34-9	4	10,769	7,000	7,000	NNS	NNS
Styrene	100-42-5	100	NNS	~~28000~~ 280,000	~~28000~~ 280,000	NNS	NNS
Sulfides		NNS	NNS	NNS	NNS	NNS	NNS

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	1746-01-6	~~0.0000003~~ 0.00003	~~0.000000004~~ 0.002	~~0.00009~~ 1.40	~~NNS~~ 1.40	NNS	NNS
1,1,2,2-Tetrachloroethane	79-34-5	~~0.17~~ 0.175	11	7	~~NNS~~ 56,000	NNS	NNS
Tetrachloroethylene	127-18-4	5	~~11~~ 4487	~~35~~ 14,000	~~1400~~ 14,000	NNS	NNS
Thallium (as Tl)	7440-28-0	2 T	~~41 T~~ 39.2	~~12 T~~ 112	~~12 T~~ 112	NNS	NNS
Toluene	108-88-3	1000	~~90000~~ 89,744	~~28000~~ 280,000	~~28000~~ 280,000	NNS	NNS
Toxaphene	8001-35-2	3	~~0.0008~~ 0.001	~~3~~ 1.27	~~NNS~~ 1400	0.005	0.005
1,2,4-Trichlorobenzene	120-82-1	70	~~155~~ 156	~~1400~~ 14,000	~~1400~~ 14,000	NNS	NNS
1,1,1-Trichloroethane	71-55-6	200	NNS	~~NNS~~ 200	~~NNS~~ 200	~~NNS~~ 1000	NNS
1,1,2-Trichloroethane	79-00-5	5	31	~~25~~ 24.6	~~560~~ 5,600	NNS	NNS
Trichloroethylene	79-01-6	5	~~NNS~~ 195,804	~~NNS~~ 280,000	~~NNS~~ 280,000	NNS	NNS
2,4,6-Trichlorophenol	88-06-2	~~3.2~~ 3.18	~~4.9~~ 4.89	~~130~~ 127.3	~~NNS~~ 127.3	NNS	NNS
2-(2,4,5-Trichlorophenoxy) proprionic acid (2,4,5-TP)	93-72-1	50	NNS	~~1120~~ 11,200	~~1120~~ 11,200	NNS	NNS
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	~~620~~ 15	~~80~~ 2	~~NNS~~ 4,200	NNS	NNS

Appendix A: Table 1. Human Health and Agricultural Designated Use Numeric Water Quality Criteria							
PARAMETER	CAS[1] NUMBER	DWS[2] (µg/L)	FC[2] (µg/L)	FBC[2] (µg/L)	PBC[2] (µg/L)	AgI[2] (µg/L)	AgL[2] (µg/L)
Xylenes (Total)	1330-20-7	10000	NNS	~~280000~~ 2,800,000	~~280000~~ 2,800,000	NNS	NNS
Zinc (as Zn)	7440-66-6	2100 T	~~22,000 T~~ 21,830 T	~~42000 T~~ 420,000 T	~~42000 T~~ 420,000 T	10000 T	25000 T

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Acenaphthene	83-32-9	850	550	850	550	850	550	NNS	~~NNS~~
Acenaphthylene	208-96-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Acrolein	107-02-8	34	30	34	30	34	30	NNS	~~NNS~~
Acrylonitrile	107-13-1	3800	250	3800	250	3800	250	NNS	~~NNS~~
Alachlor	15972-60-8	~~NNS~~ 2500	~~NNS~~ 170	~~NNS~~ 2500	~~NNS~~ 170	~~NNS~~ 2500	~~NNS~~ 170	NNS	~~NNS~~
Aldrin	309-00-2	2.0	NNS	2.0	NNS	2.0	NNS	4.5	~~NNS~~
Ammonia	7664-41-7	b	b	b	b	NNS	NNS	NNS	~~NNS~~
Anthracene	120-12-7	NNS	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	~~NNS~~
Arsenic (as As)	7440-38-2	360 D	190 D	360 D	190 D	360 D	190 D	440 D	~~230 D~~
Asbestos	1332-21-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Atrazine	1912-24-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Barium (as Ba)	7440-39-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Benzene	71-43-2	2700	180	2700	180	~~11000~~ 8800	~~700~~ 560	NNS	~~NNS~~
Benzidine	92-87-5	1300	89	1300	89	1300	89	10000	~~640~~
Benz (a) anthracene	56-55-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Benzo (a) pyrene	50-32-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Benzo (ghi) perylene	191-24-2	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Benzo (k) fluoranthene	207-08-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
3,4-Benzofluoranthene	205-99-2	NNS	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	~~NNS~~
Bis (2-chloroethoxy) methane	111-91-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Bis (2-chlorethyl) ether	111-44-4	120000	6700	120000	6700	120000	6700	NNS	~~NNS~~
Bis (2-chloroisopropyl) ether	108-60-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Boron (as B)	7440-42-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Bromodichloromethane	75-27-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
p-Bromodiphenyl ether	101-55-3	180	14	180	14	180	14	NNS	~~NNS~~
Bromoform	75-25-2	15000	10000	15000	10000	15000	10000	NNS	~~NNS~~
Bromomethane	74-83-9	5500	360	5500	360	5500	360	NNS	~~NNS~~
Butyl benzyl phthalate	85-68-7	1700	130	1700	130	1700	130	NNS	~~NNS~~
Cadmium (as Cd)	7440-43-9	c D	c D	c D	c D	c D	c D	c D	~~c D~~
Carbofuran	1563-66-2	~~NNS~~ 650	~~NNS~~ 50	~~NNS~~ 650	~~NNS~~ 50	~~NNS~~ 650	~~NNS~~ 50	NNS	~~NNS~~
Carbon tetrachloride	56-23-5	18000	1100	18000	1100	18000	1100	NNS	~~NNS~~
Chlordane	57-74-9	2.4	0.004	2.4	0.21	2.4	0.21	3.2	~~0.45~~
Chlorine (total residual)	7782-50-5	11	5.0	11	5.0	11	5.0	NNS	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Chlorobenzene	108-90-7	~~9800~~ 3800	~~620~~ 260	~~9800~~ 3800	~~620~~ 260	~~NNS~~ 3800	~~NNS~~ 260	NNS	~~NNS~~
p-Chloro-m-cresol	59-50-7	15	4.7	15	4.7	15	4.7	48000	~~15000~~
2-Chloroethyl vinyl ether	110-75-8	180000	9800	180000	9800	180000	9800	NNS	~~NNS~~
Chloroform	67-66-3	14000	900	14000	900	14000	900	NNS	~~NNS~~
Chloromethane	74-87-3	270000	15000	270000	15000	270000	15000	NNS	~~NNS~~
Chloronapthalene beta	91-58-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
2-Chlorophenol	95-57-8	2200	150	2200	150	2200	150	NNS	~~NNS~~
4-Chlorophenyl phenyl ether	7005-72-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Chromium (as Cr III)	16065-83-1	c D	c D	c D	c D	c D	c D	c D	~~d D~~
Chromium (as Cr VI)	18540-29-9	16 D	11 D	16 D	11 D	16 D	11 D	34 D	~~23 D~~
Chromium (Total as Cr)	7440-47-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Chrysene	218-01-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Copper (as Cu)	7440-50-8	c D	c D	c D	c D	c D	c D	c D	~~c D~~
Cyanide	57-12-5	22 T	5.2 T	41 T	9.7 T	41 T	9.7 T	84 T	~~19 T~~
Dibenz (ah) anthracene	53-70-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Dibromochloromethane	124-48-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
1,2-Dibromoethane (EDB)	106-93-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Dibutyl phthalate	84-74-2	470	35	470	35	470	35	1100	~~84~~
1,2-Dichlorobenzene	95-50-1	790	300	1200	470	1200	470	5900	~~2300~~
1,3-Dichlorobenzene	541-73-1	2500	970	2500	970	2500	970	NNS	~~NNS~~
1,4-Dichlorobenzene	106-46-7	560	210	2000	780	2000	780	6500	~~2500~~
3,3'-Dichlorobenzidine	91-94-1	NNS	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	~~0.02~~
p,p'-Dichlorodiphenyldichloroethylene (DDE)	72-55-9	1.1	0.001	1.1	0.02	1.1	0.02	1.1	~~0.03~~
p,p'-Dichlorodiphenyltrichloroethane (DDT)	50-29-3	1.1	0.001	1.1	0.001	1.1	0.001	1.1	~~0.006~~
1,1-Dichloroethane	75-34-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
1,2-Dichloroethane	107-06-2	59000	41000	59000	41000	59000	41000	NNS	~~NNS~~
1,1-Dichloroethylene	75-35-4	15000	950	15000	950	15000	950	NNS	~~NNS~~
1,2-cis-Dichloroethylene	156-59-2	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
1,2-trans-Dichloroethylene	156-60-5	68000	3900	68000	3900	68000	3900	NNS	~~NNS~~
Dichloromethane	75-09-2	97000	5500	97000	5500	97000	5500	NNS	~~NNS~~
2,4-Dichlorophenol	120-83-2	1000	88	1000	88	1000	88	NNS	~~NNS~~
2,4-Dichlorophenoxyacetic acid (2,4-D)	94-75-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
1,2-Dichloropropane	78-87-5	26000	9200	26000	9200	26000	9200	NNS	~~NNS~~
1,3-Dichloropropene	542-75-6	3000	1100	3000	1100	3000	1100	NNS	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Dieldrin	60-57-1	2.5	0.002	2.5	0.002	2.5	0.005	4	~~0.9~~
Diethyl phthalate	84-66-2	26000	1600	26000	1600	26000	1600	NNS	~~NNS~~
Di(2-ethylhexyl) phthalate	117-81-7	400	360	400	360	400	360	3100	~~360~~
2,4-Dimethylphenol	105-67-9	1000	310	1000	310	1100	310	150000	~~43000~~
Dimethyl phthalate	131-11-3	17000	1000	17000	1000	17000	1000	NNS	~~NNS~~
4,6-Dinitro-o-cresol	534-52-1	310	24	310	24	310	24	NNS	~~NNS~~
2,4-Dinitrophenol	51-28-5	110	9.2	110	9.2	110	9.2	NNS	~~NNS~~
2,4-Dinitrotoluene	121-14-2	~~15000~~ 14000	~~970~~ 860	~~15000~~ 14000	~~970~~ 860	~~15000~~ 14000	~~970~~ 860	NNS	~~NNS~~
2,6-Dinitrotoluene	606-20-2	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
-Di-n-octyl phthalate	117-84-0	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
1,2-Diphenylhydrazine	122-66-7	130	11	130	11	130	11	NNS	~~NNS~~
Endosulfan sulfate	1031-07-8	0.22	0.06	0.22	0.06	0.22	0.06	3.0	~~1.5~~
Endosulfan (Total)	115-29-7	0.22	0.06	0.22	0.06	0.22	0.06	3.0	~~1.5~~
Endrin	72-20-8	0.18	0.002	0.2	0.08	0.2	0.08	0.7	~~0.3~~
Endrin aldehyde	7421-93-3	0.18	0.002	0.2	0.08	0.2	0.08	0.7	~~0.3~~
Ethylbenzene	100-41-4	23000	1400	23000	1400	23000	1400	NNS	~~NNS~~
Ethyl chloride	75-00-3	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Fluoranthene	206-44-0	2000	1600	2000	1600	2000	1600	NNS	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Fluorene	86-73-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Fluorine	7782-41-4	NNS	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	~~0.1~~
Heptachlor epoxide	1024-57-3	0.52	0.004	0.52	0.004	0.58	0.013	0.9	~~0.1~~
Hexachlorobenzene	118-74-1	6.0	3.7	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Hexachlorobutadiene	87-68-3	45	8.2	45	8.2	45	8.2	NNS	~~NNS~~
Hexachlorocyclohexane alpha	319-84-6	1600	130	1600	130	1600	130	1600	~~130~~
Hexachlorocyclohexane beta	319-85-7	1600	130	1600	130	1600	130	1600	~~130~~
Hexachlorocyclohexane delta	319-86-8	1600	130	1600	130	1600	130	1600	~~130~~
Hexachlorocyclohexane gamma (lindane)	58-89-9	2.0	0.08	3.4	0.28	7.6	0.61	11	~~0.9~~
Hexachlorocyclopentadiene	77-47-4	3.5	0.3	3.5	0.3	3.5	0.3	NNS	~~NNS~~
Hexachloroethane	67-72-1	490	350	490	350	490	350	850	~~610~~
Indeno (1,2,3-cd) pyrene	193-39-5	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Isophorone	78-59-1	59000	43000	59000	43000	59000	43000	NNS	~~NNS~~
Lead (as Pb)	7439-97-1	c D	c D	c D	c D	c D	c D	c D	~~fD~~
Manganese (as Mn)	7439-96-5	NNS	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	~~2.7 D~~
Methoxychlor	72-43-5	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Naphthalene	91-20-3	1100	210	~~3300~~ 3200	~~600~~ 580	~~3300~~ 3200	~~600~~ 580	NNS	~~NNS~~
Nickel (as Ni)	7440-02-0	c D	c D	c D	c D	c D	c D	c D	~~g D~~
Nitrate (as N)	14797-55-8	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Nitrite (as N)	14797-65-0	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Nitrate/Nitrite (as Total N)		NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Nitrobenzene	98-95-3	1300	850	1300	850	1300	850	NNS	~~NNS~~
o-Nitrophenol	88-75-5	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
p-Nitrophenol	100-02-7	4100	3000	4100	3000	4100	3000	NNS	~~NNS~~
N-nitrosodimethylamine	62-75-9	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
N-nitrosodiphenylamine	86-30-6	2900	200	2900	200	2900	200	NNS	~~NNS~~
N-nitrosodi-n-propylamine	621-64-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Pentachlorophenol	87-86-5	c	c	c	c	c	c	c	~~h~~
Phenanthrene	85-01-8	30	6.3	30	6.3	54	6.3	NNS	~~NNS~~
Phenol	108-95-2	5100	730	7000	1000	7000	1000	180000	~~26000~~
Polychlorinatedbiphenyls (PCBs)	1336-36-3	2.0	0.01	2.0	0.02	2.0	0.02	11	~~2.5~~
Pyrene	129-00-0	NNS	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	~~2.0 T~~
Silver (as Ag)	7440-22-4	c D	NNS	c D	NNS	c D	NNS	c D	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria

PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Styrene	100-42-5	~~NNS~~ 5600	~~NNS~~ 370	~~NNS~~ 5600	~~NNS~~ 370	~~NNS~~ 5600	~~NNS~~ 370	NNS	~~NNS~~
Sulfides		100	NNS	100	NNS	100	NNS	100	~~NNS~~
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	~~0.01 NNS~~
1,1,2,2-Tetrachloroethane	79-34-5	4700	3200	4700	3200	4700	3200	NNS	~~NNS~~
Tetrachloroethylene	127-18-4	2600	280	6500	680	6500	680	15000	~~1600~~
Thallium (as Tl)	7440-28-0	700 D	150 D	700 D	150 D	700 D	150 D	NNS	~~NNS~~
Toluene	108-88-3	8700	180	8700	180	8700	180	NNS	~~NNS~~
Toxaphene	8001-35-2	0.73	0.0002	0.73	0.02	0.73	0.02	11	~~1.5~~
1,2,4-Trichlorobenzene	120-82-1	750	130	1700	300	NNS	NNS	NNS	~~NNS~~
1,1,1-Trichloroethane	71-55-6	2600	1600	2600	1600	2600	1600	NNS	~~NNS~~
1,1,2-Trichloroethane	79-00-5	18000	12000	18000	12000	18000	12000	NNS	~~NNS~~
Trichloroethylene	79-01-6	20000	1300	20000	1300	20000	1300	NNS	~~NNS~~
2,4,6-Trichlorophenol	88-06-2	160	25	160	25	160	25	3000	~~460~~
2-(2,4,5-Trichlorophenoxy) proprionic acid (2,4,5-TP)	93-72-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Trihalomethanes, Total		NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Uranium (as Ur)	7440-61-1	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Vinyl chloride	75-01-4	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~

Appendix A: Table 2. Aquatic & Wildlife Designated Use Numeric Water Quality Criteria									
PARAMETER	CAS[1] NUMBER	A&Wc Acute[3] (µg/L)	A&Wc Chronic[4] (µg/L)	A&Ww Acute[3] (µg/L)	A&Ww Chronic[4] (µg/L)	A&Wedw Acute[3] (µg/L)	A&Wedw Chronic[4] (µg/L)	A&We Acute[3] (µg/L)	~~A&We Chronic[4] (µg/L)~~
Xylenes (Total)	1330-20-7	NNS	NNS	NNS	NNS	NNS	NNS	NNS	~~NNS~~
Zinc (as Zn)	7440-66-6	c D	c D	c D	c D	c D	c D	c 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&Wc acute standard: $e^{(1.128 [\ln(Hardness)] + 3.828)}$~~
~~A&Wc chronic standard: $e^{(0.7852 [\ln(Hardness)] + 3.490)}$~~
~~A&Ww acute standard: $e^{(1.128 [\ln(Hardness)] + 4.615)}$~~
~~A&Ww chronic standard: $e^{(0.7852 [\ln(Hardness)] + 3.490)}$~~
~~A&Wedw acute standard: $e^{(1.128 [\ln(Hardness)] + 2.0149)}$~~
~~A&Wedw chronic standard: $e^{(0.7852 [\ln(Hardness)] + 3.490)}$~~
~~A&Wc acute standard: $e^{(1.128 [\ln(Hardness)] + 0.9691)}$~~
~~A&Wc chronic standard: $e^{(0.7852 [\ln(Hardness)] + 3.490)}$~~
~~(See Footnote 5)~~

~~d - Chromium III~~ ~~A&Wc acute standard: $e^{(0.8190 [\ln(Hardness)] + 3.688)}$~~
~~A&Wc chronic standard: $e^{(0.8190 [\ln(Hardness)] + 1.561)}$~~
~~A&Ww acute standard: $e^{(0.8190 [\ln(Hardness)] + 3.688)}$~~
~~A&Ww chronic standard: $e^{(0.8190 [\ln(Hardness)] + 1.561)}$~~
~~A&Wedw acute standard: $e^{(0.8190 [\ln(Hardness)] + 4.9361)}$~~
~~A&Wedw chronic standard: $e^{(0.8190 [\ln(Hardness)] + 1.561)}$~~
~~A&Wc acute standard: $e^{(0.8190 [\ln(Hardness)] + 3.688)}$~~
~~A&Wc chronic standard: $e^{(0.8190 [\ln(Hardness)] + 1.561)}$~~
~~(See Footnote 5)~~

