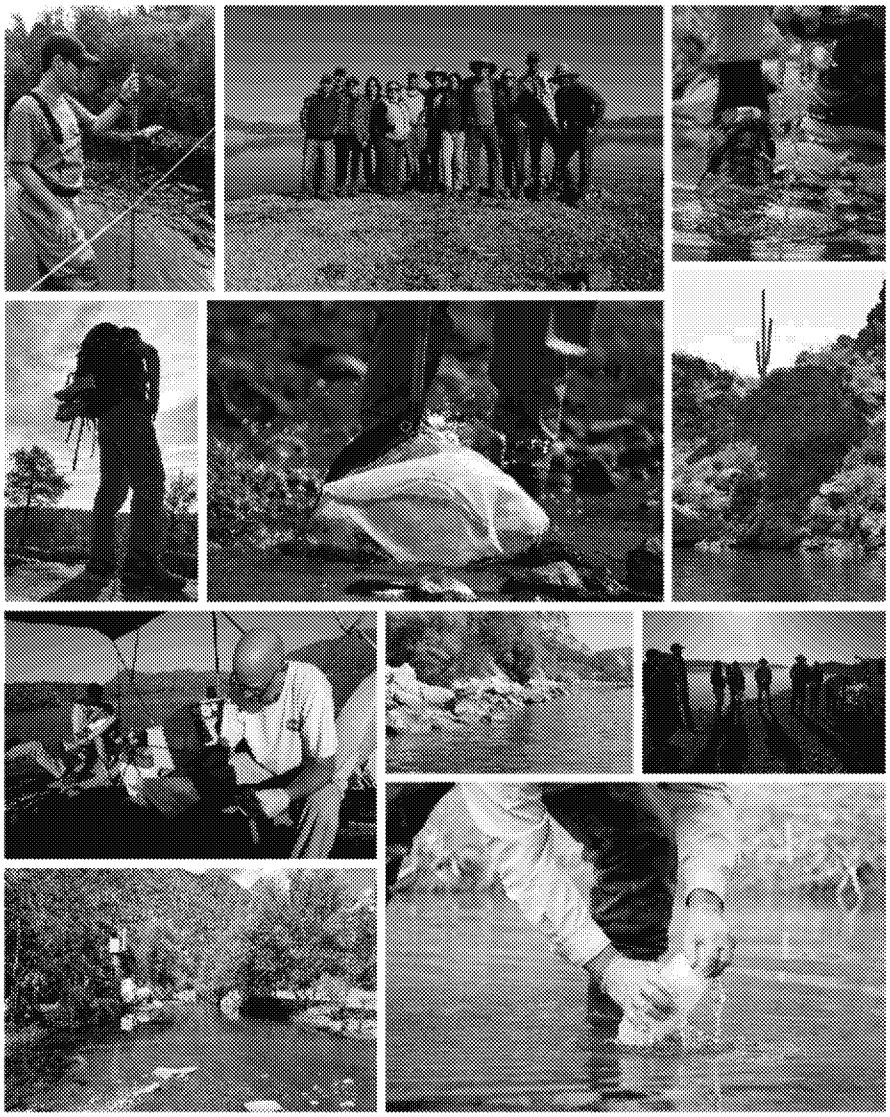
ARIZONA'S 2020 CLEAN WATER ACT ASSESSMENT
(JULY 1, 2014 TO JUNE 30, 2019)

Integrated 305(b) Assessment and 303(d) Listing Report

Revised October 2019



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Appendix A – 2020 Assessment Decisions

Appendix B – 2020 Assessment Exceedances

Appendix C – 2020 Critical Conditions

Appendix D – 2020 Impaired Waters List

Appendix E – 2020 TMDL Priority Ranking

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CHAPTER 1 – INTRODUCTION

The 2020 Clean Water Act Assessment (hereafter referred to as the assessment) covers data collected from July 1, 2014 to June 30, 2019. The purpose of this report is to conduct a comprehensive analysis of water quality data associated with Arizona's surface waters to determine whether surface water quality standards are met and designated uses are being supported. This report is due to the U.S. Environmental Protection Agency (EPA) by April 1, 2020.

The assessment serves three functions.

1. For ADEQ, it identifies waters that need to be protected, maintained or restored. This comprehensive evaluation of water quality in Arizona is used to set priorities, allocate resources, and make decisions about land use activities, discharges to the water, future monitoring, and program initiatives.
2. Nationally, it fulfills a reporting requirement of the Clean Water Act, and is submitted to the EPA. The report is used to address national water quality issues and concerns.
3. For the public, it provides an opportunity to learn about and comment on the status of water quality in Arizona.

HOW THIS DOCUMENT IS ORGANIZED

The 2020 Assessment is divided into two main parts.

1. The assessment document, which summarizes assessment information (Chapter 2), describes the assessment methodology (Chapter 3), gives an action plan for how ADEQ is addressing impairments (Chapter 4) and provides instructions for locating specific assessment decisions (Chapter 5).
2. The appendixes contain the data of the assessment and are broken out into five parts.
   - Appendix A — Assessment Decisions – The full assessment of every parameter, use and waterbody.
   - Appendix B — Assessment Exceedances. Aggregated sample results for every exceedance.
   - Appendix C — Critical Conditions. A list of critical conditions and locations for applicable sites.
   - Appendix D — Impaired Waters List (303(d) list).
   - Appendix E — Total Maximum Daily Load (TMDL) Priority Ranking. Prioritizes which impaired waters should be worked on for TMDL purposes.

REGULATORY AUTHORITY

The Clean Water Act

In 1972, Congress passed the Federal Water Pollution Control Act, commonly known as the Clean Water Act. The goal of this act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. ADEQ implements the Clean Water Act in Arizona, with oversight from the EPA. ADEQ conducts water quality assessments and determines which surface waters are impaired. This document addresses federal monitoring, assessment, and listing requirements found in Sections (§) 106, 205, 303, 305, and 314 of the Clean Water Act.

- §106 and 205 require the states to compile, analyze, and annually submit a report on surface water quality. The report is to include monitoring conducted by ADEQ and other monitoring entities under grants and contracts with ADEQ.

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- § 303 requires ADEQ to adopt, with EPA approval, water quality standards and review these standards every three years. Section 303 also requires states to monitor waters and submit a list of impaired surface waters. These impaired waters are prioritized for the development of a Total Maximum Daily Load (TMDL) for each pollutant causing an impairment. As part of the TMDL process, ADEQ must either set appropriate controls or work with stakeholders to implement actions that will improve water quality, so that the waters meet water quality standards.
- § 305 requires an assessment report that describes and analyzes water quality conditions of all surface waters in Arizona. This assessment report defines the extent that state waters are meeting water quality standards.
- § 314 adds further requirements specific to lakes.

The scope of the Clean Water Act currently includes all the major rivers, streams and lakes in Arizona. It also includes most intermittent and ephemeral streams. EPA is proposing to reduce the jurisdiction of the Clean Water Act in 2020, which will have a dramatic impact on future assessments. Approximately 95% of all waters will no longer be covered by the Clean Water Act.

Federal Regulations and Guidance

The Federal Code of Regulations § 122, 124, and 130.7 establish further and more specific federal requirements concerning the identification of impaired waters (referred to as "water quality limited waters"). No recent changes have occurred in these regulations.

EPA published the Consolidated Assessment and Listing Methodology in 2002. ADEQ has adopted many of the ideas published in this document, such as core parameter coverage. The CALM document provides information on monitoring network design and use of chemical, biological, toxicity, bacteria, and habitat data to support assessments. It also provides technical support such as statistical considerations for data quality objectives and hypothesis testing (EPA, 2002).

EPA publishes memorandums, which address current criteria for each assessment cycle. A copy of this guidance can be downloaded at [HYPERLINK "https://www.epa.gov/tmdl/integrated-reporting-guidance-under-cwa-sections-303d-305b-and-314"]. Since 2001, EPA has recommended that the states submit an integrated report that includes both the assessment required under section 305(b) and the list of impaired waters required under 303(d).

Arizona's Surface Water Standards and Designated Uses

The surface water quality standards located at [HYPERLINK "https://apps.azsos.gov/public_services/register/2019/40/contents.pdf"] were used for this assessment. Surface water quality standards are reviewed and revised on a three-year cycle. The effective date of the standards is November 9, 2019 (see [HYPERLINK "https://apps.azsos.gov/public_services/register/2019/41/contents.pdf"]).

ADEQ sets narrative and numeric surface water standards for water quality based on the ways people and wildlife use the water. These "designated uses" are specified in the standards for individual surface waters. If the surface water is not named in the rule, the designated uses are determined by the tributary rule. The tributary rule assigns designated uses based on flow regime and elevation (A.A.C. R18-11-105). A copy of the complete rules can be downloaded at the Secretary

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of State's Office website at [HYPERLINK "https://apps.azsos.gov/public_services/Title_18/18-11.pdf"].

Arizona's designated uses are:

- Aquatic Wildlife (coldwater, warmwater, effluent-dependent, or ephemeral)
- Fish Consumption
- Body Contact (Full or Partial)
- Domestic Water Source
- Agricultural Irrigation
- Agricultural Livestock Watering

Unique standards have been established for the following waters:

- Waters classified as an "Outstanding Arizona Water" identified in A.A.C. R18-11-112
- Waters classified as effluent dependent waters
- Waters with moderating provisions established in their National (or Arizona) Pollutant Discharge Elimination System (NPDES or AZPDES) discharge permits (i.e., mixing zones or a pollutant-specific variance)
- Waters with nutrient standards, as specified in A.A.C. R18-11-109(F) and
- Colorado River reaches with salinity standards (three benchmark sites along the river between Hoover Dam and Imperial Dam) as specified in A.A.C. R18-11-110

Site specific standards can also be developed for impaired waters where natural conditions alone would cause the standards to be exceeded. ADEQ has developed site-specific standards for Pinto Creek.

A water quality standard is just one of the requirements that is needed before a waterbody can be listed as impaired. Table 1-1 describes the three main elements that are needed before an impairment decision can be made.

1. **The standard**. Describes the magnitude of the standard.
2. **The Impaired Waters Identification Rule (IWIR)**. Describes the frequency and duration requirements for a standard.
3. **Implementation procedures**. Describes how narrative standards are implemented.

ADEQ has several narrative standards (Table 1-3). Implementation procedures and authority in the IWIR need to be present before a waterbody can be listed as impaired. The IWIR does not currently give ADEQ authority to add a water to the impaired waters list based on a narrative standard until if implementation procedures have been written. A.A.C. R18-11-605(D)(3) only allows ADEQ to add waters to a planning list.

Table 1-1. Standards status. Standards, Implementation Procedures (IP), and Authority in the Impaired Waters Identification Rule (IWIR) need to be present before an impairment decision can be made. Green indicates present, grey not applicable, and red not done.

	Rule	Standard	IP	IWIR
Numeric Standards	R-18-11-109 & Appendix A			

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	Rule	Standard	IP	IWIR
Bottom Deposits	R-18-11-108(A)(1)			
Aquatic Life (Wadeable streams)	R-18-11-108(E)			
Objectionable odor, off- taste in drinking water, toxic, causes growth of algae/plants, causes violation of aquifer water quality standards	R-18-11-108(A)(2 to 8)			
Oil/grease	R-18-11-108(B)			
Suspended solids that interfere with downstream WTP	R-18-11-108(C)			
Trash	R-18-11-108(D)			
Lake Nutrient Standards	R-18-11-108.03			

Arizona's TMDL Statute

In 2000, the Arizona Legislature promulgated Arizona Revised Statues (A.R.S.) Title 49, Chapter 2, Article 2.1, (the TMDL Statute) which identifies a general process for making impairment decisions and for developing TMDLs. A copy of these statutes can be downloaded at the Secretary of State's Office website at: [HYPERLINK "https://www.azleg.gov/arstitle/"]. The statute requires ADEQ to:

- Adopt, by rule, the methods used to identify impaired waters
- Use only reasonably current, credible, and scientifically defensible data
- Consider the nature of the water (e.g., ephemeral, intermittent, perennial, effluent dominated) in assessing whether an assessment unit is impaired
- Determine whether pollutant loadings solely from naturally occurring conditions are sufficient to exceed a water quality standard
- Adopt narrative standards and biocriteria implementation procedures through a public process before using these to identify impaired waters

The statute specifies a process for priority ranking, scheduling, developing, reviewing, and implementing TMDLs, and it mandates the development of rules to govern impaired water identification decisions.

Arizona's Impaired Water Identification Rule

Arizona developed the Impaired Water Identification Rules (A.A.C. R18-11-601 through 606) in 2002. These rules establish methods and criteria to:

- Provides methodology for when an assessment unit (stream reach or lake) is impaired
- Describes when an assessment unit is no longer impaired
- Sets criteria for prioritizing the development of TMDLs
- Sets criteria to determine whether a dataset is "credible," and therefore, used for assessments and TMDL development
- Established criteria for interpret data
- Allows for the consideration of contextual information in a weight-of-evidence approach
- Established criteria for determining the spatial extent of the surface water listing.

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The Impaired Water Identification Rule does not establish methods for identifying waters that are supporting their uses. Chapter 2 of this document details how "use support" and "attainment" decisions are made.

THE 2018 INTEGRATED REPORT AND IMPAIRED WATERS LIST

ADEQ did not complete a full assessment for the 2018 cycle. In 2018, ADEQ was building a tool to complete assessments faster and deferred the full assessment until the 2020 cycle. The 2018 impaired waters list (also called the 303(d) list) was submitted to EPA for approval after a public comment period. This list contained new impairments and removed existing impairments but was not a full assessment of all readily available data. The 2018 list was approved by EPA on September 14, 2018.

The 2020 Assessment is the first full integrated report since the 2016 Assessment. All data from the 2018 Assessment was or will be used in the 2016 or 2020 Assessments (Figure 1-1).

