Quality Assurance/Quality Control Manual

Municipal Separate Stormwater Sewer System

Stormwater Monitoring

August 2020

In support of

Arizona Department of Transportation
Municipal Separate Stormwater Sewer System

Permit No. AZS000018 – 2015

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ABBREVIATIONS

A.A.C. Arizona Administrative Code
ADEQ Arizona Department of Environmental Quality
ADHS Arizona Department of Health Services
ADOT Arizona Department of Transportation
A.R.S. Arizona Revised Statutes
BMP Best Management Practices
BOD Biochemical Oxygen Demand
COC Chain of Custody
COD Chemical Oxygen Demand
CRM Certified Reference Material
E. coli Escherichia coli
EPA United States Environmental Protection Agency
HPLC High Performance Liquid Chromatography
LCS Laboratory Control Sample
LOQ Limit of Quantitation
MDL Method Detection Limit
mg/L Milligrams per Liter
MQO Measurement Quality Objective
MPN Most Probable Number
MS/MSD Matrix Spike/Matrix Spike Duplicate
MS4 Municipal Separate Storm Water Sewer System
NTU Nephelometric Turbidity Units
OAW Outstanding Arizona Waters
PAH Polycyclic Aromatic Hydrocarbons
PQLs Practical Quantitation Limits
QAM Quality Assurance Manual
QAP Quality Assurance Plan
QA/QC Quality Assurance/Quality Control
SOP Standard Operating Procedure
TDS Total Dissolved Solids
TSS Total Suspended Solids
VOC Volatile Organic Compound
WLA Wasteload Allocation
µg/L Micrograms per Liter

1.0 PROJECT MANAGEMENT

1.1 INTRODUCTION

This Quality Assurance/Quality Control Manual has been prepared for the Arizona Department of Transportation (ADOT) and their contractors to assist in meeting stormwater monitoring requirements as identified within Section 12 of Arizona Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Permit No. AZS000018 (Permit). This Permit is implemented under Arizona Department of Environmental Quality (ADEQ) Arizona Pollutant Discharge Elimination System (AZPDES) and authorizes ADOT to discharge stormwater to Waters of the United States in Arizona within its Municipal Separate Storm Sewer System (MS4) and select maintenance facilities.

Quality assurance (QA) is defined as methods designed to implement the data quality objectives throughout the sampling and analytical procedure. Quality control (QC) is defined as the methods to measure how effectively the quality assurance methodologies have been applied.

1.2 DATA QUALITY OBJECTIVES

The data quality objectives of this manual are to provide a standard working tool for ADOT personnel and designated contractors in determining the type, quantity and quality of data needed to reach defensible decisions or make credible estimates in meeting Permit conditions as described in Part 12 of the ADOT's MS4 Permit. This regulatory target requires data qualifiers of precision, accuracy and representativeness that governs the data quality objectives of the program.

1.2.1 Precision

Precision refers to the closeness of two or more measurements to each other. Measurements of concentration in sampled stormwater gathered by this program will be compared to Arizona surface water quality standards (A.A.C. Title 18, Chapter 11, Article 1) applicable to receiving waters of the MS4, qualitatively used to evaluate narrative standards to impaired and unique waters. The precision of numeric water quality standards varies but is the most exact of these three uses. Therefore, the precision of any data should be comparable to applicable surface water quality standards of the specific receiving waters.

1.2.2 Accuracy

Accuracy refers to the closeness of a measured value to a standard or known value. For environmental samples the true value is never known, even for a specific aliquot. Therefore, data accuracy can only be determined by intra-laboratory methods. Acceptable levels for accuracy of regulatory data where enforcement actions are possible are quite high and these have been specified by the Arizona Department of Health Services (ADHS) Office of Laboratory Licensure and Certification. All samples collected for monitoring are analyzed by a laboratory licensed by the ADHS and accuracy determined by internal programs of those labs. See Section 3.3 – Acceptance Criteria for further discussion.

1.2.3 Representativeness

For environmental samples, representativeness is the closeness of the measured value of a random sample to that obtained from the entire population. Obviously, for water samples variability is continuous, therefore site characterization standards suggest that the physical nature of the water sample be the best criteria for representativeness. For stormwater samples, these criteria include location relative to the source of pollution and receiving water, flow discharge and the nature of the rainstorm has specified the locations, sample timing, characteristic rainfall amounts and other qualifiers for the sampling program.

1.2.4 Level of Data Quality

The MS4 permit has assumed a level of data quality needed for compliance by requiring that ADHS certified laboratories are used, by stipulating the sampling locations, frequency and antecedent rainfall conditions and by requiring that the data be compared to applicable surface water quality standards of the specific receiving waters and calculated pollutant loads of impaired waters. This level of data quality will be maintained during the implementation of the monitoring.

