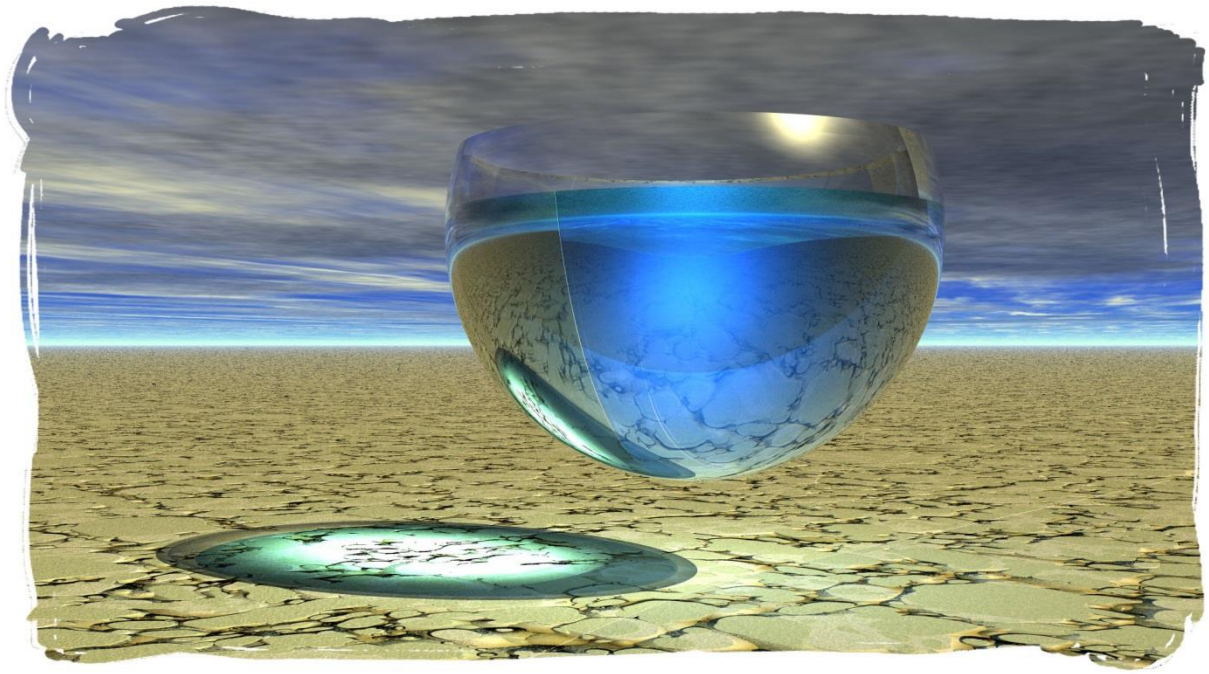
Quality Assurance Plan for the Surface Water Quality Improvement Planning Value Stream



Prepared by the

ADEQ Arizona Department of Environmental Quality

Surface Water Improvement Planning Value Stream
Revision -2, January 2021

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CHAPTER 1 PROGRAM MANAGEMENT

1.1 Purpose

The Arizona Department of Environmental Quality's (ADEQ) Quality Management System (QMS) requires that all environmental monitoring and measurement efforts mandated or supported by EPA have in place a centrally managed Quality Assurance Program Plan (QAPP). ADEQ's QMS satisfies the policy and program requirements of the United States Environmental Protection Agency (EPA) Order CIO 2105.0 as a non-EPA organization performing work in behalf of EPA through extramural agreements.

ADEQ provides this QAPP for guidance on how quality assurance and quality control procedures are applied to produce data that are:

- Scientifically valid;
- Of documented quality; and
- Legally defensible.

The purpose of this QAPP is to document the quality assurance, quality control, and other technical activities to be implemented to ensure that the results of ADEQ's Surface Water Improvement Value Stream operations are of the type and quality required by the ADEQ Quality Management System and EPA's Agency-wide Quality System. This QAPP was prepared in accordance with ADEQ's 2016 Quality Management Plan and follow USEPA guidance on developing QAPPs (USEPA, 2002).

This QAPP is also intended to meet the requirements of the credible data requirements of the Impaired Water Identification Rule pursuant to Arizona Administrative Code (A.A.C.) R18-11-602(A)(1) found on the Arizona Secretary of State website, in Article 6 of Title 18, Chapter 11, the Water Quality Standards Rules: http://www.azsos.gov/public_services/Title_18/18-11.htm.

This QAPP will provide sufficient detail to demonstrate that:

- The program's regulatory, technical and quality objectives are identified and agreed upon;
- The intended measurements, data generation, or data acquisition methods are appropriate for achieving program objectives;
- Assessment procedures are sufficient for confirming that data of the type and quality needed and expected are obtained; and
- The identification and documentation of any limitations on the use of the data.

All quality assurance and quality control processes using a standard operating procedure (SOP) are contained within Appendix E. In this QAPP document, reference to Appendix E will be a general citation (Appendix E), future updates to the QAPP will contain a more detailed citation. Appendix E is undergoing revision to reflect agency templates.

This document applies to all personnel within the Surface Water Improvement Planning Value Stream (SWQIPVS) of the ADEQ, Water Quality Division who sample surface water, work water quality data and the compliance and remediation projects they support. This QAPP applies to the following SWIVS Programs:

1. Ambient Monitoring
2. Biocriteria
3. Fish Advisory Program
4. Watershed Improvement

1.2 Program/Task Organization

ADEQ's Surface Water Improvement Value Stream ensures compliance with the Clean Water Act and state surface water regulations through sampling of waterbodies throughout Arizona. Sampling within the SWIVS involves a number of parties or organizations with specific responsibilities related to data quality. These parties or organizations have specific functions related to the operation of ADEQ's SWIVS. The following paragraphs discuss these organizations and their general responsibilities.

Environmental Protection Agency (EPA)
EPA oversees ADEQ's implementation of the Clean Water Act. Sample data is uploaded to ADEQ's water quality database and sent to EPA's Water Quality Exchange on a daily basis. Sampling data is used for the analysis and completion of the Clean Water Act assessment, this is sent to EPA every even year for review. Water quality data is also used for standards development and data analysis and project implementation.

Arizona Department of Environmental Quality (ADEQ)
Arizona Statute (A.R.S. § 49-202) designates ADEQ as the agency responsible for carrying out the Clean Water Act. The Surface Water Improvement Value Stream is part of the Water Quality Division of ADEQ. The various units referenced in Section 1.4 carry out the main functions of ADEQ's SWIVS. The value stream and units have a designated Value Stream Manager and Unit Supervisors.

Surface Water Laboratories
The SWIVS uses certified laboratories for all required analysis in accordance with A.A.C. R18-11-111. The licensed analytical laboratories are required to follow all Arizona Administrative Code (A. A. C.) applicable to ADHS laboratories (A.A.C. R9-14-601 through R9-14-621). The data produced from the analysis of environmental samples provide information and data used to make informed decisions relating to the public health and welfare of Arizona's citizens. These data must be of known quality, technically sound, and legally defensible.

All ADEQ Contract Laboratories that conduct water quality tests for ADEQ are required to meet several criteria for data to be accepted as valid and entered into the ADEQ Water Quality Database. ADEQ contract lab quality assurance is addressed via their respective quality assurance manuals, SOP's for each analytical procedure, and the quality control (QC) data summary provided with each lab report. In addition, contract labs must pass licensing requirements of the Arizona Department of Health Services State Laboratory every two years, pass a proficiency test annually, and meet the QC limits for spikes & blanks in each QC report they produce (generally 20%). In addition, ADEQ requires that contract labs must provide tests for matrix effects that include dilution, standard additions and lab fortified blanks that meet our acceptance criteria and that test results that fall outside those acceptance criteria shall be flagged as an estimated quantity. ADEQ Surface Water Improvement Value Stream currently has five Water Quality Labs under contract. Specific laboratories are listed in each Sampling and Analysis Plan.

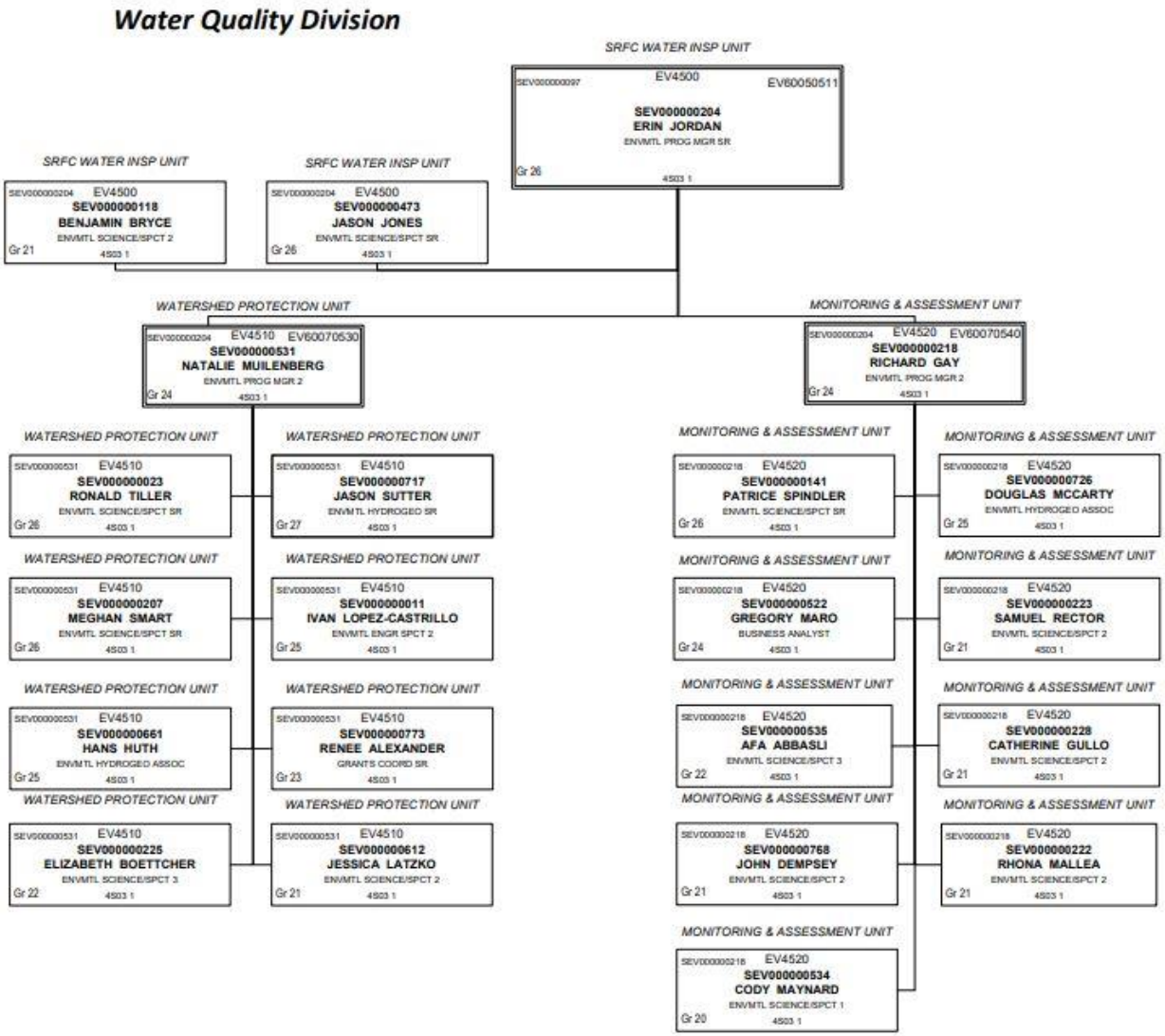
TABLE 1. List of key positions and their role regarding the QAPP.