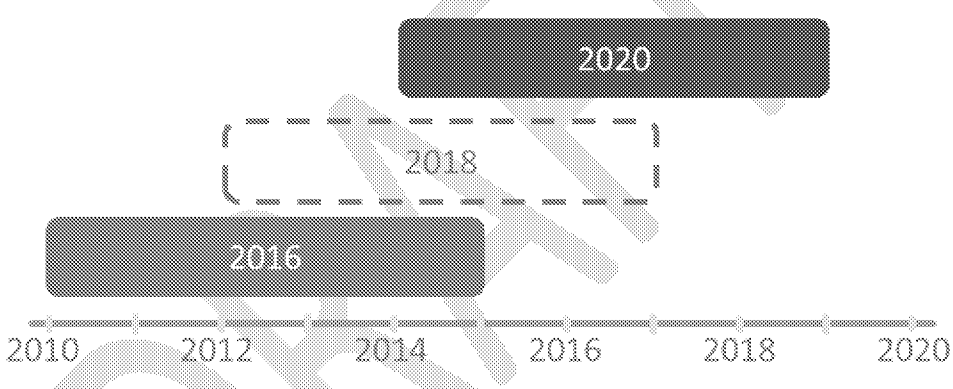

Figure 1-1. The Clean Water Act Assessment is completed every two years and covers a five-year window. Although the 2018 Assessment was not done, all the data collected during this time period is contained in the 2016 or 2020 Assessments.

TARGETED VERSUS PROBABILISTIC ASSESSMENTS

The 2020 Assessment uses a targeted approach to assessing water quality. Probabilistic assessments answer different questions than a traditional targeted assessment. A random design allows statistical inferences to be made about waterbodies that were not visited, much like an election poll. Inferences are good for exploring the condition of waterbodies throughout the state or directing policy but do not allow specific waterbody assessments to be made for sites that have not been sampled.

Answering the question, "How many actual impaired waters are in Arizona?" would be difficult using a targeted approach. There are currently 155 known impaired waters in Arizona (see Chapter 3). The actual number of impaired waters is larger. Using a targeted approach samplers would have to visit roughly 2,500 lakes and streams multiple times to determine the actual number impaired

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waters (excluding ephemeral streams). The amount of staff and lab budget to answer this question using a targeted approach is substantial.

A probabilistic approach can answer the question of how many actual impaired waters are in Arizona with much fewer resources. ADEQ has used a probabilistic approach on perennial and intermittent streams and estimates that there are at least 83 additional impaired streams. That means there are at least 238 impaired waters in Arizona (Figure 1-2), however the actual number of impaired waters is likely much higher than 238.

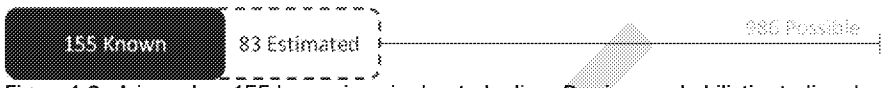

Figure 1-2. Arizona has 155 known impaired waterbodies. Previous probabilistic studies show there are at least 83 additional waterbodies that are impaired.

Targeted assessments in Arizona have historically not focused on intermittent and ephemeral waterbodies because of how difficult it is to monitor these systems. As a result, only 2.8 percent of Arizona was assessed in the last cycle (2016 Assessment). ADEQ used a probabilistic approach to monitor intermittent streams in 2018 and demonstrated how random survey designs can be used to assess these difficult systems ([HYPERLINK "http://static.azdeq.gov/wqd/reports/int_streams_2018.pdf"]).

A targeted design has different strengths compared to probabilistic designs. Targeted designs use all readily available data, which gives unambiguous results regarding which waterbodies are impaired or attaining.

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CHAPTER 2 – ARIZONA'S 2020 ASSESSMENT

ASSESSMENT HISTORY

This report is Arizona's 22nd Clean Water Act Assessment since 1972. Figure 2-1 shows the number of waterbodies assessed, the number of decisions made and the number of impaired waters for the last 20 years. The number of waterbodies assessed represents the total number of lakes or streams visited during the assessment cycle. The number of decisions counts the number attainment and impairment decisions. The **number of impaired waterbodies** describes how many lakes or streams do not support at least one designated use. Ideally, the gap between the number of streams assessed and the number of decisions made should be zero, which indicates that data gaps (inconclusive decisions) were addressed.

The number of assessed waters has been increasing since 1998 with notable declines in 2002, 2006 and 2016. The number of impaired waters decreased until the 2002 cycle and then increased from 43 impaired waters to 155 impaired waters for the 2020 cycle. The Impaired Waters Identification Rule became effective in 2002 and established methodology for listing and delisting waterbodies. The number of decisions shows a large spike in 2000 and then mostly mirrors the number of impaired waters. Methodology for waterbody attainment decisions was adopted by ADEQ during the 2002 cycle based in part on EPA's 2002 Consolidated Assessment and Listing Methodology.

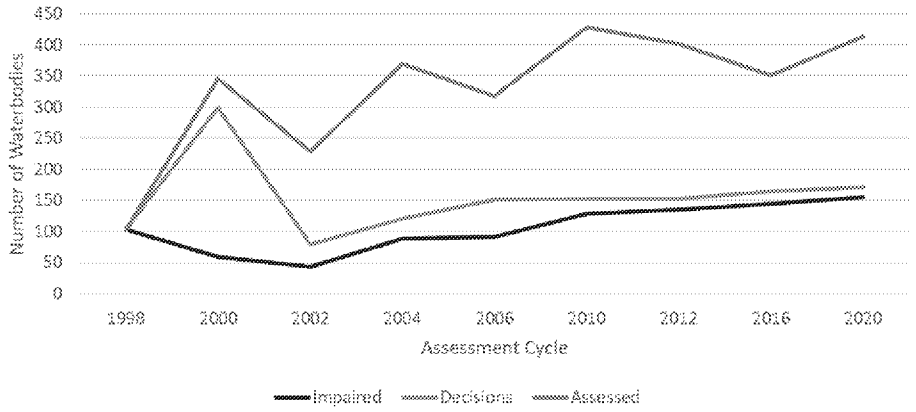

Figure 2-1. History of Assessment Decisions.

NEW IMPAIRED WATERS

In the 2020 assessment cycle, 23 new impairments were identified that did not meet criteria. This resulted in 20 new impaired waterbodies.

Table 2-1. 2020 Assessment New Impairments

WBID	Name	Use	Parameter	Previous Impair?	Type	Miles / Acres
14070006-001	COLORADO RIVER	AWC	SELENIUM	NO	Stream	16.9

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WBID	Name	Use	Parameter	Previous Impair?	Type	Miles / Acres
15020005-009	SILVER CREEK	FBC	ESCHERICHIA COLI	NO	Stream	10.7
15030101-0590	LAKE HAVASU	AWW	SELENIUM	NO	Lake	19782.913
15040005-022	GILA RIVER	AWW	COPPER	YES	Stream	5.8
15050202-006	SAN PEDRO RIVER	AWW	COPPER	NO	Stream	8.9
15050202-006	SAN PEDRO RIVER	FBC	ESCHERICHIA COLI	NO	Stream	8.9
15050202-394	CURRY DRAW	FBC	ESCHERICHIA COLI	NO	Stream	5
15050301-009	SANTA CRUZ RIVER	AWEDW	NICKEL	YES	Stream	9.1
15050301-013D	SONOITA CREEK	FBC	ESCHERICHIA COLI	NO	Stream	9.6
15050301-475	PECK CANYON CREEK	FBC	ESCHERICHIA COLI	NO	Stream	15.6
15060105-455B	BARNHARDT CREEK	AWW	COPPER	NO	Stream	6.7
15060106B-179	INDIAN BEND WASH	PBC	ESCHERICHIA COLI	NO	Stream	4.8
15060202-001	VERDE RIVER	FBC	ESCHERICHIA COLI	NO	Stream	1.1
15070102-003	SKUNK CREEK	PBC	ESCHERICHIA COLI	NO	Stream	30.4
15070102-031B	AGUA FRIA RIVER	AWW	SELENIUM	NO	Stream	17.8
15070102-033A	LYNX CREEK	AWC	CADMIUM	NO	Stream	13.1
15070102-033A	LYNX CREEK	AWC	ZINC	NO	Stream	13.1
15070102-034A	BIG BUG CREEK	AWC	ZINC	NO	Stream	5.7
15070102-034B	BIG BUG CREEK	AWW	COPPER	NO	Stream	23.3
15070102-123	MONEY METALS TRIB	AWE	CADMIUM	YES	Stream	0.5
15070102-234	UNNAMED TRIB TO BIG BUG CREEK (UB1)	AWC	COPPER	NO	Stream	1.3
15070102-234	UNNAMED TRIB TO BIG BUG CREEK (UB1)	AWC	ZINC	NO	Stream	1.3
15070102-768	EUGENE GULCH	AWE	COPPER	NO	Stream	3.1

NEW DELISTED WATERS

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Seventeen parameters were not meeting criteria in the previous assessment now meet criteria. This includes four waterbodies that were full delists which means that all parameter impairments were removed for each waterbody. For purposes of this report we say that these waters were 'delisted' even though only Category 5 waters are technically on the impaired waters list. All delists for the 2020 assessment period were due to new data.

Delisted waters are divided into Category 5 and Category 4A waters. The delisted Category 5 impact the Impaired Waters List. Aravaipa Creek, Sonoita Creek and the Agua Fria River are full delists and will not show up on the Impaired Waters List. Waterbodies that have been fully delisted do not have any parameters causing impairment. The Santa Cruz and San Pedro Rivers both are 'partial' delists, which impact just the parameters listed in Table 2-2. These waters remain impaired and will remain on the impaired waters list but the delist parameters will be removed.

Category 4A waters are "not-attaining", which means they are impaired but not placed on the Impaired Waters List (A.A.C. R18-11-601(11)). EPA does not place these on the impaired waters list even though they are impaired because these waters have a completed TMDL. This creates some confusion when data show that an impaired water with a TMDL is no longer impaired. Lakeside Lake is the only Category 4 water that data show is no longer impaired for the 2020 assessment cycle. Data for pH, ammonia, dissolved oxygen and chlorophyll all meet criteria.

Table 2-2. 2020 Assessment Delists.

WBID	Name	Use	Parameter	Full Delist?	Type	Miles / Acres
Category 5 (Impaired – No TMDL)						
15050202-008	SAN PEDRO RIVER	AWW	DISSOLVED OXYGEN (DO)	PARTIAL	Stream	28.3
15050203-004C	ARAVAIPA CREEK	FBC	ESCHERICHIA COLI	FULL	Stream	12.6
15050301-001	SANTA CRUZ RIVER	AWE DW	AMMONIA-NITROGEN	PARTIAL	Stream	8.6
15050301-008A	SANTA CRUZ RIVER	AWE DW	AMMONIA-NITROGEN	PARTIAL	Stream	4.8
15050301-013C	SONOITA CREEK	AWW	ZINC	FULL	Stream	9
15050301-013C	SONOITA CREEK	AWW	DISSOLVED OXYGEN (DO)	FULL	Stream	9
15070102-023	AGUA FRIA RIVER	FBC	ESCHERICHIA COLI	FULL	Stream	9.8
15070102-023	AGUA FRIA RIVER	AWW	SELENIUM	FULL	Stream	9.8
Category 4A (Not Attaining - TMDL Complete)						
15030202-005A	BOULDER CREEK	AWW	BERYLLIUM	PARTIAL	Stream	1.4
15030202-005A	BOULDER CREEK	AWW	COPPER	PARTIAL	Stream	1.4
15050302-0760	LAKESIDE LAKE	AWW	AMMONIA-NITROGEN	FULL	Lake	14.46
15050302-0760	LAKESIDE LAKE	AWW	PH	FULL	Lake	14.46
15050302-0760	LAKESIDE LAKE	PBC	PH	FULL	Lake	14.46
15050302-0760	LAKESIDE LAKE	AWW	DISSOLVED OXYGEN	FULL	Lake	14.46
15050302-0760	LAKESIDE LAKE	AWW	CHLOROPHYL L.	FULL	Lake	14.46
15060105-353	CHRISTOPHER CREEK	FBC	ESCHERICHIA COLI	PARTIAL	Stream	8

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WBID	Name	Use	Parameter	Full Delist?	Type	Miles / Acres
Category 5 (Impaired – No TMDL)						
15060202-025	VERDE RIVER	AWW	DISSOLVED OXYGEN (DO)	PARTIAL	Stream	25.2
15070102-036B	TURKEY CREEK	AWW	COPPER	PARTIAL	Stream	21

WATERBODY ASSESSMENT SUMMARY

Data from 59 (103,667 acres) lakes and 355 (3,635 miles) stream segments were analyzed for the 2020 assessment (Table 2-3).

Table 2-3. Waterbody Assessment Summary (Miles/Acres)

	Impaired	Inconclusive	Attaining	Assessed
Lake (Acres)	67,656	36,011	0	**103,667**
Stream (Miles)	1,013	2,433	189	**3,635**

Table 2-4. Waterbody Assessment Summary (Count of Waterbodies)

	Impaired	Inconclusive	Attaining	Assessed
Lake (Count)	32	27	0	**59**
Stream (Count)	123	217	15	**355**
Total	**155**	**244**	**15**	**414**

There are 155 impaired waterbodies in Arizona, which means that at least one use is not supported and at least one parameter is not meeting criteria for each waterbody. There are 15 waterbodies that are attaining. Attaining waterbodies have demonstrated support for all uses. 244 waterbodies are inconclusive. Inconclusive waterbodies are missing data to make an impairment or attainment decision.

Arizona has approximately 108,559 stream miles and 285,962 lake acres based on the National Hydrography Dataset (excluding Indian reservations). Over 90% of Arizona's streams are ephemeral. Almost all of Arizona's lakes are reservoirs. A very low percentage of the state's surface waters are assessed when compared to the total number of stream miles or lake acres. This is primarily due to the fact that the majority of waters in Arizona are ephemeral (flowing in response only to precipitation events) and not easily sampled. Most monitoring used in the 2020 assessment is focused on perennial waters (waters that flow year round). Monitoring ephemeral and intermittent waters is limited to special investigations, such as TMDL development.