1.3 ROLES, RESPONSIBILITIES, AND QUALIFICATIONS

The monitoring project structure is given by an organization chart, which is provided in Appendix A and will be updated as needed. The ADOT assigned project manager (ADOT PM) is responsible for compliance with the MS4 Permit. Sampling, monitoring and interpretive support will be assigned to the ADOT Contractor, who will maintain the project database. Data and narrative interpretation will be delivered to the ADOT PM for inclusion in the MS4 Permit Annual Report.

1.4 SAMPLE PARAMETERS AND FREQUENCY

Permit section 12.4.2.4(b) identifies parameters and sampling frequency. This table is provided below as Table 1 to assist users of this manual in preparing sampling activities.

Table 1. Analytes, Sample Types, and Matrices

Analyte	Sample Type	Sample Frequency
Flow	Field Measurement	Each time an outfall is sampled, for each aliquot
pH	Field Measurement	Once each wet season for each year in the
Temperature	Field Measurement	Once each wet season for each year in the
Total Dissolved Solids	Flow Weighted Composite	Once each wet season for each year in the
Total Suspended Solids	Flow Weighted Composite	Once each wet season for each year in the
Turbidity	Flow Weighted Composite	Once each wet season for each year in the
Biochemical Oxygen Demand	Flow Weighted Composite	Once each wet season for each year in the
Chemical Oxygen Demand	Flow Weighted Composite	Once each wet season for each year in the
Sulfates	Flow Weighted Composite	Once each wet season for each year in the
Nitrate	Flow Weighted Composite	Once each wet season for each year in the
Nitrite	Flow Weighted Composite	Once each wet season for each year in the
Sodium	Flow Weighted Composite	Once each wet season for each year in the
Calcium	Flow Weighted Composite	Once each wet season for each year in the
Chloride	Flow Weighted Composite	Once each wet season for each year in the
Ammonia	Discrete Manual	Once each wet season for each year in the
Chlorine	Discrete Manual	Once each wet season for each year in the
Escherichia coli	Discrete Manual	Once each wet season for each year in the
Fecal Coliform	Flow Weighted Composite	Once each wet season for each year in the
Arsenic	Flow Weighted Composite	Once each wet season for each year in the
Barium	Flow Weighted Composite	Once each wet season for each year in the
Cadmium	Flow Weighted Composite	Once each wet season for each year in the
Chromium	Flow Weighted Composite	Once each wet season for each year in the
Copper	Flow Weighted Composite	Once each wet season for each year in the
Lead	Flow Weighted Composite	Once each wet season for each year in the
Mercury	Flow Weighted Composite	Once each wet season for each year in the
Nickel	Flow Weighted Composite	Once each wet season for each year in the
Selenium	Flow Weighted Composite	Once each wet season for each year in the
Silver	Flow Weighted Composite	Once each wet season for each year in the
Zinc	Flow Weighted Composite	Once each wet season for each year in the
Dissolved Copper	Discrete Manual	Once each wet season for each year in the
Hardness	Discrete Manual	Once each wet season for each year in the
Polycyclic Aromatic	Discrete Manual	Once each wet season for each year in the

1.5 REGULATORY LIMITS

Analytical results will be compared to their applicable Arizona numeric water quality standards for surface water (A.A.C. Title 18, Chapter 11, Article 1) applicable to the MS4 receiving waters. Current surface water quality standards are available at the following link:

https://legacy.azdeq.gov/environ/water/standards/download/SWQ_Standards-1-09-unofficial.pdf

2.0 SAMPLE COLLECTION PROCEDURES

2.1 SAMPLING EQUIPMENT

Monitoring equipment will be gathered ahead of time because opportunities to sample during rainfall events often come with little advanced notice. Stormwater monitoring generally requires the following equipment:

- Field forms
- Waterproof pens
- Permanent markers
- Powder-free nitrile gloves
- Clear glass jar for visual examinations
- Sample containers
- Sample preservatives
- Sample container labels
- Chain of Custody (COC) forms
- COC seals
- Ice chest(s)
- Ice
- Foul-weather gear

A MS4 Stormwater Sampling Equipment List is provided in Appendix B to assist sampling technicians in preparing for field activities.

2.2 SAMPLE LOCATIONS

2.2.1 Maintenance Facilities Monitoring Locations

ADOT will conduct stormwater monitoring at its maintenance facilities located within a quarter mile of an impaired water or OAW, including, but not limited to:

- Nogales Maintenance Yard - 1340 N. Hohokam Drive, Nogales (31° 21’ 22.97’’ N; 110° 55’ 38.96’’ W)
- Roosevelt Maintenance Yard – SR 188 Milepost 242.8, Roosevelt (33° 39’ 45.67” N; 111° 08’ 03.16” W)
- Spring Creek Maintenance Yard – No listed address 34°48’00.50” N; 111° 55’ 20.43 W
- Superior Maintenance Yard - 951 Main Street, Superior (33° 17’ 14.14” N; 111° 06’ 40.31” W)
- Superior Storage and Fuel Yard - 952 Main Street, Superior (33° 17’ 17.12” N; 111° 06’ 43.49” W)

Maintenance Facility Sampling Parameters

ADOT will collect a minimum of one sample per facility from each representative outfall between June 1 and October 31 (summer season) and one sample between November 1 and May 31 (winter season). Samples will be collected utilizing in-ground passive collection bottles installed within protective mounting tubes and retrieved after a storm event.