Position	Reports to	Function	Employee(s)	Role/responsibility
SWIVS Manager	Director of Water Quality	SWIVS Oversight	Erin Jordan	Has the overall responsibility for direction, and any changes, in the scope of work for the program. The Value Manager will also oversee scheduling and management of all technical and non-technical aspects of the program.
Quality Assurance Manager	Director of ADEQ	Quality Assurance Oversight	Paula Panzino	Responsible for implementing and maintaining the ADEQ's Quality Management System. Conducts internal and external Management System Reviews, and provides Quality Assurance assistance needed by the ADEQ Values Streams. This position is necessarily independent of the Water Quality Division Management structure.
QA Specialist	SWIVS Manager	QA Specialist	Jason Jones (QAPP Editor), Cody Maynard (QA Specialist)	The QA Specialist will be responsible for ensuring the appropriate program personnel have the most current approved version of the Surface Water QAPP and for updating the QAPP, ensuring adherence to the QAPP (Appendix B). The QA Specialist may reject poor quality data at any step in the quality assurance process with Value Stream Manager or Agency QA Manager approval. This role last for a period of no more than 2 years.

Position	Reports to	Function	Employee(s)	Role/responsibility
Watershed Improvement Unit and Monitoring Unit Staff or Supervisors	SWIVS Manager	Sampling Design	Richard Gay, Natalie Muilenberg	Creates the sample plan and coordinates water and/or biological sampling needs, staff assignments, schedules and budgets.
SWIVS Staff	Unit Supervisors	Project Lead "Team Leader"	See Organization Chart	Responsible for on-schedule completion of assigned sampling fieldwork with strict adherence to Standard Operating Procedures (SOPs). Responsible for data entry, processing, and data quality assurance and quality control throughout the data analysis process. Responsible for all aspects of document production including: data interpretation, in-house and outside technical reviews, editing and publishing ADEQ documents.
Lab Manager	SWIVS Manager	Lab Analysis	Currently Vacant	Receive and distribute lab data, invoices, and ordering lab supplies (bottles, preservatives). Assists in all administrative aspects of coordination with lab from shipping of samples to ensuring calibration solutions are available and replaced before expiration. Processes chemical and/or biological samples. **Chemical**: Analyses chemical parameters in accordance with lab QAPP and SOPs. Produces reports either electronically or manually to ADEQ. **Biological**: Determines taxonomic identifications of specimens, records taxonomic names and abundances on bench sheets and in a database, performs QC evaluations of adherence to lab SOPs, and produces lab reports for ADEQ.
Biocriteria Program Coordinator	Monitoring and Assessment Unit Supervisor	Biocriteria Program Oversight	Patti Spindler	Responsible for project implementation, and to guarantee that technical, and scheduling objectives are achieved successfully. Coordinates all biocriteria program activities, and provides technical guidance to staff and management. Oversees data upload process.
Fish Tissue Program Manager	Monitoring and Assessment Unit Supervisor	Fish Tissue Program Oversight	John Dempsey	Responsible for project implementation, and to guarantee that technical, and scheduling objectives are achieved successfully. Coordinates all fish tissue program activities, and provides technical guidance to staff and management. Oversees data upload process.
SWIVS Database Manager	Monitoring and Assessment Unit Supervisor	WQDB Oversight	Greg Maro	Upload data into EPA's Water Quality Data Exchange (WQX). Maintains WQDB.

Position	Reports to	Function	Employee(s)	Role/responsibility
Data Validator/ Verifier	SWQIPVS Manager	Checks data for Quality	See Organization Chart	Has the main role of reviewing the project leader's data for quality control purposes.
Data Portal	SWIVS Database Manager	Receives data from labs	Greg Maro	Receives data from samplers, contractors and laboratories.

FIGURE 1. SWIVS Organization Chart



1.3 Program Definition/Background

The SWQIPVS is intended to ensure compliance with the federal Clean Water Act (33 U.S.C §§ 1251 et seq.) and state surface water regulations (Arizona Revised Statutes Title 49, Chapter 2). The objective of these regulations is to maintain and restore the chemical, biological and physical integrity of Arizona's surface waters.

1.4 Program Descriptions

1.4.1 Ambient Monitoring Program

The ambient monitoring program is a statewide data collection program, which primarily focuses gathering baseline chemical data for perennial and intermittent lakes and streams for the Clean Water Act assessment. Samples for the ambient monitoring program are typically collected on a seasonal bases by state fiscal year.

The specific objectives of the Ambient Monitoring Program are:

- To make assessment decisions at the parameter, use and waterbody level as required by §305(b) of the Clean Water Act;
- To identify impaired surface waters pursuant to §303(d) of the Clean Water Act;
- To provide credible data;
- To fill data gaps for waterbodies that have not been assessed or have been assessed as 'inconclusive';
- To develop water quality standards;
- To characterize baseline water quality for Arizona's lakes and streams;
- To determine compliance with applicable surface water quality standards;
- To characterize baseline water quality in outstanding Arizona waters and to determine whether water quality is being maintained, protected or is being degraded.

1.4.2 Biocriteria Program

The biocriteria program focuses on gathering biological data to support the determination of the aquatic and wildlife designated use. Additional information about the biocriteria program is include in Appendix C. The objectives of the biocriteria program are:

- Establish and refine biocriteria standards;
- Assess biological condition of AZ streams and identify biologically "impaired waters";
- Identify biological stressors;
- Update reference conditions through ambient monitoring.

1.4.3 Fish Advisory Program

The primary objective of the Fish Advisory Program is to obtain fish tissue data to assess the need for the issuance of a fish consumption advisory consistent with the USEPA fish advisory guidance document (USEPA, 2000). The primary target analyte for the Fish Advisory Program is mercury in fish tissue. Current fish advisories are located at https://www.azgfd.com/fishing/fishconsumption.

Specific fish advisory program objectives are to:

- To monitor fish contaminants statewide;
- To protect human health by issuing advisories in lakes and streams when standards are exceeded;
- To provide credible data;
- To fill data gaps for waterbodies that have not been sampled for fish species likely to be consumed.

1.4.4 Watershed Improvement Program

The Watershed Improvement Program focuses on identifying pollution sources and restoring impaired waters statewide. Development of a Total Daily Maximum Daily Load (TMDL) is one of several tools used to restore waters. Watershed improvement plans and application of water quality grants are also key to restoring impaired waters. These facets of operation also encompass all aspects of remediation and identification of pollution sources and restoring impaired waters related to legacy mine sites.

ADEQ's Section 319 Grants are awarded for on the ground restoration projects. QAPP/SAP requirements apply to 319 grantees who conduct water quality monitoring. This quality assurance document will be referenced and associated to all projects with a water quality monitoring component.

There are two options for developing a SAP for 319 Grant Projects:

1) ADEQ will prepare the SAP if the grant proposal includes improving water quality for a 303d listed stream that is included as part of our effectiveness program through associated projects or remediation efforts.
2) ADEQ will work with a Grantee to prepare a SAP that fulfills ADEQ QA requirements. In addition, ADEQ will prepare watershed scale effectiveness monitoring documentation and plans.

The SWIVS will meet ADEQ QAPP and SAP provisions for these future SAPs, including internal peer review and approval.

Specific Watershed Improvement Program objectives are to:
- To restore water quality in impaired waters;
- To develop watershed implementation plans;
- To identify sources and causes of pollutant loadings; maintain and restore the chemical, biological and physical integrity of Arizona's water.
- To provide data for water quality models used to calculate waste load allocations, load allocations, and margins of safety in TMDL analyses;
- To develop TMDLs for the Clean Water Act §303(d) listed waterbodies;
- To conduct effectiveness monitoring;
- To determine Best Management Practice effectiveness.

1.5 Quality Objectives and Criteria for Measurement Data

1.5.1 Data Quality Objectives

The Data Quality Objectives (DQOs) are set to clarify objectives, define the appropriate type of data, and specify the tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (USEPA, 2006). The DQOs for the SWIVS are as follows:
- Assure sampling conducted by ADEQ produces credible data;
- Require the use of only high-quality data from contracted labs for comparison to the Arizona Surface Water Quality Standards by using only ADHS licensed and certified environmental laboratories when appropriate.
- Train samplers in the use of proper sampling procedures;

1.5.2 Measurement Quality Objectives

The intent of the Measurement Quality Objective (MQO) process is to control errors at every level in the decision process. The intent of developing measurement criteria is to control errors in the measurement process. ADEQ will meet data quality objectives through insuring the completion of the following:

- Data quality will be of sound and defensible by nature due to following agency and value stream specific documentation pertaining to quality control and validation,
- Implementation of chain-of-custody procedures to ensure custody control and prevent mishandling;
- Data collected will pertain to the encompassing project and support appropriate project outcomes, data will be considered credible if the process reflects contrasting quality control documentation;
- Water quality analyses will reflect data needs, as outlined in individual project sample analysis plans and supported by the quality assurance project plan;
- Samples and field data will be collected and analyzed using identical pre-approved sample collection and analysis techniques with as few deviations from protocol as possible. Any deviations from standard protocols will be noted;
- Data collected in accordance to quality control, QAPP and SAP guidelines and found to be credible will accepted accordingly if exceeding state standards appropriate action will be acted upon as outlined in this document;

- Analyses shall be performed by a laboratory licensed by the Arizona Department of Health Services, Office of Laboratory Licensure and Certification;
- Sufficient sample volumes will be collected for proper water quality Laboratory quality control work as outlined in the QAPP and SAP's, including sample matrix spikes where necessary to ensure quality control objectives are met perpetually.

These measured quality objectives will be obtained using the appropriate quality assurance documentation within Appendix E and specifically what is within Section 10.6.2 of Appendix E which entails the QC Checklist and the specific field and lab requirements needed for successfully obtaining quality assurance via the stated mission quality objectives.

Measurement quality objectives can be expressed in terms of accuracy, precision, completeness, and sensitivity goals. Accuracy and precision are monitored by the laboratory conducting the analyses through the use of Quality Control (QC) samples. Completeness is a calculated value. Sensitivity is monitored through instrument calibration and the determination of method detection limits (MDLs) and reporting limits.

Additional detail regarding the Precision, Accuracy, Representativeness, Completeness and Comparability (PARCC) standards can be found in Appendix D.

1.6 Special Training Requirements

This section discusses training provided to SWIPVS staff in order to assure data quality. SWIPVS Manager is responsible for setting training schedules and documentation, with the exception of Quality Management System training, as noted in Section 1.6.4. Documentations of training attendance will be kept by the VS Manager and will be passed on as an element of succession planning.

1.6.1 Initial Training

All new sampling personnel shall complete the surface water sampling certification program and be given access to the most recent sampling SOPs (Appendix E). The certification program includes comprehensive instruction of field techniques, a field training and an exam. Experienced staff shall take new employees on field trips and guide staff through all steps of the sampling process (including post trip activities such as quality assurance and data entry).

1.6.2 Program Specific Training

Program specific training is provided by experienced ADEQ staff (Scientist III or greater) to new staff who participate in TMDL, ambient, biocriteria, fish tissue, or lakes monitoring before a monitoring event. This training shall cover field and/or laboratory methods for the collection of surface water samples such as *E. coli* or macroinvertebrates. Once completion of training is complete and of satisfactory effort, attendance of training and certification are documented.