Assessed Waters by Category

EPA uses a category system, which further breaks down the three categories in Table 2-3 into five categories. EPA's category system shows which impaired waters have a TMDL and gives credit to waters that are attaining some designated uses. Category descriptions are listed in the 'Assessing at the Assessment Unit Level' section. ATTAINS calculates the assessment categories using the logic outlined in "EPA Integrated Reporting (IR) Categories and How ATTAINS Calculates Them" (EPA, 2018).

Inconclusives (Category 3) make up a little over a third of the number of waterbody assessments for the 2020 assessment. There are 80 waterbodies that support all or some uses (Category 1 and 2). Sixty-five waterbodies have a TMDL complete (Category 4A) and 90 waterbodies are impaired with no

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TMDL (Category 5)(Figure 2-2 and Table 2-5). The Impaired Water's List includes all Category 5 waters and is included in Appendix D.

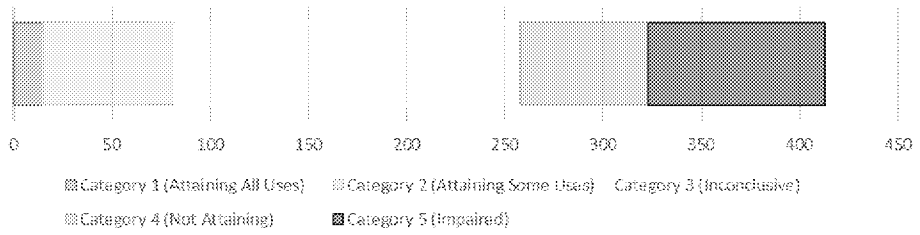

Figure 2-2. EPA category distribution.

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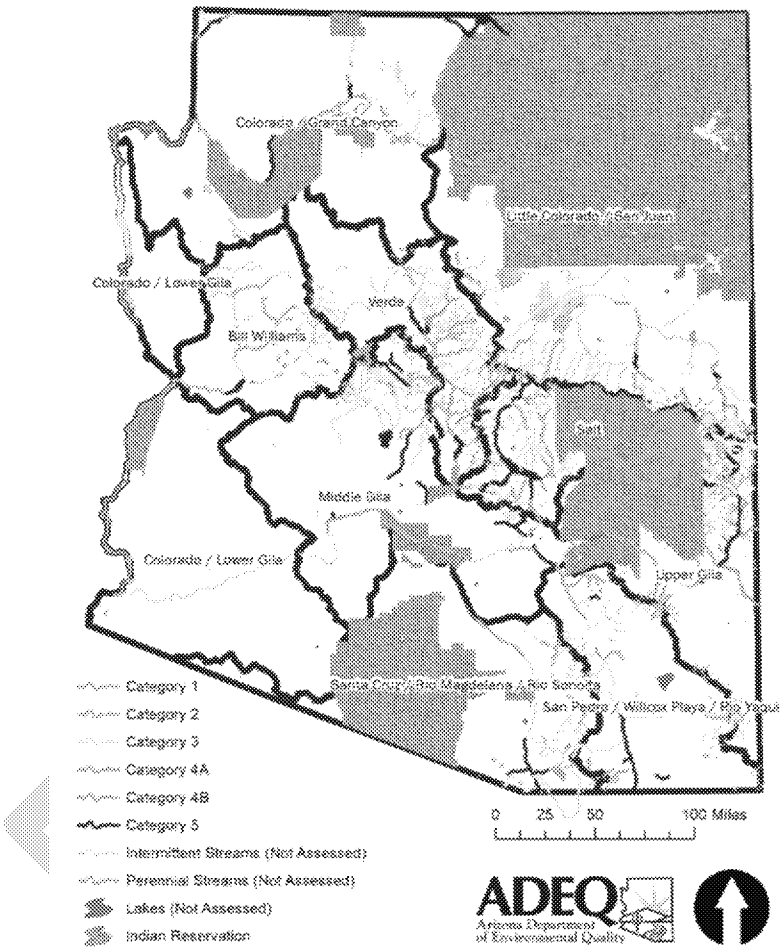

Figure 2-3. Waterbody assessment by EPA category. Category descriptions are below. Interactive map can be accessed here.

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Table 2-5. Status of Assessed Waters

Use Support Category	# Lakes	Acres	# Streams	Miles
Category 1 (Attaining All Uses)	0	0	15	189
Category 2 (Attaining Some Uses)	7	6,197	61	831
Category 3 (Inconclusive)	20	29,814	156	1,602
Category 4 (Not Attaining)	10	2,639	55	319
Category 5 (Impaired)	22	65,017	68	694
Total	**59**	**103,667**	**355**	**3,635**

USE ASSESSMENT SUMMARY

Narrative and numeric criteria were developed to protect the designated uses assigned to a surface water. Most uses are assessed as 'Insufficient Information' (Figure 2-4). Roughly 13 percent of these 'Insufficient Information' decisions are due to exceedances of standards while the remaining 77 percent is from not having a sufficient number of samples for core parameter and seasonal distribution coverage.

Designated use summary (Figure 2-4).

- Full body contact has the largest number of waterbodies not supporting (due mostly to *Escherichia coli*).
- pH is the most common cause for why the agriculture livestock and agriculture irrigation do not support uses.
- Fish consumption has the greatest number of waterbodies that are fully supporting. Twenty-six of the 28 'non-supporting' decisions are due to mercury in fish tissue.
- The domestic water source use only has one waterbody (Verde River; 15060203-004) that does not support.
- Metals account for 81% of the non-supporting decisions for the Aquatic and wildlife use.
- No uses are supported for partial body contact. pH and E. coli are the main causes of not supporting the partial body contact use.

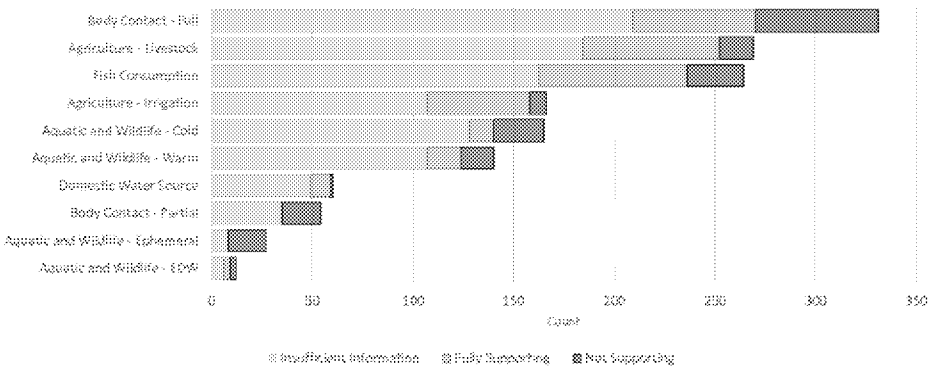

Figure 2-4. Designated Use Support Summary. Counts are the number of waterbodies for each group.

PARAMETER ASSESSMENT SUMMARY

Escherichia coli (*E. coli*) is the most common surface water quality impairment in Arizona (Figure 2-5). The water quality standard for *E. coli* was increased from 235 cfu/100 mL to 410 cfu/100 mL in the 2019 ADEQ water quality standard revisions. This change had little impact on the total number of *E. coli* impairments. The main driver for *E. coli* impairments is the low frequency and duration requirements listed in the Impaired Waters Identification Rule. Only two exceedances are needed to determine that *E. coli* does not meet criteria and to impair the waterbody.

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There are 46 copper impairments in Arizona. Most of the copper impairments are for the aquatic and wildlife use. Zinc and cadmium are also relatively common metal impairments with 21 and 17 impairments, respectively. All the mercury impairments are due to fish consumption advisories and impact the fish consumption designated use.

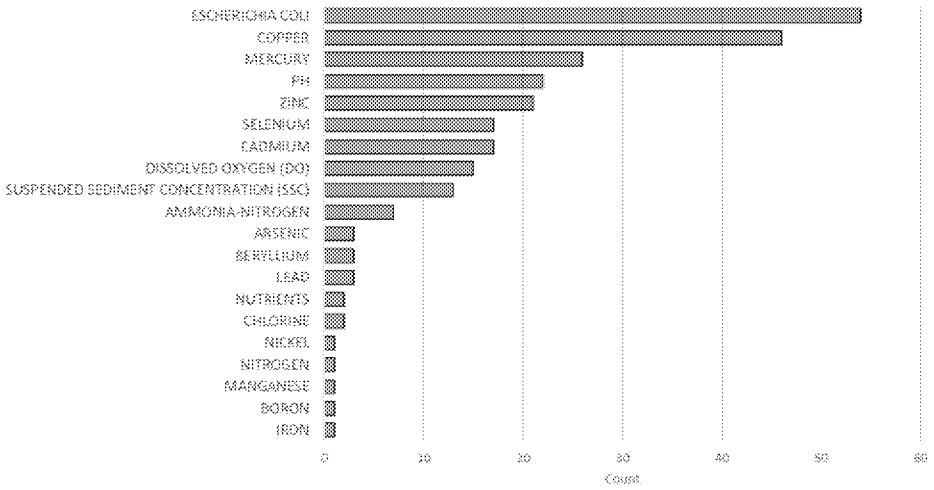

Figure 2-5. Causes of Impairment.

CONTRIBUTIONS BY ORGANIZATION

Data from 22 external entities/data sharing partners were used in the 2020 assessment. Approximately 50% of the data used in the assessment was from external sources (Figure 2-6).

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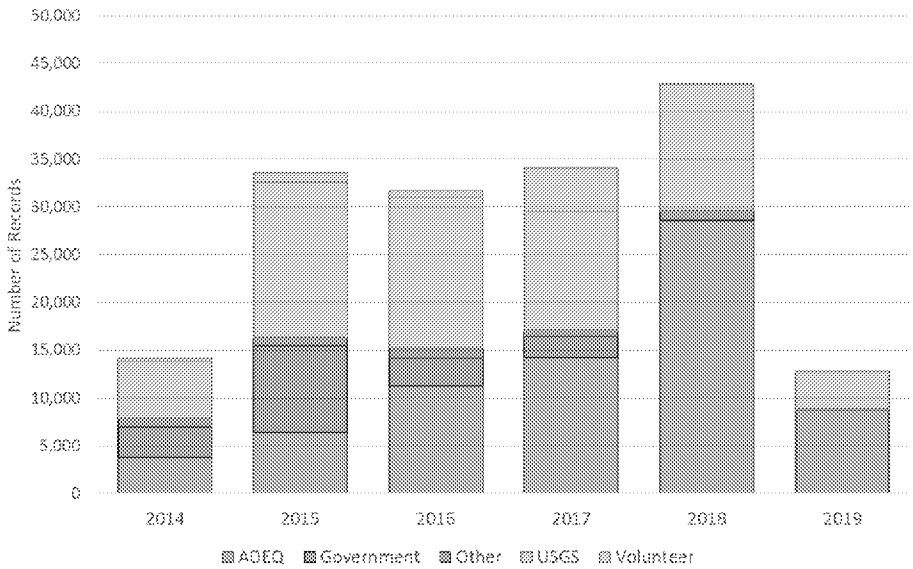

Figure 2-6. Data used in the 2020 Assessment by organization. Note: The 2020 Assessment window is from 7/1/2014 to 6/30/2019, which accounts for the differences in records for 2014 and 2019.

1. Arizona Department of Environmental Quality
2. United States Geological Survey
3. Oak Creek Watershed Improvement Council
4. Butte Creek Restoration Council
5. Friends of the Forest
6. Verde River Institute
7. Sierra Club
8. Aravaipa Group
9. Gila Watershed Partnership
10. Friends of the Tonto
11. Arizona Game and Fish
12. Arizona State Parks Park
13. Pima County
14. City of Tucson
15. National Park Service
16. Bureau of Reclamation
17. Bureau of Land Management
18. International Boundary and Water Commission
19. Golder and Associates
20. Walker Ecological Services
21. University of Arizona
22. Resolution Copper

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External groups were able to add 1,517 assessment decisions (red and green bars) at the parameter level to the 2020 assessment (Figure 2-7). An example of an assessment decision at the parameter level would be determining that Arsenic is not meeting criteria for the Fish Consumption designated use at Oak Creek.

ADEQ made 5,602 assessment decisions during the 2020 cycle. Assessment decisions could not be made for roughly half of the parameter level assessment data.

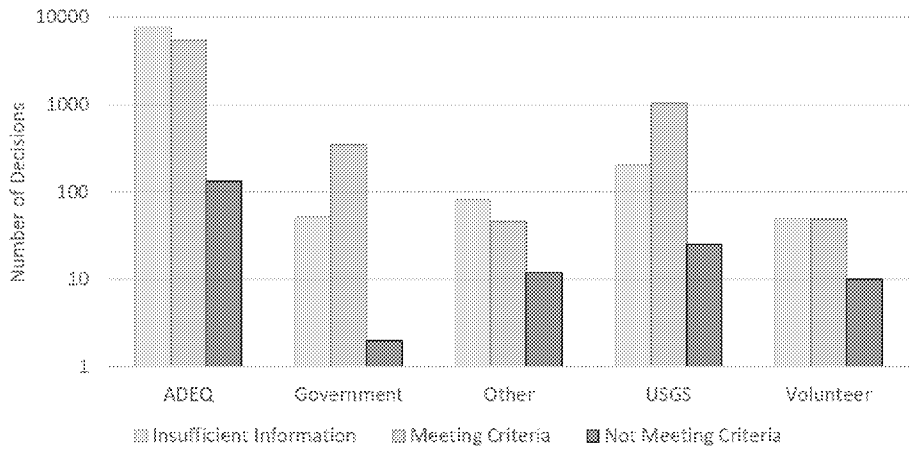

Figure 2-7. Number of parameter level assessment decisions made by organization (Log 10 scale).