Maintenance Facility Field Measurements

Field measurements at each maintenance location will consist of the following:

- pH
- Temperature
- Residual chlorine (Nogales Yard only)

Field measurements will be recorded in the site location logbook.

2.2.2 Wet Weather (MS4) Monitoring Locations

ADOT will conduct stormwater monitoring at the following five established MS4 locations:

- Flagstaff 2 MS4 - S. Beulah Blvd. along north side of street between I-40 overpass and south bound I-17 exit ramp (35°10'20.23"N; 111°39'56.18"W)
- Nogales MS4 - Morley Road at Intersection of State Route 82 (31° 21’ 02.12”N; 110° 55’ 24.52”W)
- Phoenix MS4 - East of State Route 101 on north bank of Skunk Creek (33° 37’ 19.86”N; 112° 14’ 21.65”W)
- Sedona MS4 - Below western abutment of State Route 179 bridge over Oak Creek (34° 51’43.95’N; 111° 45’ 42.72”W)
- Tucson MS4 - West of Interstate 10 north of Grant Road within ADOT Yard (32° 15’ 17.21”N; 110° 59’ 49.43”W)

A map showing the MS4 sampling locations is provided in Appendix C.

MS4 Sampling Parameters

ADOT will collect stormwater samples from the first representative storm event of each wet season (June 1- October 31 and November 1- May 31) and subsequent representative storm events as necessary to collect at least one stormwater sample for each wet season from each outfall or monitoring location. Sampling will be conducted over the first 3 hours of the discharge or for the entire discharge period, if the discharge lasts less than 3 hours. Sampling efforts should include the “first flush” (first 30 minutes of stormwater discharge) whenever possible. A representative storm event is defined in the ADOT Permit as a storm event of greater than 0.1 inches of rainfall and that occurs at least 72 hours after the previously measurable (greater than 0.1 inch of rainfall) storm event.

MS4 Field Measurements

Field measurements at each MS4 location will consist of the following:

- pH
- Temperature
- Flow

Field measurements will be recorded in the site location logbook.

MS4 Grab Samples

A minimum of one grab sample will be collected from a discharge resulting from a measurable storm event at each MS4 location and analyzed for the following

- Escherichia coli (E. coli)
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Residual chlorine (Nogales MS4 only)

Grab sampling information for E. Coli and PAHs will be recorded on the COC. Information for residual chlorine (Nogales MS4 only) will be recorded in the site location logbook.

MS4 Flow-Weighted Composite Samples

Flow-weighted composite samples will be collected at each MS4 location utilizing an ISCO automated stormwater sampler. Sampling will be conducted over the first three hours of the discharge or for the entire discharge period if the discharge is less than three hours. A list of analyses required for flow-weighted sampling is provided in Table 1 (see page 3 of this document).

2.2.3 Impaired Water Monitoring

ADOT will conduct stormwater monitoring at the following locations within one-quarter mile of an impaired waterway:

- Queen Creek, Superior, AZ for dissolved copper
- State Route 85 bridge over Gila River for total selenium

Impaired Water Sampling Parameters

Samples will be collected utilizing in-ground passive collection bottles installed within protective mounting tubes and retrieved after a storm event.

2.3 QUALITY ASSURANCE/QUALITY CONTROL SAMPLING

The Quality Assurance/Quality Control (QA/QC) program ensures that samples collected are of the highest quality and the laboratory analyzing the samples is producing reliable results. In order to be certified by ADHS, an analytical laboratory is required to have a Quality Assurance Plan (QAP) or Quality Assurance Manual (QAM) that contains a set of QA/QC procedures covering all aspects of laboratory operations. The contracted laboratory will be required to provide a copy of its QAP and maintained on file by ADOT or their contractor.

Contamination can be introduced to a sample at any point during equipment preparation, sample collection, transport, or analysis steps and is referred to as sample bias. Standardized procedures for field and laboratory activities minimize the likelihood of contamination of samples or sample bias. Different types of blank samples can be used to determine if contamination has been introduced during any of the steps. The different types of blanks are described in the remainder of this section.

Section 4 of this document outlines required correction procedures in the event of surface water quality standard exceedance.

Trip Blanks
A trip blank sample shall be analyzed every fifth sampling event to estimate sample bias in volatile organic compound (VOC) analyses and analyzed for VOCs during every sampling event. Trip blank samples will be provided by the laboratory and will remain with the sample containers throughout the sampling and shipping process.