1.6.3 Refresher Training

All sampling personnel shall attend the ADEQ Water Quality Sampling refresher training, (typically held every year). The refresher training typically includes discussion of topics identified in the QAPP, SOPs, along with a field demonstration. Employee certification documentation is consulted to determine who is required to attend refresher training.

1.6.4 QA/QC Specialist Training

The SWQIVS Manager shall appoint an appropriate staff member to be the Quality Assurance/ Quality Control (QA/QC) Specialist for the Water Quality Division. This duty will remain effective for a period of no more than two years or until the Value Stream Manager decides to appoint a new staff member or rotate the responsibility. The QA Specialist will attend trainings indicated and scheduled by ADEQ's Quality Assurance Manager, as stated in the ADEQ Quality Management Plan.

1.7 Documentation and Records

1.7.1 Department-wide Practices

ADEQ data that is cloud based or stored in the State Data Center is considered secure. Data loss mitigation efforts include Uninterruptible Power Supplies (UPS) and backup generators. Source data can be at risk; SWIVS defines source data as (define source data for Value Stream/Program here). Source data for this VS are obtained from [customers through data entry into My DEQ] or [laboratory data sheets] or [reports or data submitted by contractors] or [staff data entry]. This Value Stream ensures that it takes the appropriate measures to prevent and address data loss at the source by [List of measures taken to ensure data is not lost at defined source (backup power source, back up data storage at site, electronic storage/scan of paper document).]

The current electronic mail (e-mail) tool, Google Mail, is a cloud based storage system that is considered secure. Employee's inbox storage space is unlimited. E-mail messages that are considered critical artifacts to a program should be saved as a PDF and stored in the appropriate program folder/file location. Electronic mail messages that are moved to "trash" are archived after 30 days, but can be retrieved via an Information Technology Service Desk Request. Microsoft Outlook e-mail files have been saved to the J:/Drive and also can be retrieved as needed with a Service Desk Request.

1.7.2 Quality Assurance Documentation

The QAPP and all enclosed documents for the SWQIPVS is saved in the common SWQIPVS computer drive and in the Quality Management Program folder at J:\COMMON\ADEQ QUALITY MANAGEMENT PROGRAM_Surface Water Quality Improvement Planning\QAPPS. This document is updated at least every five years and reviewed annually; the QA/QC specialist is responsible for ensuring updates and amendments to this document and all appendices (SOP's and records) and ensuring an email will be sent out to all employees of the SWIPVS informing them of where the most current version can be found after each update is complete. The update and revision schedule can be found in Table 1.7 for when and what has been updated in this document.

Documentation, records and electronic files regarding the QAPP will continue to be store within the Quality Management Program's SWQIPVS folder. All current and previous versions of the documents will be maintained and kept within this organizational specification, all documents within and related will be subject to document and record retention, archival and disposition policies and schedules.

See Sections 5.2 and 6.2 of this QAPP to find information regarding record keeping practices for documents such as field forms, site and equipment files.

TABLE 1.7. QAPP Revision Tracking

Version No.	Revision Date	Name of QA/QC Specialist	Summary of Changes
1	11/12/2020	Cody Maynard	5-yr QAPP update, Appendix E contains current SOPs that are in the midst of being reformatted to new ADEQ template.
2	01/04/2021	Cody Maynard	5-yr QAPP update, Appendix E contains current SOPs that are in the midst of being reformatted to new ADEQ template. Generic format updates

CHAPTER 2 DATA GENERATION AND ACQUISITION

2.1 Sampling Process Design

2.1.1 Sampling and Analysis Plans

Sample and Analysis Plans (SAPs) are created on an annual or as-needed basis (see Appendix E for ADEQ's FY20 Ambient Monitoring SAP). Surface Water SAPs identify the sampling location, quantity, frequency and procedures used to collect samples. SAPs are approved by the Unit Managers and fulfill the many of the functions of the Quality Assurance Project Plan.

All Sampling and Analysis Plans will contain an explicit statement indicating that the laboratories limits such as a method reporting limit have been reviewed by ADEQ in order to meet the Measurement Quality Objective described in Section 1.5.2.

SAPs shall be developed for each Surface Water Program that conducts water quality monitoring. The Impaired Water Identification Rule (A.A.C. R18-11-602(A)(2)) requires that the following items be included in a SAP:

1. The experimental design of the project, the project goals and objectives, and evaluation criteria for data results;
2. The background or historical perspective of the project;
3. Identification of target conditions, including a discussion of whether any weather, seasonal variations, stream flow, lake level, or site access may affect the project and the consideration of these factors;
4. The data quality objectives for measurement of data that describe in quantitative and qualitative terms how the data meet the project objectives of precision, accuracy, completeness, comparability, and representativeness (equipment resolution, range and accuracy, lab methods, holding times, lab detection limits and laboratory data reporting requirements);
5. The types of samples scheduled for collection;
6. The sampling frequency;
7. The sampling periods;
8. The sampling locations and rationale for the site selection, how site locations are benchmarked, including scaled maps indicating approximate location of sites; and
9. A list of the field equipment, including tolerance range and any other manufacturer's specifications relating to accuracy and precision.

TABLE 2. Sampling and Analysis Plans by Program

Program	What the SAP Covers	When is one done?
Ambient Monitoring	Chemistry sampling	Annual by Fiscal Year
Biocriteria	Algae and macroinvertebrate sampling	Annual by Fiscal Year
Fish Advisory	Fish tissue monitoring	Annual by Fiscal Year
Watershed Improvement/TMDL	Chemistry sampling	For each Project

2.1.2 Sampling Procedures

Standard Operating Procedures (SOPs) are comprehensive standard work documents that describe best management practices along with how samples are collected regarding the current standard method methodology and criteria. ADEQ uses SOPs to take consistent measurements and are used as a general reference for all the water quality monitoring that the agency conducts. SOPs cover all sampling procedures from the, including sample data archival methods and procedures and the database management protocols associated. Samples are identified by a unique sample identification code that is used by the database and labs for tracking.

The SOP's referenced in Appendix E are currently undergoing revision to be consistent with a new ADEQ template format. Future revised QAPPs will include a specific SOP references, until then all surface water programs shall use the updated Appendix E SOPs. The current Surface Water Sampling SOPs can be downloaded at http://www.azdeq.gov/environ/water/assessment/download/sampling.pdf.

2.2 Sample Handling and Custody Requirements

The sample handling and custody SOP (Appendix E) requires the following information to be available on the COC and available on the sample label: the name and contact information of the client; sample identifier, location, date, time, sample matrix, and analyses being requested, as well as location which shows the chain of custody from relinquished to receive from the time the sample is collected to the time it is received by the laboratory this a standardized control process of identifying and indexing samples at all stages of analysis. Upon delivery, ADEQ and the laboratory should completely fill out the COCs. Samplers will provide a complete COC that stays with the sample through the analysis and validation process at the lab, once analysis is completed the original paper copy is retained by the sampler and a copy is placed in the site file and a digital copy is provided to the value stream.

2.3 Analytical Methods Requirements

Surface water samples collected by SWQIPVs must be analyzed by an ADHS Certified laboratory. The laboratory must be licensed by ADHS for the specified analytical method. ADHS certification and licensing procedures can be found in the Arizona Administrative Code Title 9, Chapter 14, Article 6. If there is an uncertified analytical method, ADEQ can request that ADHS investigate the method for approval.

2.4 Laboratory Quality Control Requirements

2.4.1 Laboratory Quality Control

The approved analytical method prescribes the number and frequency of quality control samples (blanks, blank spikes, matrix spikes, continuing calibration verification, and practical quantitation limit), holding times, and duplicate samples. The laboratories' QC manual contains this and other QC practices in accordance with, A.A.C. R9-14-615.

2.4.2 Field Quality Control Requirements

The following sections outline the types of quality control (QC) samples used by ADEQ for the collection of surface water samples. SOPs for how to collect and interpret whether results are acceptable are located in Appendix E.

2.4.2.1 Blanks

A blank is a water sample that is processed and handled in the same manner as the associated environmental samples and is intended to be free of the analytes of interest. Blank samples are analyzed to test for contamination of environmental samples by the analytes of interest during any stage of sample collection, processing, and analysis. The following types of QC blank samples are used by the SWIVS:

- Field Blanks - De-ionized water placed in a clean sample container during the field trip. Field blanks are treated as regular samples in all respects, including contact with the sampling devices and exposure to sampling station conditions, storage, preservation and filtration, if applicable. The purpose of these blanks is to determine if any of these conditions or processes have caused sample contamination, and, if so, to what extent.
- Trip Blanks - A sample of analyte-free water that is prepared in the laboratory. It is transported, unopened, to the field with other sample containers and is shipped to the laboratory for analysis with the collected samples. Trip blanks are used to identify contamination that might occur during sample transport and analysis rather than because of sample collection and processing in the field. Trip blanks are normally prepared only for volatile organic chemicals (VOCs) and trace metals.
- Equipment Blanks – De-ionized water processed using applicable field equipment in the same manner as environmental samples. Equipment Blanks are used to demonstrate that sample-collection equipment and sample-processing equipment are not introducing contamination. Equipment blanks can be prepared for individual pieces of collection and processing equipment. Typically, equipment blanks are only prepared to assure non-contamination of samples during the filtration process, for churn splitters or autosamplers.

TABLE 3 lists the minimum collection frequencies for QC blank samples. The overall QC percentage is the sum of the blank plus the split/duplicate percentages. Most parameters for blanks have a minimum percentage of five percent. For example, if a sampler visited 20 sites and sampled for total metals then at least one blank (5% of 20 samples) and one split or duplicate (5% of 20 samples) should be collected for a total of 10 percent QC.

In general, field and equipment blank contamination above the method reporting level is rejected except for parameters that are normally detected such as total dissolved solids and conductivity. See the Sampling SOP for additional information (Appendix E).

An analysis of blanks results is conducted during the data validation process. After validation is completed, qualifier codes are assigned to the data points that may have been contaminated. To the data user, qualifier codes indicate that chemicals were detected in the associated blank and the sample may be potentially contaminated.

Labs use the B1-B7 qualifiers. Field blanks use FB2 qualifier (See Sampling SOP in Appendix E).

2.4.2.2 Splits and Duplicates

Split samples are used to determine consistency between labs. A split sample is one sample that is divided equally into two or more sample containers and then analyzed by different analysts or laboratories. Splits samples are typically taken from a churn splitter that has been filled with sub-samples and homogenized. Split samples may be equated to "identical twins" in that they contain the same chemical composition as each other. Laboratory analyses of split samples ideally produce identical results. Protocols for labeling split samples are found in the most current sampling SOP (Appendix E).

Duplicate samples are a set of similar samples collected from the same site, at about the same time, and analyzed in the same manner and are used to determine consistency in analytical methodology. Duplicate samples may be equated to "fraternal twins" in that they originate from one source but each sample may contain a slightly different chemical composition. Duplicate samples can be collected from a churn splitter or as side by side grab samples. Some types of analyses preclude the use of a plastic churn splitter (e.g., volatile organic chemicals).

Target frequencies for collecting split and duplicate samples are listed in TABLE 3. Criteria for determining reasonable agreement between splits and duplicates are locate in Appendix E Sampling SOP. Most parameters for blanks have a minimum quality control percentage of five percent. For example, if a sampler visited 20 sites and sampled for total metals then at least one blank (5% of 20 samples) and one split or duplicate (5% of 20 samples) should be collected for a total of 10 percent QC.