In future assessments, ADEQ will use the real time assessment tool to identify data gaps needed to make assessment decisions and reduce the samples resulting in 'insufficient information'. ADEQ has begun to employ the data gap tool to give real time monitoring needs for every site and ADEQ also works with external groups to help fill these monitoring needs.

FISH CONSUMPTION ADVISORIES

Fish consumption advisories are issued to inform the public about possible adverse health effects and they contain recommendations for how many fish meals (8-ounce portions) can safely be consumed. EPA issued a national advisory for mercury in fish tissue in 2001.

As of 2019, 20 fish consumption advisories are in place in Arizona for mercury. There have been no new fish advisories since 2017. EPA will not need to add any impaired segments due to fish consumption advisories for the 2020 assessment.

A map of current fish advisories and a list by county can be found at [HYPERLINK "http://www.azdeq.gov/node/1485"].

Additional information about fish tissue screening and fish advisories can be obtained by contacting ADEQ at (602) 771-4536 or Arizona Game and Fish Department (AGFD) at (602) 789-3260.

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CHAPTER 3 - ASSESSMENT PROCESS AND METHODOLOGY

The Arizona Clean Water Act Assessment process can be broken down into six basic steps.

1. Preparing the Assessment
2. Review of the Draft Assessment
3. Public Comment
4. Publish Comments and Impaired Water's List to the Arizona Administrative Register
5. Submit to EPA/ATTAINS (Due April 1st of even years)
6. EPA Finalizes

States are required by the Clean Water Act to submit their assessments to EPA by April 1st of even years (step 5). According to EPA's 2014 integrated report memorandum, only 16 percent of states submitted on time for the 2012 assessment. Arizona has historically struggled to meet the April 1st deadline. Arizona missed the April 1st deadline for the last assessment cycle (2016) by 258 days (Table 3-1).

Table 3-1. Process time for the 2016 Assessment

#	Step	Date Step Completed	Days
1	Prepare the Assessment	7/1/15	Start
2	Review of the Draft Assessment	3/28/16	271
3	Public Comment	6/13/16	77
4	Publish Response and List to AAR	9/30/16	109
5	Submit to EPA/ATTAINS (Due 4/1/16)	12/15/16	76
6	EPA Finalizes	9/25/17	284

ADEQ has developed a 'Real Time Assessment Tool' to make assessment decisions faster. The assessment tool was built using R and modeled after states like New Jersey and South Carolina.

Arizona's Real Time Assessment Tool

ADEQ uses the Real Time Assessment Tool to provisionally assess water quality data as it becomes available. This approach allows ADEQ to identify possible new impairments or delists on a week-to-week basis rather than waiting until the end of the two-year assessment cycle. Assessing in real time allows ADEQ to identify assessment data gaps and adjust before the assessment window closes.

STEP 1 - PREPARING THE ARIZONA CLEAN WATER ACT ASSESSMENT

Arizona's tool takes data from the water quality portal ([HYPERLINK "http://www.waterqualitydata.us"]), calculates assessments based on Arizona standards and then pushes the final results to EPA's Assessment TMDL Tracking And Implementation System (ATTAINS). ATTAINS retains a historical record of all assessments (Figure 3-1). Recent upgrades also track changes during each assessment cycle such as recording any changes made during the public notice period.

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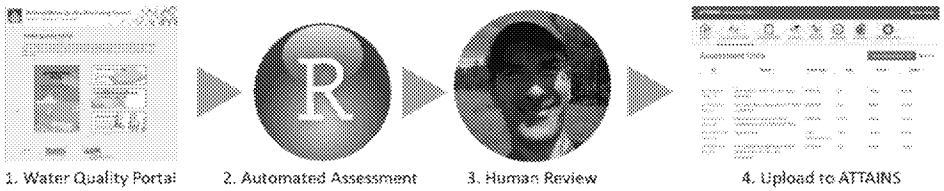

Figure 3-1. Data from the Water Quality Portal is Assessed, Reviewed and Sent to ATTAINS.

A. Gathering Data

States must consider all readily available data when preparing the Clean Water Act Assessment. ADEQ uses data from the water quality portal ([HYPERLINK "http://www.waterqualitydata.us"]) as the main source of data for the assessment. The portal is the main repository for the nation's water quality data and includes data from multiple organizations in a common format. ADEQ sends data to the portal through EPA's Water Quality Exchange (WQX) on a daily basis. This includes data collected by ADEQ and organizations that do not want to submit directly to WQX.

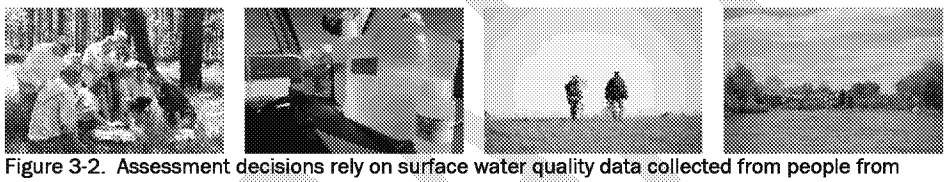

Figure 3-2. Assessment decisions rely on surface water quality data collected from people from many organizations.

Call for Data

ADEQ solicits data for the assessment through a 'Call for Data' each February. The most recent call for data was sent in February 2019 to 1,299 recipients and was posted on ADEQ's website.

Interested parties may subscribe to receive 'Request-for-Data' emails and other updates by clicking this link or copying and pasting into an internet browser: [HYPERLINK "https://public.govdelivery.com/accounts/AZDEQ/subscriber/new?topic_id=AZDEQ_62"]. Subscribe to the TMDL and/or Water Quality Improvement Grant list serves to be included in the next call for data.

To be considered in the assessment and listing process, data from agencies and other entities must have been received by July 1, 2019.

How to Submit Data

ADEQ prefers that data be loaded directly to the water quality portal. Instructions for uploading data to the portal can be found at [HYPERLINK "https://www.waterqualitydata.us/upload_data/"]. Alternatively, data can be submitted directly to ADEQ by following the surface water data submission guidance document [HYPERLINK "http://static.azdeq.gov/swq/data_submittal_guidance.pdf"].

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Credible Data Requirements

ADEQ uses data that meets the credible data requirements defined in Arizona Administrative Code R18-11-602. The rule requires that:

- Data must be collected and analyzed following an appropriate Quality Assurance Plan (QAP) and Sampling and Analysis Plan (SAP), by adequately trained personnel using approved field and laboratory methods.
- Data must be evaluated to determine whether it is reliable, accurately reflects current water quality conditions, and is valid. This is determined by considering factors such as:
    - Laboratory detection limits,
    - Lab notations or qualifiers,
    - Whether the sampling was representative and reproducible,
    - Whether approved sampling and analysis methods were used, and
    - Quality control of the data when collected and analyzed.
- The monitoring entity must submit documentation that these requirements have been met and other information necessary to assist ADEQ in interpreting and validating the data.

Data from organizations that do not meet the Credible Data rule is excluded from the assessment and is not used to make impairment decisions.

B. Data Preparation and Formatting

The data preparation and formatting step has traditionally been the most time consuming part of the assessment. ADEQ has significantly shortened this time by using the water quality portal and by using its new tool.

ADEQ performs the following steps to prepare and format the assessment.

Exclusion of Tribal Data

Data located within tribal jurisdiction is excluded from the assessment.

Exclusion of Quality Control Samples

Quality control samples such as duplicates, splits and blanks are excluded from the assessment. Quality control samples are not used to evaluate surface waters because these data can unfairly weight the result for a particular time and day. Although quality control samples are not used directly in the assessment, they may be used to ensure that data is credible (appropriate number of quality control samples and results within acceptance criteria).

Reporting Units

Result and detection limit units are transformed to common units such as milligrams per liter (mg/L). This includes converting pH to hydrogen ion concentration so that summary statistics can be calculated.

Speciation

Some results from the water quality portal are reported in units like mg/l as NO3. A compound like nitrate that has a result of 10 mg/L as NO3 would need to be converted to Nitrate as N before it can be used in the assessment. Conversions are available in EPA's 2017 'Best Practices for Submitting Nutrient Data to the Water Quality eXchange).

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Sample Values Less Than the Laboratory Reporting Limit

The Impaired Water Identification Rule (A.A.C. R18-11-603(A)(1)(b)) explains how to handle 'non-detects' with appropriate method reporting limits. The rules further describes that "less than" data can be used in trend analysis, descriptive statistics, or modeling as follows:

- If there are sufficient data to support statistically estimating the values reported as "less than" the reporting limit; or
- If there are not sufficient data to support statistically estimating the values reported as "less than" the reporting limit, then ADEQ will use one-half of the value of the RL.

When the result is reported as less than the method reporting limit and that value is above the standard, the sample is not included in assessment. For example, a result of <5 mg/L that has a standard is 2 mg/L is not used in the assessment because results less than 5 can both exceed the standard and meet the standard.

Reviewing Dissolved and Total Standards

Dissolved results are used if a total result for the same parameter (same date and time and depth) is not available.

Calculated Total Nitrogen

Total nitrogen is calculated for samples that have nitrate and nitrite and total Kjeldahl nitrogen (TKN) but do not have a total nitrogen value. Total nitrogen is calculated by adding nitrate/nitrite and TKN. TKN is calculated by adding ammonia and organic nitrogen.

Field Data

Field data is used instead of lab data for time sensitive parameters such as pH and dissolved oxygen.

Data Qualifiers

Water quality data and information may include data qualifiers or field comments that denote a deviation from acceptable sampling, handling, storage, or analytical procedures. Some data qualifiers invoke questions as to the accuracy of the data in representing the actual water quality conditions. For example, values reported by the laboratory as estimates are not used for listing decisions. ADEQ identifies qualifiers that compromise data quality in Chapter 10 of the Surface Water Sampling Standard Operating Procedures Manual (Jones, 2018) [HYPERLINK "http://static.azdeq.gov/wqd/sampling.pdf"]. Data qualified as 'Reject' from the water quality portal is excluded from the dataset. A case-by-case evaluation of the lab qualifiers from the water quality portal is used to determine the reliability of the data.

Linking the Assessment Unit to the Monitoring Location

Water quality samples are taken at a site or monitoring location. Standards are assigned to an assessment unit or waterbody, which can have multiple sites. Each monitoring location is associated with a waterbody so that standards can be applied.

The assessment unit for a stream is the stream reach. Stream reaches were derived from EPA's Reach File System, which divide a stream into segments based on intervening tributaries. Over the

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years, these reaches have been further segmented to reflect changes in designated uses or differences in impairment.

The assessment unit for a lake is generally the entire lake.

Each assessment unit is assigned a unique number that identifies a particular waterbody (e.g., 15060202-028). Arizona uses a variant of the 8-digit hydrologic unit code number (HUC) for the drainage area, and

- A 3 or 4 digit/character stream reach number (derived from EPA's original Reach File System), or
- A 4-digit lake number (derived from AGFD's lake numbering system).

Multiple sampling sites can be located in each assessment unit.

Uses are assigned to waterbodies in rule (A.A.C. Title 18, Chapter 11, Article 1). Each use has specific parameters with specific criteria. For example, Boulder Creek (15030202-005A) has a designated use for fish consumption with a total arsenic criterion of 80 µg/L.

C. Aggregation

Spatial and temporal independence are determined after data has been prepared and formatted.

Spatial Independence

Rather than define the maximum coverage of a single station, Arizona's Impaired Water Identification Rule relies on minimum numbers of samples, spatial independence, and temporal independence. Samples are considered spatially independent if they are collected more than 200 meters apart; or if less than 200 meters apart, samples were taken to characterize the effect of an intervening tributary, outfall, pollution source, or significant hydrographic or hydrologic change.

Temporal Independence

Temporal separation of samples is important in the assessment process, because surface waters should be identified as impaired only if the exceedances of water quality standards are persistent or recurring. Impairment decisions should not be based on one-time events that cause a temporary elevation in pollutant concentrations that may never be repeated. Similarly, a decision of "attaining" should also not be made based on samples collected all at one time.

Temporal separation of samples is ensured by first applying the 7-day rule and then grouping sites in the same assessment unit.

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1. Temporal Aggregation - 7 Day Rule

If multiple samples are available at one site within a 7-day period, a representative value is determined. This value is counted as one sample for that one-week period at that site. The criteria listed in Table 3-2 is used to aggregate data within a 7-day period:

Table 3-2. Temporal aggregation rules.

PARAMETERS	REPRESENTATIVE 7-DAY VALUE
Dissolved oxygen	Minimum value
Acute aquatic and wildlife criteria Nitrate and nitrate/nitrite criteria *E. coli* single sample maximum standard phosphorus and nitrogen single sample maximum	Maximum value
pH	Minimum or maximum (the pH standard is a range of numbers)
Chronic aquatic and wildlife criteria. ALL OTHER DATA	Use the mean value for the 7-day period.

2. Temporal Aggregation - Group by Waterbody

If multiple sites have been sampled within the assessment unit within a seven-day period, they are counted as one sample, and one worst-case exceedance is used as the representative exceedance for the assessment unit. Grouping by waterbody happens after the 7 day rule.

Exceptions to the 2-step data aggregation

- Applying 90th Percentile standards to nutrient data or
- Applying geometric mean standards to *E. coli* bacteria data

Data aggregation avoids over-counting exceedances (a type 1 error that would lead to listing when not impaired) and avoids over-counting samples collected during one week that could dilute out a problem (a type 2 error that would lead to not listing when impaired).

D. Assessing at the Parameter, Use and Assessment Unit Levels

Up to this point, data from the portal has been formatted, aggregated and compared to standards. The next step is to count the total number of samples and the number of samples that do not meet standards. These results are then rolled up to the parameter, use and assessment unit levels. Figure 3-3 illustrates how data from various inputs (data/standards/previous impairments/etc.) is run through the assessment calculator (the funnel) and produces outputs at the parameter, use and waterbody levels. EPA nomenclature for each level is shown below and will be used throughout this document to describe assessment decisions at each level.