Equipment Blanks
Equipment blanks shall be collected by pouring analyte-free water over the decontaminated field equipment before collecting samples from a site. One equipment blank sample will be collected during seasonal maintenance activity (winter and summer). The equipment blank will be submitted to the laboratory and analyzed for the same parameters as the site sample(s).

Matrix Spikes and Matrix Spike Duplicates
Matrix spikes and matrix spike duplicates (MS/MSD) are collected at the same location as the original samples and the laboratory adds (spikes) the sample with a known concentration of analyte to a sample. The samples are then analyzed to determine the concentration of the sample plus the spike. Deviation from 100 percent in the spike recoveries indicates matrix interference. One MS/MSD will be collected for every ten VOC.

Method Blanks
A method blank is used to determine if any contamination is being introduced by laboratory reagents or glassware. For each batch of samples, method blanks will be run by the laboratory and the results of the method blank analysis reported with the sample results as percent recovery. Method blanks are conducted by the laboratory and no action on the part of the field sampling personnel is required.

Laboratory Duplicates
A laboratory duplicate is a sample that is split into two aliquot samples and then analyzed separately to determine the reproducibility of the laboratory analytical methods. Results of the laboratory duplicate analysis is reported with the sample results. At least one laboratory duplicate sample should be collected once a year from the five MS4 sampling locations. Laboratory duplicates are conducted by the laboratory and no action on the part of the field sampling personnel is required.

2.4 PRESERVATIVES AND HOLDING TIMES

Water sample preservation procedure is based on the particular type of analysis methodology.

- Bottle sets are typically shipped from the contract laboratory with preservatives contained in the bottle but may include separately-contained preservative vials for special circumstances.
- The type of preservative used for the analysis to be performed is typically identified by a colored dot or sticker on the pre-preserved bottle, which may also include a written notation of the added preservative.
- Sample bottles should be shipped for each sampling event on a per event/request basis.
- Bottles shall be new and contain the pre-measured amount of the preservative, except as noted above.

- Any pre-preserved bottle that is discolored around the cap, lost its preservative label, or appears to lack sufficient preservative shall be discarded.
- A crucial requirement for sample preservation is to extract the sample within established hold times for the specific analysis.

A list of analysis methods, bottle requirements, preservatives and hold times for the required analysis is listed in Table 2 and in accordance with EPA SW-846 requirements.

Table 2. Preservatives and Holding Times

Analysis	Method	Preservative	Container	Volume Required	Hold Time
Ammonia	SM4500NH3 D	Sulfuric Acid	Plastic 500 mL - Wide - H2SO4	100 mL	28 Days
Anions, Ion Chromatography	300 ORGFMS	None	Plastic 500 mL - Wide - unpreserved	30 mL	48 Hours
BOD, 5-Day	SM5210B Calc	None	Plastic 500 mL - Wide - unpreserved	400 mL	48 Hours
COD	5220D	Sulfuric Acid	Plastic 500 mL - Wide - H2SO4	100 mL	28 Days
Coliforms, Fecal (Colilert - Quanti Tray)	9223B ColiQT FC	Sodium Thiosulfate	Bacti Bottle - Idexx 125 mL w/thio	100 mL	8 Hours
E. Coli	9221F	None	Bacti Bottle - Idexx 125 mL	125 mL	8 Hours
Mercury (CVAA)	245.1 CWA	Nitric Acid	Plastic 500 mL - Wide - HNO3	100 mL	28 Days
Metals (ICP)	200.7 CWA	Nitric Acid	Plastic 500 mL - Wide - HNO3	100 mL	180 Days
Metals (ICP/MS)	200.8 CWA LL	Nitric Acid	Plastic 500 mL - Wide - HNO3	100 mL	180 Days
PAHs (HPLC)	8310	None	Amber Glass 1 liter Wide - unpreserved	2000 mL	7 Days
Solids, Total Dissolved (TDS)	2540C Calcd	None	Plastic 500 mL - Wide- unpreserved	200 mL	7 Days
Solids, Total Suspended (TSS)	2540D	None	Plastic 500 mL - Wide- unpreserved	200 mL	7 Days
Turbidity, Nephelometric	180.1	None	Plastic 500 mL - Wide- unpreserved	100 mL	48 Hours
Chlorine	SM4500Cl-G	None	Plastic or Glass 250 mL brown poly	100 mL	15 Minutes

2.5 SAMPLE NOMENCLATURE

A consistent system for naming samples ensures that sample data are readily identifiable as to time and location and avoids confusion when samples are collected regularly at the same location over a long period of time. All samples should be named according to the following two-part labeling system:

Part 1 - Location Code

FLAG2 - Flagstaff MS4
NOGMS4 - Nogales MS4
PHX - Phoenix MS4
SED - Sedona MS4
TUC - Tucson MS4

NOGYARD - Nogales Maintenance Yard
ROSVLT - Roosevelt Yard
SPRCRK - Spring Creek Yard
SUPYARD - Superior Maintenance Yard
SUPFUEL - Superior Storage and Fuel Yard

Part 2 - Date Code

Include the date in the following format: YYMMDD. An example sample from the Tucson MS4 sampling location collected on November 15, 2016 would be labeled:

TUC161115

An example of a completed COC is provided in Appendix D of this document.