~~e - Copper~~ ~~A&Wc acute standard: $e^{(0.9422 [\ln(Hardness)] + 1.464)}$~~
~~A&Wc chronic standard: $e^{(0.8545 [\ln(Hardness)] + 1.465)}$~~
~~A&Ww acute standard: $e^{(0.9422 [\ln(Hardness)] + 1.464)}$~~
~~A&Ww chronic standard: $e^{(0.8545 [\ln(Hardness)] + 1.465)}$~~
~~A&Wedw acute standard: $e^{(0.9422 [\ln(Hardness)] + 1.464)}$~~
~~A&Wedw chronic standard: $e^{(0.8545 [\ln(Hardness)] + 1.465)}$~~
~~A&Wc acute standard: $e^{(0.9422 [\ln(Hardness)] + 1.1514)}$~~
~~A&Wc chronic standard: $e^{(0.8545 [\ln(Hardness)] + 1.1448)}$~~
~~(See Footnote 5)~~

~~f - Lead~~ ~~A&Wc acute standard: $e^{(1.2730 [\ln(Hardness)] + 1.460)}$~~
~~A&Wc chronic standard: $e^{(1.2730 [\ln(Hardness)] + 4.705)}$~~
~~A&Ww acute standard: $e^{(1.2730 [\ln(Hardness)] + 1.460)}$~~
~~A&Ww chronic standard: $e^{(1.2730 [\ln(Hardness)] + 4.705)}$~~
~~A&Wedw acute standard: $e^{(1.2730 [\ln(Hardness)] + 1.460)}$~~
~~A&Wedw chronic standard: $e^{(1.2730 [\ln(Hardness)] + 4.705)}$~~
~~A&Wc acute standard: $e^{(1.2730 [\ln(Hardness)] + 0.7131)}$~~
~~A&Wc chronic standard: $e^{(1.2730 [\ln(Hardness)] + 3.9518)}$~~
~~(See Footnote 5)~~

~~g - Nickel~~ ~~A&Wc acute standard: $e^{(0.8460 [\ln(Hardness)] + 2.568)}$~~
~~A&Wc chronic standard: $e^{(0.8460 [\ln(Hardness)] + 0.371)}$~~
~~A&Ww acute standard: $e^{(0.8460 [\ln(Hardness)] + 2.568)}$~~
~~A&Ww chronic standard: $e^{(0.8460 [\ln(Hardness)] + 0.371)}$~~
~~A&Wedw acute standard: $e^{(0.8460 [\ln(Hardness)] + 2.568)}$~~
~~A&Wedw chronic standard: $e^{(0.8460 [\ln(Hardness)] + 0.371)}$~~
~~A&Wc acute standard: $e^{(0.8460 [\ln(Hardness)] + 4.4389)}$~~
~~A&Wc chronic standard: $e^{(0.8460 [\ln(Hardness)] + 2.2417)}$~~
~~(See Footnote 5)~~

~~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&Wc acute standard: $e^{(1.005 (pH) - 3.4306)}$~~
~~A&Wc chronic standard: $e^{(1.005 (pH) - 3.9006)}$~~
~~(See Footnote 6)~~

~~i - Silver~~ ~~A&Wc acute standard: $e^{(1.72 [\ln(Hardness)] - 6.52)}$~~
~~A&Ww acute standard: $e^{(1.72 [\ln(Hardness)] - 6.52)}$~~
~~A&Wedw acute standard: $e^{(1.72 [\ln(Hardness)] - 6.52)}$~~
~~A&Wc acute standard: $e^{(1.72 [\ln(Hardness)] - 6.52)}$~~
~~(See Footnote 5)~~

~~j - Zinc~~ ~~A&Wc acute standard: $e^{(0.8473 [\ln(Hardness)] + 0.532)}$~~
~~A&Wc chronic standard: $e^{(0.8473 [\ln(Hardness)] + 0.433)}$~~
~~A&Ww acute standard: $e^{(0.8473 [\ln(Hardness)] + 0.532)}$~~
~~A&Ww chronic standard: $e^{(0.8473 [\ln(Hardness)] + 0.433)}$~~
~~A&Wedw acute standard: $e^{(0.8473 [\ln(Hardness)] + 0.532)}$~~
~~A&Wedw chronic standard: $e^{(0.8473 [\ln(Hardness)] + 0.433)}$~~
~~A&Wc acute standard: $e^{(0.8473 [\ln(Hardness)] + 3.1342)}$~~
~~A&Wc chronic standard: $e^{(0.8473 [\ln(Hardness)] + 3.0484)}$~~
~~(See Footnote 5)~~

c. Criteria for hardness-dependent and pH-dependent parameters are contained in separate tables at the end of Appendix A.

d 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.

Acute Water Quality Standards for dissolved **Cadmium**
Aquatic and Wildlife coldwater, warmwater, 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	0.03	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	0.06	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	0.09	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	0.13	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	0.16	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	0.20	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	0.24	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	0.27	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	0.31	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	0.35	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	0.39	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	0.43	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	0.47	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	0.50	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	0.54	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	0.58	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	0.62	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	0.66	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	0.70	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	0.74	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	0.78	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	0.82	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	0.87	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	0.91	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
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

Formula: EXP(1.128*LN(hardness)-3.6867)*(1.136672-LN(hardness)*0.041838)

Chronic Water Quality Standards for 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	0.073	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	0.12	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	0.17	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	0.21	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	0.24	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	0.28	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	0.31	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	0.34	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	0.38	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	0.41	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	0.44	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	0.46	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	0.49	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	0.52	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	0.55	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	0.58	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	0.60	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	0.63	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	0.65	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	0.68	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	0.70	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	0.73	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	0.75	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	0.78	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

Formula: EXP(0.7852*LN(hardness)-2.715)*(1.101672-LN(hardness)*0.041838)

Acute Water Quality Standards for dissolved **Cadmium**
Aquatic and Wildlife 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	0.43	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	0.92	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	1.43	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	1.95	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	2.49	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	3.04	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	3.60	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	4.16	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	4.73	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	5.30	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	5.88	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	6.46	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	7.05	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	7.64	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	8.24	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	8.84	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	9.44	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	10.04	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	10.65	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	11.26	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	11.87	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	12.49	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	13.11	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	13.73	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

Formula:EXP(1.128*LN(hardness)-0.9691)*(1.136672-LN(hardness)*0.041838)

Chronic Water Quality Standards for dissolved **Chromium III**
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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

Formula: EXP(0.819*LN(hardness)+0.6848)*(0.86)

Acute Water Quality Standards for dissolved **Chromium III**
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	13	41	275	81	479	121	666	161	842	201	1009	241	1171	281	1328	321	1481	361	1630
2	23	42	280	82	484	122	671	162	846	202	1013	242	1175	282	1332	322	1485	362	1634
3	32	43	285	83	489	123	675	163	850	203	1017	243	1179	283	1336	323	1488	363	1638
4	41	44	291	84	494	124	680	164	854	204	1022	244	1183	284	1340	324	1492	364	1641
5	49	45	296	85	499	125	684	165	859	205	1026	245	1187	285	1343	325	1496	365	1645
6	57	46	302	86	504	126	688	166	863	206	1030	246	1191	286	1347	326	1500	366	1649
7	65	47	307	87	508	127	693	167	867	207	1034	247	1195	287	1351	327	1504	367	1653
8	72	48	312	88	513	128	697	168	871	208	1038	248	1199	288	1355	328	1507	368	1656
9	79	49	318	89	518	129	702	169	876	209	1042	249	1203	289	1359	329	1511	369	1660
10	86	50	323	90	523	130	706	170	880	210	1046	250	1207	290	1363	330	1515	370	1664
11	93	51	328	91	527	131	711	171	884	211	1050	251	1211	291	1367	331	1519	371	1667
12	100	52	334	92	532	132	715	172	888	212	1054	252	1215	292	1370	332	1522	372	1671
13	107	53	339	93	537	133	720	173	893	213	1058	253	1219	293	1374	333	1526	373	1675
14	114	54	344	94	542	134	724	174	897	214	1062	254	1223	294	1378	334	1530	374	1678
15	120	55	349	95	546	135	729	175	901	215	1067	255	1226	295	1382	335	1534	375	1682
16	127	56	354	96	551	136	733	176	905	216	1071	256	1230	296	1386	336	1537	376	1686
17	133	57	360	97	556	137	737	177	909	217	1075	257	1234	297	1390	337	1541	377	1689
18	140	58	365	98	560	138	742	178	914	218	1079	258	1238	298	1393	338	1545	378	1693
19	146	59	370	99	565	139	746	179	918	219	1083	259	1242	299	1397	339	1549	379	1697
20	152	60	375	100	570	140	751	180	922	220	1087	260	1246	300	1401	340	1552	380	1700
21	159	61	380	101	574	141	755	181	926	221	1091	261	1250	301	1405	341	1556	381	1704
22	165	62	385	102	579	142	759	182	930	222	1095	262	1254	302	1409	342	1560	382	1708
23	171	63	390	103	584	143	764	183	935	223	1099	263	1258	303	1413	343	1564	383	1711
24	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

Formula: EXP(0.819*LN(hardness)+3.7256)*(0.316)

Acute Water Quality Standards for dissolved **Chromium III**
Aquatic and Wildlife 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	44	41	921	81	1609	121	2235	161	2824	201	3386	241	3929	281	4456	321	4969	361	5470
2	78	42	939	82	1625	122	2250	162	2838	202	3400	242	3942	282	4469	322	4981	362	5483
3	108	43	958	83	1641	123	2265	163	2852	203	3414	243	3956	283	4481	323	4994	363	5495
4	137	44	976	84	1657	124	2280	164	2867	204	3428	244	3969	284	4494	324	5007	364	5507
5	164	45	994	85	1673	125	2295	165	2881	205	3441	245	3982	285	4507	325	5019	365	5520
6	191	46	1012	86	1690	126	2310	166	2895	206	3455	246	3996	286	4520	326	5032	366	5532
7	217	47	1030	87	1706	127	2325	167	2909	207	3469	247	4009	287	4533	327	5045	367	5545
8	242	48	1048	88	1722	128	2340	168	2924	208	3483	248	4022	288	4546	328	5057	368	5557
9	266	49	1066	89	1738	129	2355	169	2938	209	3496	249	4035	289	4559	329	5070	369	5569
10	290	50	1084	90	1754	130	2370	170	2952	210	3510	250	4049	290	4572	330	5082	370	5582
11	314	51	1101	91	1770	131	2385	171	2966	211	3524	251	4062	291	4585	331	5095	371	5594
12	337	52	1119	92	1785	132	2400	172	2981	212	3537	252	4075	292	4598	332	5108	372	5606
13	360	53	1137	93	1801	133	2415	173	2995	213	3551	253	4088	293	4611	333	5120	373	5619
14	382	54	1154	94	1817	134	2429	174	3009	214	3565	254	4102	294	4624	334	5133	374	5631
15	404	55	1172	95	1833	135	2444	175	3023	215	3578	255	4115	295	4637	335	5145	375	5643
16	426	56	1189	96	1849	136	2459	176	3037	216	3592	256	4128	296	4649	336	5158	376	5656
17	448	57	1206	97	1865	137	2474	177	3051	217	3606	257	4141	297	4662	337	5171	377	5668
18	469	58	1224	98	1880	138	2489	178	3066	218	3619	258	4155	298	4675	338	5183	378	5680
19	491	59	1241	99	1896	139	2503	179	3080	219	3633	259	4168	299	4688	339	5196	379	5693
20	512	60	1258	100	1912	140	2518	180	3094	220	3646	260	4181	300	4701	340	5208	380	5705
21	532	61	1275	101	1927	141	2533	181	3108	221	3660	261	4194	301	4714	341	5221	381	5717
22	553	62	1292	102	1943	142	2548	182	3122	222	3673	262	4207	302	4726	342	5233	382	5730
23	574	63	1309	103	1958	143	2562	183	3136	223	3687	263	4220	303	4739	343	5246	383	5742
24	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

Formula: EXP(0.819*LN(hardness)+4.9361)*(0.316)

Acute Water Quality Standards for dissolved **Copper**
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	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	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	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	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	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	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	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	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	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	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	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
12	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	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	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	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	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	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	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	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	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	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	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	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	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

Formula: EXP(0.9422*LN(hardness)-1.7)*(0.96)

Chronic Water Quality Standards for dissolved **Copper**
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	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	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	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	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	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	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	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	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	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	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	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
12	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	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	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	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	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	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	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	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	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	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	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	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	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

Formula: EXP(0.8545*LN(hardness)-1.702)*(0.96)

Acute Water Quality Standards for dissolved **Copper**
Aquatic and Wildlife 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	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	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	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	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	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	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	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	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	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	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	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
12	3.16	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	3.40	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	3.65	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	3.89	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	4.14	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	4.38	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	4.62	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	4.86	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	5.11	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	5.35	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	5.59	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	5.82	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	6.06	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

Formula: EXP(0.9422*(LN(hardness))-1.1514)*(0.96)

Acute Water Quality Standards for dissolved **Lead**
Aquatic and Wildlife coldwater, warmwater and edw

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	0.34	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	0.76	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	1.22	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	1.71	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	2.21	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	2.73	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	3.26	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	3.80	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	4.35	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	4.91	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	5.47	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
12	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	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	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	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	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	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	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	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	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	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	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	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	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

Formula: EXP(1.273*LN(hardness)-1.46)*(1.46203-(LN(hardness))*(0.145712))

Acute Water Quality Standards for dissolved **Lead**
Aquatic and Wildlife 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	0.72	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	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	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	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	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	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	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	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	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	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	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
12	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	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	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	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	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	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	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	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	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	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	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	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	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

Formula: EXP(1.273*(LN(hardness))-0.7131)*(1.46203-(LN(hardness))*(0.145712))

Chronic Water Quality Standards for dissolved **Lead**
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	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	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	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	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	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	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	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	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	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	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	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
12	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	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	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	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	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	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	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	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	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	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	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	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	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

Formula: EXP(1.273*LN(hardness)-4.705)*(1.46203-(LN(hardness))*(0.145712))

Acute Water Quality Standards for dissolved **Nickel**
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	10	41	220	81	392	121	550	161	701	201	845	241	985	281	1122	321	1256	361	1387
2	17	42	225	82	396	122	554	162	704	202	849	242	989	282	1126	322	1259	362	1390
3	24	43	229	83	400	123	558	163	708	203	852	243	992	283	1129	323	1263	363	1394
4	31	44	234	84	404	124	562	164	712	204	856	244	996	284	1132	324	1266	364	1397
5	37	45	238	85	408	125	566	165	715	205	859	245	999	285	1136	325	1269	365	1400
6	43	46	243	86	412	126	569	166	719	206	863	246	1003	286	1139	326	1272	366	1403
7	49	47	247	87	416	127	573	167	723	207	867	247	1006	287	1142	327	1276	367	1407
8	55	48	252	88	420	128	577	168	726	208	870	248	1010	288	1146	328	1279	368	1410
9	61	49	256	89	424	129	581	169	730	209	874	249	1013	289	1149	329	1282	369	1413
10	67	50	260	90	428	130	585	170	734	210	877	250	1017	290	1153	330	1286	370	1416
11	72	51	265	91	432	131	588	171	737	211	881	251	1020	291	1156	331	1289	371	1420
12	78	52	269	92	436	132	592	172	741	212	884	252	1023	292	1159	332	1292	372	1423
13	83	53	274	93	440	133	596	173	744	213	888	253	1027	293	1163	333	1296	373	1426
14	89	54	278	94	444	134	600	174	748	214	891	254	1030	294	1166	334	1299	374	1429
15	94	55	282	95	448	135	604	175	752	215	895	255	1034	295	1169	335	1302	375	1433
16	99	56	287	96	452	136	607	176	755	216	898	256	1037	296	1173	336	1305	376	1436
17	105	57	291	97	456	137	611	177	759	217	902	257	1041	297	1176	337	1309	377	1439
18	110	58	295	98	460	138	615	178	763	218	905	258	1044	298	1179	338	1312	378	1442
19	115	59	300	99	464	139	619	179	766	219	909	259	1047	299	1183	339	1315	379	1445
20	120	60	304	100	468	140	622	180	770	220	912	260	1051	300	1186	340	1319	380	1449
21	125	61	308	101	472	141	626	181	774	221	916	261	1054	301	1189	341	1322	381	1452
22	130	62	312	102	476	142	630	182	777	222	919	262	1058	302	1193	342	1325	382	1455
23	135	63	317	103	480	143	634	183	781	223	923	263	1061	303	1196	343	1328	383	1458
24	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

Formula: EXP(0.846*LN(hardness)+2.255)*(0.998)

Chronic Water Quality Standards for dissolved **Nickel**
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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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
24	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

Formula: EXP(0.846*LN(hardness)+0.0584)*(0.997)

Acute Water Quality Standards for dissolved **Nickel**
Aquatic and Wildlife 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	85	41	1956	81	3479	121	4886	161	6221	201	7506	241	8752	281	9966	321	11154	361	12319
2	152	42	1996	82	3516	122	4920	162	6254	202	7538	242	8783	282	9996	322	11183	362	12348
3	214	43	2036	83	3552	123	4954	163	6287	203	7569	243	8813	283	10026	323	11213	363	12377
4	273	44	2076	84	3588	124	4988	164	6319	204	7601	244	8844	284	10056	324	11242	364	12405
5	330	45	2116	85	3624	125	5022	165	6352	205	7632	245	8875	285	10086	325	11271	365	12434
6	385	46	2156	86	3660	126	5056	166	6385	206	7664	246	8905	286	10116	326	11301	366	12463
7	438	47	2195	87	3696	127	5090	167	6417	207	7695	247	8936	287	10146	327	11330	367	12492
8	491	48	2235	88	3732	128	5124	168	6450	208	7727	248	8967	288	10176	328	11359	368	12521
9	542	49	2274	89	3768	129	5158	169	6482	209	7758	249	8997	289	10206	329	11389	369	12549
10	593	50	2313	90	3804	130	5192	170	6514	210	7790	250	9028	290	10235	330	11418	370	12578
11	643	51	2352	91	3839	131	5226	171	6547	211	7821	251	9058	291	10265	331	11447	371	12607
12	692	52	2391	92	3875	132	5259	172	6579	212	7852	252	9089	292	10295	332	11476	372	12636
13	740	53	2430	93	3911	133	5293	173	6612	213	7884	253	9119	293	10325	333	11506	373	12664
14	788	54	2469	94	3946	134	5327	174	6644	214	7915	254	9150	294	10355	334	11535	374	12693
15	835	55	2508	95	3982	135	5360	175	6676	215	7946	255	9180	295	10385	335	11564	375	12722
16	882	56	2546	96	4017	136	5394	176	6708	216	7978	256	9211	296	10414	336	11593	376	12751
17	929	57	2585	97	4053	137	5427	177	6741	217	8009	257	9241	297	10444	337	11622	377	12779
18	975	58	2623	98	4088	138	5461	178	6773	218	8040	258	9272	298	10474	338	11652	378	12808
19	1020	59	2661	99	4123	139	5494	179	6805	219	8071	259	9302	299	10504	339	11681	379	12837
20	1066	60	2699	100	4158	140	5528	180	6837	220	8102	260	9332	300	10533	340	11710	380	12865
21	1110	61	2737	101	4193	141	5561	181	6869	221	8133	261	9363	301	10563	341	11739	381	12894
22	1155	62	2775	102	4229	142	5594	182	6901	222	8165	262	9393	302	10593	342	11768	382	12922
23	1199	63	2813	103	4264	143	5628	183	6934	223	8196	263	9423	303	10622	343	11797	383	12951
24	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