1. **Parameter**. This is the lowest level and determines whether a particular waterbody and use and parameter meets criteria or **does not meet criteria** Parameters that do not meet criteria are carried forward from previous assessments (Figure 3-4). This insures that impairments are tracked and prioritized for remediation. A parameter that was not meeting criteria for arsenic in 2000 will stay 'impaired' for arsenic on future assessments until there is a good reason to remove it (see the delisting section). Parameters that do meet criteria or have insufficient information are not carried forward from previous assessments because the data is not timely.

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2. **Use**. Uses include aquatic and wildlife, fish consumption, recreation (body contact), domestic water source, agriculture irrigation, and agriculture livestock. Uses roll up from the parameter level and are either supporting or **not supporting** the use.
3. **Assessment Unit**. Assessment unit determinations are for the entire stream reach or lake. Attainment or **impairment** determinations roll up from the use level.

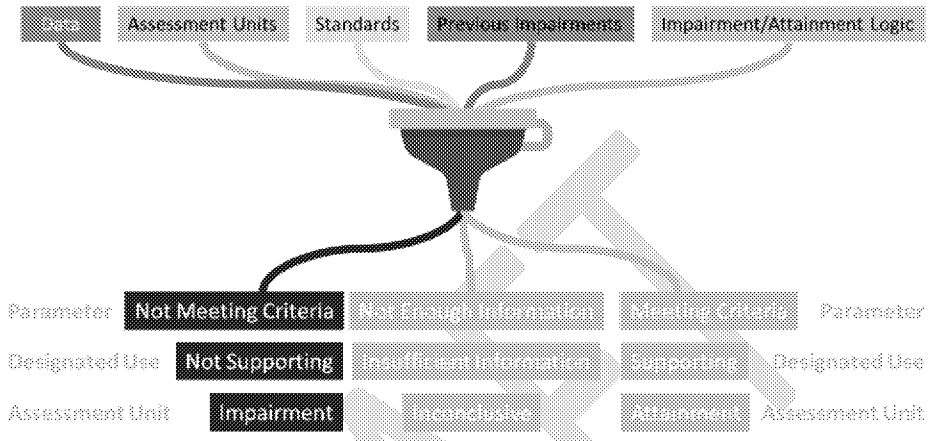

Figure 3-3. Basic Schematic of Assessment Inputs and Levels.

A parameter that **does not meet criteria** means that the use for that parameter is **not supported** and that the waterbody is **impaired**. For example, if arsenic is **not meeting criteria** for the domestic water source use then the domestic water source use is said to be **not supporting** and the waterbody is **impaired** (Figure 3-4).

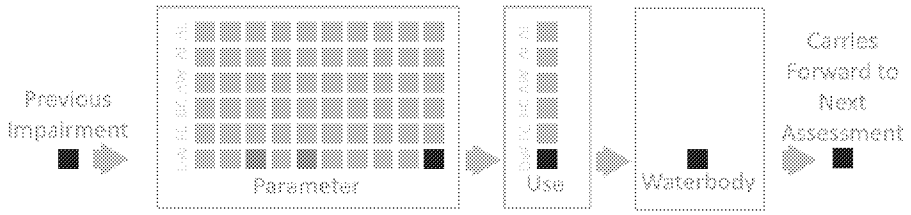

Figure 3-4. Schematic showing how impairments at the parameter level can come from previous impairments and then roll up to the use and waterbody levels.

Attainment of a waterbody is harder to demonstrate than impairment. To demonstrate attainment all core parameters must be present, meet criteria and be seasonally distributed before a use can be said to be supporting. All uses must be supporting for the waterbody to be attaining. (Figure 3-5)

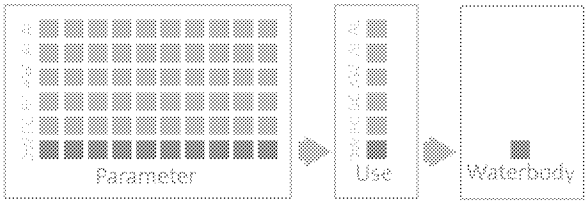

Figure 3-5. All core parameters in the proper seasons are needed to determine use support. All uses must support for the waterbody to be 'Attaining'.

Assessing at the Parameter Level

Aggregated data is compared to the appropriate standard to determine if criteria are met. The 2020 Assessment is using the standards in the triennial review. Surface water quality standards for Arizona are listed in Arizona Administrative Code Title 18, Chapter 11, Article 1. Not meeting a standard does not mean that a waterbody is impaired. The number of aggregated samples **not meeting criteria** and the number of aggregated total samples needs to be considered before making impairment determinations.

The waterbody's designated uses must be known to determine what standards apply. For example, Boulder Creek (15030202-005A) has a designated use for fish consumption and a total arsenic criterion of 80 µg/L. An aggregated result of 82 µg/L would not meet criteria, while an aggregated result of 62 µg/L would meet criteria.

Some standards are more complex. These include:

- Dissolved oxygen (depth specific in lakes, criteria met if above the limit, must also have 90 percent saturation)
- Hardness dependent standards (standard criteria changes depending on hardness value)
- Suspended sediment concentration (excludes storm samples, criteria is a median of 4 samples)
- Ammonia (dependent on both pH and temperature)
- Nutrient standards (single sample maximum, annual mean and 90 percentile)
- pH (the only standard that has a range, criteria not met if outside the range)
- *Escherichia coli* (has both a single sample maximum standard and a geometric mean value, both have different criteria).

EPA uses the terms meeting criteria, **not meeting criteria** and not enough information to describe assessment at the parameter level. The term 'exceedance' is also used to describe when a parameter is not meeting criteria even though parameters like dissolved oxygen or pH may have 'exceedances' that are below the standard rather than exceeding the standard. Numeric parameters are included in Appendix A of Arizona Administrative Code Title 18, Chapter 11 and in R18-11-109.

The methods for determining if criteria are being met vary by type of criteria and potential toxicity of the pollutant. A pollutant that exceeds an acute aquatic and wildlife standard even once, for example, may be lethal to aquatic life and wildlife. On the other hand, some of the human health standards were set at levels that protect for lifetime exposures. Several criteria use 'the last three years of monitoring'. This means using a three-year window from the last day of the assessment

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window rather than the full five-year window. For the 2020 assessment, the last three years would be from July 1, 2016 to June 30, 2019.

Table 3-3 summarizes the assessment criteria used to determine whether criteria at the parameter level are meeting criteria, **not meeting criteria** or classified as not having enough information.

Table 3-3. Criteria for each parameter

	Exceedance Definition	Assessed As Not Meeting Criteria	Assessed As Not Enough Information	Assessed As Meeting Criteria
ALL CRITERIA FOR Body Contact, Fish Consumption, Domestic Water Source, Agriculture Irrigation, Agriculture Livestock Watering PH AND DISSOLVED OXYGEN NITROGEN AND PHOSPHORUS SINGLE SAMPLE MAXIMUM CRITERIA	1 exceedance = 1 grab sample exceeds a criterion	At least 10% of samples exceed criterion at a 90% confidence rate; Minimum of 5 exceedances (See following binomial-based table)	If an exceedance, insufficient data to determine if criteria are met (see criteria to left)	No exceedances see following binomial-based table
ACUTE CRITERIA Aquatic and Wildlife NITRATE OR NITRATE/NITRITE CRITERIA Domestic Water Source *E. COLI* BACTERIA SINGLE SAMPLE MAXIMUM CRITERIA Body Contact	1 exceedance = 1 grab sample exceeds a criterion	Two or more exceedances during the last 3 years of monitoring	Only one exceedance during the last 3 years of monitoring	No exceedances during the last 3 years of monitoring
CHRONIC CRITERIA Aquatic and Wildlife	1 exceedance = 1 grab sample exceeds a criterion and absence of contextual information indicating unstable conditions	Two or more exceedances during the assessment period	Only one exceedance during the assessment period	No exceedances during the assessment period
E. COLI BACTERIA GEOMETRIC MEAN CRITERIA Body Contact	1 exceedance = the geometric mean of at least 4 samples taken during a 30-day period exceeds a criterion	Two or more exceedances during the assessment period	Only one exceedance during the assessment period	No exceedances (Sufficient data to calculate a monthly geometric mean is not required)
NITROGEN AND PHOSPHORUS ANNUAL MEAN CRITERIA Body Contact and Aquatic and Wildlife	1 exceedance = the annual mean of at least 3 monthly means exceeds a criterion	Two or more exceedances during the assessment period	Only one exceedance during the assessment period; or Many samples exceeded the criterion although the annual mean was not exceeded	No exceedances (Sufficient data to calculate an annual mean is not required)

	Exceedance Definition	Assessed As Not Meeting Criteria	Assessed As Not Enough Information	Assessed As Meeting Criteria
NITROGEN AND PHOSPHORUS 90th PERCENTILE CRITERIA Body Contact and Aquatic and Wildlife	1 exceedance = the 90th Percentile of at least 10 samples collected at least 10 days apart exceeds a criterion.	Two or more exceedances during the assessment period	Only one exceedance during the assessment period; or Many samples exceeded the criterion although the 90th Percentile was not exceeded	No exceedances (Sufficient data to calculate a 90th Percentile is not required)
SUSPENDED SEDIMENT CONCENTRATION MEDIAN CRITERION Aquatic and Wildlife	1 exceedance = the median of at least 4 consecutive samples collected at least 7 days apart exceeds the criterion, excluding samples collected during or within 48 hours of a local storm event	Two or more exceedances during the assessment period	Only one exceedance during the assessment period; or Many samples exceeded the criterion, but the median did not exceed the criterion or could not be calculated due to insufficient data	No exceedances (Sufficient data to calculate a median is not required)
TOTAL DISSOLVED SOLIDS FLOW-WEIGHTED ANNUAL MEAN CRITERIA On the Colorado River	1 exceedance = the flow-weighted mean of all samples collected during a 12 month period exceeds a site-specific criterion.	Two or more exceedances during the assessment period	Only one exceedance during the assessment period; or Many samples exceeded the criterion although the annual mean was not exceeded.	No exceedances (Sufficient data to calculate a flow-weight mean is not required)

The 'Binomial Approach'

Most criteria for parameters listed in Appendix A of the surface water quality standards use the binomial distribution, which defines the minimum sample requirements based on the number of samples collected (Table 3-4). Collecting the minimum number of samples ensures that there is at least a 90 percent confidence level that there is a 10 percent or greater exceedance rate.

EPA's CALM document (2002) suggests that an exceedance rate greater than 10 percent for conventional parameters, such as dissolved oxygen and pH, indicates impairment of a designated use. ADEQ has extended this approach to Arizona's human health standards that were established to protect for 70-year lifetime exposure periods, since an exceedance rate under a 10 percent should not negatively impact human health (with the exception of *E. coli* bacteria and nitrate which are pollutants that can be acutely toxic to humans).

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Table 3-4. Criteria for binomial parameters based on number of samples and number of samples not meeting criteria. NA = Not applicable.

Samples Collected		Minimum Exceedances		Maximum Exceedances
FROM	TO	Not Meeting Criteria (Binomial)	Not Enough Information	Meeting Criteria
3	9	NA	NA	0
10	15	NA	3	2
16	19	NA	4	3
20	23	5	4	3
24	32	6	5	4
33	40	7	6	5
41	47	8	7	6
48	55	9	8	7
56	63	10	9	8
64	71	11	10	9
72	79	12	11	10
80	88	13	12	11
89	96	14	13	12
97	104	15	14	13
105	113	16	15	14
114	121	17	16	15
122	130	18	17	16
131	138	19	18	17
139	147	20	19	18
148	146	21	20	19
157	164	22	21	20

Aquatic and Wildlife Acute Standards

Toxic pollutant criteria for the Aquatic and Wildlife use were developed to protect for shorter periods of exposure (compared to chronic standards) due to the shorter lifespan of the aquatic life and wildlife they protect. Studies show that test organisms can tolerate no more than one exceedance of either the acute or the chronic aquatic and wildlife criteria. In fact, studies show that even one exceedance can cause damage if the magnitude of exceedance was very high or the affected area was very large (EPA, 1991). A statistical approach based on a percentage of exceedances, such as the binomial, is not valid for these standards and would not protect the designated use.

Acute criteria protect against short-term effects of high level pollutant concentrations, which include lethality and immobilization. Acute criteria protect for one-hour exposure periods. Aquatic life may recover from one exceedance of criteria per three-year period; however, recovery is not likely if even minor exceedances occur more often. Determinations that parameters are **not meeting criteria** are based on two or more exceedances in a three-year period, regardless of whether the sample size is small or large. The three-year period for acute standards is determined by subtracting three years from the end of the assessment window.

Note that although listing based on one large exceedance could potentially be justified, it is ADEQ's policy, and standard practice throughout the country, that listings will be made only if evidence is available to show that the impairment is persistent or recurring. Therefore, two or more exceedances

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are needed to make a 303(d) listing. This requirement is also consistent with EPA assessment guidance recommendations: CALM (2002), Guidance for 2006 Assessment, Listing and Reporting (2005), and the Technical Support Document for Water Quality-based Toxics Control (1991).

Aquatic and Wildlife Chronic Standards

"Chronic" conditions for aquatic life are determined by as short as a four-day exposure, as compared to a one-hour exposure for acute criteria. The four-day period was selected by EPA to develop chronic criteria because it was the shortest duration over which chronic effects are sometimes observed. Longer exposures would be even more likely to cause chronic impacts. Chronic exposures can be lethal to aquatic organisms, although the effects are not usually immediate upon exposure. Chronic impacts include disease, behavioral abnormalities, inability to reproduce, reduced growth and survival, physical abnormalities, genetic mutations, and eventual death.

EPA's Technical Support Document (1991) and current assessment guidance documents all indicate that an aquatic community should be able to recover from one chronic exposure every three years, unless there is a long exposure duration. Therefore, ADEQ's assessment method determines that a parameter is **not meeting criteria** when there are two or more 'exceedances' during the assessment period. Parameters that **do not meet criteria** mean that the applicable use is **not supported** and the waterbody is **impaired**.