Laboratory Selection

Laboratories selected for analyses of stormwater samples may include any ADHS certified laboratory. Currently, the following labs have been providing service to ADOT for stormwater analyses:

- Pace Analytical
- Turner Laboratories, Inc.
- Xenco Laboratories

The sampling technician will also document field measurements and observations in the Water Sampling Data Form provided in Appendix E or within the site logbook.

3.0 APPROVED ANALYTICAL METHODS

3.1 ANALYTICAL METHODS

ADOT MS4 Permit Section 12.2.1.2 specifies the process for selecting analytical methods for stormwater sample analysis. The recommended analytical methods, limits of quantification (LOQs) and method detection limits (MDLs) for specific analytes are provided in Table 3 below and are in accordance with EPA SW-846 requirements.

The analytical method will be specified on the COC form. In addition to these requirements, the Permit requires the selected analytical method to have a LOQ less than the applicable numeric surface water quality standard. If all methods have LOQs higher than applicable numeric surface water quality criteria, ADOT must use the approved analytical method with the lowest LOQ. The laboratory contracted for ADOT stormwater sample analysis must also use a standard calibration where the lowest standard point is equal to or less than the LOQ. This will be verified through review of laboratory data in comparison of the LOQ to surface water quality standards.

Table 3. Analytical Methods

Analyte	Method	LOQ	MDL	Units
Ammonia	SM 4500 NH3 D	0.5	0.383	mg/L
Biochemical Oxygen Demand	SM 5210B	5.0	5.00	mg/L
Chemical Oxygen Demand	SM 5220D	20.0	4.53	mg/L
Chlorine, Residual	SM 4500 Cl G	0.05	0.0096	mg/L
Nitrate as N	300.0	0.1	0.0509	mg/L
Nitrite as N	300.0	0.1	0.0329	mg/L
Chloride	300.0	2.0	0.291	mg/L
Sulfate	300.0	2.0	0.214	mg/L
Calcium	200.7 Rev 4.4	2.0	0.0139	mg/L
Sodium	200.7 Rev 4.4	0.5	0.154	mg/L
Arsenic	200.8 LL	0.5	0.247	µg/L
Barium	200.8 LL	0.5	0.259	µg/L
Cadmium	200.8 LL	0.1	0.0231	µg/L
Chromium	200.8 LL	0.5	0.433	µg/L
Copper	200.8 LL	0.5	0.332	µg/L
Lead	200.8 LL	0.5	0.220	µg/L
Nickel	200.8 LL	0.5	0.344	µg/L
Selenium	200.8 LL	0.5	0.0743	µg/L
Silver	200.8 LL	0.1	0.0121	µg/L
Zinc	200.8 LL	12.5	3.12	µg/L
Hardness	SM 2340B	3.3	0.07	mg/L
Mercury	245.1	0.0002	0.00007	mg/L
Total Dissolved Solids	SM 2540C	20.0	20	mg/L

Analyte	Method	LOQ	MDL	Units
Total Suspended Solids	SM 2540D	10.0	10	mg/L
Turbidity	180.1	0.2	0.2	NTU
Acenaphthene	8310	1.0	0.312	µg/L
Acenaphthylene	8310	1.0	0.689	µg/L
Anthracene	8310	0.05	0.0341	µg/L
Benzo[a]anthracene	8310	0.2	0.0308	µg/L
Benzo[a]pyrene	8310	0.05	0.0173	µg/L
Benzo[b]fluoranthene	8310	0.1	0.0272	µg/L
Benzo[g,h,i]perylene	8310	0.1	0.0299	µg/L
Benzo[k]fluoranthene	8310	0.05	0.0197	µg/L
Chrysene	8310	0.1	0.0162	µg/L
Dibenz(a,h)anthracene	8310	0.1	0.0417	µg/L
Fluoranthene	8310	0.1	0.0831	µg/L
Fluorene	8310	0.1	0.092	µg/L
Indeno[1,2,3-cd]pyrene	8310	0.1	0.025	µg/L
Naphthalene	8310	0.5	0.468	µg/L
Phenanthrene	8310	0.1	0.0988	µg/L
Pyrene	8310	0.1	0.0473	µg/L
Escherichia coli	SM 9221F	1.8	1.8	MPN/100 mL
Coliform, Fecal	SM 9223B	1.0	1.0	MPN/100 mL

3.2 QUALITY CONTROL RESULTS

The subcontracted laboratory will provide the standard Level II data package with the analytical results. This will provide the QA/QC data necessary to evaluate the laboratory results. The standard Level 2 data package will reports include all of the elements of a Level 1 report (the sample analytical results) and also include surrogates and batch QC results. This allows for review of the reliability of the sample data provided.