In general, acceptable relative percent difference between split or duplicate samples is 20% or less so long as the value of the results of the duplicate samples are greater than two times the method reporting limit.

2.4.2.3 Frequency of Field Quality Control Samples

TABLE 3. Summary of Typical Quality Control Sampling Frequencies.

Parameter	Field Splits or Duplicates	Equipment / Churn Blanks	Total
D Metals	None	5%	5%
T Metals	5%	5%	10%
Nutrients	5%	5%	10%
Inorganics	5%	5%	10%
Radiochemistry	5%	5%	10%
Bacteria	1 per trip		
Clean Metals	1 per trip		
Pesticides	5%	5%	10%
Macroinvertebrates	10%	None	10%
Fish Tissue	5%	5%	10%
Algae	10%	None	10%

2.5 Field Instrumentation Calibration and Maintenance

2.5.1 Field and Equipment Files

All field equipment and logbooks are housed at the ADEQ Phoenix offices, in the Water Quality Lab. SOPs for these instruments can be found in Appendix E.

2.5.2 Field Equipment Calibration

All field equipment must be inspected and calibrated according to the frequency in the SOP (Appendix E). Results of equipment inspections and calibration will be noted in the logbook for each instrument. Any deficiencies in equipment must also be noted in the logbook and reported immediately to the Watershed Improvement or Monitoring and Assessment Unit Supervisor. Samplers will coordinate with the lab manager to arrange for repair by the manufacturer or for purchase of a replacement. Surface Water Improvement Value Stream staff will not use equipment if the working condition of the equipment is in doubt.

2.6 Data Acquisition and Management

2.6.1 Recordkeeping

This QAPP and referenced SOPs include written procedures for all methods and procedures related to the collection, processing, analysis, reporting and tracking of environmental data. All data generated must be of sufficient quality to withstand challenges to their validity, accuracy and legibility. To meet this objective, data are recorded in standardized formats and in accordance with prescribed procedures. The documentation of all environmental data collection activities must meet the following minimum requirements:

- Data must be documented directly, promptly, and legibly. Pen should be used unless using rite-in-the-rain® paper then use pencil since pen smudges. All reported data must be uniquely traceable to the raw data. All data reduction formulas must be documented.
- All original data records include, as appropriate, a description of the data collected, units of measurement, unique sample identification, station or location identification (if applicable), name (signature or initials) of the person collecting the data, and date of data collection.
- Any changes to the original (raw data) entry must not obscure the original entry. The reason for the change must be documented, the change must be initialed and dated by the person making the change.

Other specific documentation requirements are discussed throughout this QAPP and the sampling SOP (Appendix E Section 10.4.6) and the record retention schedules for the value stream can be found in (TABLE 3.5).

TABLE 3.5. Record Retention Timeline

Record Series	Ret. Remarks
Macroinvertebrate and Fish Tissue Data Records	Permanent
305 305(b) Assessment and 303(d) Listing Report (including supporting documents)	After Completed
208 Consistency Reviews	After Completed
208 Areawide Water Quality Management Plans	Keep until Superseded
Complaint Investigation Files	After Resolved
Monitoring Site Files (including bicriteria files)	From data generated
Triennial Reviews	Date of report
Surface Water Quality Monitoring Program Files (Sample plans, annual data reports, guidance)	After fiscal year that monitoring program ends

2.6.1.1 Quality Control Files

Quality assurance information is contained in either the site files or a section quality assurance file (TABLE 4). Electronic files are located at J:\WQD\Surface Water Section\QA Reports.

TABLE 4. QA Files.

Information	Location/Level
Water Quality Control Worksheets (chemistry, biocriteria, and/or fish tissue for each site), including any correspondence with the lab regarding rerunning samples or other data quality issues (see Appendices A & C).	Site File
Quality Assurance Specialist Worksheet for each fiscal year (Appendix B)	Section QA File

Information	Location/Level
Field audit information (Appendix F)	Section QA File
Data Review audit information (Appendix G)	Section QA File
Certifications (for example, mercury free tubing, bottles, and filters)	Section QA File
Quality Control results (duplicates, splits, or blanks)	Site File

2.6.1.2 Field Documentation and Forms

Records are maintained for each field activity to ensure that samples and data are traceable and defensible. Field records will be documented on field forms or in designated field logbooks to provide a secure record of field activities, observations and measurements during sampling. Field data and observations will be recorded in real time on activity-specific data forms. Completion of appropriate field documentation and forms for each sample is the responsibility of the project lead or designee.

2.6.1.3 Site Files

A site file containing raw data and field notes is maintained by SWIVS indefinitely according to ADEQ's retention schedule (See Sampling SOP – Appendix E). This file contains all analytical request forms, all field notes concerning the investigation, and all data verification/validation results for the survey. In addition to water quality data, this file may also contain all copies of benthic macroinvertebrate, habitat, fish, pebble count, cross sectional, periphyton data, and site photos.

2.6.1.4 Database Records

An electronic copy of the data is housed in the Water Quality Database. This includes all chemistry, macroinvertebrate, algae, fish and habitat data. This data is backed up on main and external database systems and past update records and can be obtained in the event of emergency. These records are also uploaded to the Water Quality Exchange and can be obtained via the water quality portal interface at www.waterqualitydata.us.

2.6.1.5 Equipment Files

All field equipment must be inspected and calibrated as necessary prior to each sampling trip. Results of equipment inspections will be noted in the logbook for each instrument. Any deficiencies in equipment must be noted in the equipment log in the file and reported immediately to appropriate staff that will recheck the equipment and arrange for repair by the manufacturer or for purchase of a replacement. SWIVS staff will not use equipment if the working condition of the equipment is in doubt.

2.6.2 Water Quality Database

Field and laboratory water quality data are entered by the project lead into the Water Quality Database in accordance with the Data Management SOP (Appendix E).

It is the project lead's responsibility to conduct a lab data review using the QA checklist (Appendix B) to ensure that all necessary data verification and validation procedures have been completed (Appendix A). These checklists walk through the quality control steps of scanning for obvious errors and standards violations, checking the relative percent difference between duplicates and regular samples, adding applicable lab and field data qualifiers and event flags, conducting chemistry ion checks, checking Lab QC. The project lead is responsible for making decisions to reject data that does not meet QC criteria.

The Sampling SOP (Appendix E, Section 10.6.2) provides step by step instructions for how to fill out the QA checklist.

The applicable data qualifiers are then entered into the WQDB to flag the results in question (Sampling SOP - Appendix E). Qualifiers that have a 'Reject' in the Reject column are retained but not used in assessment and listing decisions. Qualifiers that have a 'No' in the 'For 303d list' column or are flagged in the WQDB so that the data will not be used for 303d listing decisions. Blank cells in the decision and 303d list columns indicate that the data will be loaded into the WQDB and used for the assessment. Qualified data are still assessed by staff and may still be

rejected or flagged as not to be used for assessment based on best professional judgment. The QC Checklists are retained in the site files along with the sample lab reports.

All SWIPVS water quality data, which meets QA requirements, is uploaded on a regular basis to WQX. Data is currently uploaded through ADEQ's node regularly to WQX from the agency internal database, Arizona Water Quality Database and is publicly available at www.waterqualitydata.us.

2.6.2.1 Electronic Uploading of Data from Laboratories

Most data from laboratories is directly loaded to ADEQ's Water Quality Database (WQDB) electronically. Most laboratory QC flags are attached to the sample test results when they are uploaded to the WQDB. Additional data flags are added during the QA Checklist review, as needed.

2.6.2.2 Database Rights

Data is 'approved' after it has been validated by the WQDB and has been reviewed using the WQDB Data Entry & Lab Data Package Review Checklist (Appendix A). Staff only have "Read-Only" rights for approved data. This effectively locks the records and prevents accidental changes and deletions. The approved data must be unapproved by a project lead or database administrator before making additional changes.

2.6.3 Biocriteria Reference Specimen Collection Storage

The Biocriteria Program utilizes both macroinvertebrates and algae (diatoms) as biological indicators. A reference collection of macroinvertebrate specimens and diatom images shall be maintained permanently in the laboratory at the Phoenix ADEQ office, as validation for taxonomic identifications contained in our Water Quality Database. The reference specimen collection is required:

1) To support the biocriteria research used to develop the macroinvertebrate biocriteria and diatom biocriteria standards;
2) For verification of taxonomic identifications, when questions arise;
3) For inter-laboratory taxonomy QC checks;
3) To share with outside labs or researchers; and
4) For in-house taxonomic identifications, training and internal study purposes.

Preservation of macroinvertebrate specimens shall be checked and re-preserved on an annual basis. Macroinvertebrate specimens are stored in 5mL vials with a solution of 70 ethanol or 99% isopropanol, with a rite-in-the-rain® paper label which includes taxon name, site id/stream name, date collected, habitat sampled, and collector name (ADEQ). New specimens are added when new taxa are encountered, when needed to refresh degraded specimens, and to ensure that there is replicate material from different locations around the state. Typically, the contracted taxonomy lab prepares a batch of representative specimens from the annual sample batch and ships to ADEQ annually, to incorporate into the specimen collection.

Diatoms are not visible to the naked eye and thus have no "reference specimens" like the macroinvertebrates. Instead, the externally contracted taxonomy lab prepares a set of microscope images of representative diatoms found in the sample batch. The set of images comprises the "reference collection". A set of images, labeled with the taxa name, is submitted to the project manager (usually a CD) along with the electronic data package of diatom taxonomy data. The Biocriteria Program Coordinator must upload the imagery to a folder containing the taxonomy data for the year. The reference collection of diatom images for each year is stored in a folder on the shared drive titled "Taxonomy QC imagery" under each year's data files (eg. J:\WQD\Surface Water Section\Monitoring Unit\DATA\ALGAE-stream diatoms\2018 Diatoms\Taxonomy QC imagery\).

CHAPTER 3 ASSESSMENT/OVERSIGHT

3.1 Assessments and Response Actions

3.1.1 Management Systems Review (MSR)

As described in the ADEQ QMS, all ADEQ programs (including the SWIVS programs) will have an MSR conducted by an external party (typically the QAM) once every four years. This review will focus on the Program's adherence to and implementation of this QAPP. The QAM's MSR will focus on the overall structure and procedures for accomplishing the QA program and will be conducted in accordance with the Guidance on Assessing Quality Systems (March, 2003, EPA QA/G-3).

3.1.2 Data Review

Samplers manually enter all field data after water samples have been collected and sent to the lab. The lab typically directly uploads data directly into the Water Quality Database. The database will not accept data that does not have all relevant and needed information. The lead sampler ensures that the data is correct using the Quality Assurance Checklist (Appendix A). The lead then approves the data, which allows the data to be released to EPA's Water Quality Exchange (WQX). This process is discussed in more detail in the Data Management SOP (Appendix E).

Data review audits are conducted quarterly by the quality assurance specialist using the checklist in Appendix G. At least one data review audit per sampler must be done annually. Site files should be randomly picked from the current Fiscal Year's sampling plan.

3.1.3 Certified Laboratory Technical System Audit (TSA)

As described in the ADEQ QMS, Arizona Department of Health Services (ADHS) is responsible for conducting TSAs on the Arizona licensed/certified laboratories. The primary goal of the TSA will be to review the laboratory organization, operation, and capabilities; determine the reliability of data; and note corrective action for any apparent deficiencies. The ADEQ QAM may also perform or designate auditors to perform laboratory TSAs, if necessary.