EPA's Assessment Guidance (EPA, 2006) recommends that for criteria with multiple day averaging periods (such as chronic criteria), states should develop decision rules for concluding impairment where information indicates a reasonable likelihood that the average was exceeded. For example, if conditions have remained stable over the period of interest (four days), it would be valid to use a grab sample to represent that period.

ADEQ has developed a method for determining chronic criteria exceedances based on grab samples. This method assumes that stable conditions were occurring at the time unless there is information to the contrary. ADEQ looks at the following information to determine whether 4-day stable conditions were occurring when criteria are not met:

- Field notes and weather records concerning precipitation and runoff;
- Gaging station records, when available;
- Point source discharge records in the reach or immediately upstream;
- Land uses in the vicinity;
- Records of chemical spills or other unusual events; and
- Historic patterns of pollutant concentrations, when available

If readily available contextual information indicates that the pollutant and stream flow likely remained constant over that four-day period, ADEQ will conclude that the grab sample result is valid for the chronic Aquatic and Wildlife criteria.

Chronic results that are not collected under stable conditions are excluded from the assessment. This data will not be used for listing decisions when unstable conditions are likely, especially in watersheds with precipitation-dependent sources of pollutants (e.g., mine tailings piles). Examples of evidence of unstable conditions include, but are not limited to, samples being collected during:

- A precipitation event with runoff lasting shorter than 4-days;

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- The first flush of a precipitation event; or
- A short-lived but high intensity monsoon flow.

However, if the data were collected after 4 or more days of high flow, the sample would be assumed representative of the 4-day average conditions.

In a lake, stable conditions will assume to be occurring unless lake "turnover" or other disturbances are documented when the sample was collected. Lake temperature profiles and other field information will be used to look for such disturbances.

In a lake or stream, if one or more point source discharges provide a significant contribution to the receiving water, the facility discharge records are reviewed to determine whether flow and associated pollutant discharges were relatively consistent during the four-day period when the exceedance occurred.

Weight of Evidence

In addition to the 'bright-line' numeric standards, there are many other factors that can be considered when making a decision about whether a parameter does not meet the criteria in Table 3-3. A true weight-of-evidence approach considers multiple environmental indicators (biological, toxicological, physical, and chemical measurements) in assessing water quality. However, the 303(d) listing decisions are based primarily on chemical-physical measurements with numeric water quality standards, because biological and toxicological results cannot be used until narrative standard implementation procedures are adopted and/or the Impaired Waters Identification Rule is revised to allow for impairments based on narrative standards.

The weight of evidence approach in A.A.C. R18-11-605(B) allows ADEQ to consider contextual information during the assessment process, such as:

- Data quality –Newer or more reliable data is given more weight than data where quality is more questionable, especially where two different datasets may indicate conflicting results.
- Critical conditions and locations – Critical conditions describe patterns in the data for an assessment unit such as stormflow, seasonality, low flow, or anthropogenic activities. Data may be segregated when it is demonstrated that impairment occurs during 'critical conditions'. Critical locations are the locations at which critical conditions apply. Critical conditions and locations are identified in Appendix C.
- Waterbody Improvements. Waterbodies that do not show persistent, seasonal or recurring conditions are not placed on the impaired waters list. This includes waterbody improvements such as a wastewater treatment plant upgrade. Data before the improvement are filtered out of the dataset unless it is determined that the improvement is not effective.
- Evidence of toxic impacts – Evidence of toxic impacts include fish kills, fish consumption advisories, beach closures, and bioaccumulation in prey species.
- NPDES/AZPDES information – Water quality discharge data or compliance issues with the pollutant of concern.
- Anthropogenic influences – Activities in the watershed, especially adjacent to an assessment unit, that might be the source of a pollutant.
- Natural conditions and characteristics of the pollutant – Geomorphology, geology, hydrology, and characteristics of the pollutant are considered when establishing whether the

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exceedance was solely due to natural conditions or whether human activities may be contributing to the exceedance, or provide other support for listing decision.

For example, flow conditions are a crucial piece of information when reviewing the data for streams. In some systems, stream flow volume is regulated by impoundments and diversions to accommodate irrigation, industrial cooling water, or hydroelectric needs. Low flows may be the critical condition when an adit or other point source discharge is the primary source of pollutant loadings.

High flows resulting from precipitation events are variable and hard to predict. Duration, frequency, magnitude, time of year, land use, and applied treatments are all factors that influence the impact a precipitation event may have on stream flow volume and corresponding water quality. For nonpoint sources of pollutants, high flow conditions will frequently result in pollutant loading from the watershed.

These factors do not supersede any minimum data requirements.

Assessments Based on Nitrate and *E. coli* Criteria

Nitrate (or nitrate/nitrite) and *E. coli* bacteria are two pollutants that may be acutely toxic to humans. The Impaired Water Identification Rule established the same assessment criteria as used for acute Aquatic and Wildlife criteria. Criteria are not met if there are two or more exceedances of the single sample maximum criteria during the last three years of a monitoring period.

Assessments Based on Statistically Derived Standards

Statistically derived standards include:

- *Escherichia coli* geometric mean;
- Suspended sediment concentration (SSC) median;
- Nutrient 90th percentile;
- Nutrient annual mean; and
- Total dissolved solids (TDS) flow-weighted annual mean in the Colorado River.

When two or more exceedances of a statistically-derived standard occur, the parameter is assessed as **not meeting criteria** and the surface water is assessed as **impaired**.

Escherichia coli Geometric Mean

The *Escherichia coli* bacteria geometric mean standard is applied only to locations with a minimum of four samples in a 30-day period (e.g., Slide Rock State Park on Oak Creek). Single sample maximum criteria are also applied to *E. coli* (see discussion above.) For assessment purposes, a 30-day period is interpreted as one month. Temporal aggregation does not apply to the *E. coli* geometric standard. Therefore, any four consecutive samples collected at a single site in a single month can be used to calculate one geometric mean for the site. Samples taken at the same time, date, location and depth are aggregated using the median (duplicates/splits).

Using the Suspended Sediment Concentration Standard

In 2002, ADEQ adopted a Suspended Sediment Concentration (SSC) standard to protect Aquatic and Wildlife designated uses and concurrently repealed the turbidity standard. SSC standards were

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revised in 2009 creating a different standard for warm and cold waters. The standard for SSC is 80 mg/L for aquatic and wildlife warmwater and 25 mg/L for aquatic and wildlife coldwater, expressed as a median value of a minimum of four samples collected at least seven days apart. The standards do not apply to lakes or to ephemeral or effluent-dependent streams.

Any SSC samples collected during or within 48 hours of storm events are excluded from the median calculation. Storm events within 48 hours of the sampling event are checked by looking at field notes, site comments, USGS flow data, or NOAA precipitation records.

Nutrient 90th Percentile

A minimum of 10 samples taken 10 days apart in a consecutive 12-month period is needed to determine the 90th percentile for the site-specific nutrient standards.

Nutrient Annual Means

The annual mean is defined in A.A.C. R18-11-101(4) as "the arithmetic mean of monthly values determined over a consecutive 12-month period, provided that monthly values are determined for at least three months. A monthly value is the arithmetic mean of all values determined in a calendar month." At least two independent monthly samples are needed to calculate the monthly mean.

Total Dissolved Solids Flow Weighted Annual Mean for the Colorado River

In accordance with A.A.C. R18-11-110, a flow weighted annual mean shall be used to determine if salinity criteria are met.

Delisting Waters by Parameter

Waterbodies with parameters that do not meet criteria are placed on the 303(d) Impaired Water's List. This section describes the process for determining that a parameter that caused a waterbody impairment is no longer impaired. See 'Delisting Waters by Waterbody' for other ways a waterbody can be delisted.

If the delisting is based on new data, then the number of samples required and the number of exceedances depend on the criteria used for listing, as shown in the following table:

Table 3-5. Delisting criteria by parameter.

	Exceedance Definition	Assessed As No Longer Impaired
ALL CRITERIA FOR Body Contact, Fish Consumption, Domestic Water Source, Agriculture Irrigation, Agriculture Livestock Watering PH AND DISSOLVED OXYGEN NITROGEN AND PHOSPHORUS SINGLE SAMPLE MAXIMUM CRITERIA	1 exceedance = 1 grab sample exceeds a criterion	Minimum 10 samples and no more than the maximum exceedances shown in "Meeting Criteria" column in the binomial-based table (Table 1)
ACUTE CRITERIA Aquatic and Wildlife NITRATE OR NITRATE/NITRITE CRITERIA Domestic Water Source *E. COLI* BACTERIA SINGLE SAMPLE MAXIMUM CRITERIA Body Contact	1 exceedance = 1 grab sample exceeds a criterion	No exceedances during the last three years of monitoring the parameter of concern

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	Exceedance Definition	Assessed As No Longer Impaired
CHRONIC CRITERIA Aquatic and Wildlife	1 exceedance = 1 grab sample exceeds a criterion and absence of contextual information indicating unstable conditions	No exceedances during the assessment period and parameter of concern samples were collected
E. COLI BACTERIA GEOMETRIC MEAN CRITERIA Body Contact	1 exceedance = the geometric mean of at least 4 samples taken during a 30-day period exceeds a criterion	Sufficient samples to determine at least two monthly geometric means and no exceedances
NITROGEN AND PHOSPHORUS ANNUAL MEAN CRITERIA Body Body Contact Aquatic and Wildlife	1 exceedance = the annual mean of at least three monthly means exceeds a criterion	Sufficient samples to determine at least two annual means and no exceedances
NITROGEN AND PHOSPHORUS 90th PERCENTILE CRITERIA Body Contact Aquatic and Wildlife	1 exceedance = the 90th Percentile of at least 10 samples collected at least 10 days apart exceeds a criterion	Sufficient samples to determine at least two 90th Percentiles and no exceedances
SUSPENDED SEDIMENT CONCENTRATION MEDIAN CRITERION Aquatic and Wildlife	1 exceedance = the median of at least four consecutive samples collected at least 7 days apart exceeds the criterion, excluding samples collected during or within 48 hours of a local storm event	Sufficient samples to determine at least two medians and no exceedances
TOTAL DISSOLVED SOLIDS FLOW-WEIGHTED ANNUAL MEAN CRITERIA On the Colorado River	1 exceedance = the flow-weighted mean of all samples collected during a 12 month period exceeds a site-specific criterion	Sufficient samples to determine at least two annual flow-weighted means and no exceedances

Samples should be collected during critical conditions or locations, if either applies.

Assessing at the Use Level

Results from the parameter level are rolled up to the use level to determine if a use for a particular waterbody is supported or is **not supported**.

Results that were determined to be **not meeting criteria** for a parameter and use mean that the entire use is **not supporting**. For example, if an assessment unit is **not meeting criteria** for the fish consumption designated use for arsenic then the fish consumption designated use for this waterbody would be said to be '**not supporting**'.

Core Parameters and Seasonal Distribution

Monitoring data are collected at sites and during conditions selected to be representative of the varying conditions. Samples must be collected under different conditions to determine whether the surface water is really supporting its designated uses since a water quality standard might be more likely to be exceeded during critical conditions such as high or low flows, or during seasonal conditions when recreation is more active,.

ADEQ uses a set of indicators, called "core parameters" to determine if each designated use is being supported. Arizona's core parameters are shown in the Table 3-6. Core parameters were selected based on EPA's CALM guidance (2002).

Table 3-6. Core parameters.

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DESIGNATED USE	CORE PARAMETERS
Aquatic and Wildlife	Dissolved oxygen (not required if ephemeral) Stream flow (if a stream) Sample depth (if a lake) pH Total nitrogen (if nutrient standards established) Total phosphorus (if nutrient standards established) Dissolved cadmium, copper, and zinc and hardness
Fish Consumption	Mercury in fish tissue (no minimum sample or seasonal distribution requirement). If fish tissue data is not available, use total mercury in water as a core parameter (minimum sample and seasonal distribution requirements apply).
Full Body or Partial Body Contact	*Escherichia coli* (not required if ephemeral) pH
Domestic Water Source	Nitrate/nitrite or nitrate pH Fluoride Total arsenic, chromium or chromium VI, and lead
Agricultural Irrigation	pH Total boron and manganese
Agricultural Livestock Watering	pH Total copper and lead

Core parameters were chosen using the following criteria:

- Frequently exceeded standards in past assessments;
- Routinely included in ambient monitoring suites;
- Lab reporting limits routinely below applicable surface water criteria;
- Critical toxicity recognized; and
- Standards and implementation procedures support application of the criteria.

For example, dissolved metals exceedances and low pH measurements are often found in historic mining areas. *E. coli* bacteria and nitrate were chosen because they can cause serious human illness or death if standards are exceeded, and they are important in determining support of Body Contact and Domestic Water Source designated uses.

Core parameters must be sampled at least three times and samples must be distributed to reflect seasonal changes (seasonally distributed). For assessment purposes, at least one sample must be collected in three of the four seasons:

- Winter (January – March)
- Spring (April – June)
- Summer (July – September)
- Fall (October – December).

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If this does not occur then the designated use is assessed as insufficient information. Uses assessed as **not supporting** overrule supporting and insufficient information determinations.

Attainment decisions are not limited to core parameters. All parameters with surface water quality criteria are considered. For a use to be attaining all core parameters must be present and seasonally distributed. Parameters that are not core parameters do not have to be meet criteria for the use to be supporting, but they must not be **not meeting criteria**.

ADEQ acknowledges that three sampling events are not enough to assess use support with statistical confidence. However, three seasonally distributed samples with no exceedances indicate that monitoring resources may be better spent at other sites. Such attainment decisions reflect limited monitoring resources and ADEQ's focus on identifying and resolving water quality impairments.

Assessing at the Assessment Unit Level

Results from the use level are rolled up to the assessment unit or waterbody level to determine if a waterbody is attaining or **impaired**. Results that were determined to be **not supporting** for a use mean that the entire waterbody is **impaired**. For example, if an assessment unit is **not supporting** for the fish consumption designated use then the entire waterbody is **impaired**.