3.3 ACCEPTANCE CRITERIA

The process of acceptance criteria for laboratory data is important to ensure quality and reliability of the sample results. This process will be conducted by ADOT and/or their designated contractor and may include one or more of the following elements:

- Percent recovery of the laboratory control sample
- Percent recovery of the matrix spike
- Percent difference of the matrix spike duplicate
- Laboratory duplicates and field duplicates
- Replicate analyses

If the sample doesn't completely comply with the criteria it must be rejected and new sample collected and analyzed.

4.0 CORRECTIVE ACTION

Corrective action is required in response to administrative or technical failures. Any corrective action required will be implemented and documented accordingly. Once the corrective action is identified, ADOT personnel or their designated contractor will initiate activities and provide appropriate documentation of actions taken. A copy of the corrective action will be maintained with this QAM and kept on file for a minimum of five years past the date of the expired permit.

4.1 Laboratory Corrective Action

Failures in laboratory measurement systems include, but are not limited to: instrument malfunction, calibration failure, sample container breakage, contamination, and QC sample failure. If the failure can be corrected, the analyst documents the issue and resolution in the laboratory records and completes the analyses. If the failure is not resolved, it is conveyed to the respective supervisor who will determine if the analytical failure compromised associated results. The nature and disposition of the problem must be documented in the data report sent to the ADOT Project Manager.

4.2 Field Corrective Action

The field technician team is responsible for responding to failures in their sampling and field measurement systems. These failures may include equipment or technical failures as presented below:

- *Equipment Failures* - If monitoring equipment fails, personnel are to record the issue accordingly. Failing equipment must be replaced or repaired prior to subsequent sampling events.
- *Technical Failures* - Technical failures may include dropped or broken sample containers during collection due to site conditions (rain, low visibility, slick surfaces, etc.). If such an event occurs the sampling technician will document the occurrence in the site logbook.

It is the combined responsibility of all members of the field sampling team to determine if requirements of the specific sampling method have been met. The field sampling team will also determine if additional sampling is required and analyses is required.

5.0 DATA REVIEW

The initial data review is conducted by the laboratory to verify holding times, proper COC procedures, preservation, sample data, QC sample data, and laboratory QC data. Any deviations from the requirements are noted by the laboratory and reported with the analytical results.

5.1 REVIEW PROCESS

The laboratory will provide a standard Level II data package and standard turnaround time for analytical results. Standard turnaround times for laboratory data of two to three weeks for electronic data are generally satisfactory for stormwater samples. Receiving the electronic data more quickly allows an early data review to identify any problems that may be corrected

through re-extraction or re-analysis of leftover sample still at the laboratory (unless notified to do otherwise, the laboratory only keeps leftover samples for 30 days). The data package should be delivered as electronic.

The data package will include a narrative identifying any problems, corrections, anomalies, and conclusions, as well as completed COC documentation. The standard Level II data package will include:

- Sample extraction and analysis dates
- Results of method blanks
- Summary of analytical accuracy (matrix spike, duplicate compound recoveries, and lab control samples)
- Summary of analytical precision (comparison of laboratory control samples, matrix duplicate, and matrix spike duplicate results)
- Summary of organic method performance (surrogate spike compound recoveries)
- Practical Quantitation Limits (PQLs) and MDLs

The field sampling sheets and analytical data package will be reviewed for unacceptable procedures in the field or laboratory. Analytical data will be reviewed as soon as it is received from the laboratory.

5.2 REPORTING RESULTS

The Permit requires sampling results from the field sampling data forms and the laboratory to be included in the Annual Report. This reporting is the responsibility of the ADOT Water Resources Group.

5.3 RESOVING DATA QUALITY ISSUES

A Data Quality Assurance Worksheet as provided in Appendix F will be completed upon receipt of laboratory reports to assist in validity of the data. The purpose of this review is not to reject that data, but rather assist in improving the data collection process. In general, given the time constraints involved in stormwater sampling, exceeded hold times on analyses for E. coli and fecal coliform will not automatically trigger resampling. These data will be flagged as necessary for reporting purposes.