3.1.3.1 Performance Evaluations/Proficiency Tests

Proficiency evaluation samples are a required aspect of an Arizona licensed/certified laboratory to keep their certification pursuant to A.A.C. R19-14-609. These proficiency evaluations demonstrate that the lab is proficient by analyzing samples for testing programs, category of testing, parameter, and approved methods for analyses, which they are licensed. These tests are performed for each analysis/parameter a lab offers at least once in each 12-month period.

3.1.4 Field Audits

Field audits are used to ensure that sampling procedures are adhered to in a consistent and defensible manner. At least one field audit per sampler per year is required. Field audits may be conducted by any hydrologist or scientist who are up to date on core training and are a grade three or above and if approved by their supervisor. Auditors shall use the checklist in Appendix F.

3.2 Reports to Management

3.2.1 MSR Reports

Each MSR conducted on the SWIVS will result in a written draft report of all findings and corrective actions to be addressed, submitted to the Program's senior management, as soon as reasonably practical from the completion of the audit. A final report will be completed as soon as reasonably practical, once the Program senior management's comments have been received.

3.2.2 Certified Laboratory TSA

As described in the ADEQ QMS, Arizona Department of Health Services (ADHS) is responsible for conducting TSAs on the Arizona licensed/certified laboratories. Any deficiencies found during a laboratory TSA that would affect the reliability or accuracy of data used by ADEQ, are addressed via a report sent to the appropriate ADEQ

division. ADEQ would then determine the best course of action in response to this report and determine if the affected data is able to be used for compliance purposes.

3.2.3 Data Review Reports

Each data review conducted by the QA specialist on the SWIVS will result in a written draft report of all findings and corrective actions to be addressed, submitted to the unit supervisors, as soon as reasonably practical from the completion of the audit. A final report will be completed as soon as reasonably practical, once the unit supervisor's comments have been received.

3.2.4 Field Audit Reports

If major inconsistencies with the SOP are discovered during the field audit, they will be immediately reported to the sampler and the sampler's unit supervisor, who will review and take corrective actions as necessary. Corrective actions may include retraining employees on specific sampling techniques.

CHAPTER 4 DATA VALIDATION AND USABILITY

4.1 Data Verification

Laboratory data is typically submitted directly to ADEQ's database and is stored in a staging area. Once staff have verified that the requested lab test are present, they will move the data from the staging table into the WQDB for a complete quality assurance review. This process is discussed in more detail in the Data Management SOP (Appendix E).

4.2 Data Validation

4.2.1 Water Quality Database Validation

Validation checks are an automated function of the Water Quality Database and include:

- Confirmation of required fields and electronic format (i.e. valid dates and times).
- Addition of data qualifiers for identification of blank contamination, relative percent differences with splits and duplicates, potential exceedances and issues with lab qualifiers.

Data from external organizations such as volunteer groups is validated using a checklist modeled from the credible data rule (A.A.C. R18-11-602) and is available in (Appendix I)

4.2.2 Field Audits

Various SWIVS field personnel will accompany project leads on sampling trips to ensure standardization of procedures among staff. Field Audits will be conducted to provide assessment of the implementation of the procedures outlined and/or referenced in this QAPP.

The field audit checklist (Appendix F) is used to assure consistency and adherence to SOPs. Data collected by samplers is validated at a rate of one field audit per sampler per year.

4.2.3 Rejecting Data

Data may be rejected because of unacceptable field blank contamination, unacceptable relative percent differences between duplicates or splits, failed equipment calibration, specific lab qualifiers or a combination of reasons that call the data into question. Rejected data is flagged in the water quality database with a comment as to why it was rejected and is not deleted. Rejected data is not sent to the public facing Water Quality Exchange and is not used for assessment and listing decisions.

4.3 Quality Control

Staff have the largest role in assuring quality data. Staff are responsible for collecting the water chemistry data, transferring the data to the database, and reviewing the data to ensure quality. The project lead is responsible for all aspects of data handling from field to laboratory, from laboratory to storage, and from storage to validation.

4.3.1 Water Chemistry Quality Assurance and Quality Control

Quality assurance and control for water chemistry is done for every sampling trip and covers the following five steps, which are also outlined in FIGURE 2:

1. Samples are collected in the field.
2. Field and lab parameters are stored in the Water Quality Database.
3. The project leader reviews the data and completes the "WQDB Data Entry & Laboratory Data Package Review Checklist" in (Sampling SOP, Appendix A). Specific instructions on how to complete the worksheet which are provided in the Sampling SOP (Appendix E). A copy of this form goes into the site file.
4. Once the data is approved it is ready for the public access through WQX.

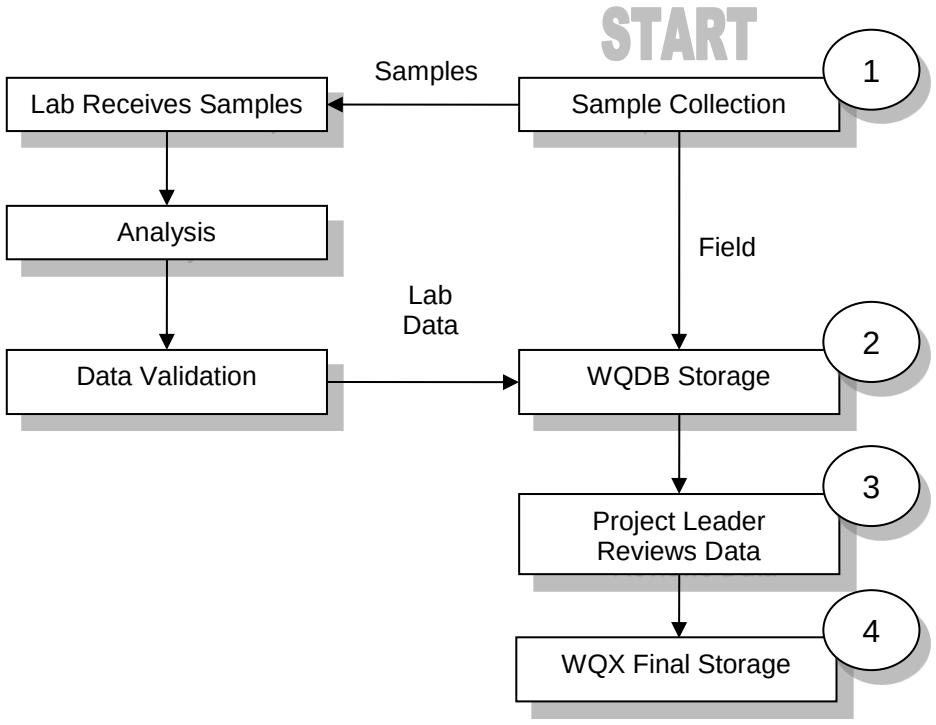


FIGURE 2. Water quality data collection process.

4.3.2 Macroinvertebrate and Algae Quality Control

The macroinvertebrate and algae datasets follow a different paradigm for Quality Control checks than water quality samples. The sections below are specific to each biological sample type and the QC forms/Reports are specific for each. Data review includes validation of the Lab dataset, verification of ADEQ protocols followed, and data review of uploaded data. A copy of the ADEQ QAQC report along with signed chain of custody form, list of samples, invoice, and Lab correspondence shall be filed in the following directory: J:\WQD\Surface Water Section\QA Reports. Macroinvertebrate and algae data review is in Appendix C.

4.3.3 Fish Tissue Quality Control

Quality control for fish tissue is done for every sampling event. The basic process for fish tissue collection is as follows:

1. Fish are collected in the field. Fish tissue is processed and sent to the lab.
2. Lab parameters are stored in the Water Quality Database.
3. The project leader reviews the data and completes the "WQDB Data Entry & Lab Data Package Quality Control Worksheet" in Appendix A. A copy of this form goes into the site file.
4. The worksheet is peer reviewed and approved on the worksheet and in the database. Approval means that the data has been reviewed and accepted, data qualifiers have been applied and data quality QA/QC requirements and standards have been met.

4.3.4 Quality Assurance Specialist Level Quality Assurance and Quality Control

The QA Specialist is responsible for completing the form titled "QA Specialist Quality Control Worksheet". This form, located in Appendix B, is to be filed in the yearly quality control file. This form shall be filled out annually by the assigned QA Specialist.

The QA Specialist checks for completeness of the data and basic data accuracy for all data collected by the Surface Water Improvement Value Stream. The QA Specialist acts as a check on the SWIVS staff. The QA Specialist has the authority to reject data that does not meet the outlined data quality objectives with Section Manager approval.

Once the data is unapproved, either it will be completely rejected or problems with the data shall be corrected and resubmitted to the QA Specialist for reapproval.

4.5 Corrective Actions

Corrective actions can be the result of situations involving field activities or laboratory activities. Corrective actions will be taken as necessary to assure that the environmental measurements will be of a known quality and will be sufficient to meet the program data quality objectives. Corrective actions will be adopted by SWIVS staff, laboratories, or contractors as appropriate.

Field corrective actions generally are the responsibility of the project lead. Some corrective actions can be taken in the field. Problems can result from situations such as malfunctioning or broken field equipment, inability to access a surface water sampling site, or an inability to get samples into a laboratory before their holding time is exceeded. Regardless of the source of the problem or whether or not it can be corrected, it will be documented in the appropriate field forms. Corrective actions can include items such as performing additional decontamination of equipment, re-sampling, locating alternative sample sites or obtaining additional training of field personnel. Each corrective action will be documented with a description of the deficiency and the corrective action taken, and the person responsible for implementing the corrective action.

Laboratory corrective actions are typically worked out between the project lead and the laboratory. Problems can result from situations such sample labels that do not match chain of custody documents, insufficient preservation, missed holding times, duplicate sample criteria not met, or other conditions relating to the sample or laboratory. Some corrective actions will require the notification of the individual that submitted the sample. Other corrective actions may be internal to the laboratory and automatically implemented by laboratory personnel. Corrective actions involving notification of the ADEQ will be documented in the site file.

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APPENDIX A – WQDB DATA ENTRY & LAB DATA PACKAGE REVIEW CHECKLIST

Instructions: Complete instructions for filling out this sheet are in the Sampling SOP (Appendix E, Section 10.6.2). The current form is located at J:\WQD\Surface Water Section\SAMPLING\Forms. QC Checklists are electronically filed by site.

Sample Information

WBID	
SiteID	
Date Sampled	
Time Sampled	
Sample #	
Dataset #	

Manage Sites - Update locational information:

☐ Elevation, drainage area, site access directions, current site type (ref, nonref, stressed) if known, biocriteria exemption (eg. intermittent or edw), GIS slope, Stream order, Flow Regime (P, I, E or Edw).

Upload Sample/Result Data:

☐ Upload edi dataset for Test America test results

Sample/Result Data Entry – Header tab:

☐ Fill in all Sample information fields possible; collection date & time must match labels on sample collection bottles.
☐ Select correct "sample purpose" and "Sample type" to match the sample types collected
☐ Crew chief should be Lead sampler on the trip
☐ Select appropriate Flow Condition in the "Sample Taken?" field (This is a requirement for Assessments)
☐ Select collection equipment and Method (eg. Chem-01 is the standard one for water chemistry samples, ADEQ Riffle bugs for perennial stream bug samples)
☐ Enter field notes under "notes" section
☐ Enter "ADEQ" for Reporting agency, and your code for "collecting agency"

Sample/Result Data Entry – Field Chem tab:

☐ Select Test Plan = Stream-field measurements & Enter Field data results
☐ Double check field data entry records for 100% correct entry
☐ For E.coli dups – Enter into Lakes field data spreadsheet for uploading to database. To manual entry after field data has been loaded- Click Edit button for E.coli parameter, enter new result, place "DUP" in comments box, then "Save as New" to add a 2nd Ecoli value.
☐ To add "Event conditions" for Weather, algae blooms, equipment problems, QC samples collected: add a parameter for each Event. Click New result, substance=Event condition, Protocol=water, Lookup result= parameter, then click save.