EPA created five categories for reporting assessments to provide a summary of states' water quality status to Congress.

Category 1 Supporting all designated uses
Assessment units with sufficient data to determine that all designated uses are supporting. In these assessment units, at least three samples were collected to represent seasonal differences for all core parameters for each use.

Category 2 Supporting some designated uses, and no use is impaired
Assessment units with sufficient data to determine that one or more designated use is supporting and the remaining designated uses are assessed as insufficient information. No use is classified as **not supporting**. The specific reasons a designated use is assessed as insufficient information can vary, but in general there are not enough samples to make a decision as to whether the use is supporting or **not supporting**.

Category 3: Insufficient or no data and information to determine if any designated use is supporting
Assessment units with insufficient data to assess any designated use as supporting or **not supporting**. All designated uses are assessed as insufficient information.

Category 4: Not supporting for one or more designated uses but a TMDL is not necessary
Assessment units with at least one use assessed as **not supporting** but development of a TMDL analysis is not needed (at this time), for the following reasons:

Category 4A – Assessment units where TMDLs have been completed and the pollutants are covered under those TMDLs. The TMDL is an investigative study of pollutant sources that includes recommendations for pollutant reductions; however, even after recommended improvements have

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begun, it may take several years to see the effects. Therefore, the assessment unit remains **impaired** and listed in Category 4A until it is attaining standards again. The TMDL remains in effect even if a waterbody is 'delisted'.

Category 4B – (Not Common) Assessment units where alternative pollution control requirements are being used to meet standards, rather than a TMDL. To be categorized as 4B, ADEQ must submit to EPA for evaluation and review the following information:

- Statement of the problem causing the impairment, identifying pollutants and their sources
- Description of the alternative pollution controls being implemented, including the funding mechanism for any associated costs and binding agreements to complete implementation;
- Reasonable time schedule for implementation of controls
- Projection of when water quality standards will be met
- Description of and schedule for monitoring, that will show progress with the control strategy
- Commitment to revise the control strategy if progress towards meeting water quality standards is not being shown

Category 4C – (Not Common) Assessment units where the impairment is not caused by a pollutant, but instead by other types of pollution. For example, a designated use may be impaired solely due to lack of adequate flow or stream channelization. In such cases, the specific cause and source of the impairment has been carefully studied, generally through the TMDL process.

On the other hand, although low dissolved oxygen is not a pollutant, under EPA assessment guidance it is listed as the cause of impairment and a TMDL is required when the low dissolved oxygen is caused by the presence of a pollutant (e.g., nutrients or chemical oxygen demand). Similarly, low or high pH is listed as the cause of impairment in Category 5, rather than 4C, when pollutants are thought to be causing or contributing to the impairment. To date, ADEQ has not used Category 4C.

Category 5: Not supporting for one or more designated uses by a pollutant, and a TMDL needs to be developed or revised

Assessment units with at least one designated use classified as **not supporting** and a Total Maximum Daily Load analysis needs to be completed. The assessment unit remains in Category 5 until EPA has approved the TMDL or the pollutant is otherwise delisted. Only category 5 waters are placed on the 303(d) impaired water's list.

Delisting Waters by Waterbody

The Impaired Water Identification Rule currently provides criteria to determine when an assessment unit is no longer **impaired** (R18-11-605(E)). An assessment unit is removed from the 303(d) List when the TMDL is completed or alternative pollution control requirements have made the development of a TMDL unnecessary. These waters are still impaired even though a TMDL has been completed. ADEQ uses the term 'not attaining' to distinguish impairments that have a completed TMDL.

As required in the TMDL Statute §49-232(C)(4), the criteria for establishing that an assessment unit is no longer impaired cannot be any more stringent than the criteria for adding an assessment unit to the impaired water list.

Criteria to determine if a waterbody is "no longer impaired":

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- The water quality criterion is no longer exceeded due to a change in standard or designated use
- New data indicate that the parameter is meeting criteria, and the new data was collected during critical conditions if critical conditions apply
- Reevaluation of the assessment information indicates an error or deficiency in the original analysis resulted in an inappropriate listing
- Pollutant loadings from naturally occurring conditions are the sole cause of the criterion not being met
- One reach is split into two segments. One reach remains impaired. The other reach may be removed if no current or historic data exists that would support listing a portion of the impaired reach.

When to Exclude Waterbodies from being Listed as Impaired

The Impaired Water Identification Rule identifies situations when an assessment unit may be excluded from the impaired waters list. Surface waters are not assessed as impaired when:

- Pollutant loadings from naturally occurring conditions alone are sufficient to cause a violation of water quality standards (A.A.C. R18.11.604.C(1))
- Water quality results were collected under a moderating provision of an NPDES/AZPDES permit, such as a mixing zone, and the result does not exceed any discharge limitation established in the permit (A.A.C. R18-11-604.C.(2))
- The non-attainment is due to an activity or situation exempted under the surface water quality standards in R18-11-117 (canals and municipal park lakes), R18-11-118 (dams and flood control structures) or R18-11-119 (natural background).

If an assessment unit is impaired solely due to naturally occurring conditions (no human-caused influences), the surface water is not listed based on the exemption provided by A.A.C. R18-11-119. However, if there is evidence that the surface water is impaired due to naturally occurring conditions and as a result of human activity, ADEQ will place the surface water on the 303(d) List for further investigation to determine what portion of the impairment is "natural" versus what is human-induced and therefore, eligible for reduction and allocation under a TMDL analysis.

The TMDL investigation can also determine whether a site-specific standard or use-attainability analysis should be developed to address the naturally occurring pollutant loadings. 40 CFR 131.10(g) provides that site-specific criteria can be adopted when waters cannot attain standards because of naturally occurring pollutant concentrations or legacy pollutants. However, the human-caused impacts would be subject to reduction and/or remediation through the TMDL process to bring the water quality back into attainment of the pollutant concentrations that would naturally occur.

Other Considerations

Fish Tissue Data

Some chemical pollutants concentrate in fish and shellfish by accumulating in fatty tissue or selectively binding to muscle tissue. These pollutants may be found at low concentrations in the water column or in bottom sediments, but bioaccumulate in aquatic life and species that prey on aquatic life. The bioaccumulation poses a threat to human health if the organisms are eaten on a

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regular basis in excess of the federal fish consumption advisory levels. In January 2001, EPA issued a national advisory concerning risks associated with mercury in freshwater fish, especially for women who are pregnant or may become pregnant, nursing mothers, and young children.

ADEQ issues fish consumption advisories if the mean minus one standard deviation for a minimum of five fish per species exceeds the mercury standard of 0.3 mg/kg. ADEQ, in association with AGFD, issues a fish consumption advisory based on one or more exceedances of fish tissue mercury for certain fish species.

Swimming Area Closures, Fish Kills, and Drinking Water Advisories

In previous assessments, ADEQ has used issuance of swimming beach closures, documentation of fish kills, or issuance of a drinking water advisory on an assessment unit used for domestic water supply as indications of impairment. These advisories are not, however, issued by ADEQ; therefore, criteria for determining these may vary. Until narrative implementation procedures are developed regarding the issuance of such notices or how to evaluate fish kills and abnormalities, such information is included in the assessment report for informational purposes, but cannot be used as the sole basis in determining impairment.

Applying Narrative Standards

No impairment determinations were made in the assessment based on narrative standards. ADEQ used macroinvertebrate and bottom deposit data in the 2020 assessment to assess the aquatic life wildlife designated use to demonstrate where there was insufficient information to make an assessment decision. If chemistry data indicated that the use was supporting but **criteria was not met** for macroinvertebrate or bottom deposit data then the overall aquatic life use was classified as insufficient information. These narratives and their associated numeric criteria will be used to identify impaired waters in future assessments, after the Impaired Waters Identification Rule is revised to include them.

Nutrient criteria

ADEQ is conducting investigations to revise stream and lake nutrient criteria, in accordance with EPA's 1998 National Nutrient Criteria Initiative requiring states to develop nutrient criteria or adopt USEPA ecoregion criteria. ADEQ's water quality standards currently contain stream nutrient criteria for nitrogen and phosphorus for ten perennial streams and their perennial tributaries, which are used in this assessment. New nutrient criteria for lakes were proposed in 2009, but were disapproved by EPA, and are not currently used in the assessment. ADEQ is currently working with EPA through the 'N-STEPS' technical advisory committees to revise the lake nutrient criteria and to develop statewide stream nutrient criteria. Criteria are expected to be proposed in the next triennial review of water quality standards in 2022.

Prioritizing the 303(d) List

Prioritization criteria for scheduling TMDL development are established in the Impaired Water Identification Rule (A.A.C. R18-11-606). In general, if a substantial threat to health and safety of humans, aquatic life, or wildlife is noted, the surface water is listed as high priority and ADEQ will try to develop a TMDL within two years following EPA's approval of the 303(d) List.

High priority factors:

- The pollutant is listed for eight or more years on the 303(d) Impaired Waters List.

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- Substantial threat to health and safety of humans, aquatic life, or wildlife based on toxicity of the pollutant and magnitude or duration of the exceedance.
- The presence of a Threatened or Endangered species (T&E species) that may be further jeopardized by the water quality pollutant. This is determined by looking at critical habitat, published reasons for decline and vulnerability of the species, and discussions with the AGFD and the U.S. Fish and Wildlife Service.
- Special protection of the water resources, such as classification as a "Outstanding Arizona Water," "wilderness area," "wild and scenic river," or other state or federal designation.
- Delay in the TMDL could jeopardize a timely permit action or ADEQ's ability to gather sufficient credible data to support the TMDL.
- Public interest and support for development of the TMDL.
- The assessment unit has an important recreational and economic significance.

Medium and low priority ranking factors:

The Impaired Water Identification Rule states that several low priority factors can take precedence over high priority factors because completing a TMDL at this time would either be inappropriate, premature, or an inefficient use of resources. The low priority factors that trump high priority factors include:

- ADEQ has formally submitted to EPA a proposal to delist the surface water or pollutant based on new data, new standards, or new designated uses.
- Flow conditions inhibit collecting samples during critical conditions or a variety of conditions necessary for modeling.
- The uncertainty of timely coordination with Mexico, another state, or a tribal nation needed to conduct the TMDL or implement necessary watershed improvements.
- The assessment unit is expected to attain water quality standards due to:
    - Changes in treatment or best management practices.
    - Discharges or activities related to impairment have stopped.
    - Other controls are in place or scheduled.
- Naturally occurring conditions are the major contributor to the impairment.

It may become necessary to shift priority ranking of an assessment unit due to significant changes in resources to complete TMDLs or as new information is obtained concerning one of the priority factors.

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STEP 2 – REVIEW OF THE DRAFT ASSESSMENT

The draft assessment is sent to EPA for an informal review before it goes out to public comment. ADEQ signed an agreement with EPA in 2017, which is effective until 2022. The 2017 performance partnership agreement states:

> 3. INFORMAL COMMENT PROCESS
>
> a. When possible ADEQ will provide the EPA opportunities to review and comment on documents subject to EPA jurisdiction prior to the public comment period.
>
> b. ADEQ will make attempts to adequately address the EPA's comments and will make modifications in the document as is reasonable and prudent.
>
> c. Where provided the ability to comment prior to official public comment, EPA will endeavor to provide comments during that informal review period to the extent practicable.

Coordinating with Neighboring Jurisdictions

Affected states, tribes or countries are directly notified of any new impairments or delistings at the same time the EPA is completing the informal review. Arizona may work with neighboring jurisdictions during several stages of the assessment process, including standards development and assessment methods development. The five states surrounding Arizona and the 22 Tribal nations within Arizona are routinely included in our public review notification. Comments received are evaluated and additional discussion may be initiated. If a conflict cannot be resolved between ADEQ and the other jurisdiction, EPA will be notified.

ADEQ's Border Program works with any issues including impairments that involve Mexico. However, international resolution of impaired waters is a very complex matter, involving high-level actions, and requiring coordination with State Departments of both nations.

STEP 3 - PUBLIC COMMENT

This draft assessment is provided for public review and comment. Interested stakeholders are encouraged to comment about criteria used to make attainment and impairment decisions about Arizona's waters. ADEQ will review the comments and make changes as appropriate and publish the comments, response to comments and changes in the Arizona Administrative Register before the final assessment is completed and submitted to EPA.

Public participation and review are important aspects of developing the integrated assessment and listing report. The public comment period for the assessment is 30 days. The draft assessment and instructions for how to comment are posted under the 'public notices' portion of ADEQ's website at [HYPERLINK "http://azdeq.gov/notices"].

STEP 4 - PUBLISH TO ARIZONA ADMINISTRATIVE REGISTER

ADEQ's response to public comments and the revised 303(d) impaired waters list are published in the Arizona Administrative Register. Notices are placed in the register for 45 days as required by A.R.S § 49-232(A).

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The listing of an assessment unit or pollutant can be appealed pursuant to A.R.S. Title 41, Chapter 6, Article 10 by anyone who submitted comments on the draft list. If a notice of appeal is filed, the listing involved is not included in ADEQ's submission to EPA until the listing is upheld by ADEQ's Director or the appeal is withdrawn.

STEP 5 - SUBMISSION TO ATTAINS

ATTAINS tracks the assessment starting with step 3 – public comment. ADEQ updates ATTAINS with changes after the public comment period and after the submission to the Arizona Administrative Register (Step 4). ADEQ then finalizes the assessment in ATTAINS and sends EPA Region 9 the following:

- A cover letter;
- Copies of comments received on the draft and ADEQ's responses to those comments;
- Documentation of the public process used;
- An electronic version of the assessment through ATTAINS; and
- A link to the full Clean Water Act Assessment document.
- Geographic Information System (GIS) shapefiles for streams and lakes that list the assigned EPA category.

Arizona's ATTAINS data can be accessed here [HYPERLINK "https://www.epa.gov/waterdata/attains"]. Note: EPA is working on a national application for the public entitled 'How's My Waterway' which displays current assessment information for each state based on ATTAINS. 'How's My Waterway' is expected to go live at the end of 2019.