5.4 DATA USE LIMITATIONS

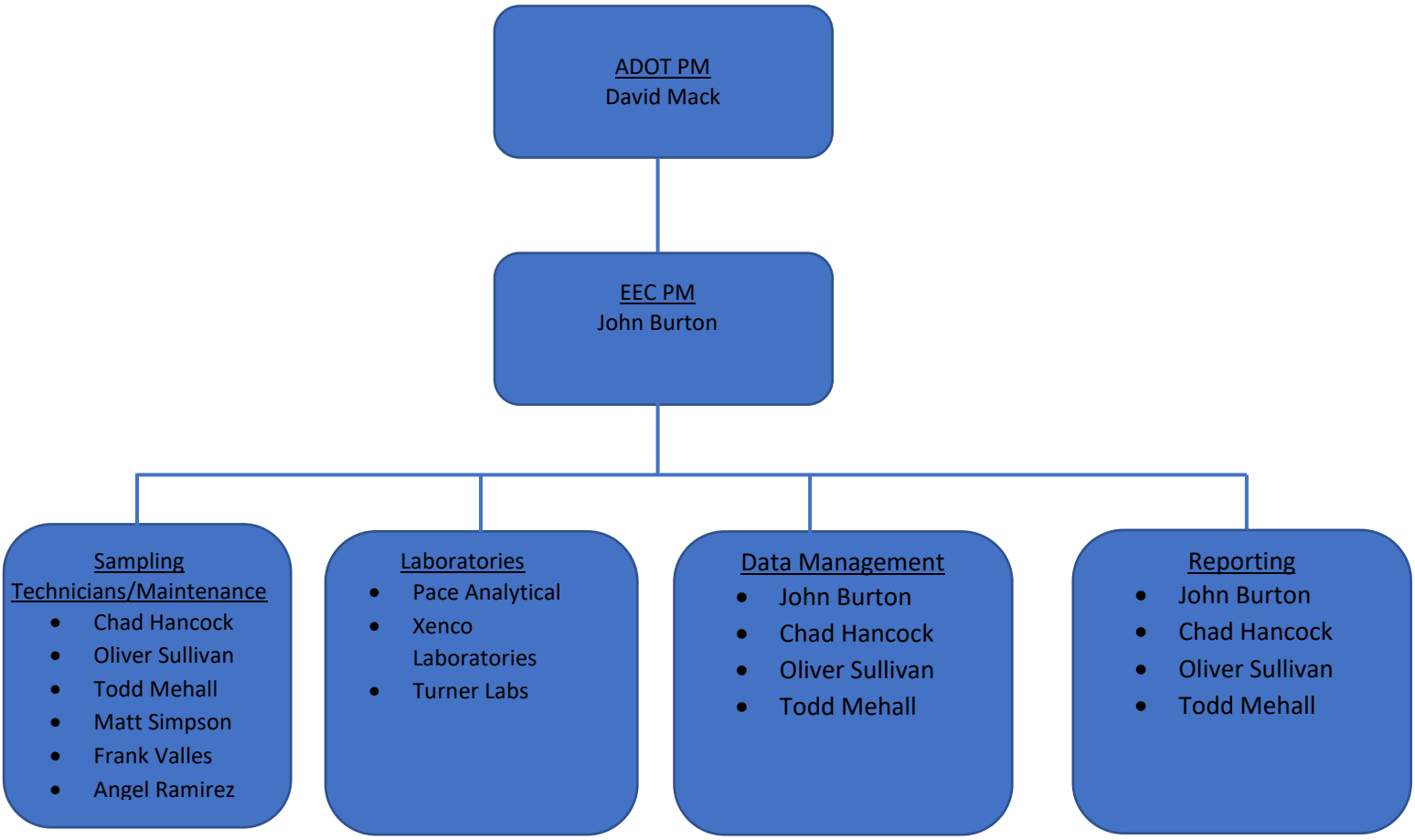
Data use limitations may also be identified in the Data Quality Assurance Worksheet as provided in Attachment F. Data that do not meet the measurement performance criteria specified in this QAM will be identified and the impact on the project quality objectives documented. Specific actions for data that do not meet the measurement performance criteria depend on the use of the data and may require additional samples be collected or the use of the data restricted. Determination of the overall data quality for a specific sampling event program will be conducted upon receipt of final laboratory report.

5.5 DATA RETENTION

Data will be retained by ADOT for a period of 5 year past the expired/termination date of the permit.

Appendix A: Project Organization Chart

Project Organization Chart



Appendix B: MS4 Stormwater Sampling Equipment List

MS4 Stormwater Sampling Equipment List
(all equipment may not be required)

Documentation

____field log book or
____laminated field book
____camera(if required)
____GPS (if required)

Sample Collection

____disp. bailers____>qty.
____disp. filters____>qty.
____disp. gloves
____pH/temp/SC/E_h meter
____peristaltic pump
____geo-pump tubing
____ calibration standards
____ 200' garden hose
____350' rope for bailing
____electric wire pigtails
____controller for ready-flow II
____QED Pump controller
____QED compressor
____solinist
____long solinist
____1/4" poly tubing
____discharge hose
____4 water pales & lids
____decon tube for pump
____Hand Radios
____Keck

Access/Maintenance

____tool box
____3/8" socket set
____shovel
____decon soap
____sponges
____deionized water
____loppers
____machete
____bow saw
____J-plugs

Sample Shipping

____shipping tape/dispenser
____coolers__1_ >qty.
____custody seals
____shipping labels

Health and Safety

____first aid kit
____fire extinguisher
____local phone book
____mobile phone
____shade umbrella
____water igloo container
____truck flags