Formula: EXP(0.846*LN(hardness)+4.4389)*(0.998)

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	0.001	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	0.004	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	0.008	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	0.01	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	0.02	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	0.03	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	0.04	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	0.04	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	0.05	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	0.07	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	0.08	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	0.09	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	0.10	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	0.12	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	0.13	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	0.15	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	0.16	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	0.18	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	0.20	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	0.22	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	0.24	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	0.26	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	0.28	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	0.30	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

Formula: EXP(1.72*LN(hardness)-6.52)*(.85)

Acute Water Quality Standards for dissolved **Zinc**
Aquatic and Wildlife 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	22	41	522	81	930	121	1307	161	1665	201	2009	241	2343	281	2669	321	2987	361	3300
2	40	42	533	82	940	122	1316	162	1674	202	2018	242	2351	282	2677	322	2995	362	3307
3	57	43	544	83	950	123	1325	163	1682	203	2026	243	2360	283	2685	323	3003	363	3315
4	73	44	555	84	959	124	1334	164	1691	204	2034	244	2368	284	2693	324	3011	364	3323
5	88	45	565	85	969	125	1343	165	1700	205	2043	245	2376	285	2701	325	3019	365	3331
6	103	46	576	86	979	126	1353	166	1708	206	2051	246	2384	286	2709	326	3027	366	3338
7	117	47	587	87	988	127	1362	167	1717	207	2060	247	2392	287	2717	327	3034	367	3346
8	131	48	597	88	998	128	1371	168	1726	208	2068	248	2401	288	2725	328	3042	368	3354
9	145	49	608	89	1007	129	1380	169	1735	209	2077	249	2409	289	2733	329	3050	369	3362
10	158	50	618	90	1017	130	1389	170	1743	210	2085	250	2417	290	2741	330	3058	370	3369
11	171	51	629	91	1027	131	1398	171	1752	211	2093	251	2425	291	2749	331	3066	371	3377
12	184	52	639	92	1036	132	1407	172	1761	212	2102	252	2433	292	2757	332	3074	372	3385
13	197	53	649	93	1046	133	1416	173	1769	213	2110	253	2442	293	2765	333	3082	373	3392
14	210	54	660	94	1055	134	1425	174	1778	214	2119	254	2450	294	2773	334	3089	374	3400
15	223	55	670	95	1065	135	1434	175	1787	215	2127	255	2458	295	2781	335	3097	375	3408
16	235	56	680	96	1074	136	1443	176	1795	216	2135	256	2466	296	2789	336	3105	376	3416
17	248	57	691	97	1084	137	1452	177	1804	217	2144	257	2474	297	2797	337	3113	377	3423
18	260	58	701	98	1093	138	1461	178	1813	218	2152	258	2482	298	2805	338	3121	378	3431
19	272	59	711	99	1103	139	1470	179	1821	219	2161	259	2491	299	2813	339	3129	379	3439
20	284	60	721	100	1112	140	1479	180	1830	220	2169	260	2499	300	2821	340	3136	380	3446
21	296	61	732	101	1121	141	1488	181	1838	221	2177	261	2507	301	2829	341	3144	381	3454
22	308	62	742	102	1131	142	1497	182	1847	222	2186	262	2515	302	2837	342	3152	382	3462
23	320	63	752	103	1140	143	1506	183	1856	223	2194	263	2523	303	2845	343	3160	383	3469
24	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

Formula: EXP(0.8473 *LN(hardness)+3.1342)*(0.978)

Acute Water Quality Standards for dissolved **Zinc**
Aquatic and Wildlife coldwater, warmwater and edw

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	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	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	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	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	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	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	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
8	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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

Formula: EXP(0.8473*LN(hardness)+0.884)*(0.978)

Chronic Water Quality Standards for dissolved **Zinc**
Aquatic and Wildlife coldwater, warmwater, and edw

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	2.39	41	55.50	81	98.82	121	138.85	161	176.86	201	213.45	241	248.93	281	283.52	321	317.36	361	350.57
2	4.29	42	56.65	82	99.85	122	139.82	162	177.79	202	214.35	242	249.80	282	284.37	322	318.20	362	351.39
3	6.05	43	57.79	83	100.89	123	140.79	163	178.72	203	215.25	243	250.68	283	285.23	323	319.04	363	352.21
4	7.73	44	58.92	84	101.91	124	141.76	164	179.65	204	216.14	244	251.55	284	286.08	324	319.87	364	353.03
5	9.33	45	60.06	85	102.94	125	142.73	165	180.58	205	217.04	245	252.43	285	286.93	325	320.71	365	353.85
6	10.89	46	61.19	86	103.97	126	143.69	166	181.51	206	217.94	246	253.30	286	287.79	326	321.55	366	354.68
7	12.41	47	62.31	87	104.99	127	144.66	167	182.43	207	218.83	247	254.17	287	288.64	327	322.38	367	355.50
8	13.90	48	63.43	88	106.01	128	145.62	168	183.36	208	219.73	248	255.04	288	289.49	328	323.22	368	356.32
9	15.36	49	64.55	89	107.03	129	146.59	169	184.28	209	220.62	249	255.91	289	290.34	329	324.05	369	357.14
10	16.79	50	65.66	90	108.05	130	147.55	170	185.20	210	221.52	250	256.78	290	291.19	330	324.89	370	357.96
11	18.20	51	66.78	91	109.07	131	148.51	171	186.13	211	222.41	251	257.65	291	292.04	331	325.72	371	358.78
12	19.60	52	67.88	92	110.08	132	149.47	172	187.05	212	223.30	252	258.52	292	292.90	332	326.55	372	359.60
13	20.97	53	68.99	93	111.09	133	150.43	173	187.97	213	224.20	253	259.39	293	293.74	333	327.39	373	360.41
14	22.33	54	70.09	94	112.10	134	151.39	174	188.89	214	225.09	254	260.26	294	294.59	334	328.22	374	361.23
15	23.68	55	71.19	95	113.11	135	152.34	175	189.81	215	225.98	255	261.13	295	295.44	335	329.05	375	362.05
16	25.01	56	72.28	96	114.12	136	153.30	176	190.73	216	226.87	256	262.00	296	296.29	336	329.88	376	362.87
17	26.32	57	73.37	97	115.13	137	154.25	177	191.65	217	227.76	257	262.86	297	297.14	337	330.72	377	363.69
18	27.63	58	74.46	98	116.13	138	155.21	178	192.56	218	228.65	258	263.73	298	297.99	338	331.55	378	364.50
19	28.93	59	75.55	99	117.14	139	156.16	179	193.48	219	229.54	259	264.60	299	298.83	339	332.38	379	365.32
20	30.21	60	76.63	100	118.14	140	157.11	180	194.40	220	230.42	260	265.46	300	299.68	340	333.21	380	366.14
21	31.49	61	77.71	101	119.14	141	158.06	181	195.31	221	231.31	261	266.33	301	300.53	341	334.04	381	366.95
22	32.75	62	78.79	102	120.14	142	159.01	182	196.22	222	232.20	262	267.19	302	301.37	342	334.87	382	367.77
23	34.01	63	79.87	103	121.14	143	159.96	183	197.14	223	233.08	263	268.05	303	302.22	343	335.70	383	368.58
24	35.26	64	80.94	104	122.13	144	160.91	184	198.05	224	233.97	264	268.92	304	303.06	344	336.53	384	369.40
25	36.50	65	82.01	105	123.13	145	161.85	185	198.96	225	234.85	265	269.78	305	303.91	345	337.36	385	370.22
26	37.73	66	83.08	106	124.12	146	162.80	186	199.87	226	235.74	266	270.64	306	304.75	346	338.18	386	371.03
27	38.96	67	84.14	107	125.11	147	163.74	187	200.78	227	236.62	267	271.50	307	305.59	347	339.01	387	371.84
28	40.18	68	85.21	108	126.10	148	164.69	188	201.69	228	237.50	268	272.37	308	306.44	348	339.84	388	372.66
29	41.39	69	86.27	109	127.09	149	165.63	189	202.60	229	238.39	269	273.23	309	307.28	349	340.67	389	373.47
30	42.59	70	87.33	110	128.08	150	166.57	190	203.51	230	239.27	270	274.09	310	308.12	350	341.49	390	374.28
31	43.79	71	88.38	111	129.06	151	167.51	191	204.42	231	240.15	271	274.95	311	308.96	351	342.32	391	375.10
32	44.99	72	89.44	112	130.05	152	168.45	192	205.32	232	241.03	272	275.81	312	309.81	352	343.15	392	375.91
33	46.18	73	90.49	113	131.03	153	169.39	193	206.23	233	241.91	273	276.66	313	310.65	353	343.97	393	376.72
34	47.36	74	91.54	114	132.01	154	170.33	194	207.13	234	242.79	274	277.52	314	311.49	354	344.80	394	377.53
35	48.54	75	92.58	115	132.99	155	171.26	195	208.04	235	243.67	275	278.38	315	312.33	355	345.62	395	378.35
36	49.71	76	93.63	116	133.97	156	172.20	196	208.94	236	244.55	276	279.24	316	313.17	356	346.45	396	379.16
37	50.88	77	94.67	117	134.95	157	173.13	197	209.84	237	245.42	277	280.10	317	314.01	357	347.27	397	379.97
38	52.04	78	95.71	118	135.92	158	174.07	198	210.75	238	246.30	278	280.95	318	314.85	358	348.10	398	380.78
39	53.20	79	96.75	119	136.90	159	175.00	199	211.65	239	247.18	279	281.81	319	315.69	359	348.92	399	381.59
40	54.35	80	97.79	120	137.87	160	175.93	200	212.55	240	248.05	280	282.66	320	316.52	360	349.74	400	382.40

Formula: EXP(0.8473*LN(hardness)+0.884)*(0.986)

Water Quality Standards for **Pentachlorophenol**

Acute Aquatic and Wildlife coldwater, warmwater and edw Formula: EXP(1.005*(pH)-4.83)

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

Chronic Aquatic and Wildlife coldwater, warmwater and edw Formula: EXP(1.005*(pH)-5.29)

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

Acute Aquatic and Wildlife ephemeral Formula: EXP(1.005*(pH)-3.4306)

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

Acute Criteria for Total Ammonia (in mg N / L)		
pH	A&Wc	A&Ww
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

Chronic Criteria for Total Ammonia in mg N / L for A&Wc, and A&Ww Designated Uses										
pH	Temperature, °C									
	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
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
AgI = Agricultural Irrigation
AgL = Agricultural Livestock Watering

Other

U = Unique Water
EDW = Effluent Dependent Water
WWTP = Wastewater Treatment Plant
Km = kilometers

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
BW	Alamo Lake	34°14'45"/113°35'00"		A&Ww			FBC			FC		Ag L
BW	Big Sandy River	~~Aquarius & Hualapai Mountains~~ Tributary to the Santa Maria River at 34°18'36"/113°31'34"		A&Ww			FBC			FC		Ag L
BW	Bill Williams River	~~Buckskin & Rawhide Mountains~~ Tributary to the Colorado River at 34°18'04"/114°08'10"		A&Ww			FBC			FC		Ag L
BW	Blue Tank	34°40'14"/112°58'16"		A&Ww			FBC			FC		Ag L
BW	Boulder Creek	~~Tributary to Burro Creek~~ Headwaters to confluence with unnamed tributary at 34°41'14"/113°03'34"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
BW	Boulder Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC	AgI	Ag L
BW	Burro Creek (Unique Water)	Headwaters to confluence with Boulder Creek at 34°36'47"/113°18'00"		A&Ww			FBC			FC		Ag L
BW	Burro Creek	Below confluence with Boulder Creek		A&Ww			FBC			FC		Ag L
BW	Conger Creek	~~Tributary to Burro Creek~~ Headwaters to confluence with unnamed tributary at 34°45'13"/113°05'45"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
BW	Conger Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
BW	Coors Lake	34°36'20"/113°11'25"		A&Ww			FBC			FC		
BW	Copper Basin Wash	Headwaters to confluence with unnamed tributary at 34°28'11"/112°35'31"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
BW	Copper Basin Wash	Below confluence with unnamed tributary			A&We			PBC				Ag L
BW	Cottonwood Canyon	~~Tributary to the Santa Maria River~~ Headwaters to Bear Trap Spring at 34°45'10"/112°52'32"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
BW	Cottonwood Canyon	Below Bear Trap Spring		A&Ww			FBC			FC		Ag L
BW	Date Creek	Tributary to the Santa Maria River at 34°18'11"/113°29'53"		A&Ww			FBC			FC		Ag L
BW	Francis Creek (Unique Water)	Tributary to Burro Creek at 34°44'28"/113°14'35"		A&Ww			FBC		DWS	FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
BW	Kirkland Creek	Tributary to Santa Maria River at 34°32'02"/112°59'38"		A&Ww			FBC			FC	AgI	Ag L
BW	Knight Creek	~~East of Hualapai Mountains~~ Tributary to the Big Sandy River at 34°55'16"/113°37'30"		A&Ww			FBC			FC		Ag L
BW	Peoples Canyon (Unique Water)	Tributary to the Santa Maria River at 34°20'35"/113°15'11"		A&Ww			FBC			FC		Ag L
BW	Santa Maria River	Tributary to ~~Alamo Lake~~ the Bill Williams River at 34°18'36"/113°31'34"		A&Ww			FBC			FC	AgI	Ag L
BW	Trout Creek	~~Tributary to Big Sandy River~~ Headwaters to confluence with unnamed tributary at 35°06'47"/113°13'01"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
BW	Trout Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
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	Agate Canyon Creek	Grand Canyon, tributary to the Colorado River at 36°08'38"/112°16'48"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Beaver Dam Wash	Tributary to the Virgin River at 36°53'42"/113°55'09"		A&Ww			FBC			FC		Ag L
CM	Big Springs Tank	36°36'10"/112°20'58"	A&Wc				FBC			FC		Ag L
CM	Boucher Creek	Grand Canyon, tributary to the Colorado River at 36°06'54"/112°13'44"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Bright Angel Creek	Headwaters to confluence with Roaring Springs Canyon at 36°11'34"/112°01'54"	A&Wc				FBC			FC		
CM	Bright Angel Creek	Below confluence with Roaring Spgs Canyon		A&Ww			FBC			FC		
CM	Bright Angel Wash (EDW)	South rim WWTP outfall to Coconino Wash				A&Wedw		PBC				Ag L
CM	~~Bull Rush~~ Bulrush Canyon Wash	Tributary to Kanab Creek at 36°46'55"/112°37'08"			A&We			PBC				
CM	Cataract Creek	Headwaters to Santa Fe Reservoir	A&Wc				FBC		DWS	FC	AgI	Ag L
CM	Cataract Creek	Santa Fe Reservoir to Williams WWTP outfall	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
CM	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&Wc	~~A&Ww~~			FBC			FC		Ag L
CM	Cataract Creek	Red Lake Wash to Havasupai Reservation			A&We			PBC				Ag L
CM	Cataract Lake	35°15'05"/112°12'58"	A&Wc				FBC		DWS	FC		Ag L
CM	Chuar Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°11'36"/111°52'17"	A&Wc				FBC			FC		
CM	Chuar Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Cibola Lake	33°14'20"/114°40'16"		A&Ww			FBC			FC		
CM	City Reservoir	35°13'57"/112°11'23"	A&Wc				FBC		DWS	FC		
CM	Clear Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°09'12"/111°58'25"	A&Wc				FBC			FC		
CM	Clear Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Clear Lake	33°01'57"/114°31'26"		A&Ww			FBC			FC		
CM	Colorado River	Lake Powell to Topock	A&Wc				FBC		DWS	FC	AgI	Ag L
CM	Colorado River	Topock to ~~Imperial~~ Morelos Dam		A&Ww			FBC		DWS	FC	AgI	Ag L
CM	Colorado River	~~Imperial~~ Morelos Dam to Mexico		A&Ww			FBC			FC	AgI	Ag L
CM	Cottonwood Creek	Headwaters to confluence with unnamed tributary at 35°20'45.5"/113°35'31"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
CM	Cottonwood Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
CM	Crystal Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°13'42"/112°11'48"	A&Wc				FBC			FC		
CM	Crystal Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Deer Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°26'16"/112°28'15.5"	A&Wc				FBC			FC		
CM	Deer Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
CM	Detrital Wash	Tributary to Lake Mead at 36°02'20"/114°27'47"			A&We			PBC				
CM	Dogtown Reservoir	35°12'40"/112°07'46"	A&Wc				FBC		DWS	FC	AgI	Ag L
CM	Dragon Creek	Grand Canyon; headwaters to confluence with Milk Creek at 36°12'25"/112°09'33"	A&Wc	~~A&Ww~~			FBC			FC		
CM	Dragon Creek	Below confluence with Milk Creek		A&Ww			FBC			FC		
CM	Garden Creek	Grand Canyon, tributary to Pipe Creek at 36°05'35"/112°06'40"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Gonzalez Lake	35°15'26"/112°12'07"	A&Wc				FBC			FC	AgI	Ag L
CM	Grand Wash	Tributary to Lake Mead at 36°15'29"/114°00'18"			A&We			PBC				
CM	Grapevine Creek	Grand Canyon; tributary to the Colorado River at 36°03'29"/112°00'00"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Grapevine Wash	Tributary to Lake Mead at 36°06'29"/114°00'07"			A&We			PBC				
CM	Hakatai Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°14'42"/112°22'59"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Hance Creek	Grand Canyon; tributary to the Colorado River at 36°02'46"/111°57'07"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Havasu Canyon Creek	Below the Havasupai Indian Reservation; tributary to the Colorado River at 36°18'29"/112°45'43"		A&Ww			FBC			FC		
CM	Hermit Creek	Grand Canyon; headwaters to Hermit Pack Trail crossing at 36°03'23"/112°13'25"	A&Wc				FBC			FC		
CM	Hermit Creek	Below Hermit Pack Trail crossing		A&Ww			FBC			FC		
CM	Holy Moses Wash (EDW)	Kingman WWTP outfall to 3 km downstream				A&Wedw		PBC				
CM	Horn Creek	Grand Canyon; tributary to the Colorado River at 36°05'56"/112°07'59"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Hualapai Wash	Tributary to ~~the Colorado River~~ 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		Ag L
CM	Imperial Reservoir	32°53'04"/114°27'40"		A&Ww			FBC		DWS	FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
CM	Island Lake	33°01'52"/114°35'07"		A&Ww			FBC			FC		
CM	Jacob Lake	36°42'26"/112°13'48"		A&Ww			FBC			FC		
CM	Kaibab Lake	35°17'04"/112°09'17"	A&Wc				FBC		DWS	FC	AgI	Ag L
CM	Kanab Creek	Kanab Plateau; ~~northwestern Arizona~~; tributary to the Colorado River at 36°23'31"/112°37'44"		A&Ww			FBC		DWS	FC		Ag L
CM	Kwagunt Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°13'29"/111°55'24"	A&Wc				FBC			FC		
CM	Kwagunt Creek	Below conf with unnamed tributary		A&Ww			FBC			FC		
CM	Laguna Reservoir	32°51'15"/114°28'38"		A&Ww			FBC		DWS	FC	AgI	Ag L
CM	Lake Havasu	34°18'15"/114°08'15"		A&Ww			FBC		DWS	FC	AgI	Ag L
CM	Lake Mead	36°01'00"/114°44'15"	A&Wc				FBC		DWS	FC	AgI	Ag L
CM	Lake Mohave	35°11'45"/114°34'00"	A&Wc				FBC		DWS	FC	AgI	Ag L
CM	Lake Powell	36°57'00"/111°29'15"	A&Wc				FBC		DWS	FC	AgI	Ag L
CM	Lonetree Canyon Creek	Grand Canyon; tributary 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	Ag L
CM	Matkatamiba Creek	~~Grand Canyon, South Rim~~ Below Havasupai Indian Reservation; tributary to the Colorado River at 36°20'38"/112°40'19"	~~A&Wc~~	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	Monument Creek	Grand Canyon; tributary to the Colorado River at 36°05'53"/112°10'55"		A&Ww			FBC			FC		
CM	Nankoweap Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°15'30"/111°57'23"	A&Wc				FBC			FC		
CM	Nankoweap Creek	Below confluence with unamed tributary		A&Ww			FBC			FC		