Figure 3-6. EPA's ATTAINS tracks historical assessments and changes to the current assessment

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STEP 6- EPA FINALIZES

The 303(d) List of impaired waters is either approved, disapproved, or partially approved / disapproved by EPA within 30 days. If a portion of the list is partially approved or disapproved, EPA proposes changes to the list and initiates another public review and comment period. Proposed revisions to Arizona's 303(d) List are published in the Federal Register. EPA works with ADEQ to attempt to notify all interested parties of this publication. At the end of the comment period, EPA evaluates public comments and compiles the final approved 303(d) List. EPA provides comments to ADEQ for the assessment report even though only the 303(d) impaired waters list is subject to approval.

In the past, EPA has identified assessment units and pollutants of concern that needed to be added to Arizona's impaired water list to make the list consistent with federal regulations (over-filings). In subsequent assessments, EPA must decide when these additional impairments are removed from Arizona's 303(d) List. In this respect, these impairments are tracked separately. However, once listed by EPA, ADEQ recognizes these waters as impaired, initiates TMDL according to priorities, and protects them from further pollutant loadings according to Arizona's antidegradation rules and permit requirements.

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CHAPTER 4 – ACTION PLAN

Monitoring and assessing waters are part of a process to identify impaired waters and then reduce discharges of pollutants in the watershed. Waters in Category 4 and 5 are protected under Arizona's Antidegradation Rule (Arizona Administrative Code R18-11-107), as "Tier 1" waters. No further degradation by that pollutant is allowed. Potential pollutant loadings must be considered by ADEQ and several federal agencies before permits or certifications are issued (e.g. AZPDES discharge permits, grazing permits).

Figure 4-1. Aerial view of restoration activities on Boulder Creek (15030202-005A) which was delisted for copper and beryllium.

WATER QUALITY IMPROVEMENT STRATEGIES

Historically, ADEQ's approach to improving water quality began with developing TMDLs for impaired waters. TMDLs identify sources of pollution, conditions leading to the impairment and reductions necessary to attain water quality standards. Pollution can originate from two types of sources: point and nonpoint. Point sources are discrete conveyances of pollutants discharged directly to a surface water, such as wastewater treatment plant outfalls. Nonpoint sources are non-discrete discharges, including storm water runoff influenced by activities such as grazing, agriculture and forestry.

Waste load reductions from point sources can be managed through permitting programs such as AZPDES. There are few regulatory actions available to control nonpoint pollution, so load reductions

from these sources are primarily voluntary. Nonpoint source pollution may include excessive sediment caused by the denudation of grasslands, road erosion near streams, bacteria from wildlife and/or recreation, metals from road cuts through ore bodies, and pesticides from historic agricultural practices.

In the past, TMDLs would include a TMDL Implementation Plan that identified generic strategies, agencies or groups who potentially would be involved in implementation, a tentative schedule, and how effectiveness of improvements would be determined. Once a TMDL study was complete, the ADEQ Water Quality Improvement Grant Program would then work with interested stakeholders to implement water quality improvement projects. Unfortunately, this approach has proven to be ineffective for reducing nonpoint source pollution.

ADEQ revised this approach in 2013 by coordinating the TMDL and grant programs with a goal of improving water quality. The focus has shifted from simply completing TMDLs to developing proactive watershed plans that will be implemented. Watershed plans provide an analytic framework for managing efforts to both restore water quality in known areas of impairment and to maintain overall watershed health in areas of good water quality.

Common components of watershed plans include:

- Identification of causes and sources of pollution
- Estimate of current pollutant loading into the watershed and the expected load reductions
- Descriptions of management measures that will achieve load reductions and targeted critical areas
- Estimates of technical and financial assistance and the stakeholder support needed to implement the plan
- A project schedule
- Descriptions of interim, measurable milestones
- Indicators to measure progress
- A monitoring and evaluation component
- A framework for adaptive management, (Plan, Do, Check, Act)

ADEQ's Nonpoint Source (NPS) Program considers many different factors when prioritizing nonpoint source activities:

- Human health concerns
- Ecosystem health including ecological risk
- The beneficial uses of water
- Value of the watershed or groundwater basin to the public
- Vulnerability of the surface or ground water to additional environmental degradation
- Ability to implement
- Likelihood of achieving demonstrable environmental results
- Extent of alliance with other federal agencies and states to coordinate resources and actions
- Readiness to proceed.

ADEQ includes the most recent copy of the 303(d) impaired waters list in the annual Nonpoint Source Annual Report- [HYPERLINK "http://azdeq.gov/programs/water-quality-programs/watershed-protection"]. The NPS report allows the program to focus efforts on high priority Targeted

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Watersheds, while keeping track of the potential role that nonpoint source resources may be able to play in other waters throughout the state.

WATER QUALITY IMPROVEMENT GRANTS

Clean Water Act Section 319(h) funds are used to implement on-the-ground water quality improvement projects that address nonpoint sources of pollution. ADEQ administers these grants through our water quality improvement grants. Projects designed to reduce loadings of pollutants causing impairment are given highest priority. Additional information can be obtained from the ADEQ website ([HYPERLINK "http://azdeq.gov/node/315"]).

DRAFT

CHAPTER 5 – HOW TO LOCATE AN ASSESSMENT DECISION FOR A SPECIFIC LAKE OR STREAM

Most users of this document want to know how to locate a specific waterbody. This chapter provides instructions for how to locate specific assessment decisions. There are two main ways to locate assessment decisions for a specific waterbody.

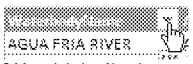
1. Use eMaps.

eMaps has the overall assessment decision and the 'Waterbody Identification Code' or WBID. The WBID is the address for the lake or stream and identifies each waterbody with a unique code. The 2020 assessment map is located at [HYPERLINK "http://gisweb.azdeq.gov/arcgis/emaps/?topic=impaired2018"].

Commented [JJ2]: Update url when final.

2. Open 'Appendix A – 2020 Assessment Decisions'.

Appendix A - 2020 Assessment Decisions gives specific details for how each assessment decision was made in a searchable format.



For example, To see specific records for the Agua Fria River, click the down arrow next to waterbody name and enter 'agua fria' next to search and click OK, which displays all 2020 assessment information for the Agua Fria River. For the 2020 assessment, this includes five reaches, which can be viewed in the WBID field.

The ORIGIN and TERMINUS fields are included to help narrow down results to specific reaches. Results for the Agua Fria River could be further narrowed by selecting the reach between Sycamore Creek and Bishop Creek. This is WBID 15070102-023 (Figure 1-1).

15070102-023	AGUA FRIA RIVER	AGI	ARSENIC	5	0	5	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	BORON	5	0	5	No	Full Core Parameter and Seasonal C	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	CHROMIUM	3	0	3	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	COPPER	5	0	5	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	LEAD	4	0	4	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	MANGANESE	5	0	5	No	Full Core Parameter and Seasonal C	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	PH	6	0	6	No	Full Core Parameter and Seasonal C	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	SELENIUM	4	0	4	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGI	ZINC	4	0	4	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	ARSENIC	5	0	5	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	CHROMIUM	3	0	3	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	COPPER	5	0	5	No	Full Core Parameter and Seasonal C	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	LEAD	4	0	4	No	Full Core Parameter and Seasonal C	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	MERCURY	4	0	4	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	PH	6	0	6	No	Full Core Parameter and Seasonal C	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	SELENIUM	4	0	4	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AGL	ZINC	4	0	4	No	No comment	meeting criteria	Supporting	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	AMMONIA-NITROGEN	4	0	4	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	AMMONIA-NITROGEN	4	0	4	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	ANTIMONY	4	0	4	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	ANTIMONY	4	0	4	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	ARSENIC	5	0	5	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	ARSENIC	5	0	5	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	BERYLLIUM	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	BERYLLIUM	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	CADMIUM	4	0	4	No	Full Core Parameter and Seasonal C	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	CADMIUM	4	0	4	No	Full Core Parameter and Seasonal C	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	CHROMIUM	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	CHROMIUM	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	COPPER	5	0	5	No	Full Core Parameter and Seasonal C	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	COPPER	5	0	5	No	Full Core Parameter and Seasonal C	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	IRON	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	LEAD	4	0	4	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	LEAD	4	0	4	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	MERCURY	4	0	4	No	No comment	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	NICKEL	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	NICKEL	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	SELENIUM	4	0	4	Existing Impairment	Delist - Exclude 8/2/16 sample due	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	SILVER	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	SUSPENDED SEDIMEI	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	THALLIUM	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	THALLIUM	1	0	1	No	No comment	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	ZINC	4	0	4	No	Full Core Parameter and Seasonal C	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	ZINC	4	0	4	No	Full Core Parameter and Seasonal C	meeting criteria	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	DISSOLVED OXYGEN	5	1	6	No	Insufficient Information - Exceedanc	not enough information	Insufficient information	[illegible]
15070102-023	AGUA FRIA RIVER	AWW	PH	6	0	6	No	Full Core Parameter and Seasonal C	meeting criteria	Insufficient information	[illegible]

Figure 1-1. Assessment decisions by waterbody. Note: Not all fields are shown.

The results are organized by parameter and show which aggregated samples meet criteria and which do not. This is rolled up to the designated use and waterbody level. The Agua Fria River (15070102-023) is supporting all uses except the aquatic and wildlife warm and domestic water source designated uses. The aquatic and wildlife warm use was assessed as 'insufficient information' because dissolved oxygen had one exceedance. One exceedance is not enough to determine impairment of the waterbody. The domestic water source use was assessed as 'insufficient information' because total arsenic had three exceedances (not enough exceedances to determine impairment). Dissolved oxygen and total arsenic are core parameters that use the binomial rule (See sections on 'The Binomial Approach' and 'Core Parameters'). Descriptions of column headings in 'Appendix A – 2020 Assessment Decisions' are in Table 1-1.

Table 1-1. Descriptions of each column in the 'Assessment Decision' Appendix.

Column Name	Description
WBID	The 'Waterbody Identification Code'. This is the address of the lake or stream. The first 8 digits are the Hydrologic Unit Code (HUC) and are followed by a reach code for a stream or lake code for a lake.
WaterbodyName	Name of the waterbody.
AcuteChronic	Shows acute or chronic use information for the aquatic and wildlife designated use. NA = not applicable and typically applies to existing impairments that were not sampled during the assessment cycle.
Use	The designated use code. DWS = Domestic Water Source FBC|PBC = Full Body Contact or Partial Body Contact FC = Fish Consumption AWC|AWW|AWEDE|AWE = Aquatic & Wildlife Cold, Warm, Effluent Dependent Water or Ephemeral, respectively AGI = Agriculture Irrigation AGL = Agriculture Livestock
CharacteristicName	The parameter or substance of concern.
ResultSampleFractionText	The parameter's fraction (total, dissolved, suspended). This is important for determining which standards apply.
Binomial	Identifies whether the parameter uses the binomial approach or not.
NumberCriteriaMet	Identifies the number of aggregated samples that meet criteria/standards.
NumberCriteriaNotMet	Identifies the number of aggregated samples that do not meet criteria/standards.
TotalSamples	Identifies the total number of aggregated samples.
ImpairmentType	Identifies if the impairment is carried over from a previous assessment.
Comment	Assessment comment.
DecisionParameter	Determination if criteria are met at the parameter level. Worst case used when more than one parameter present. Ex. DecisionParameter = 'not meeting criteria' if Chronic COPPER = 'not enough information' & Acute COPPER = 'not meeting criteria'.
DecisionUse	Determination if uses are supported.
DecisionWBID	Determination if the waterbody is attaining or impaired.
EPACategory	Describes EPA Categories 1-5. See 'Assessing at the Assessment Unit Level' section for full descriptions.
WATERSHED	Two-digit code for Arizona's 10 major watersheds. BW = Bill Williams

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Column Name	Description
	CG = Colorado Grand Canyon CL = Colorado – Lower Gila LC = Little Colorado MG = Middle Gila SC = Santa Cruz SP = San Pedro SR = Salt River UG = Upper Gila VR = Verde River
REACH_DISTANCE	Assessed stream reach distance in miles.
LAKE_ACRES	Assessed lake acres.
ORIGIN	The point where a stream reach begins.
TERMINUS	The point where a stream reach ends.

There were four exceedances of standards for the Agua Fria River (15070102-023). 'Appendix B – 2020 Assessment Exceedances' provides specific information regarding each exceedance.

15070102-023	AGUA FRIA RIVER	DWS	6/23/2016	0.013	none		0.01	Yes
15070102-023	AGUA FRIA RIVER	DWS	11/15/2016	0.012	none		0.01	Yes
15070102-023	AGUA FRIA RIVER	DWS	10/15/2017	0.012	none		0.01	Yes
15070102-023	AGUA FRIA RIVER	AWWChronic	6/29/2016	5.03		1736457	6	Yes

Figure 1-2. Exceedances for the Agua Fria River (15070102-023) for the 2020 Assessment from Appendix B – 2020 Assessment Exceedances.

Table 1-2. Descriptions of each column in the 'Appendix B – 2020 Assessment Exceedances'. Note: All fields from Assessment Decisions – Appendix A are also included (see Table 1-1 for descriptions)

Column Name	Description
SampleDate	Aggregated sample date. Generally, a seven day aggregation with some exceptions like suspended sediment concentration (SSC).
SampleResult	Aggregated results based on the parameter and use. All chemistry results are in mg/L. *Escherichia coli* units are in MPN/100 mL and pH is in standard units.
ExceedanceComment	Hardness dependent standards will provide the hardness value used to calculate the standard. Ammonia will provide the temperature and/or pH. For pH the standard range is given.
Standard	The standard for the particular use/parameter. Note: The standard for pH is listed as 999999.9. pH is the only standard that applies to a range of values and not one set value range of values listed in the 'Exceedance Comment' field.
Exceed	Yes if the standard is not met.

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