Personal Gear

____hard hat
____respirator
____coveralls
____rain gear
____hard toed boots
____safety glasses
____personal cooler

Appendix C: ADOT MS4 Sampling Locations

ADOT MS4 Sampling Locations

Appendix D: Example Chain-of-Custody Form

For Example Use Only

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

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Page: of

Section A **Required** Client Information:	Section B **Required** Project Information:	Section C Invoice Information:
Company: EEC	Report To: John Burton	Attention: Accounts Payable
Address: 7740 N. 16th St., #135 Phoenix, AZ 85020	Copy To:	Company Name: EEC
		Address: 7740 N. 16th St., #135, Phx, AZ
Email To: jburton@eeccorp.com	Purchase Order No.:	Pace Quote Reference:
Phone: 602-248-7702 Fax:	Project Name: Phoenix MS4	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location ***STATE:*** _____

Requested Analysis Filtered (Y/N)

Section D **Required** Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Matrix Codes MATRIX / CODE

Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

ITEM #	Section D SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COLLECTED: COMPOSITE START TIME	COLLECTED: COMPOSITE END/GRAB DATE	COLLECTED: COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	Preservatives: H_2SO_4	Preservatives: HNO_3	Preservatives: HCl	Preservatives: NaOH	Preservatives: $Na_2S_2O_3$	Preservatives: Methanol	Preservatives: Other	Analysis Test Y/N	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	PHX200715																			
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER: **DATE Signed (MM/DD/YY):**

Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

Instructions for completing Chain of Custody (COC)

1. **Section A and B:** Complete all Client information at top of sheet: company name, address, phone, fax, contact (the person to contact if there are questions, and who will receive the final report.), e-mail address (if available), PO#, Project Name and/or Project Number as you would like to see it appear on the report.

2. **Section C:** Invoice Information: Billing information is included in this section. This information should include the name and address of the person receiving the invoice.

3. Quote Reference should be completed if a quotation was provided by Pace Analytical. The Project Manager, and Profile No. will be completed by Pace Analytical Services.

4. **Site Location:** A separate COC must be filled out for each day of sample collection. Record the two letter postal code for the US state in which the samples were collected.

5. **Regulatory Agency:** List the program that is guiding the work to ensure proper regulations are followed.

6. **Section D:** Complete a Sample Description in the "SAMPLE ID' section as you would like it to appear on the laboratory report. The following information should also be included: the sample matrix, sample type (G (grab) or C (composite). When collecting a composite, the start time and end time should be documented in the respective boxes. The collection time for a grab (G) sample should be entered in the boxes marked 'Composite End/Grab'), Sample temp at collection (if required by state), the total number of containers, and preservative used.

7. Mark if the sample was filtered in the field by marking Y or N in 'Filtered' row by the Analysis requested.

8. Requested Analysis: List the required analysis and methods on the lines provided and place a check in the column for the samples requiring the analysis. Additional comments should be referenced in the bottom left hand corner or include attachments for extended lists of parameters.

9. The sampler should print their name in the space provided and sign their name followed by the date of the sampling event at the bottom of the COC in the spaces designated for 'SAMPLER NAME AND SIGNATURE'.

10. When relinquishing custody of the samples to a representative of the laboratory or other organization, indicate the Item Numbers of those samples being transferred; sign relinquished by, date and time, and include your affiliation.

***Important Note:**

Standard Turnaround Time is 2 Weeks/10 business days. Results will be delivered by end of business on the date due unless other arrangements have been made with your project manager.

Special Project Requirements such as Low Level Detection Limits or level of QC reported must be included on the chain of custody in the Additional Comments section.

Appendix E: Stormwater Sampling Data Form

MS4 Stormwater Sampling

Record the following information in the site logbook and take a photo:

Sample ID: _____ Sample Date: _____

Sampler Name(s): _____ Time (24 hr time): _____

Sampling Event: Summer / Winter

Site Parameter	Reading	Comments
Flow (gpm)		
pH (SU)		
Temperature (°C)		

*Note: Site parameter readings are not required for Yard Sites

CURRENT WEATHER:

Temperature _____

Humidity _____

Cloud Cover _____

Wind/Direction _____

FLOW CALCULATION:

Signature: _____

Appendix F: Data Quality Assurance Worksheet

Data Quality Assurance Worksheet

Monitoring Site: _____

Sample Date: _____ Sample Time: _____

Sample Type (underline): *Regular* *Duplicate* *Split*

Analytical Laboratory: _____

		YES (√)	NO (√)	REMARKS
All Samples	Did the laboratory analyze all parameters requested on the chain of custody?			
	Were the samples analyzed with the analytical methods specified in the monitoring plan?			
	Were all holding times met by both the monitoring personnel and the laboratory?			
	Were the reported values at or below the reporting limits specified in the monitoring plan?			

		YES (√)	NO (√)	REMARKS
QC Samples	For duplicate samples: Does sample duplicate precision meet the specified criteria?			
	For split samples: Does sample duplicate precision meet the criteria specified in the monitoring plan?			
	If not, did the laboratories use the same analytical methods?			