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
CM	National Canyon Creek	Grand Canyon; those reaches not located on the Hualapai Indian Reservation	~~A&Wc~~	A&Ww			FBC			FC		
CM	North Canyon Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°33'57"/111°55'39"	A&Wc				FBC			FC		
CM	North Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Nortons Lake	33°02'35"/114°37'58"		A&Ww			FBC			FC		
CM	Olo Creek	Grand Canyon; tributary to the Colorado River at 36°22'16"/112°38'56"		A&Ww			FBC			FC		
CM	Parashant Canyon	Headwaters to confluence with unnamed tributary at 36°21'26"/113°28'10"	A&Wc				FBC			FC		
CM	Parashant Canyon	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Paria River	Paria Plateau; ~~Northern AZ Border~~ tributary to the Colorado River at 36°51'29"/111°36'04"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Phantom Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°10'04"/112°07'50"	A&Wc				FBC			FC		
CM	Phantom Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Pipe Creek	Grand Canyon; tributary to the Colorado River at 36°05'56"/112°06'36"	~~A&Wc~~	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	Red Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°02'42"/111°55'08"		A&Ww			FBC			FC		
CM	Red Lake	35°40'00"/114°03'45"		A&Ww			FBC			FC		Ag L
CM	Redondo Lake	32°44'32"/114°29'02"		A&Ww			FBC			FC		
CM	Roaring Springs	Headwaters of Roaring Springs Creek	A&Wc				FBC		DWS	FC		
CM	Roaring Springs Canyon	Grand Canyon; tributary to Bright Angel Creek at 36°11'35"/112°01'55"	A&Wc				FBC			FC		
CM	Rock Canyon	Tributary to Truxton Wash at 35°26'56"/113°36'29"			A&We			PBC				
CM	Royal Arch Creek	Grand Canyon; tributary to the Colorado River at 36°11'53"/112°26'56"	~~A&Wc~~	A&Ww			FBC			FC		

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
CM	Ruby Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°11'24"/112°18'54"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Russell Tank	34°52'22"/111°52'44"	A&Wc				FBC			FC		Ag L
CM	Sacramento Wash	Tributary to Topock Marsh at 34°43'48"/114°29'13"			A&We			PBC				
CM	Saddle Canyon Creek	Marble Canyon; headwaters to confluence with unnamed tributary at 36°21'35.5"/112°22'46"	A&Wc				FBC			FC		
CM	Saddle Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Santa Fe Reservoir	35°14'26"/112°11'04"	A&Wc				FBC		DWS	FC		
CM	Sapphire Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°08'49"/112°17'28"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Sawmill Canyon	Headwaters to abandoned gaging station at 35°09'46.5"/113°57'51"		A&Ww			FBC			FC		Ag L
CM	Sawmill Canyon	Below abandoned gaging station			A&We			PBC				Ag L
CM	Serpentine Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°12'22"/112°19'37"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Shinumo Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°18'21"/112°18'03"	A&Wc				FBC			FC		
CM	Shinumo Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
CM	Short Creek	Tributary to the Virgin River at 36°58'23"/113°16'08"			A&We			PBC				
CM	Slate Creek	Grand Canyon; tributary to the Colorado River at 36°08'06"/112°14'42"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Spring Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°01'08"/113°21'00"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Stone Creek	Grand Canyon; tributary to the Colorado River at 36°20'49"/112°27'14"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Tapeats Creek	Grand Canyon; tributary to the Colorado River at 36°22'16"/112°28'05"	A&Wc				FBC			FC		
CM	Thunder River	Tributary to Tapeats Creek at 36°23'31"/112°27'00"	A&Wc				FBC			FC		~~Ag L~~
CM	Topock Marsh	34°47'30"/114°31'00"		A&Ww			FBC		DWS	FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
CM	Trail Canyon Creek	Grand Canyon; tributary to the Colorado River at 35°50'20"/113°19'37"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Transept Canyon (EDW)	North Rim WWTP outfall to 1 km downstream				A&Wedw		PBC				
CM	Travertine ~~Falls~~ Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°06'11"/112°13'05"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Truxton Wash	Tributary to Red Lake Playa at 35°37'23"/114°03'00"			A&We			PBC				
CM	Turquoise Canyon Creek	Grand Canyon; tributary to the Colorado River at 36°09'14"/112°18'07"	~~A&Wc~~	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	Unkar Creek	Below conf with unnamed tributary		A&Ww			FBC			FC		
CM	Vasey's Paradise	Grand Canyon; 36°26'49"/111°50'46"	A&Wc				FBC			FC		
CM	Virgin River	Tributary to the Colorado River at 36°47'28"/114°06'11"		A&Ww			FBC			FC	AgI	Ag L
CM	Vishnu Creek	Grand Canyon; tributary to the Colorado River at 36°03'18"/111°59'42"	~~A&Wc~~	A&Ww			FBC			FC		
CM	Warm Springs Creek	Grand Canyon; tributary to the Colorado River at 36°11'49"/113°04'55"		A&Ww			FBC			FC		
CM	Wellton Canal	Yuma Canal System							DWS		AgI	Ag L
CM	Wellton Ponds	32°42'15"/114°06'15"		A&Ww			FBC			FC		
CM	West Cataract Creek	Tributary to Cataract ~~Lake~~ Creek at 35°15'40"/112°11'38"	A&Wc				FBC			FC		Ag L
CM	White Creek	Grand Canyon; headwaters to confluence with unnamed tributary at 36°18'42"/112°21'03"	A&Wc	~~A&Ww~~			FBC			FC		
CM	White Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		
~~CM~~	~~Wia Manua Park Lake~~	~~In Kingman~~		~~A&Ww~~			~~FBC~~			~~FC~~		
CM	Wright Canyon Creek	Headwaters to confluence with unnamed tributary at 35°20'54"/113°30'35"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
CM	Wright Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
CM	YPG Pond	32°50'22"/114°26'25"		A&Ww			FBC			FC		