Sample/Result Data Entry – Lab Chem tab:

☐ Is Dataset complete? Field parameters, flow, E.coli, water chem. results, Nutrients, SSC results, dissolved Ca & Mg
☐ Spot check that uploaded lab values are correct & matching pdf lab report
☐ Equipment blanks Clean? See new SOP regarding field blanks and qualifiers for info on Reruns and flagging Rejected Analytes:_____
☐ Splits/Dups within Limits for water chemistry analytes (RPD<20% where results are >2x MRL)? (If not, Request rerun and/or Flag parameter for all samples on the run)

- ☐ E.coli Dups are within limits (Confidence intervals overlap using IDEXX calculator)?
- ☐ Field/Lab ratios calculated and qualifiers applied? (Run "QA Flagging" procedure in "Schedule trips" page). Check that ADEQ qualifiers are correctly applied.
- ☐ Lab qualifiers correctly applied?
  - o Check that all flags in Lab report pdf copy are listed for test results in Lab Chem tab.
  - o Scan Lab Report –QC Sample Results for any dilutions or qualifiers that apply to your sample & ensure those data are applied to test results.
  - o Reruns: follow WQDB Chapter 10 guidance for entering qualifier RR1, RR2, or RR3

Sample/Result Data Entry – Exceedances?

- ☐ Check for Standard exceedances: Field pH, DO, E.coli & Lab metals, nutrients (if site-specific standard applies), and SSC [use Metals calculator spreadsheet for any dissolved metals detections, using dissolved Ca/Mg Hardness value & check Standards tables for Ammonia]
  List Here: _____
- ☐ Exceedance letter for Human health Standards sent to Landowner & County Health Dept?
- ☐ Exceedance letter filed in Site File?

Approval Information

Date Approved:	
Approved by:	

APPENDIX B – QUALITY ASSURANCE SPECIALIST CHECKLIST

Instructions: QA Specialist should run the reports outlined in Step 1 and 2 at least quarterly.

Quarterly

1. Has all data been Approved and Reviewed?

☐ A) Run the QA Report for Unapproved Data at J:\WQD\Surface Water Section\Monitoring Unit\LEAN\RMetrics \unapproved to determine unapproved data greater than 30 days from the date collected. Note acceptable exceptions such as lab reruns. Copies of reports go in the root folder and in J:\WQD\Surface Water Section\QA Reports.

☐ B) Email staff to review and approve data identified in report.

2. Is the Data Accurate?

☐ A) Run the QA Report for Suspect Data at J:\WQD\Surface Water Section\Monitoring Unit\LEAN\RMetrics \outlier to determine if any outliers present. Copies of reports go in the root folder and in J:\WQD\Surface Water Section\QA Reports and which staff have suspect data.

☐ B) Email staff to assess and correct values that are incorrect.

Annually

1. Field Data Audits –

☐ A) Audits have been conducted for each sampler for the current fiscal year? Audit forms have been filed in the QA file next to the Surface Water Improvement Value Stream Manager Office.

2. Lab Data Audits –

☐ A) Audits have been conducted for each sampler for the current fiscal year? Audit forms have been filed in the QA file next to the Surface Water Improvement Value Stream Manager Office.

APPENDIX C – BIOCRITERIA PROGRAM DETAILS AND QUALITY ASSURANCE REPORTS

ADEQ began development of its Biocriteria Program in 1992 with a statewide reference site sampling network (Meyerhoff and Spindler, 1994) in order to develop a new biocriteria standard for benthic macroinvertebrates. Biocriteria also includes algae. ADEQ samples both macroinvertebrates and algae throughout Arizona. Standard currently exist for macroinvertebrates, but not for algae or other biological groups.

C.1 Macroinvertebrate Background

Classification of streams with similar macroinvertebrate communities was performed using the statewide biological monitoring data. An elevation based classification system was defined based on macroinvertebrate species distribution across the Arizona. This classification scheme consists of two broad macroinvertebrate regions and community types: 1) a warm water community located at <5000' feet and a cold water community located at >5000' feet (Spindler, 2001). All small to medium sized, wadeable, non-effluent dependent, perennial streams located in these regions, with a few exceptions, are predicted to have the same general macroinvertebrate community type. Indexes of Biological Integrity (IBI) were developed for warm water and cold water communities (Gerritsen and Leppo, 1998; Leppo and Gerritsen, 2000).

ADEQ's cold and warm water indexes consist of several metrics or key attributes of the benthic macroinvertebrate community, which best distinguish impairment from the reference condition. The cold water IBI consists of seven metrics selected for their ability to discriminate impairments in cold water streams located at >5000' elevation:

1) Total taxa richness,
2) Diptera taxa richness,
3) Intolerant taxa richness,
4) Hilsenhoff Biotic Index,
5) Percent composition by Plecoptera (stoneflies),
6) Percent composition by scrapers, and
7) Scraper taxa richness.

The warm water IBI consists of nine metrics, which best discern impairment in warm water streams located at <5000' elevation:

1) Total taxa richness,
2) Ephemeroptera taxa richness (mayflies),
3) Trichoptera taxa richness (caddisflies),
4) Diptera taxa richness,
5) Percent composition of Ephemeroptera (mayflies),
6) Percent composition by the dominant taxon,
7) Percent Hilsenhoff Biotic Index,
8) Percent composition by scrapers, and
9) Scraper taxa richness.

The metrics are calculated from a list of species and their abundances. The total IBI score is an average of the metric scores. The macroinvertebrate community is then rated as attaining the aquatic life use meeting the biocriteria standard when a sample IBI score is greater than or equal to the 25th percentile of reference scores, inconclusive when a sample IBI score falls between the 10th and 25th percentile of reference score, or violating when the sample IBI score falls below the 10th percentile of reference scores. An IBI score that falls between the 10th and 25th percentile of reference condition is determined to be inconclusive and a

verification bioassessment is required to determine whether there is a violation. If the verification sample IBI score falls below the 25th percentile, the biocriterion is violated. In effect, a violation of the biocriteria standard occurs when a sample result from a study site either: 1) has an IBI score less than the 10th percentile of reference threshold value, or 2) has an IBI score between the 10th and 25th percentile of reference threshold values and a verification sample also falls below the 25th percentile of reference threshold value. The narrative biocriterion applies only to perennial, wadeable stream segments with either a warm or cold water aquatic life designated use. ADEQ has not characterized reference conditions for other waterbody types.

ADEQ will determine compliance with the narrative biocriterion based on a macroinvertebrate sample collected from a wadeable, perennial stream with riffle or run habitat that is collected during the appropriate spring index period. The warm water IBI will apply to perennial, wadeable streams found at <5,000' elevation and the cold water IBI will apply to perennial, wadeable streams found at >5,000' elevation. ADEQ standard methods for biological sample collection and data analysis must be followed to compare bioassessment results to these macroinvertebrate based IBIs. The procedures for sample collection, laboratory analysis and for calculating the indexes are provided in the standard operating procedures for surface water quality sampling.

In general, macroinvertebrate samples from perennial streams are collected and composited from three $1m^2$ areas of riffle habitats at each site, using a D-frame kick net. Samples are only minimally processed to remove large debris and sand in the field. Samples are preserved with 99% isopropyl alcohol on-site. Samples are held in chain of custody from time of collection until delivery to the taxonomy laboratory, as per chain of custody and shipping procedures. Laboratory analysis consists of sorting and enumerating a minimum of 500 macroinvertebrates per sample. The macroinvertebrates are identified to genus or species level for the insects and levels specified in the Appendix H for all other taxa groups. General lab procedures are also listed in Appendix H. There is no maximum holding time for preserved macroinvertebrate samples, however ADEQ requests that lab analyses be completed within 6 months of sample delivery. Procedures for calculating the Indexes are provided in Appendix J and the IBI scoring thresholds are shown in TABLE C1.

TABLE C1. Macroinvertebrate IBI thresholds for wadeable, perennial streams of Arizona

Macroinvertebrate bioassessment result	**Index of Biological Integrity Score**	
	Cold water	Warm water
Greater than the 25th percentile of reference condition	≥ 52	≥ 50
Between the 10th and 25th percentile of reference condition	41 –519	40 - 49
Less than the 10th percentile of reference condition	≤ 45	≤ 39

C.1.1 Calculating the Arizona Index of Biological Integrity

The Arizona Indexes of Biological Integrity can be applied to macroinvertebrate taxonomic data generated by the sample collection procedures provided in Standard Operating Procedures for Surface Water Sampling (Appendix E). All the appropriate sample collection conditions must be met in order to calculate the IBIs for bioassessment purposes (i.e. application of the narrative biocriteria standard). There are currently two Indexes; a cold and a warm water IBI. The following narrative provides the steps needed to calculate these Indexes from taxonomic lists and abundance data generated by taxonomy laboratories from the field collected macroinvertebrate samples.

1. Identify the appropriate reference community using the site elevation.
   - The warm water community is defined as being located below the 5000 foot elevation.
   - The cold water community is defined as being located above the 5000 foot elevation.
2. Calculate the macroinvertebrate metric values for the study sample following metric calculation procedures listed below. Metrics required for each index are listed in Table C2.

Use the following formula to calculate the metric score (percentage of reference) for sensitive metrics whose values decrease with disturbance. Apply this formula to the following metrics.

Metric Score = (Sample value / metric threshold value) * 100

1. Total taxa richness
2. Number of Ephemeroptera taxa
3. Number of Trichoptera taxa
4. Number of Diptera taxa
5. Number of intolerant taxa
6. Percent Ephemeroptera
7. Percent Plecoptera
8. Percent scrapers
9. Number of scraper taxa

Apply the following formulas to calculate the metric score (percentage of reference) for tolerant metrics whose values increase with disturbance.

1. Hilsenhoff Biotic Index

   Metric score = (10 – Sample value) / (10 – Metric threshold value) * 100

2. Percent dominant taxon

   Metric score = (100 – Sample value) / (100 – Metric threshold value) * 100

3. Calculate the metric percent of reference score using either the warm or cold water reference metric threshold values associated with that community type (Tables C3 and C4).
4. Calculate an average of the percent of reference scores for all metrics to produce the IBI score. Table J4 provides an example of the scoring system for a warm water stream.
5. Determine assessment category for the IBI score from Table C5.

TABLE C2. Descriptions for the warm water and cold water metrics used in Arizona's IBIs.

Category	**Metric**	**Definition**	**Expected Response to increasing disturbance**
Richness measures	Total number of taxa	Number of different macroinvertebrate taxa	Decrease
	# Ephemeroptera taxa	Number of mayfly taxa	Decrease
	# Trichoptera taxa	Number of caddisfly taxa	Decrease
	# Diptera taxa	Number of true fly larvae.	Decrease
	# Intolerant taxa	Number of taxa having a tolerance value #3	Decrease

Category	Metric	Definition	Expected Response to increasing disturbance
Composition measures	% Dominant taxon	Percent abundance of the single most abundant taxon.	Increase
	% Ephemeroptera	Percent abundance of mayflies, compared to total abundance of the sample	Decrease
	% Plecoptera	Percent abundance of stoneflies, compared to total abundance of the sample	Decrease
Tolerance measure	Hilsenhoff Biotic Index	Abundance-weighted average tolerance of assemblage	Increase
Trophic measures	% Scrapers	Percent abundance of the scraper functional feeding group, compared to total abundance of the sample	Decrease
	# Scraper taxa	Number of taxa in the scraper functional feeding group	Decrease

TABLE C3. Reference scoring thresholds for Warm Water metrics, used in the Arizona Warm Water Index of Biological Integrity.

Metric	Metric threshold value
Total taxa	37
Trichoptera taxa	9.0
Ephemeroptera taxa	9.0
Diptera taxa*	10.0
Scraper taxa	7.0
Percent scraper	23.7
Percent Ephemeroptera	70.0
Percent Dominant Taxon	19.1
Hilsenhoff Biotic Index	4.89

* Appropriate taxonomic effort is to genus for insects and to family for midges.

TABLE C4. Reference scoring thresholds for Cold Water metrics, used in the Arizona Cold Water Index of Biological Integrity.

Metric	Scoring threshold
Total taxa	38
Diptera taxa*	11
Intolerant taxa	6
Scraper taxa	11
Percent scraper	45.1
Percent Plecoptera	19.1
Hilsenhoff Biotic Index	4.23

* Appropriate taxonomic effort is to genus for insects and to family for midges

TABLE B5. Example of the ADEQ Warm Water Index of Biological Integrity scoring system; Sycamore Creek near Round Valley bridge (Hwy 87) collected during spring 1995.

Metric	Metric Value	Metric Score (compared to warm water reference scoring threshold)
Total taxa	24	65
Trichoptera taxa	6	67
Ephemeroptera taxa	5	56
Diptera taxa	7	70
Scraper taxa	3	43
Percent scraper	20.3	86
Percent Ephemeroptera	26	37
Percent Dominant Taxon	41	73
Hilsenhoff Biotic Index	5.73	84
Index Score(average of all Metric Scores)		65 = Attaining

TABLE C6. Assessments based on ADEQ macroinvertebrate IBI scores.

Macroinvertebrate bioassessment result	Index of Biological Integrity Score		Assessment
	Cold water	Warm water	
Greater than the 25th percentile of reference condition	≥ 52	≥ 50	Attaining
Between the 10th and 25th percentile of reference condition	46 – 51	40 – 49	Inconclusive
Less than the 10th percentile of reference condition	≤ 45	≤ 39	Impaired

C.1.2 Macroinvertebrate Data Verification and Validation Report

Instructions: Use the following checklist to ensure macroinvertebrate data quality upon receipt of macroinvertebrate data (typically once per year). "No" values are generally unacceptable unless a valid comment provided. Place the completed copy of this form, along with signed COC, QC report, Invoice, and important correspondence in the Section QA File. File electronic copies at J:\WQD\Surface Water Section\QA Reports

Fiscal Year:
Date of Review:
Data Validator:
Data Package:
Lab Name:

QC Item	Y/N	Comment
ADEQ sample collection SOP's followed? Comment on any modifications to sampling protocol and any samples collected outside the index period, different habitat, preservation issues.		
Chain of custody procedures followed from collection to lab receipt?		
Chain of Custody forms with Lab receipt signatures submitted?		
Complete Dataset from Lab? Have laboratory taxonomic data results been provided for each biological sample submitted in electronic format?		
Lab Quality control report and narrative provided? List any problem areas in the dataset to address		
Data Accuracy. Taxonomic identification QC check performed on 10% of samples, yielding 90% accuracy		
Sorting efficiency check (>90%) completed for 10% of samples		
List of new taxa and attributes provided		
ADEQ Field duplicates similar, with <10% difference in metrics/IBI score?		
Provided record of Caton Tray proportion of sample analyzed		
Minimum of 500 count per sample recorded		
Data package submitted within 6 months of sample delivery?		
Lab communications on the data package attached (optional)?		
Dataset acceptable for upload and data analysis?		

C.2 Algae Background

Algae is sampled primarily for the development of nutrient standards for lakes and streams or for harmful algal blooms. Algal collection protocols are outlined in ADEQ's sampling SOP (ADEQ. 2018). Use the algae data verification and validation report in section C.2.1 when algae data is received from the lab.

C.2.1 Algae Data Verification and Validation Report

Instructions: Use the following checklist to ensure algae data quality upon receipt of macroinvertebrate data (typically once per year). "No" values are generally unacceptable unless a valid comment provided. Place the completed copy of this form, along with signed COC, QC report, Invoice, and important correspondence in the Section QA File.

Fiscal Year:
Date of Review:
Data Validator:
Data Package:
Lab Name:

QC Item	Y/N	Comment
ADEQ sample collection SOP's followed? Comment on any modifications to sampling protocol, index period, habitat, preservation		
Chain-of-custody procedures were followed and a Lab signed COC form is on file		
Lab results provided for each sample on COC form		
Complete Dataset from Lab? Have laboratory taxonomic data results been provided for each biological sample submitted in electronic format?		
Lab Quality control report and narrative provided? List any problem areas in the dataset to address		
Data Accuracy. Taxonomic identification QC check performed on 10% of samples?		
Percent taxonomic disagreement (PTD) and Percent difference in Enumeration (PDE) meet Lab's internal QC targets (PTD <15% and PDE <5%)		
Minimum count of 600 diatom valves (300 cells) met for all samples? If not, provide rationale.		
ADEQ Field duplicates similar, with <10% difference in metrics/IBI score?		
List of new Taxa and attributes provided?		
Data package submitted within 6 months of sample delivery?		

APPENDIX D – PARCC STANDARDS

1. Water Chemistry

Water chemistry is used to determine the chemical integrity in waterbodies (lakes, streams and rivers) and to determine compliance with water quality standards. To ensure data quality, water quality field and laboratory procedures listed in the most current version of Standard Operating Procedures for Surface Water Quality Sampling shall be followed. Some of the major PARCC considerations are listed below.

A. Precision – Precision is achieved by replication of chemical tests in the Lab and duplicate and split samples in the field.
B. Accuracy – Water quality samples shall be collected in accordance with the most current ADEQ Field SOPs. Field audits shall be performed in accordance with QAPP requirements. Field equipment shall be properly maintained and calibrated according to the Surface Water Sampling SOP (Appendix E). Accuracy in the Laboratory is achieved by various tests including method and spiked blanks, matrix spikes and duplicates, and serial dilutions. ADEQ checklists will be utilized to approve Lab data packages and to approve field data for entry into the WQDB.
C. Representativeness – Representative samples are achieved primarily through sample design, selection of sites and procedures to meet project objectives. The Sampling & Analysis Plan contains the objectives for sample collection and analysis each year for the Surface Water Improvement Value Stream. Representativeness is primarily achieved through adherence to the Sample plan design. Representativeness is also addressed in the field through collection of water samples in carefully selected locations that are most representative of the stream reach or lake region. Representativeness is also achieved in the laboratory through (1) the proper handling, homogenizing, compositing, and storage of samples and (2) analysis within the specified holding times so that the material analyzed reflects the material collected as accurately as possible.
D. Completeness – The completeness goal is 100% valid data entered into the ADEQ WQDB.
E. Comparability – Comparability is a measure of the confidence with which one data set can be compared to another. This is a qualitative assessment and is addressed primarily in sampling design through re-sampling of stations over time or duplicate samples at a station. In the laboratory, comparability is ensured through the use of comparable analytical procedures and ensuring that project staff are trained in the proper application of the procedures. Within-study comparability will be assessed through analytical performance (QC samples).

F. Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Sensitivity is addressed primarily through the selection of appropriate analytical methods, equipment and instrumentation. The methods selected for a study are chosen to provide the sensitivity required for the end-use of the data. This is a quantitative assessment and is monitored through the instrument calibrations and calibration verification samples and the analysis of procedural blanks with every analytical batch.

2. Biocriteria

Bioassessments are used for determining biological integrity in perennial, wadeable streams and to determine compliance with the narrative biocriterion in Arizona Administrative Code R18-11-108.01. To ensure data quality, biocriteria field and laboratory QC procedures listed in the table below are used. In addition, the following data quality criteria shall be applied for assessment purposes:

A. Precision – Studies of variability of IBI scores within reference sites across replicates or years will be conducted periodically. Target is standard deviation of <10 points.
B. Accuracy – Laboratory SOPs shall be followed such that a target of 90% sorting efficiency and 90% taxonomic accuracy is achieved for each batch of samples analyzed by our taxonomy lab.
C. Bias – Sampling bias shall be avoided by using a D-frame dip net with a standard mesh size. Only riffle habitats are sampled.
D. Bias – Samples are sorted in the laboratory with a dissecting scope; no field sorting is conducted.

E. Sampling interferences shall be avoided; sampling shall not be conducted during high flow events. Sampling shall occur during the spring index period (April-June).
F. Completeness – A target of ten reference sites is the objective for sampling from each surface water basin each monitoring year for maintenance and updating of the IBIs.
G. Samples shall only be collected from appropriate habitats. For purposes of meeting the ADEQ narrative biocriteria standard, the following sampling site conditions must be met: wadeable, perennial, riffle/run habitat, heterogeneous substrates, sampled during the spring index period (April-May for warmwater streams and May-June for coldwater streams).
H. Decisions to be made using biological data - The ADEQ Indexes of Biological Integrity are the primary tool for analyzing macroinvertebrate data for purposes of 305b assessments of the aquatic life use. Since the new narrative biocriterion uses the 25th percentile of reference condition as the threshold value for meeting the aquatic life use standard, the warmwater and coldwater 25th percentile value is used for making decisions about whether the use is being adequately protected. A sample IBI score must be greater than or equal to the 25th percentile of reference IBI threshold to comply with the narrative biocriteria standard. When a sample IBI score is less than the 10th percentile of reference condition, the sample has exceeded the standard and is impaired. When a sample IBI score falls between the 10th and 25th percentile of reference score, the result is inconclusive and a verification sample is required. If the verification sample IBI score falls below the 25th percentile, the biocriteria standard is exceeded. ADEQ sampling and analysis methods must be followed for valid bioassessments.

TABLE C1. Biocriteria procedures related to PARCC.

Procedure	Performance Characteristic	Description
Sampling device (field)	Precision - repeatability in a habitat	We have shown good repeatability in studies of variability within sites sampled over multiple years. These samples had low variability of site IBI scores (standard deviation of 6.5 points on a 100 point scale) for replicate spring, riffle samples within a site.
	Bias - exclusion of certain taxa (mesh size)	The D-frame sampler is outfitted with a 500µ mesh size net opening, which retains organisms of a consistent size for identification and excludes very small specimens of early larval instars which are difficult to identify.
	Performance Range	The D-frame dip net is an efficient sampler for use in Arizona streams, as it can be used in large or small streams with variable habitats and substrate sizes.
	Interferences - matrix/physical limitations	The D-frame sampler functions well in a variety of water depths and velocities, without limitation.
Sampling method (field)	Precision - variable metrics or measures among replicate samples at a site	Measurement error is quantified by replicate sampling at 10% of our sampling sites each year. Samples are processed and analyzed separately and their metrics and IBI score compared to obtain a measure of the method precision. This is an estimate of the precision of the entire method, which includes variability due to small-scale spatial variability within a site, operator consistency and bias, and laboratory consistency.
	Bias - exclusion of certain taxa (mesh size) or habitats	Only Riffle habitats are sampled. Pools are excluded. We exclude organisms smaller than 500µ.