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
CM	Yuma Area Canals	Above municipal water treatment plant intakes							DWS		AgI	Ag L
CM	Yuma Area Canals	Below municipal water treatment plant intakes and all drains									AgI	Ag L
LC	Als Lake	35°02'17"/111°25'13"		A&Ww			FBC			FC		Ag L
LC	Ashurst Lake	35°01'10"/111°24'09"	A&Wc				FBC			FC	AgI	Ag L
LC	Atcheson Reservoir	34°00'00"/109°20'41"		A&Ww			FBC			FC	AgI	Ag L
LC	Auger Creek	Tributary to Nutrioso Creek at 33°57'22"/109°12'58"	A&Wc				FBC			FC		Ag L
LC	Barbershop Canyon Creek	Tributary to East Clear Creek at 34°33'00"/111°09'43"	A&Wc				FBC			FC		Ag L
LC	Bear Canyon Creek	Tributary to ~~Blue Ridge Reservoir~~ General Springs Canyon at 34°32'18"/111°12'15"	A&Wc				FBC			FC		Ag L
LC	Bear Canyon Creek	Tributary to Willow Creek at 34°27'29"/111°00'00"	A&Wc				FBC			FC		Ag L
LC	Bear Canyon Lake	34°24'10"/111°00'09"	A&Wc				FBC			FC	AgI	Ag L
LC	Becker Lake	34°09'16"/109°18'18"	A&Wc				FBC			FC		Ag L
LC	Billy Creek	Tributary to Show Low Creek at 34°12'25"/110°00'00"	A&Wc				FBC			FC		Ag L
LC	Black Canyon Creek	Tributary to Chevelon Creek at 34°47'38"/110°36'22"	A&Wc				FBC			FC	AgI	Ag L
LC	Black Canyon Lake	34°19'50"/110°41'59"	A&Wc				FBC		DWS	FC	AgI	Ag L
LC	Blue Ridge Reservoir	34°33'15"/111°11'01"	A&Wc				FBC			FC	AgI	Ag L
LC	Boot Lake	34°58'53"/111°20'00"		A&Ww			FBC			FC		Ag L
LC	Buck Springs Canyon Creek	Tributary to Leonard Canyon Creek at 34°28'52"/111°05'24"	A&Wc				FBC			FC		Ag L
LC	Bunch Reservoir	34°02'12"/109°26'45"	A&Wc				FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
LC	Camillo Tank	34°55'03"/111°22'41"		A&Ww			FBC			FC		Ag L
LC	Carnero Lake	34°06'57"/109°31'39"	A&Wc				FBC			FC		Ag L
LC	Chevelon Canyon Lake	34°30'39"/110°49'28"	A&Wc				FBC			FC	AgI	Ag L
LC	Chevelon Creek	Tributary to the Little Colorado River at 34°57'04"/110°31'30"	A&Wc				FBC			FC	AgI	Ag L
LC	Chevelon Creek, West Fork	Tributary to Chevelon Creek at 34°36'58"/110°46'05"	A&Wc				FBC			FC		Ag L
LC	Chilson Tank	34°51'46"/111°22'52"		A&Ww			FBC			FC		Ag L
LC	Cholla Lake	34°56'00"/110°17'12"		A&Ww			FBC			FC		~~Ag L~~
LC	Clear Creek	~~Mogollon Plateau; east of Winslow~~ Tributary to the Little Colorado River at 34°59'13"/110°38'17"	A&Wc				FBC		DWS	FC		Ag L
LC	Clear Creek Reservoir	34°58'10"/110°38'33"	A&Wc				FBC		DWS	FC	AgI	Ag L
LC	Coconino Reservoir	35°00'16"/111°23'52"	A&Wc				FBC			FC	AgI	Ag L
LC	Colter Creek	Tributary to Nutrioso Creek at 33°58'19"/109°12'29"	A&Wc				FBC			FC		Ag L
LC	Colter Reservoir	33°56'40"/109°28'50"	A&Wc				FBC			FC		Ag L
LC	Concho Creek	Tributary to Carrizo Wash at 34°36'25"/109°33'54"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
LC	Concho Lake	34°26'36"/109°37'40"	A&Wc				FBC			FC	AgI	Ag L
LC	Cow Lake	34°53'19"/111°18'49"		A&Ww			FBC			FC		Ag L
LC	Coyote Creek	Tributary to ~~Upper~~ the Little Colorado River at 34°18'22"/109°20'53"	A&Wc				FBC			FC	AgI	Ag L
LC	Crisis Lake (Snake Tank #2)	34°47'51"/111°17'01"		A&Ww			FBC			FC		Ag L
LC	Dane Canyon Creek	Tributary to Barbershop Canyon Creek at 34°30'29"/111°09'07"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
LC	Daves Tank	34°44'23"/111°17'08"		A&Ww			FBC			FC		Ag L
LC	Deep Lake	35°03'30"/111°24'55"		A&Ww			FBC			FC		Ag L
LC	Dry Lake (EDW)	34°37'52"/110°23'40"				A&Wedw						
LC	Ducksnest Lake	34°59'15"/111°23'53"		A&Ww			FBC			FC		Ag L
LC	East Clear Creek	Tributary to Clear Creek ~~Reservoir~~ at 34°38'31"/110°59'49"	A&Wc				FBC			FC	AgI	Ag L
LC	Ellis Wiltbank Reservoir	34°05'25"/109°28'24"		A&Ww			FBC			FC	AgI	Ag L
LC	Fish Creek	Tributary to the Little Colorado River at 34°04'05"/109°26'49"	A&Wc				FBC			FC		Ag L
LC	Fool's Hollow Lake	34°16'14"/110°04'15"	A&Wc				FBC			FC		Ag L
LC	General Springs Canyon Creek	Tributary to ~~Blue Ridge Reservoir~~ East Clear Creek at 34°32'17"/111°12'18"	A&Wc				FBC			FC		Ag L
LC	Geneva Reservoir	34°01'44"/109°31'44"		A&Ww			FBC			FC		Ag L
LC	Hall Creek	Tributary to ~~White Mountain Reservoir~~ the Little Colorado River at 34°03'58"/109°27'07"	A&Wc				FBC			FC	AgI	Ag L
LC	Hart Canyon Creek	Tributary to Willow Creek at 34°30'40"/110°59'28"	A&Wc				FBC			FC		Ag L
LC	Hay Lake	34°00'11"/109°25'55"		A&Ww			FBC			FC		Ag L
LC	Hog Wallow Lake	33°58'57"/109°25'38"		A&Ww			FBC			FC	AgI	Ag L
LC	Horse Lake	35°03'53"/111°27'51"		A&Ww			FBC			FC		Ag L
LC	Huffer Tank	34°27'45"/111°23'09"		A&Ww			FBC			FC		Ag L
LC	Hulsey Creek	Tributary to Nutrioso Creek at 33°56'28"/109°11'28"	A&Wc				FBC			FC		Ag L
LC	Hulsey Lake	33°55'57"/109°09'33"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
LC	Indian Lake	35°00'38"/111°22'37"		A&Ww			FBC			FC		Ag L
LC	Jack's Canyon Creek	Tributary to the Little Colorado River at 35°00'07"/110°39'07"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
LC	Jarvis Lake	33°58'59"/109°12'33"		A&Ww			FBC			FC		Ag L
LC	Kinnikinick Lake	34°53'52"/111°18'20"	A&Wc				FBC			FC		Ag L
LC	Knoll Lake	34°25'38"/111°05'10"	A&Wc				FBC			FC		Ag L
LC	Lake Humphreys (EDW)	35°11'51"/111°35'16"				A&Wedw		PBC				
LC	Lake Mary, Lower	35°06'22"/111°34'20"	A&Wc				FBC			FC		Ag L
LC	Lake Mary, Upper	35°04'45"/111°31'56"	A&Wc				FBC		DWS	FC		Ag L
LC	Lake of the Woods	34°09'39"/109°58'45"	A&Wc				FBC			FC	AgI	Ag L
LC	Lee Valley Creek	Tributary to ~~Colter Reservoir~~ the East Fork of the Little Colorado River at 33°56'35"/109°29'06"	A&Wc				FBC			FC		Ag L
LC	Lee Valley Reservoir	33°56'30"/109°30'00"	A&Wc				FBC			FC	AgI	Ag L
LC	Leonard Canyon Creek	Tributary to ~~East~~ Clear Creek at 34°37'26"/111°02'20"	A&Wc				FBC			FC		Ag L
LC	Leonard Canyon Creek, East Fork	Tributary to Leonard Canyon Creek at 34°25'52"/111°05'06"	A&Wc				FBC			FC		Ag L
LC	Leonard Canyon Creek, Middle Fork	Tributary to Leonard Canyon, West Fork at 34°26'17"/111°06'47"	A&Wc				FBC			FC		Ag L
LC	Leonard Canyon Creek, West Fork	Tributary to Leonard Canyon, East Fork at 34°28'01"/111°05'28"	A&Wc				FBC			FC		Ag L
LC	Lily Creek	~~Escudilla Mountain~~ Tributary to Coyote Creek at 33°59'46"/109°03'58"	A&Wc				FBC			FC		Ag L
LC	Little Colorado River	Headwaters to Lyman Reservoir	A&Wc				FBC			FC	AgI	Ag L
LC	Little Colorado River	Below Lyman Reservoir, to confluence with the Puerco River at 34°53'20"/110°07'41"	A&Wc	~~A&Ww~~			FBC		DWS	FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
LC	Little Colorado River	Below confluence with Puerco River		A&Ww			FBC		DWS	FC	AgI	Ag L
LC	Little Colorado River, East Fork	~~White Mountains~~ Tributary to the Little Colorado River at 34°00'14"/109°27'22"	A&Wc				FBC			FC	~~AgI~~	Ag L
LC	Little Colorado River, South Fork	~~White Mountains~~ Tributary to the Little Colorado River at 34°05'20"/109°24'58"	A&Wc				FBC			FC	~~AgI~~	Ag L
LC	Little Colorado River, West Fork (Unique Water)	Headwaters to Government Springs at 33°59'33"/109°27'52"	A&Wc				FBC			FC		
LC	Little Colorado River, West Fork	Below Government Springs	A&Wc				FBC			FC	~~AgI~~	Ag L
LC	Little George Reservoir	34°00'37"/109°19'15"		A&Ww			FBC			FC	AgI	
LC	Little Mormon Lake	34°17'00"/109°58'03"		A&Ww			FBC			FC	AgI	Ag L
LC	Little Ortega Lake	34°22'45"/109°40'00"	A&Ww				FBC			FC		
LC	Long Lake, Lower	34°46'45"/111°12'00"	A&Wc				FBC			FC	AgI	Ag L
LC	Long Lake, Upper	35°00'00"/111°21'00"		A&Ww			FBC			FC		Ag L
LC	Long Tom Tank	34°20'37"/110°49'20"	A&Wc				FBC			FC		Ag L
LC	Lower Walnut Canyon Lake (EDW)	35°12'04"/111°34'07"				A&Wedw		PBC				
LC	Lyman Reservoir	34°21'30"/109°21'30"	A&Wc				FBC			FC	AgI	Ag L
LC	Mamie Creek	~~Escudilla Mountain~~ Tributary to Coyote Creek at 33°59'24"/109°03'50"	A&Wc				FBC			FC	~~AgI~~	Ag L
LC	Marshall Lake	35°07'10"/111°32'01"	A&Wc				FBC			FC		Ag L
LC	McKay Reservoir	34°01'27"/110°29'07"	A&Wc				FBC			FC	AgI	Ag L
LC	Merritt Draw Creek	Tributary to Barbershop Canyon Creek at 34°29'38"/111°09'54"	A&Wc				FBC			FC		Ag L
LC	Mexican Hay Lake	34°01'57"/109°21'25"	A&Wc				FBC			FC	AgI	Ag L
LC	Milk Creek	Tributary to Hulsey Creek at 33°56'31"/109°11'17"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
LC	Miller Canyon Creek	Tributary to East Clear Creek at 34°33'00"/111°14'17"	A&Wc				FBC			FC		Ag L
LC	Miller Canyon Creek, East Fork	Tributary to Miller Canyon Creek at 34°30'18"/111°14'53"	A&Wc				FBC			FC		Ag L
LC	Mineral Creek	~~Near Vernon, Sitgreaves NF~~ Tributary to Little Ortega Lake at 34°22'52"/109°39'50"	A&Wc				FBC			FC	AgI	Ag L
LC	Mormon Lake	34°56'40"/111°27'10"	A&Wc				FBC		DWS	FC	AgI	Ag L
LC	Morton Lake	34°53'36"/111°17'39"	A&Wc				FBC			FC		Ag L
LC	Mud Lake	34°55'24"/111°21'18"		A&Ww			FBC			FC		Ag L
LC	Ned Lake (EDW)	32°17'18"/110°03'20"				A&Wedw		PBC				
LC	Nelson Reservoir	34°03'12"/109°11'18"	A&Wc				FBC			FC	AgI	Ag L
LC	Norton Reservoir	34°03'57"/109°31'21"		A&Ww			FBC			FC		Ag L
LC	Nutrioso Creek	Tributary to the Little Colorado River at 34°09'04"/109°17'35"	A&Wc				FBC			FC	AgI	Ag L
LC	Paddy Creek	Tributary to Nutrioso Creek at 33°54'47"/109°10'16"	A&Wc				FBC			FC		Ag L
LC	Phoenix Park Wash	Tributary to Dry Lake at 34°37'30"/110°22'12"			A&We			PBC				
LC	Pine Tank	34°46'49"/111°17'17"		A&Ww			FBC			FC		Ag L
LC	Pintail Lake (EDW)	34°18'06"/110°01'17"				A&Wedw		PBC				
LC	Pool Corral Lake	33°58'16"/109°24'53"		A&Ww			FBC			FC	AgI	Ag L
LC	Porter Creek	Tributary to Show Low Creek at 34°10'16"/109°58'48"	A&Wc				FBC			FC		Ag L
LC	Potato Lake	34°27'44"/111°20'42"	A&Wc				FBC			FC		Ag L
LC	Pratt Lake	34°01'31"/109°04'16"	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	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
LC	Rainbow Lake	34°09'03"/109°59'01"	A&Wc				FBC			FC	AgI	Ag L
LC	Reagan Reservoir	~~Apache-Sitgreaves National Forest~~ 34°02'09"/109°08'43"		A&Ww			FBC			FC		Ag L
LC	Rio de Flag (EDW)	Flagstaff WWTP outfall 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"	A&Wc				FBC			FC	AgI	Ag L
LC	Rogers Reservoir	33°58'30"/109°16'18"		A&Ww			FBC			FC		Ag L
LC	Rudd Creek	Tributary to Nutrioso Creek at 34°04'12"/109°11'56"	A&Wc				FBC			FC		Ag L
LC	Russel Reservoir	33°59'29"/109°20'00"		A&Ww			FBC			FC	AgI	Ag L
LC	San Salvador Reservoir	33°58'51"/109°19'51"		A&Ww			FBC			FC	AgI	Ag L
LC	Salt House Lake	33°57'06"/109°20'12"		A&Ww			FBC			FC		Ag L
LC	Scott Reservoir	34°10'27"/109°57'27"	A&Wc				FBC			FC	AgI	Ag L
LC	Show Low Creek	Tributary to Silver Creek at 34°25'26"/110°04'05"	A&Wc				FBC			FC	AgI	Ag L
LC	Show Low Lake	34°11'25"/109°59'55"	A&Wc				FBC			FC	AgI	Ag L
LC	Silver Creek	Tributary to the Little Colorado~~, near Holbrook~~ River at 34°44'24"/110°02'17"	A&Wc				FBC			FC	AgI	Ag L
LC	Slade Reservoir	33°59'50"/109°20'00"		A&Ww			FBC			FC	AgI	Ag L
LC	Soldiers Annex Lake	34°47'13"/111°13'48"	A&Wc				FBC			FC	AgI	Ag L
LC	Soldiers Lake	34°47'49"/110°13'59"	A&Wc				FBC			FC	AgI	Ag L
LC	Spaulding Tank	34°30'17"/111°02'03"		A&Ww			FBC			FC		Ag L
LC	Sponseller Lake	34°14'10"/109°50'42"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
LC	St Johns Reservoir (Little Reservoir)	34°29'14"/109°21'57"		A&Ww			FBC			FC	AgI	Ag L
LC	Telephone Lake (EDW)	34°17'35"/110°02'39"				A&Wedw		PBC				
LC	Tremaine Lake	34°46'00"/111°14'10"	A&Wc				FBC			FC		Ag L
LC	Tunnel Reservoir	34°01'51"/109°26'32"	A&Wc				FBC			FC	AgI	Ag L
LC	Vail Lake	35°05'24"/111°30'42"	A&Wc				FBC			FC		Ag L
LC	Walnut Creek	Tributary to Billy Creek at 34°09'50"/109°58'48"	A&Wc				FBC			FC		Ag L
LC	Water Canyon Creek	Tributary to the Little Colorado River at 34°06'47"/109°18'43"	A&Wc				FBC			FC		Ag L
LC	Water Canyon Reservoir	34°00'15"/109°20'05"		A&Ww			FBC			FC	AgI	Ag L
LC	Whale Lake (EDW)	35°12'32"/111°34'42"				A&Wedw		PBC				
LC	Whipple Lake	34°16'47"/109°58'28"		A&Ww			FBC			FC		Ag L
LC	White Mountain Lake	34°21'54"/109°59'38"	A&Wc				FBC			FC	AgI	Ag L
LC	White Mountain Reservoir	34°00'15"/109°30'48"	A&Wc				FBC			FC	AgI	Ag L
LC	Willow Creek	Tributary to ~~East~~ Clear Creek at 34°38'31"/110°59'49"	A&Wc				FBC			FC		Ag L
LC	Willow Springs Canyon Creek	Tributary to Chevelon Creek at 34°21'32"/110°53'20"	A&Wc				FBC			FC		Ag L
LC	Willow Springs Lake	34°18'45"/110°52'34"	A&Wc				FBC			FC	AgI	Ag L
LC	Woodland Reservoir	34°07'36"/109°57'06"	A&Wc				FBC			FC	AgI	Ag L
LC	Woods Canyon Creek	Tributary to Chevelon Creek at 34°21'32"/110°53'20"	A&Wc				FBC			FC		Ag L
LC	Woods Canyon Lake	34°20'05"/110°56'35"	A&Wc				FBC		DWS	FC	AgI	Ag L
LC	Zuni River	Tributary to the Little Colorado River at 34°38'42"/109°40'26"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
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	Ag L
LG	Painted Rock (Borrow Pit) Lake	33°05'00"/113°01'20"		A&Ww			FBC			FC	AgI	Ag L
MG	Agua Fria River	~~Above~~ 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				Ag L
MG	Agua Fria River (EDW)	Below confluence with unnamed wash receiving treated wastewater from the Prescott Valley WWTP to State Route 169				A&Wedw		PBC				Ag L
MG	Agua Fria River	State Route 169 to Lake Pleasant		A&Ww			FBC		DWS	FC	AgI	Ag L
MG	Agua Fria River	Below Lake Pleasant to the El Mirage WWTP			A&We			PBC				Ag L
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			A&We			PBC				
MG	Agua Fria River	Below State Highway 85		A&Ww			FBC			FC		
MG	Alvord Park Lake	Municipal Park Lake: 35th Avenue & Baseline Road, Phoenix		A&Ww				PBC		FC		
MG	Antelope Creek	Tributary to Martinez Creek at 34°16'37"/112°08'46"		A&Ww			FBC			FC	~~AgI~~	Ag L
MG	Arlington Canal	Above Wilson Avenue										Ag L
MG	Ash Creek	~~Tributary to the Agua Fria River~~ Headwaters to confluence with Tex Canyon at 34°34'44"/112°07'18"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
MG	Ash Creek	Below confluence with Tex Canyon		A&Ww			FBC			FC	AgI	Ag L
MG	Beehive Tank	32°52'36"/111°02'19"		A&Ww			FBC			FC		Ag L
MG	Big Bug Creek	~~Tributary to the Agua Fria River~~ Headwaters to confluence with Eugene Gulch at 34°27'11"/112°18'28.5"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
MG	Big Bug Creek	Below confluence with Eugene Gulch		A&Ww			FBC			FC	AgI	Ag L
MG	Black Canyon Creek	Tributary to the Agua Fria River at 34°04'12"/112°09'29"		A&Ww			FBC			FC	~~AgI~~	Ag L
MG	Blind Indian Creek	Tributary to the Hassayampa River at 34°12'40"/112°32'17"		A&Ww			FBC			FC	~~AgI~~	Ag L
MG	Bonsall Park Lake	Municipal Park Lake; 59th Avenue & Bethany Home Road, Phoenix		A&Ww				PBC		FC		
MG	Canal Park Lake	Municipal Park Lake; College Avenue & Curry Road, Tempe		A&Ww				PBC		FC		
MG	Cave Creek	Headwaters to the Cave Creek Dam		A&Ww			FBC			FC		Ag L
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~~; west of Hassayampa~~ at 33°13'44"/112°46'16"			A&We			PBC				Ag L
MG	Centennial Wash Ponds	33°55'10"/113°23'05"		A&Ww			FBC			FC		Ag L
MG	Chaparral Park Lake	Municipal Park Lake; Hayden Road & Chaparral Road, Scottsdale		A&Ww				PBC		FC	AgI	
MG	Cortez Park Lake	Municipal Park Lake; 35th Avenue & Dunlap, Glendale		A&Ww				PBC		FC	AgI	
MG	Desert Breeze Lake	Municipal Park Lake; Galaxy Drive, West Chandler		A&Ww				PBC		FC		
MG	Devils Canyon	Tributary to Mineral Creek at 33°12'58"/110°59'42"		A&Ww				FBC		FC		Ag L
MG	Dobson Lake	Municipal Park Lake; Dobson Road & Los Lagos Vista Avenue, Mesa		A&Ww				PBC		FC		
MG	Eldorado Park Lake	Municipal Park Lake; Miller Road & Oak Street, Tempe		A&Ww				PBC		FC		
MG	Encanto Park Lake	Municipal Park Lake; 15th Avenue & Encanto Blvd., Phoenix		A&Ww				PBC		FC	AgI	
MG	Fain Lake	Park Lake, city of Prescott Valley		A&Ww				PBC		FC		
MG	Galena Gulch	Tributary to the Agua Fria River at 34°28'37"/112°15'14"			A&We			PBC				Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
MG	Gila River	San Carlos Indian Reservation to the Ashurst-Hayden Dam		A&Ww			FBC			FC	AgI	Ag L
MG	Gila River	Ashurst-Hayden Dam to the Florence WWTP outfall			A&We			PBC				Ag L
MG	Gila River (EDW)	Florence WWTP outfall to Felix Road				A&Wedw		PBC				
MG	Gila River	Felix Road to the Gila River Indian Reservation			A&We			PBC				Ag L
MG	Gila River (EDW)	Salt River to the Gillespie Dam				A&Wedw		PBC		FC	AgI	Ag L
MG	Gila River	Gillespie Dam to Painted Rock Dam		A&Ww			FBC			FC	AgI	Ag L
MG	Granada Park Lake	Municipal Park Lake; 6505 North 20th Street, Phoenix		A&Ww				PBC		FC		
MG	Groom Creek	Tributary to the Hassayampa River at 34°27'14"/112°29'24"	A&Wc				FBC		DWS	FC		Ag L
MG	Hank Raymond Lake	33°50'18"/112°16'07"		A&Ww			FBC			FC	AgI	Ag L
MG	Hassayampa Lake	34°25'45"/112°25'29"	A&Wc				FBC		DWS	FC		
MG	Hassayampa River	~~Headwaters to 8 miles south of Wickenburg~~ Headwaters to confluence with unnamed tributary at 34°26'09"/112°30'32"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
MG	Hassayampa River	Below confluence with unnamed tributary to 8 miles south of Wickenberg		A&Ww			FBC			FC	AgI	Ag L
MG	Hassayampa River	8 miles south of Wickenburg to the Buckeye Irrigation Company Canal			A&We			PBC				Ag L
MG	Hassayampa River	Buckeye Irrigation Company canal to the Gila River		A&Ww			FBC			FC		Ag L
MG	Horsethief Lake	34°09'42"/112°17'56"	A&Wc				FBC		DWS	FC		Ag L
MG	Indian Bend Wash	~~Scottsdale~~ Tributary to the Salt River at 33°26'13"/111°54'58"		~~A&Ww~~	A&We			PBC		~~FC~~		
MG	Indian Bend Wash Lakes	Municipal Park Lakes; Scottsdale		A&Ww				PBC		FC		
MG	Indian School Park Lake	Municipal Park Lake; Indian School Road & Hayden Road, Scottsdale		A&Ww				PBC		FC		
MG	Kiwanis Park Lake	Municipal Park Lake; 6000 South Mill Avenue, Tempe		A&Ww				PBC		FC	AgI	

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
MG	Lake Pleasant	33°51'15"/112°16'15"		A&Ww			FBC		DWS	FC	AgI	Ag L
MG	Lion Canyon	Tributary to Weaver Creek at 34°10'12"/112°41'49"		A&Ww			FBC			FC		Ag L
MG	Little Ash Creek	Tributary to Ash Creek~~; Prescott NF~~ at 34°20'46"/112°04'16"		A&Ww			FBC			FC		Ag L
MG	Lynx Creek	~~Tributary to Lynx Lake~~ Headwaters to confluence with unnamed tributary at 34°34'29"/112°21'05"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
MG	Lynx Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
MG	Lynx Lake	34°31'08"/112°23'05"	A&Wc				FBC		DWS	FC	AgI	Ag L
MG	Maricopa Park Lake	33°35'30"/112°18'16"		A&Ww				PBC		FC		
MG	Martinez Canyon	Tributary to Box Canyon at 33°06'33"/111°12'48"		A&Ww			FBC			FC		Ag L
MG	Martinez Creek	Tributary to the Hassayampa River at 33°59'56"/112°44'38"		A&Ww			FBC			FC	AgI	Ag L
MG	McKellips Park Lake	Municipal Park Lake; Miller Road & McKellips Road, Scottsdale		A&Ww				PBC		FC	AgI	
MG	Mineral Creek	Tibutary to the Gila River at 34°17'42"/112°13'34"		A&Ww			FBC			FC		Ag L
MG	Minnehaha Creek	Tributary to the Hassayampa River at 34°11'49"/112°32'24"		A&Ww			FBC			FC		Ag L
MG	New River	Headwaters to I-17		A&Ww			FBC			FC	AgI	Ag L
MG	New River	Below I-17			A&We			PBC				Ag L
MG	Painted Rock Reservoir	33°04'15"/113°00'30"		A&Ww			FBC			FC	AgI	Ag L
MG	Papago Park Ponds	Municipal Park Lake; Galvin Parkway, Phoenix		A&Ww				PBC		FC		
MG	Perry Mesa Tank	34°11'03"/112°01'59"		A&Ww			FBC			FC		Ag L
MG	Phoenix Area Canals	Granite Reef Dam to all municipal WTP intakes							DWS		AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
MG	Phoenix Area Canals	Below municipal WTP intakes and all other locations									AgI	Ag L
MG	Picacho Reservoir	32°51'17"/111°28'49"		A&Ww			FBC			FC	AgI	Ag L
MG	Poland Creek	~~Tributary to the Agua Fria; Bradshaw Mtns~~ Headwaters to confluence with Lorena Gulch at 34°12'32"/112°19'07"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
MG	Poland Creek	Below confluence with Lorena Gulch		A&Ww			FBC			FC		Ag L
MG	Queen Creek	Headwaters to the Superior Sanitary District WWTP ~~Mining Division discharge~~ outfall		~~A&Ww~~	A&We			PBC	~~DWS~~	~~FC~~		Ag L
MG	Queen Creek (EDW)	Superior ~~Mining Division discharge~~ Sanitary District WWTP outfall to confluence with Potts Canyon				A&Wedw		PBC				
MG	Queen Creek	Potts Canyon to El Camino Viejo Road		A&Ww			FBC			FC		Ag L
MG	Queen Creek	Below El Camino Viejo Road			A&We			PBC				
MG	Riverview Park Lake	Municipal Park Lake; Dobson Road & 8th Street, Mesa		A&Ww				PBC		FC		
MG	Roadrunner Park Lake	Municipal Park Lake; 36th Street & Cactus, Phoenix		A&Ww				PBC		FC		
MG	Sycamore Creek	~~Tributary to the Agua Fria River~~ Headwaters to confluence with Tank Canyon at 34°19'32"/111°50'12"	A&Wc				FBC			FC		Ag L
MG	Sycamore Creek	Below confluence with Tank Canyon		A&Ww			FBC			FC		Ag L
MG	Tempe Town Lake	Below Mill Avenue Bridge		A&Ww			FBC			FC		
MG	Tule Creek	Tributary to the Agua Fria River at 33°57'25"/112°14'13"		A&Ww			FBC			FC		Ag L
MG	Turkey Creek	~~Tributary to Black Canyon Creek~~ Headwaters to confluence with unnamed tributary at 34°19'28"/112°21'28"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
MG	Turkey Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC	AgI	Ag L
MG	Unnamed Wash (EDW)	Gila Bend WWTP outfall to the Gila River				A&Wedw		PBC				
MG	Unnamed Wash (EDW)	Luke Air Force Base WWTP outfall to the Agua Fria River				A&Wedw		PBC				

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
MG	Unnamed Wash (EDW)	Prescott Valley WWTP outfall to the Agua Fria River				A&Wedw		PBC				
MG	Unnamed Wash (EDW)	Queen Valley Sanitary District WWTP outfall to the confluence with Queen Creek				A&Wedw		PBC				
MG	Vista Del Camino Park North	Municipal Park Lake; 7700 East Roosevelt Street, Scottsdale		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 ~~upper~~ Gila River at 33°06'47"/111°05'20"		A&Ww			FBC			FC		Ag L
MG	Weaver Creek	Tributary to Martinez Creek at 34°03'18"/112°46'48"		A&Ww			FBC			FC		Ag L
MG	White Canyon Creek	Tributary to Walnut Canyon Creek at 33°09'25"/111°04'48"		A&Ww			FBC			FC		Ag L
RM	Abbot Canyon	Mule Mountains		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Ash Creek	Chiricahua Mountains	~~A&Wc~~	A&Ww			FBC			FC	AgI	Ag L
RM	Bear Creek	Headwaters to U.S./Mexico border at 31°19'59"/110°22'58.5"		A&Ww			FBC			FC		Ag L
RM	Blackwater Draw	San Bernardino Valley		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Buck Canyon	~~Chiricahua Mountains~~ Headwaters to Buck Creek Tank at 31°33'06"/109°52'43"		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Buck Canyon	Below Buck Creek Tank			A&We			PBC				Ag L
RM	California Gulch	South of Ruby		A&Ww			FBC			FC		Ag L
RM	Dixie Canyon	Mule Mountains		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Dry Canyon	Mule Mountains		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Gadwell Canyon	Mule Mountains		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Glance Creek	Mule Mountains		A&Ww			FBC			FC	~~AgI~~	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
RM	Gold Gulch	Mule Mountains		A&Ww			FBC			FC	~~AgI~~	Ag L
RM	Holden Canyon Creek	Coronado National Forest		A&Ww			FBC	~~PBC~~		FC		
RM	Johnson Canyon	Chiricahua Mountains		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Leslie Canyon Creek	Chiricahua Mountains		A&Ww			FBC		~~DWS~~	FC		Ag L
RM	Mexican Canyon	Mule Mountains		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Mule Gulch	Headwaters to ~~the Bisbee WWTP~~ just above the Lavender Pit		A&Ww				PBC		FC	~~AgI~~	~~Ag L~~
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				~~Ag L~~
RM	Mule Gulch	Below the Highway 80 bridge			A&We			PBC				Ag L
RM	Quitobaquito Spring	(Pond and Springs) 31°56'39"/113°01'06"		A&Ww			FBC			FC		Ag L
RM	Ruby Lakes	Near the town of Ruby		A&Ww			FBC			FC		Ag L
RM	Rucker Canyon Creek	Chiricahua Mtns; tributary to Whitewater Draw at 31°44'46"/109°26'06"	A&Wc				FBC		~~DWS~~	FC		Ag L
RM	Rucker Canyon Lake	31°46'46"/109°18'30"	A&Wc				FBC			FC		Ag L
RM	Soto Canyon	Mule Mountains		A&Ww			FBC		~~DWS~~	FC	~~AgI~~	Ag L
RM	Sycamore Canyon Creek	~~Coronado National Forest~~ Headwaters to the U.S./Mexico border at 31°22'48"/111°13'19"		A&Ww			FBC			FC		Ag L
RM	Unnamed Wash (EDW)	Bisbee-Douglas International Airport WWTP outfall to Whitewater Draw				A&Wedw		PBC				
RM	Whitewater Draw	~~Sulphur Springs Valley~~ Headwaters to confluence with unnamed tributary at 31°20'36"/109°34'46"		~~A&Ww~~	A&We		~~FBC~~	PBC		~~FC~~	~~AgI~~	Ag L
RM	Whitewater Draw	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SC	Agua Caliente Lake	Municipal Park Lake; 12325 East Roger Road, Tucson		A&Ww				PBC		FC		
SC	Agua Caliente Wash	Headwaters to the Coronado National Forest boundary at 32°17'50"/110°42'43"		A&Ww			FBC			FC		Ag L
SC	Agua Caliente Wash	Below the Coronado National Forest boundary			A&We			PBC				Ag L
SC	Aguirre Wash	~~Aguirre Valley~~ 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	~~Altar Valley~~ Tributary to Brawley Wash at 31°57'47"/111°23'28"			A&We			PBC				
SC	Alum Gulch	Headwaters to ~~T22S R16E Sec 19 CBA SW1/4~~ 31°28'20"/110°43'51"		~~A&Ww~~	A&We		~~FBC~~	PBC		~~FC~~		Ag L
SC	Alum Gulch	From 31°28'20"/110°43'51" to 31°29'17"/110°44'25"		A&Ww			FBC			FC		Ag L
SC	Alum Gulch	~~Below T22S R16E Sec 19 CBA SW1/4~~ Below 31°29'17"/110°44'25"			A&We			PBC				Ag L
SC	Arivaca Creek	Tributary to ~~Arivaca Lake~~ Altar Wash at 31°43'01"/111°25'41"		A&Ww			FBC			FC		Ag L
SC	Arivaca Lake	31°31'50"/111°15'05"		A&Ww			FBC			FC	AgI	Ag L
SC	Atterbury Wash	Tributary to Pantano Wash at 32°10'52"/110°48'50"			A&We			PBC				Ag L
SC	Bear Grass Tank	31°33'01"/111°11'32"		A&Ww			FBC			FC		Ag L
SC	Big Wash	Tributary to Cañada del Oro at 32°24'47"/110°56'28"			A&We			PBC				
SC	Bog Hole Tank	31°28'34"/110°37'07"		A&Ww			FBC			FC		Ag L
SC	Brawley Wash	~~Avra Valley~~ Tributary to Los Robles Wash at 32°21'54"/111°17'31"			A&We			PBC				
SC	Cañada del Oro	Headwaters to Highway 89 at 32°24'48"/110°56'14"		A&Ww			FBC		~~DWS~~	FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SC	Cañada del Oro	Below Highway 89			A&We			PBC				Ag L
SC	Cienega Creek	Headwaters to Interstate 10 at 31°59'08"/110°33'59"		A&Ww			FBC			FC		Ag L
SC	Cienega Creek (Unique Water)	Interstate 10 to ~~Del Lago Dam~~ USGS gaging station at 32°02'09"/110°40'34"		A&Ww			FBC			FC		Ag L
~~SC~~	~~Cienega Creek~~	~~Below Del Lago Dam~~		~~A&Ww~~			~~FBC~~			~~FC~~		~~Ag L~~
SC	Davidson Canyon	~~Tributary to Cienega Creek~~ Headwaters to unnamed spring at 31°59'00"/110°38'46"			A&We			PBC				Ag L
SC	Davidson Canyon	Unnamed Spring to confluence with unnamed tributary at 31°59'32.5"/110°38'43.5"		A&Ww			FBC			FC		Ag L
SC	Davidson Canyon	Below confluence with unnamed tributary			A&We			PBC				Ag L
SC	Empire Gulch	Headwaters to ~~Empire Ranch~~ unnamed Spring at 31°47'15"/110°38'17"			A&We			PBC				
SC	Empire Gulch	Below ~~Empire Ranch~~ unnamed Spring		A&Ww			FBC			FC		Ag L
SC	Flux Canyon	Tributary to Alum Canyon at 31°30'22"/110°46'41"			A&We			PBC				Ag L
SC	Gardner Canyon Creek	~~Tributary to Cienega Creek~~ Headwaters to confluence with Sawmill Canyon at 31°42'51"/110°44'43"	A&Wc	~~A&Ww~~			FBC			FC		
SC	Gardner Canyon Creek	Below Sawmill Canyon		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 ~~Wash~~ Creek	Tributary to Sonoita Creek at 31°32'35"/110°44'42"		~~A&Ww~~	A&We		~~FBC~~	PBC		~~FC~~		Ag L
SC	Hit Tank	32°43'57"/111°03'18"		A&Ww			FBC			FC		Ag L
SC	Huachuca Tank	31°21'11"/110°30'12"		A&Ww			FBC			FC		Ag L
SC	Julian Wash	Tributary to the Santa Cruz River at 32°11'20"/110°59'13"			A&We			PBC				
SC	Kennedy Lake	Municipal Park Lake; Mission Road & Ajo Road, Tucson		A&Ww				PBC		FC		