Procedure	Performance Characteristic	Description
	Performance range - limitations in certain habitats or substrates	Method is currently limited to only riffle habitats of wadeable, perennial streams. Intermittent and ephemeral streams, effluent dependent waters and lakes are excluded waterbody types. Bedrock/travertine dominated substrates, wetlands, pool dominated streams, and sand dominated habitats are excluded.
	Interferences - high river flows, training of personnel	Sampling is limited to low flow conditions, which are more suitable for sampling than during high flows. Our sampling SOPs recommend sampling a minimum of 4 weeks after a bankfull flood has occurred. Methods have not yet been developed for large river sampling.
	Bias - efficiency of locating small organisms in sample transfer	The sieve is carefully rinsed after straining a sample to obtain every specimen visible to the naked eye. Then the sieve is washed prior to leaving a sample site. All samples are sorted in the laboratory using 6-10X powered dissecting scopes.
	Performance range - sample preservation and holding time	Samples are preserved with isopropanol and a capful of formalin in the field. Formalin is used for better preservation in the Arizona heat.
	Interferences – Rainfall	Field sorting is not part of our routine SOPs, so rainfall is not limiting.
	Accuracy - of sample transfer process and labeling	Our contract laboratory follows sorting and labeling procedures according to their Laboratory SOP to prevent labeling errors.
Laboratory sample processing	Precision - split samples	Duplicate samples are collected at the rate of 10% of the total # of samples during each year's index period. We do not currently compare taxonomy from different laboratories.
	Bias - sorting certain taxonomic groups or organism size	Large specimens are removed first from the entire sample for best identifications. All organisms retained by the 500 micron mesh sieve are identified utilizing a Caton Tray and subsampling procedures.
	Interferences - equipment	A Caton Tray and specific subsampling SOPs are used to limit errors associated with subsampling.
	Accuracy - sorting method, lab equipment	Sorting efficacy is checked for 10% of the samples processed by a trained technician using a dissecting scope with up to 6x magnification at the contract lab. A second sorter checks a sorted subsample to ensure that the target of 90% sorting efficiency is met.
Taxonomic enumeration	Precision - split samples	We do not currently conduct split sample analyses between two different laboratories.
	Bias - counts and identifications for certain taxonomic groups	Our taxonomy lab provides a minimum 500 count of insects per sample, which accounts for approximately 90% of the taxa present in the sample, missing only those that are rarely occurring in the sample.
	Interferences - appropriateness of taxonomic keys	The taxonomy lab uses the most current southwestern, western and North American taxonomy keys for identification of Arizona samples.

Procedure	Performance Characteristic	Description
	Sensitivity - level of taxonomy related to type of stressor	A standard taxonomic effort is required for various macroinvertebrate groups, with insect identifications to genus or species level and midges identified to family level.
	Accuracy - identification and counts	A quantitative check of taxonomic accuracy is provided on 10% of the samples processed by a trained and experienced taxonomist at the contract lab. The taxonomy contractor is responsible for obtaining the most accurate, consistently achievable identifications for ADEQ samples, using specialists as needed to obtain identifications to the general taxonomic levels listed in Table H2 below. A second taxonomy analyst re-identifies a subsample of specimens to ensure that the target of 90% accuracy is met. In addition, a macroinvertebrate reference specimen collection shall be permanently maintained in the laboratory at ADEQ for verification purposes.

TABLE C2. ADEQ Taxonomic levels of identification for macroinvertebrates.

Invertebrate Group	Level of taxonomy required
Aquatic insects (except the family Chironomidae)	Genus (or species where consistently identifiable)
Chironomidae	Family
Semi-aquatic insects	Family
Arachnida (Mites)	Class
Cladocera, Copepoda, Ostracoda	Class
Amphipoda, Decapoda, Isopoda	Class
Nematoda, Nematomorpha	Phylum
Turbellaria	Class
Annelida	Class
Mollusca	Family or Genus

APPENDIX E – DOCUMENTS TO BE PROVIDED BY ADEQ TO EPA FOR REVIEW

The following documents were provided to EPA Region IX as part of the QAPP approval process.

- Surface Water Sampling SOPs and Data Management SOPs, 2018
- Test America – Quality Systems Manual, Document No. PX-QAD-011, December 2019.
- Fiscal Year 2021 ADEQ Sampling and Analysis Plan for Streams, Lakes, and Fish

APPENDIX F - FIELD AUDIT CHECKLIST

Instructions: The field audit is meant to ensure consistency of sampling and adherence to current SOPs. Samplers will be given immediate feedback of any minor or major issues identified. File forms in Section QA files. Currently next to the Value Stream Manager office in the lateral bin. Current forms are maintained at J:\WQD\Surface Water Section\SAMPLING\Field Audits.

Fiscal Year:

Site ID:

Date of Review:

Field Auditor Name:

Name(s) of Staff being Reviewed:
(Identify Trip Lead)

Trip Preparation				
#	**Staff**	**Item**	**Pass?**	**Comments**
1		Calibrated multiprobe & clearly recorded calibration information in log book?	☐	
2		Routing form complete?	☐	
3		Directions up to date in WQDB and Sample Plan	☐	
4		Chain of custody available (trip/sample#, data set #)?	☐	
5		SOP onsite/available?	☐	

Sampling				
#	**Staff**	**Item**	**Pass?**	**Comments**
6		Used GPS to locate site?	☐	
7		Completely filled out datasheet & data checked before leaving site?	☐	
8		Demonstrated safe practices (driving, hiking etc)?	☐	

Sampling				
#	**Staff**	**Item**	**Pass?**	**Comments**
9		Triple rinsed bottle?	☐	
10		Bottles labeled clearly & correctly?	☐	
11		QC sampled correctly?	☐	
12		Appropriate # of points used for flow (>15)?	☐	
13		Appropriate flow method used (1 vs. 2 point for streams)?	☐	
14		Representative sample taken (Grab vs. EWI)?	☐	
15		Lake profile taken correctly (results every meter)?	☐	
16		Sampling location representative? For lakes was photic zone and stratified sampling locations identified correctly?	☐	
17		Gloves w/ E. Coli collection?	☐	
18		Any equipment forgotten?	☐	
19		Were Standard Operating Procedures followed and deviations noted on field form?	☐	

Processing				
#	**Staff**	**Item**	**Pass?**	**Comments**
20		Turbidity sampled correctly?	☐	
21		Gloves w/ acid?	☐	
22		Gloves w/ E. coli?	☐	
23		Deconned equipment (includes boat if a lake)?	☐	
24		Dilution equipment available (DI water, graduated cylinder, extra bottles?)	☐	

Post-Trip				
#	**Staff**	**Item**	**Pass?**	**Comments**
25		Contact person called each night?	☐	
26		Sample run and trip organized well?	☐	
27		Appropriate permissions and contacts?	☐	
28		Samples dropped off in good shape (<4º C, clearly labeled bottles & COC, full bottle sets)	☐	
29		QC samples labeled correctly on bottles. Matching information written on field forms.	☐	
30		Post Calibration of multiprobe completed correctly?	☐	
31		E. Coli processing and enumeration done within timelines and according to protocols.	☐	

Auditor Comments

Recommendations / Corrective Actions

Minor Fixes:	
Major Problems:	
Corrective Actions:	

Staff Comments

Distribution

* QA File (next to VS manager office in labeled lateral bin)
* Sampler

APPENDIX G – DATA REVIEW AUDIT CHECKLIST

Instructions: The data review audit is meant to ensure consistency of documentation and adherence to current SOPs. Samplers will be given immediate feedback of any minor or major issues identified. Store forms in Section QA files. Currently next to the Value Stream Manager office in the lateral bin. Current forms are maintained at J:\WQD\Surface Water Section\SAMPLING\Field Audits. The data review is specific to the sampler and sites picked for the audit.

Fiscal Year:

Site ID:

Date of Review:

Auditor Name:

Name(s) of Staff being reviewed:
(Identify Trip Lead)

Site File Review				
#	**Staff**	**Item**	**Pass?**	**Comments**
1		Site file can be located?	☐	
2		Field datasheet, lab report and chain of custody for sample of interest present?	☐	
3		Field form completely filled out?	☐	
4		Current field form version used?	☐	
5		QA checklist present and completely filled out?	☐	
6		Current QA Checklist version used?	☐	
7		Field form and lab data for sample match database? Check sample level information like sample collected "Yes, stormflow", site comments, and spot check data from lab/field sheets.	☐	

Data Review				
#	**Staff**	**Item**	**Pass?**	**Comments**
8		Is current QC % >= 10 %? (See J:\WQD\Surface Water Section\Monitoring Unit\LEAN\RMetrics\qcpercent)	☐	
9		Are all samples for the fiscal year approved within 30 days? Are exceptions such as reruns clearly identified? (See J:\WQD\Surface Water Section\Monitoring Unit\LEAN\RMetrics\unapproved)	☐	
10		Are there any outliers? (See J:\WQD\Surface Water Section\Monitoring Unit\LEAN\RMetrics\outliers)	☐	

APPENDIX I – CHECKLIST FOR USING EXTERNAL DATA FOR CWA ASSESSMENT

CHECKLIST FOR USING EXTERNAL DATA FOR THE CLEAN WATER ACT ASSESSMENT

A review is required for each agency that has data used to make new impairments or new delistings. Go through the following checklist to document that the minimum elements in the credible data rule (A.A.C. R18-11-602) are met. Comments are required for all "No" and "NA". Note R18-11-602(A)(2)(b) provides discretion when looking at sampling plan credibility, which allows for less than the required elements. R18-11-602(A)(4)(b) provides a general exception to QAP/SAP requirements if the data yield results of comparable reliability to subsections (A)(1) [Quality Assurance Plan] and (A)(2) [Sample and Analysis Plan].

Workflow: Every June Assessment Specialist will pull data from the Portal (www.waterqualitydata.us) to be used for the assessment and run the new decisions by agency report. The Volunteer Coordinator will process the Volunteer Agencies using this check sheet and the Assessment Specialist will complete the remaining agencies. Forms will be saved to J:\WQD\Surface Water Section\Assessments\2020 Assessment\Credible Data Review

Date Review Done				**ADEQ Staff Conducting Review**			
Name of Organization (from Assessment Calculator)							
Impacted WBIDs (from Assessment Calculator)							
Impaired Parameters of Concern							
Point of Contact Name				**Phone**		**Email**	

#	Yes	No	NA	Description
Quality Assurance Plan (From A.A.C. R18-11-602(A)(1))				
1.				(a) Approval page with project manager, quality assurance coordinator or equivalent.
2.				(b) Project personnel and laboratories doing the sampling
3.				(c) Sample design and data yields representative samples
4.				(d) Documented sampling procedures (standard operating procedures for labeling, calibration, maintenance, sampling, etc).
5.				(e) Are methods approved by ADHS http://apps.azsos.gov/public_services/Title_09/9-14.pdf.
6.				(f) Data handling process (automated tool covers this)
Sample Plan for Waterbody of Interest (From A.A.C. R18-11-602(A)(2))				
7.			X	(a) Describes the plan for what, where, when and how often samples are to be collected.

Provide comments here for each No or NA.

#	Comment

DECISION

☐Data is credible and may be used for assessment and listing purposes

☐Data is not credible. Do not use for assessment and listing purposes