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SC	Lakeside Lake	Municipal Park Lake; 8300 East Stella Road, Tucson		A&Ww				PBC		FC		
SC	Lemmon Canyon Creek	~~Tributary to Sabino 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		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	~~Tributary to the Santa Cruz River~~ Headwaters to confluence with unnamed tributary at 31°43'42"/110°52'50"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SC	Madera Canyon Creek	Below unnamed tributary		A&Ww			FBC			FC		Ag L
SC	Mattie Canyon	Tributary to Cienega Creek at 31°51'31"/110°34'25"		A&Ww			FBC			FC		Ag L
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	~~Tributary to Sabino 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		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	~~Near Arizona City~~ 32°44'18"/111°40'42"		A&Ww			FBC				AgI	
SC	Parker Canyon Creek	~~Tributary to Parker Canyon Lake~~ Headwaters to confluence with unnamed tributary at 31°24'17"/110°28'44.5"	A&Wc	~~A&Ww~~			FBC			FC		
SC	Parker Canyon Creek	Below unnamed tributary		A&Ww			FBC			FC		
SC	Parker Canyon Lake	31°25'35"/110°27'15"	A&Wc				FBC			FC	AgI	Ag L
SC	Patagonia Lake	31°29'30"/110°52'00"	A&Wc				FBC		DWS	FC	AgI	Ag L
SC	Peña Blanca Lake	31°24'12"/111°05'04"	A&Wc				FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SC	Potrero Creek	Headwaters to Interstate 19 at 31°23'24"/110°57'30"			A&We			PBC				Ag L
SC	Potrero Creek	Below Interstate 19		A&Ww			FBC			FC		Ag L
SC	Puertocito Wash	Tributary to Altar Wash at 31°43'01"/111°25'41"			A&We			PBC				
SC	Redrock Canyon Creek	Tributary to ~~Sonoita Creek~~ 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				Ag L
SC	Romero Canyon Creek	~~Tributary to Cañada del Oro~~ Headwaters to confluence with unnamed tributary at 32°24'30"/110°50'35"	A&Wc				FBC			FC		
SC	Romero Canyon Creek	Below unnamed tributary		A&Ww			FBC			FC		
SC	Rose Canyon Creek	Tributary to Rose Canyon Lake at 32°23'10"/110°43'01"	A&Wc	~~A&Ww~~			FBC			FC		
SC	Rose Canyon Lake	32°23'13"/110°42'38"	A&Wc				FBC			FC	~~AgI~~	Ag L
SC	Sabino Canyon Creek	~~Tributary to Tanque Verde 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		A&Ww			FBC		DWS	FC	AgI	
SC	Salero Ranch Tank	31°35'42"/110°53'22"		A&Ww			FBC			FC		Ag L
SC	Santa Cruz River	Headwaters to the International Boundary at 31°19'58"/110°35'48"		A&Ww			FBC			FC	AgI	Ag L
SC	Santa Cruz River	International Boundary to the Nogales International WWTP outfall		A&Ww			FBC		DWS	FC	AgI	Ag L
SC	Santa Cruz River (EDW)	Nogales International WWTP outfall to the Tubac Bridge				A&Wedw		PBC				Ag L
SC	Santa Cruz River	The Tubac Bridge to Roger Rd WWTP outfall			A&We			PBC				Ag L
SC	Santa Cruz River (EDW)	Roger Road WWTP outfall to Baumgartner Road				A&Wedw		PBC				
SC	Santa Cruz River (Wash)	Baumgartner Road to the Gila River Indian Reservation			A&We			PBC				Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SC	Santa Cruz River, West Branch	Tributary to the Santa Cruz River at 32°12'07"/110°59'20"			A&We			PBC				Ag L
SC	Santa Cruz River, N. Fork	Tributary to the Santa Cruz River at 32°55'55"/111°53'10"			A&We			PBC				
SC	Santa Rosa Wash	Below ~~Papago~~ Tohono O'odham Indian Reservation to the Santa Cruz Wash at 32°53'49"/111°56'46"			A&We			PBC				
SC	Soldier Lake	32°25'34"/110°44'41"	A&Wc				FBC			FC		Ag L
SC	Sonoita Creek	Headwaters to ~~1 km downstream of the State Route 82 bridge~~ the Town of Patagonia WWTP outfall			A&We			PBC				Ag L
~~SC~~	~~Sonoita Creek~~	~~1 km downstream of the State Route 82 bridge to the Town of Patagonia WWTP outfall~~		~~A&Ww~~			~~FBC~~			~~FC~~		~~Ag L~~
SC	Sonoita Creek (EDW)	Town of Patagonia WWTP outfall to 750 feet downstream of outfall				A&Wedw		PBC				Ag L
SC	Sonoita Creek	Below 750 feet downstream of Town of Patagonia WWTP outfall		A&Ww			FBC			FC	AgI	Ag L
SC	Split Tank	31°28'15"/111°05'15"		A&Ww			FBC			FC		Ag L
SC	Sutherland Wash	Tributary to Cañada del Oro at 32°25'05"/110°55'26"			A&We			PBC				
SC	Sycamore Reservoir	32°20'57"/110°44'52"	A&Wc				FBC			FC		Ag L
SC	Tanque Verde Creek	Headwaters to Wentworth Road at 32°14'23"/110°43'13"		A&Ww			FBC			FC		Ag L
SC	Tanque Verde Creek	Below Wentworth Road			A&We			PBC				Ag L
SC	The Lake Tank	32°54'14"/111°04'14"		A&Ww			FBC			FC		Ag L
SC	Three R Canyon	Headwaters ~~to bottom of perennial reach~~ to Lat/Long: 31°28'35"/110°46'19"		~~A&Ww~~	A&We		~~FBC~~	PBC		~~FC~~		Ag L
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		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SC	Three R Canyon	~~Bottom of perennial reach to Sonoita Creek~~ From Lat/Long: 31°28'27"/110°47'12" to Sonoita Creek			A&We			PBC				Ag L
SC	Tinaja Wash	Eastern foothills, Sierrita Mountains			A&We			PBC				Ag L
SC	Unnamed Wash (EDW)	Oracle Sanitary District WWTP outfall to 5 km downstream				A&Wedw		PBC				
SC	Vekol Wash	~~Tributary to Santa Cruz Wash~~ Those reaches not located on the Ak-Chin, Tohono O'odham and Gila River Indian Reservations			A&We			PBC				
SC	Wakefield Canyon	Headwaters to confluence with unnamed tributary 31°52'47"/110°26'25"	A&Wc				FBC			FC		Ag L
SC	Wakefield Canyon	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SC	Wild Burro Canyon	Headwaters to confluence with unnamed tributary at 32°28'36"/111°05'18"		A&Ww			FBC			FC		Ag L
SC	Wild Burro Canyon	Below confluence with unnamed tributary			A&We			PBC				Ag L
SC	Williams Ranch Tanks	31°55'15"/110°25'30"		A&Ww			FBC			FC		Ag L
SP	Aravaipa Creek	Headwaters to confluence with Stowe Gulch at 32°52'10"/110°22'00"		A&Ww			FBC		~~DWS~~	FC		Ag L
SP	Aravaipa Creek (Unique Water)	Stowe Gulch confluence to downstream boundary of Aravaipa Canyon Wilderness Area at 32°54'23"/110°33'40"		A&Ww			FBC		~~DWS~~	FC		Ag L
SP	Aravaipa Creek	below downstream boundary of Aravaipa Canyon Wilderness Area		A&Ww			FBC		~~DWS~~	FC		Ag L
SP	Babocomari Creek	Tributary to the San Pedro River at 31°43'19"/110°11'35"		A&Ww			FBC			FC		Ag L
SP	Bass Canyon Creek	~~Mulcshoe Preserve~~ Headwaters to confluence with unnamed tributary at 32°26'06"/110°13'18"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SP	Bass Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SP	Bass Canyon Tank	32°24'00"/110°13'00"		A&Ww			FBC			FC		Ag L
SP	Blacktail Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SP	Booger Canyon Creek	Tributary to Aravaipa Creek at 32°54'54"/110°29'35"		A&Ww			FBC			FC		Ag L
SP	Buehman Canyon Creek (Unique Water)	~~Southeast slope, Santa Catalina Mountains~~ Headwaters to confluence with unnamed tributary at 32°24'31.5"/110°32'08"		A&Ww			FBC			FC		Ag L
SP	Buehman Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SP	Bull Tank	32°31'15"/110°12'45"		A&Ww			FBC			FC		Ag L
SP	Bullock Canyon	Tributary to Buehman Canyon at 32°23'00"/110°33'04"		A&Ww			FBC			FC		Ag L
SP	Carr Canyon Creek	~~Huachuca Mtns~~ Headwaters to confluence with unnamed tributary at 31°27'00"/110°15'45"	A&Wc				FBC			FC		Ag L
SP	Carr Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SP	Copper Creek	Headwaters to confluence with Prospect Canyon at 32°44'48"/110°30'18"		A&Ww			FBC			FC		Ag L
SP	Copper Creek	Below confluence with Prospect Canyon			A&We			PBC				Ag L
SP	Deer Creek	~~Tributary to Aravaipa Creek~~ Headwaters to confluence with unnamed tributary at 32°59'56"/110°20'09"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SP	Deer Creek	Below confluence with unnamed tributary to Aravaipa Creek		A&Ww			FBC			FC		Ag L
SP	Double R Canyon Creek	Tributary to Bass Canyon at 32°21'06"/110°14'23"		A&Ww			FBC			FC		
SP	East Gravel Pit Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Espiritu Canyon Creek	Tributary to Soza Wash at 32°18'52"/110°28'35"		A&Ww			FBC			FC		Ag L
SP	Fly Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Fourmile Canyon Creek	Tributary to Aravaipa Creek at 32°50'14"/110°20'08"		A&Ww			FBC			FC		Ag L
SP	Fourmile Canyon, Left Prong	Headwaters to confluence with unnamed tributary at 32°43'14"/110°23'43"	A&Wc				FBC			FC		Ag L
SP	Fourmile Canyon, Left Prong	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SP	Fourmile Canyon, Right Prong	Tributary to Fourmile Canyon at 32°47'33"/110°22'36"		A&Ww			FBC			FC		Ag L
SP	Garden Canyon Creek	~~Eastern Slope, Huachuca Mtns~~ Headwaters to confluence with unnamed tributary at 31°29'00"/110°19'42"	A&Wc	~~A&Ww~~			FBC		DWS	FC	AgI	
SP	Garden Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC		DWS	FC	AgI	
SP	Golf Course Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Gravel Pit Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Hidden Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Horse Camp Canyon Creek	Tributary to Aravaipa Creek at 32°55'07"/110°30'56"		A&Ww			FBC			FC		Ag L
SP	Hot Springs Canyon Creek	~~Muleshoe Preserve~~ Tributary to the San Pedro River at 32°17'24"/110°22'55"		A&Ww			FBC			FC		Ag L
SP	Lower Garden Canyon Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Miller Canyon Creek	~~Eastern Slope, Huachuca Mtns~~ Headwaters to Broken Arrow Ranch Road at 31°25'33"/110°15'08"	A&Wc				FBC		DWS	FC		Ag L
SP	Miller Canyon Creek	Below Broken Arrow Ranch Road		A&Ww			FBC		DWS	FC		Ag L
SP	Oak Grove Creek	Tributary to Turkey Creek~~; Aravaipa Basin~~ at 32°45'32"/110°14'06"		A&Ww			FBC			FC		Ag L
SP	Officers Club Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Paige Canyon Creek	Tributary to the San Pedro River at 32°17'10"/110°22'48"		A&Ww			FBC			FC		Ag L
SP	Parsons Canyon Creek	Tributary to Aravaipa Creek at 32°54'11"/110°27'40"		A&Ww			FBC			FC		Ag L
SP	Ramsey Canyon Creek	~~Huachuca Mtns~~ Headwaters to Forest Service Road #110 at 31°27'44"/110°17'27"	A&Wc				FBC		~~DWS~~	FC	AgI	Ag L
SP	Ramsey Canyon Creek	Below Forest Service Road #110		A&Ww			FBC			FC	AgI	Ag L
SP	Rattlesnake Canyon	~~Tributary to Aravaipa Creek~~ Headwaters to confluence with Brush Canyon at 32°38'27"/110°21'24"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SP	Rattlesnake Canyon	Below confluence with Brush Canyon		A&Ww			FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SP	Redfield Canyon Creek	~~Galiuro Mtns~~ Headwaters to confluence with unnamed tributary at 32°33'39"/110°18'41"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SP	Redfield Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SP	San Pedro River	U.S./Mexico Border to Redington		A&Ww			FBC			FC	AgI	Ag L
SP	San Pedro River	Redington to the Gila River		A&Ww			FBC			FC		Ag L
SP	Swamp Springs Canyon Creek	~~Mulcshoe Preserve~~ Tributary to Redfield Canyon at 32°26'10"/110°19'30"		A&Ww			FBC			FC		Ag L
SP	Sycamore Pond I	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Sycamore Pond II	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SP	Turkey Creek	Tributary to Aravaipa Creek at 32°53'49"/110°26'35"		A&Ww			FBC			FC	~~AgI~~	Ag L
SP	Virgus Canyon Creek	Tributary to Aravaipa Creek at 32°54'58"/110°31'16"		A&Ww			FBC			FC		Ag L
SP	Walnut Gulch (EDW)	Tombstone WWTP outfall to the confluence of Tombstone Wash				A&Wedw		PBC				
SP	Woodcutters Pond	Fort Huachuca Military Reservation		A&Ww			FBC			FC		
SR	Ackre (Judge) Lake	33°37'00"/109°20'37"	A&Wc				FBC			FC	AgI	Ag L
SR	Apache Lake	33°35'30"/111°20'30"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Barnhardt Creek	~~Tributary to Rye Creek, Mazatzal Wilderness~~ Headwaters to confluence with unnamed tributary at 34°05'36"/111°26'38"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SR	Barnhardt Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SR	Basin Lake	33°55'00"/109°26'05"		A&Ww			FBC			FC		Ag L
SR	Bear Creek	Tributary to the Black River at 33°43'26"/109°22'30"	A&Wc				FBC			FC	AgI	Ag L
SR	Bear Wallow Creek	Tributary to the Black River at 33°37'44"/109°31'23"	A&Wc				FBC			FC	~~AgI~~	Ag L
SR	Bear Wallow Creek, North Fork	Tributary to Bear Wallow Creek at 33°35'53"/109°26'49"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SR	Bear Wallow Creek, South Fork	Tributary to Bear Wallow Creek at 33°35'53"/109°26'49"	A&Wc				FBC			FC		Ag L
SR	Beaver Creek	Tributary to the Black River at 33°43'44"/109°21'07"	A&Wc				FBC			FC	AgI	Ag L
SR	Big Lake	33°52'45"/109°25'00"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Black River	Tributary to the Salt River at 33°44'20"/110°13'30"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Black River, East Fork	Tributary to the Black River at 33°45'07"/109°21'43"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Black River, N Fork of E Fork	Tributary to Black River, East Fork at 33°56'17"/109°24'11"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Black River, West Fork	Tributary to the Black River at 33°45'07"/109°21'43"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Bloody Tanks Wash	Headwaters to Schultze Ranch at 33°22'29"/110°54'39"			A&We			PBC				Ag L
SR	Bloody Tanks Wash	Schultze Ranch to Miami Wash			A&We			PBC				
SR	Boggy Creek	Tributary to the Black River at 33°44'31"/109°26'20"	A&Wc				FBC			FC	AgI	Ag L
SR	Boneyard Creek	Tributary to Black River, East Fork at 33°51'22"/109°18'50"	A&Wc				FBC			FC	AgI	Ag L
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		Ag L
SR	Canyon Creek	~~Tributary to the Salt River~~ Headwaters to the White Mountain Apache Reservation at 33°57'53"/110°47'00"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Canyon Lake	33°33'15"/111°26'30"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Centerfire Creek	Tributary to the Black River at 33°42'47"/109°26'17"	A&Wc				FBC			FC	AgI	Ag L
SR	Chambers Draw Creek	Tributary to Black River, N Fork of E Fork at 33°53'03"/109°20'13"	A&Wc				FBC			FC		Ag L
SR	Cherry Creek	~~Tributary to the Salt River~~ Headwaters to confluence with unnamed tributary at 34°05'09"/110°56'04"	A&Wc				FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SR	Cherry Creek	Below unnamed tributary		A&Ww			FBC			FC	AgI	Ag L
SR	Christopher Creek	Tributary to Tonto Creek at 34°18'36"/111°04'23"	A&Wc				FBC			FC	AgI	Ag L
SR	Cold Spring Canyon Creek	~~Tributary to Cherry Creek~~ Headwaters to confluence with unnamed tributary at 33°49'50"/110°52'55"	A&Wc				FBC			FC		Ag L
SR	Cold Spring Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SR	Conklin Creek	Tributary to the Black River at 33°41'49"/109°27'36"	A&Wc				FBC			FC	AgI	Ag L
SR	Coon Creek	~~Salt River Canyon Wilderness Area~~ Headwaters to confluence with unnamed tributary at 33°46'42"/110°54'25"	A&Wc				FBC			FC		Ag L
SR	Coon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SR	Corduroy Creek	Tributary to Fish Creek~~, Apache NF~~ at 33°59'46"/110°17'31"	A&Wc				FBC			FC	AgI	Ag L
SR	Coyote Creek	Tributary to the Black River, East Fork at 33°50'53"/109°18'18"	A&Wc				FBC			FC	AgI	Ag L
SR	Crescent Lake	33°54'36"/109°25'08"	A&Wc				FBC			FC	AgI	Ag L
SR	Deer Creek	Tributary to the Black River, East Fork at 33°48'07"/109°19'26"	A&Wc				FBC			FC		Ag L
SR	Del Shay Creek	Tributary to Gun Creek~~, Del Shay Basin~~ at 34°00'22"/111°15'43"	~~A&Wc~~	A&Ww			FBC			FC		Ag L
SR	Devils Chasm Creek	~~Tributary to Cherry Creek~~ Headwaters to confluence with unnamed tributary at 33°48'46"/110°52'33"	A&Wc				FBC			FC		Ag L
SR	Devils Chasm Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SR	Dipping Vat Reservoir	33°55'54"/109°25'15"		A&Ww			FBC			FC		Ag L
SR	Double Cienega Creek	Tributary to Fish Creek at 33°38'35"/109°22'08"	A&Wc				FBC			FC		Ag L
SR	Fish Creek	Tributary to the Black River at 33°42'40"/109°26'31"	A&Wc				FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SR	Fish Creek	~~Superstition Wilderness Area~~ Tributary to the Salt River at 33°34'37"/111°21'11"		A&Ww			FBC			FC		
SR	Gold Creek	~~Tributary to Tonto Creek~~ Headwaters to confluence with unnamed tributary at 33°59'47"/111°25'07"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SR	Gold Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SR	Gordon Canyon Creek	~~Tributary to Haigler Creek~~ Headwaters to confluence with Hog Canyon at 34°13'49"/111°00'27"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
SR	Gordon Canyon Creek	Below confluence with Hog Canyon		A&Ww			FBC			FC		Ag L
SR	Greenback Creek	Tributary to Tonto Creek at 33°47'38"/111°15'22"		A&Ww			FBC			FC		Ag L
SR	Haigler Creek	~~Tributary to Tonto Creek; Hellsgate Wilderness~~ Headwaters to confluence with unnamed tributary at 34°12'23.5"/111°00'11"	A&Wc				FBC			FC	AgI	Ag L
SR	Haigler Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC	AgI	Ag L
SR	Hannagan Creek	Tributary to Beaver Creek at 33°42'07"/109°14'46"	A&Wc				FBC			FC		Ag L
SR	Hay Creek	Tributary to the Black River, West Fork at 33°48'32"/109°25'16"	A&Wc				FBC			FC		Ag L
SR	Home Creek	Tributary to the Black River, West Fork at 33°45'43"/109°22'48"	A&Wc				FBC			FC		Ag L
SR	Horse Creek	Tributary to the Black River, West Fork at 33°45'11"/109°21'50"	A&Wc				FBC			FC		Ag L
SR	Horse Camp Creek	~~Tributary to Cherry Creek~~ Headwaters to confluence with unnamed tributary at 33°53'53"/110°50'10"	A&Wc				FBC			FC		Ag L
SR	Horse Camp Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
SR	Horton Creek	Tributary to Tonto Creek at 34°20'24"/111°05'42"	A&Wc				FBC			FC	AgI	Ag L
SR	Houston Creek	Tributary to Tonto Creek at 34°07'30"/111°15'25"		A&Ww			FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SR	Hunter Creek	Tributary to Christopher Creek at 34°18'29"/111°01'55"	A&Wc				FBC			FC		Ag L
SR	LaBarge Creek	Superstition Wilderness Area; tributary to Canyon Lake		A&Ww			FBC			FC		
SR	Lake Sierra Blanca	33°52'25"/109°16'05"	A&Wc				FBC			FC	AgI	Ag L
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	Ag L
SR	Open Draw Creek	Tributary to the Black River, East Fork at 33°49'52"/109°18'18"	A&Wc				FBC			FC		Ag L
SR	P B Creek	~~Tributary to Cherry Creek~~ Headwaters to Forest Service Road #203 at 33°57'08"/110°56'09"	A&Wc				FBC			FC		Ag L
SR	P B Creek	Below Forest Service Road #203		A&Ww			FBC			FC		Ag L
SR	Pinal Creek	Headwaters to confluence with unnamed EDW wash (Globe WWTP)			A&We			PBC				Ag L
SR	Pinal Creek (EDW)	Below unnamed EDW wash to Radium				A&Wedw		PBC				
SR	Pinal Creek	Radium to Setka Ranch			A&We			PBC				Ag L
SR	Pinal Creek	Setka Ranch to Salt River		A&Ww			FBC			FC		Ag L
SR	Pine Creek	~~Superstition Wilderness Area~~ Tributary to the Salt River at 33°36'04"/111°12'36"		A&Ww			FBC			FC		
SR	Pinto Creek	~~Tributary to the Salt River~~ Headwaters to confluence with unnamed tributary at 33°19'27"/110°54'56"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
SR	Pinto Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC	AgI	Ag L
SR	Pueblo Canyon Creek	~~Tributary to Cherry Creek~~ Headwaters to confluence with unnamed tributary at 33°50'30"/110°53'13"	A&Wc				FBC			FC		Ag L
SR	Pueblo Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
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	~~AgI~~	Ag L
SR	Reynolds Creek	Tributary to Workman Creek at 33°52'16"/111°00'14"	A&Wc				FBC			FC		Ag L
SR	Roosevelt Lake	33°40'45"/111°09'15"		A&Ww			FBC		DWS	FC	AgI	Ag L
SR	Rye Creek	Tributary to Tonto Creek at 34°01'41"/111°17'06"		A&Ww			FBC			FC		Ag L
SR	Saguaro Lake	33°34'00"/111°32'06"	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Salome Creek	Tributary to the Salt River at 33°41'56"/111°05'46"	~~A&Wc~~	A&Ww			FBC			FC	AgI	Ag L
SR	Salt River	Above Roosevelt Lake		A&Ww			FBC			FC	AgI	Ag L
SR	Salt River	Theodore Roosevelt Dam to the Verde River	A&Wc				FBC		DWS	FC	AgI	Ag L
SR	Salt River	Verde River to 2 km below Granite Reef Dam		A&Ww			FBC		DWS	FC	AgI	Ag L
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&Ww				PBC		~~FC~~		
SR	Salt River (EDW)	23rd Ave WWTP to confluence with Gila River				A&Wedw		PBC		FC	AgI	Ag L
SR	Slate Creek	Tributary to Tonto Creek at 33°56'24"/111°18'25"		A&Ww			FBC			FC		Ag L
SR	Snake Creek	Tributary to the Black River at 33°40'30"/109°28'55"	A&Wc				FBC			FC		Ag L
SR	Spring Creek	Tributary to Tonto Creek at 34°09'54"/111°10'08"	~~A&Wc~~	A&Ww			FBC			FC		Ag L
SR	Stinky Creek	Tributary to the Black River, West Fork at 33°51'22"/109°27'07"	A&Wc				FBC			FC		Ag L
SR	Thomas Creek	Tributary to Beaver Creek at 33°42'29"/109°15'11"	A&Wc				FBC			FC		Ag L
SR	Thompson Creek	Tributary to the Black River, West Fork at 33°53'24"/109°28'48"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
SR	Tonto Creek	~~Tributary to Roosevelt Lake~~ Headwaters to confluence with unnamed tributary at 34°18'10"/111°04'14"	A&Wc				FBC			FC	AgI	Ag L
SR	Tonto Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC	AgI	Ag L
SR	Turkey Creek	Tributary to Rock Creek~~; Sierra Ancha Mtns~~ at 33°58'30"/111°06'47"	A&Wc	~~A&Ww~~			FBC			FC		
SR	Unnamed Wash (EDW)	Globe WWTP outfall to Pinal Creek				A&Wedw		PBC				
SR	Wildcat Creek	Tributary to Centerfire Creek at 33°43'41"/109°26'28"	A&Wc				FBC			FC		Ag L
SR	Willow Creek	Tributary to Beaver Creek at 33°43'52"/109°18'04"	A&Wc				FBC			FC		Ag L
SR	Workman Creek	~~Tributary to Salome Creek~~ Headwaters to cofluence with Reynolds Creek at 33°52'17"/111°00'14.5"	A&Wc				FBC			FC	AgI	Ag L
SR	Workman Creek	Below confluence with Reynolds Creek		A&Ww			FBC			FC	AgI	Ag L
UG	Apache Creek	Tributary to the Gila River at 32°52'08"/109°11'53"		A&Ww			FBC			FC		Ag L
UG	Ash Creek	~~Tributary to the Gila River~~ Headwaters to confluence with unnamed tributary at 32°45'37"/109°52'22"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
UG	Ash Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
UG	Bennett Wash (EDW)	ADOC-Safford WWTP outfall 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	~~PBC~~		FC		
UG	Blue River	~~Tributary to the San Francisco River~~ Headwaters to confluence with Strayhorse Creek at 33°29'02"/110°12'12"	A&Wc				FBC			FC	AgI	Ag L
UG	Blue River	Below confluence with Strayhorse Creek		A&Ww			FBC			FC	AgI	Ag L
UG	Bonita Creek (Unique Water)	San Carlos Indian Reservation to the Gila River at 32°53'35"/109°28'41"		A&Ww			FBC		DWS	FC		Ag L
UG	Buckalou Creek	Tributary to Castle Creek at 33°43'34"/109°09'07"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
UG	Campbell Blue Creek	Tributary to the ~~upper~~ Blue River at 33°43'30"/109°02'46"	A&Wc				FBC			FC		Ag L
UG	Castle Creek	Tributary to Campbell Blue Creek at 33°44'06"/109°08'10"	A&Wc				FBC			FC		Ag L
UG	Cave Creek (Unique Water)	Headwaters to confluence with South Fork Cave Creek at 31°53'04"/109°10'27"	A&Wc				FBC			FC	AgI	Ag L
UG	Cave Creek (Unique Water)	Below confluence with South Fork Cave Creek to Coronado NF Boundary		A&Ww			FBC			FC	AgI	Ag L
UG	Cave Creek	Below Coronado NF Boundary	~~A&Wc~~	A&Ww			FBC			FC	AgI	Ag L
UG	Cave Creek, South Fork	Tributary to Cave Creek~~; Chiricahua Mtns~~ at 31°53'04"/109°10'27"	A&Wc				FBC			FC	AgI	Ag L
UG	Chase Creek	Headwaters to the Phelps-Dodge Morenci Mine		A&Ww			FBC			FC		Ag L
UG	Chase Creek	Below the Phelps-Dodge Morenci Mine			A&We			PBC				
UG	Chitty Canyon Creek	Tributary to Salt House Creek at 33°30'32"/109°24'04"	A&Wc				FBC			FC		Ag L
UG	Cima Creek	Tributary to Cave Creek~~; Chiricahua Mtns~~ at 31°52'19"/109°14'02"	A&Wc				FBC			FC		Ag L
UG	Cluff Ranch Pond #1	32°48'55"/109°49'15"		A&Ww			FBC			FC	AgI	Ag L
UG	Cluff Ranch Pond #2	32°49'15"/109°50'33"		A&Ww			FBC			FC	AgI	Ag L
UG	Cluff Ranch Pond #3	32°48'20"/109°51'43"		A&Ww			FBC			FC	AgI	Ag L
UG	Coleman Creek	Tributary to Campbell Blue Creek at 33°44'20"/109°09'32"	A&Wc				FBC			FC		Ag L
UG	Dankworth Ponds	32°43'15"/109°42'15"	A&Wc				FBC			FC		
UG	Deadman Canyon Creek	~~Tributary to the Gila River~~ Headwaters to confluence with unnamed tributary at 32°43'50"/109°49'01"	A&Wc				FBC		DWS	FC		Ag L
UG	Deadman Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC		DWS	FC		Ag L
UG	Eagle Creek	~~Tributary to the Gila River, below Clifton~~ Headwaters to confluence with unnamed tributary at 33°23'24"/109°29'35"	A&Wc				FBC		DWS	FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
UG	Eagle Creek	Below confluence with unnamed tributary		A&Ww			FBC		DWS	FC	AgI	Ag L
UG	East Eagle Creek	Tributary to Eagle Creek at 33°29'38"/109°28'05"	A&Wc				FBC			FC		Ag L
UG	East Turkey Creek	~~Eastern slope, Chiricahua Mntns~~ Headwaters to confluence with unnamed tributary at 31°58'22"/109°12'17"	A&Wc				FBC			FC		Ag L
UG	East Turkey Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
UG	East Whitetail	Chiricahua Mountains		A&Ww			FBC			FC		Ag L
UG	Emigrant Canyon	Chiricahua Mountains		A&Ww			FBC			FC		Ag L
UG	Evans Pond	32°49'15"/109°51'15"		A&Ww			FBC			FC		
UG	Fishhook Creek	Tributary to the ~~upper~~ Blue River at 33°35'13"/109°10'01"	A&Wc				FBC			FC		Ag L
UG	Foote Creek	Tributary to the ~~upper~~ Blue River at 33°35'24"/109°08'49"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
UG	Frye Canyon Creek	~~Eastern slope, Pinaleno Mountains~~ Headwaters to Frye Mesa Reservoir at 32°45'09.5"/109°50'02"	A&Wc				FBC		DWS	FC		Ag L
UG	Frye Canyon Creek	Below Frye Mesa Reservoir		A&Ww			FBC			FC		Ag L
UG	Frye Mesa Reservoir	32°45'13"/109°50'00"	A&Wc				FBC		DWS	FC		
UG	Gibson Creek	Tributary to Marijilda Creek at 32°41'24"/109°48'11"	A&Wc				FBC			FC		Ag L
UG	Gila River	New Mexico border to the San Carlos Indian Reservation at 33°05'37"/110°03'21"		A&Ww			FBC			FC	AgI	Ag L
UG	Grant Creek	Tributary to the ~~upper~~ Blue River at 33°34'16"/109°10'37"	A&Wc				FBC			FC		Ag L
UG	Judd Lake	33°51'15"/109°09'15"	A&Wc				FBC			FC		
UG	K P Creek	Tributary to the ~~upper~~ Blue River at 33°31'44"/109°12'04"	A&Wc				FBC		~~DWS~~	FC		Ag L
UG	Lanphier Canyon Creek	Tributary to the ~~upper~~ Blue River at 33°35'42"/109°07'52"	A&Wc				FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
UG	Little Blue Creek	~~Tributary to the upper Blue River~~ Headwaters to confluence with Dutch Blue Creek at 33°24'26.5"/109°09'18"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
UG	Little Blue Creek	Below confluence with Dutch Blue Creek		A&Ww			FBC			FC		Ag L
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	~~Near Alpine~~ 33°51'23.5"/109°08'28"	A&Wc				FBC			FC		Ag L
UG	Luna Lake	33°49'45"/109°05'15"	A&Wc				FBC			FC		Ag L
UG	Marijilda Creek	~~Tributary to the Gila River~~ Headwaters to confluence with Gibson Creek at 32°41'23"/109°48'13"	A&Wc				FBC			FC	~~AgI~~	Ag L
UG	Marijilda Creek	Below confluence with Gibson Creek		A&Ww			FBC			FC	AgI	Ag L
UG	Markham Creek	Tributary to the Gila River at 32°56'17"/109°53'13"		A&Ww			FBC			FC		Ag L
UG	Pigeon Creek	Tributary to the ~~lower~~ Blue River at 33°16'08"/109°11'42"		A&Ww			FBC			FC		Ag L
UG	Raspberry Creek	Tributary to the ~~upper~~ Blue River at 33°30'07"/109°12'32"	A&Wc	~~A&Ww~~			FBC			FC		
UG	Roper Lake	32°45'20"/109°42'11"		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	Ag L
UG	San Francisco River	New Mexico border to the Gila River at 33°14'25"/109°02'49"		A&Ww			FBC			FC	AgI	Ag L
UG	San Simon River	Tributary to the Gila River at 32°49'52"/109°38'53"			A&We			PBC				Ag L
UG	Sheep Tank	32°46'15"/109°48'08"		A&Ww			FBC			FC		Ag L
UG	Smith Pond	32°49'09"/109°50'26"		A&Ww			FBC			FC		
UG	Squaw Creek	Tributary to Thomas Creek at 33°23'38"/109°12'22"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
UG	Stone Creek	Tributary to the San Francisco River at 33°50'38"/109°02'46"	A&Wc				FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
UG	Strayhorse Creek	Tributary to the Blue River at 33°29'02"/109°12'11"	A&Wc				FBC			FC		
UG	Thomas Creek	~~Tributary to the upper Blue River~~ Headwaters to confluence with Rousensock Creek at 33°23'45"/109°13'13"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
UG	Thomas Creek	Below confluence with Rousensock Creek		A&Ww			FBC			FC		Ag L
UG	Tinny Pond	33°47'49"/109°04'23"		A&Ww			FBC			FC		Ag L
UG	Turkey Creek	Tributary to Campbell Blue Creek at 33°44'10"/109°04'05"	A&Wc				FBC			FC		Ag L
UG	Unnamed Wash (EDW)	ADOC-Globe WWTP outfall to the San Carlos Indian Reservation				A&Wedw		PBC				
VR	American Gulch	Headwaters to the Northern Gila County Sanitary District WWTP outfall (Payson)		A&Ww			FBC			FC	AgI	Ag L
VR	American Gulch (EDW)	Northern Gila County Sanitary District WWTP outfall (Payson) to the East Verde River				A&Wedw		PBC				
VR	Apache Creek	Tributary to Walnut Creek at 34°55'12"/112°50'42"		A&Ww			FBC			FC		Ag L
VR	Ashbrook Wash	Headwaters to the Ft McDowell Reservation at 33°36'54"/111°42'06"			A&We			PBC				
VR	Aspen Creek	~~Near Prescott~~ Tributary to Granite Creek at 34°31'55"/112°28'19"		A&Ww				~~PBC~~		FC		
VR	Bar Cross Tank	35°00'40"/112°05'34"		A&Ww			FBC			FC		Ag L
VR	Barrata Tank	35°02'43"/112°24'17"		A&Ww			FBC			FC		Ag L
VR	Bartlett Lake	33°49'00"/111°37'45"		A&Ww			FBC		DWS	FC	AgI	Ag L
VR	Beaver Creek	Tributary to the Verde River at 34°34'26"/111°51'14"	~~A&Wc~~	A&Ww			FBC			FC		Ag L
VR	Big Chino Wash	Tributary to Sullivan Lake at 34°52'37"/112°28'37"			A&We			PBC				Ag L
VR	Bitter Creek	Headwaters to the Jerome WWTP outfall		~~A&Ww~~	A&We			PBC		~~FC~~		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
VR	Bitter Creek (EDW)	Jerome WWTP outfall to ~~2.5 km downstream~~ the Yavapai Apache Indian Reservation at 34°45'45.5"/112°04'44"				A&Wedw		PBC				Ag L
VR	Bitter Creek	Below ~~2.5 km downstream of the Jerome WWTP outfall~~ the Yavapai Apache Indian Reservation		A&Ww			FBC			FC	AgI	Ag L
VR	Black Canyon Creek	~~Mingus Mountains~~ Headwaters to confluence with unnamed tributary at 34°39'20"/112°05'05"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
VR	Black Canyon Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
VR	Bonita Creek	Tributary to ~~Perley Creek; Tonto NF~~ Ellison Creek at 34°20'56"/111°14'20"	A&Wc				FBC		~~DWS~~	FC		
VR	Bray Creek	Tributary to Webber Creek at 34°22'37"/111°20'53"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
VR	Camp Creek	Tributary to the Verde River at 33°45'32"/111°30'14"		A&Ww			FBC			FC		Ag L
VR	Carter Tank	34°52'27"/112°57'28"		A&Ww			FBC			FC		Ag L
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		Ag L
VR	Coffe Creek	Tributary to Spring Creek at 34°48'18"/111°55'41"		A&Ww			FBC			FC		Ag L
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"	A&Wc				FBC			FC		
VR	Deadman Creek	Tributary to Horseshoe Reservoir at 34°00'00"/111°42'36"		A&Ww			FBC			FC		Ag L
VR	Del Rio Dam Lake	34°48'55"/112°28'00"		A&Ww			FBC			FC		Ag L
VR	Dry Beaver Creek	Tributary to Beaver Creek at 34°37'59"/111°49'34"		A&Ww			FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
VR	Dude Creek	Tributary to the East Verde River at 34°23'06"/111°16'26"	A&Wc				FBC			FC	AgI	Ag L
VR	East Verde River	~~Tributary to the Verde River~~ Headwaters to confluence with Ellison Creek at 34°21'10"/111°16'47.5"	A&Wc				FBC		DWS	FC	AgI	Ag L
VR	East Verde River	Below confluence with Ellison Creek		A&Ww			FBC		DWS	FC	AgI	Ag L
VR	Ellison Creek	Tributary to the East Verde River at 34°21'11"/111°16'48"	A&Wc				FBC			FC		Ag L
VR	Fossil Creek	Tributary to the Verde River at 34°18'22"/111°40'30"		A&Ww			FBC			FC		Ag L
VR	Fossil Springs	34°25'24"/111°34'25"		A&Ww			FBC		DWS	FC		
VR	Foxboro Lake	34°53'48"/111°40'00"		A&Ww			FBC			FC		Ag L
VR	Fry Lake	35°03'45"/111°48'02"		A&Ww			FBC			FC		Ag L
VR	Gap Creek	~~Tributary to the Verde River; Prescott NF~~ Headwaters to Government Spring at 34°23'23"/111°50'53.5"	A&Wc				FBC			FC		Ag L
VR	Gap Creek	Below Government Spring		A&Ww			FBC			FC		Ag L
VR	Garrett Tank	35°18'57"/112°42'16"		A&Ww			FBC			FC		Ag L
VR	Goldwater Lake, Lower	34°29'55"/112°27'18"	A&Wc				FBC		DWS	FC		
VR	Goldwater Lake, Upper	34°29'51"/112°26'55"	A&Wc				FBC		DWS	FC		
VR	Granite Basin Lake	34°37'01"/112°42'16"		A&Ww			FBC			FC	AgI	Ag L
VR	Granite Creek	~~Tributary to the Verde River~~ Headwaters to confluence with Willow Creek at 34°36'55"/112°25'05"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
VR	Granite Creek	Below confluence with Willow Creek		A&Ww			FBC			FC	AgI	Ag L
VR	Heifer Tank	35°20'28"/112°32'56"		A&Ww			FBC			FC		Ag L
VR	Hell Canyon Tank	35°05'00"/112°24'06"		A&Ww			FBC	~~PBC~~		FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
VR	Homestead Tank	35°21'23"/112°41'32"		A&Ww			FBC			FC		Ag L
VR	Horse Park Tank	34°58'15"/111°36'29"		A&Ww			FBC			FC		Ag L
VR	Horseshoe Reservoir	33°59'00"/111°42'30"		A&Ww			FBC			FC	AgI	Ag L
VR	Houston Creek	Tributary to the Verde River at 34°16'55"/111°41'06"		A&Ww			FBC			FC		Ag L
VR	J.D. Dam Lake	35°04'01"/112°01'40"	A&Wc				FBC			FC	AgI	Ag L
VR	Jacks Canyon Wash (EDW)	Big Park WWTP outfall to Dry Beaver Creek				A&Wedw		PBC				
VR	Lime Creek	Tributary to Horseshoe Reservoir at 33°59'20"/111°44'13"		A&Ww			FBC			FC		Ag L
VR	McLellan Reservoir	35°13'15"/112°17'05"		A&Ww			FBC			FC	AgI	Ag L
VR	Meath Dam Tank	35°07'46"/112°27'35"		A&Ww			FBC			FC		Ag L
VR	Mullican Place Tank	34°44'16"/111°36'08"		A&Ww			FBC			FC		Ag L
VR	Oak Creek (Unique Water)	~~Tributary to the Verde River~~ Headwaters to confluence with unnamed tributary at 34°57'08.5"/111°45'13"	A&Wc				FBC		DWS	FC	AgI	Ag L
VR	Oak Creek (Unique Water)	Below confluence with unnamed tributary		A&Ww			FBC		DWS	FC	AgI	Ag L
VR	Oak Creek, West Fork (Unique Water)	Tributary to Oak Creek at 34°59'13"/111°44'46"	A&Wc				FBC			FC		Ag L
VR	Odell Lake	34°56'02"/111°37'52"	A&Wc				FBC			FC		
VR	Peck's Lake	34°47'07"/112°02'30"	A&Wc				FBC			FC	AgI	Ag L
VR	Perkins Tank	35°06'42"/112°04'08"	A&Wc				FBC			FC		Ag L
VR	Pine Creek	~~Tributary to the East Verde River~~ Headwaters to confluence with unnamed tributary at 34°21'51"/111°26'46"	A&Wc				FBC		DWS	FC	AgI	Ag L
VR	Pine Creek	Below confluence with unnamed tributary		A&Ww			FBC		DWS	FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
VR	Red Creek	Tributary to the Verde River at 34°09'47"/111°43'12"		A&Ww			FBC			FC		Ag L
VR	Red Lake	35°12'19"/113°03'55"		A&Ww			FBC			FC		Ag L
VR	Reservoir #1	35°13'05"/111°50'07"		A&Ww			FBC			FC		
VR	Reservoir #2	35°13'16"/111°50'36"		A&Ww			FBC			FC		
VR	Roundtree Canyon Creek	Tributary to Tangle Creek at 34°09'04"/111°48'18"		A&Ww			FBC			FC		Ag L
VR	Scholze Lake	35°11'53"/112°00'31"		A&Ww			FBC			FC		Ag L
VR	Spring Creek	~~Tributary to Oak Creek~~ Headwaters to confluence with unnamed tributary at 34°57'23.5"/111°57'19"	A&Wc	~~A&Ww~~			FBC			FC	AgI	Ag L
VR	Spring Creek	Below confluence with unnamed tributary to Oak Creek		A&Ww			FBC			FC	AgI	Ag L
VR	Steel Dam Lake	35°13'36"/112°24'51"	A&Wc				FBC			FC		Ag L
VR	Stehr Lake	34°21'59"/111°40'00"		A&Ww			FBC			FC		Ag L
VR	Stone Dam Lake	35°13'36"/112°24'16"	A&Wc				FBC			FC	AgI	Ag L
VR	Stoneman Lake	34°46'44"/111°31'05"	A&Wc				FBC			FC	AgI	Ag L
VR	Sullivan Lake	34°51'46"/112°27'41"		A&Ww			FBC			FC	AgI	Ag L
VR	Sycamore Creek	~~Tributary to Verde River Coconino NF~~ Headwaters to confluence with unnamed tributary at 35°03'40"/111°57'28"	A&Wc				FBC			FC	AgI	Ag L
VR	Sycamore Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC	AgI	Ag L
VR	Sycamore Creek	Tributary to Verde River at 33°37'55"/111°39'58" ~~, Tonto National Forest~~		A&Ww			FBC			FC	AgI	Ag L
VR	Sycamore Creek	Tributary to Verde River at 34°04'42"/111°42'14"		A&Ww			FBC			FC		Ag L
VR	Tangle Creek	Tributary to the Verde River at 34°05'06"/111°42'36"		A&Ww			FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
VR	Trinity Tank	35°27'44"/112°47'56"		A&Ww			FBC			FC		Ag L
VR	Verde River	Above Bartlett Dam		A&Ww			FBC			FC	AgI	Ag L
VR	Verde River	Below Bartlett Dam		A&Ww			FBC		DWS	FC	AgI	Ag L
VR	Walnut Creek	Tributary to Big Chino Wash at 34°58'12"/112°34'55"		A&Ww			FBC			FC		Ag L
VR	Watson Lake	34°35'15"/112°25'05"		A&Ww			FBC			FC	AgI	Ag L
VR	Webber Creek	Tributary to the East Verde River at 34°18'50"/111°19'55"	A&Wc				FBC			FC		Ag L
VR	West Clear Creek	~~Tributary to the Verde River~~ Headwaters to confluence with Meadow Canyon at 34°33'40"/111°31'30"	A&Wc				FBC			FC		Ag L
VR	West Clear Creek	Below confluence with Meadow Canyon		A&Ww			FBC			FC	AgI	Ag L
VR	Wet Beaver Creek	~~Tributary to Beaver Creek~~ Headwaters to unnamed springs at 34°41'17"/111°34'34"	A&Wc				FBC			FC	AgI	Ag L
VR	Wet Beaver Creek	Below unnamed springs		A&Ww			FBC			FC	AgI	Ag L
VR	Whitehorse Lake	35°07'00"/112°00'47"	A&Wc				FBC		DWS	FC	AgI	Ag L
VR	Williamson Valley Wash	Headwaters to confluence with Mint Wash at 34°49'05"/112°37'55"			A&We			PBC				Ag L
VR	Williamson Valley Wash	Confluence of Mint Wash to 10.5 km dwnstm		A&Ww			FBC			FC		Ag L
VR	Williamson Valley Wash	Below 10.5 km downstream of Mint Wash confluence			A&we			PBC				Ag L
VR	Williscraft Tank	35°11'23"/112°35'38"		A&Ww			FBC			FC		Ag L
VR	Willow Creek	Tributary to ~~Willow Creek Reservoir~~ Granite Creek at 34°51'47"/112°25'52"	A&Wc				FBC			FC		Ag L
VR	Willow Creek Reservoir	34°36'17"/112°26'19"		A&Ww			FBC			FC	AgI	Ag L
VR	Willow Valley Lake	34°41'08"/111°19'57"		A&Ww			FBC			FC		Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
WP	Big Creek	~~Pinaleno Mountains~~ Tributary to Pitchfork Canyon at 32°35'24"/109°57'07"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
WP	Goudy Canyon Creek	Pinaleno Mountains	A&Wc				FBC			FC		Ag L
WP	Grant Creek	~~Pinaleno Mountains~~ Headwaters to confluence with unnamed tributary at 32°38'09.5"/109°56'35"	A&Wc				FBC		DWS	FC		Ag L
WP	Grant Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
WP	High Creek	~~Galiuro Mountains~~ Headwaters to confluence with unnamed tributary at 32°33'07"/110°14'40"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
WP	High Creek	Below confluence with unnamed tributary		A&Ww			FBC			FC		Ag L
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		Ag L
WP	Pinery Creek	~~Chiricahua Mtns~~ Headwaters to State Highway 181 at 32°00'24"/109°25'16"	A&Wc	~~A&Ww~~			FBC		DWS	FC		Ag L
WP	Pinery Creek	Below State Highway 181		A&Ww			FBC		DWS	FC		Ag L
WP	Post Creek	Tributary to Grant Creek at 32°40'05"/109°54'58"	A&Wc				FBC			FC	AgI	Ag L
WP	Riggs Flat Lake	32°42'27"/109°57'51"	A&Wc				FBC			FC	AgI	Ag L
WP	Rock Creek	Tributary to Turkey Creek at 31°53'20"/109°30'00"	A&Wc	~~A&Ww~~			FBC			FC		Ag L
WP	Snow Flat Lake	32°39'09"/109°51'52"	A&Wc				FBC			FC	AgI	Ag L
WP	Soldier Creek	Tributary to Post Creek~~; Coronado National Forest~~ at 32°40'52"/109°54'40"	A&Wc				FBC			FC		Ag L
WP	Turkey Creek	~~Western slope, Chiricahua Mtns~~ Headwaters to confluence with Rock Creek at 31°53'20"/109°30'00"	A&Wc				FBC			FC	AgI	Ag L
WP	Turkey Creek	Below confluence with Rock Creek		A&Ww			FBC			FC	AgI	Ag L

BASIN	SEGMENT	LOCATION	A&Wc	A&Ww	A&We	A&Wedw	FBC	PBC	DWS	FC	AgI	Ag L
WP	Ward Canyon Creek	Tributary to Turkey Creek at 31°51'47"/109°20'13"	A&Wc				FBC			FC		Ag L
WP	Willcox Playa	Sulphur Springs Valley		A&Ww			FBC			FC		Ag L