

Water Quality Program Quality Assurance Project Plan (QAPP) Template for Water Quality Components of Required Feasibility Studies for Managed Aquifer Recharge (MAR) Projects



Publication 19-10-050

General Information

This document presents a template for Quality Assurance Project Plans (QAPPs) for the Water Quality Components of Managed Aquifer Recharge (MAR) Projects.

According to the General Terms and Conditions found in Ecology grant and loan agreements, recipients must prepare a QAPP when a project involves the collection and/or use of environmental measurement data. Those requirements further specify that this QAPP must be developed based on Ecology Publication No. 04-03-030, Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (Ecology, 2004).

For work funded under Water Resources Program Streamflow Restoration grants, and other MAR project proposals, a Feasibility Study is required. The Hydrologic Feasibility Components QAPP can be developed based on the requirements described and presented in Publication No. 18-11-018. The Water Quality Feasibility Components QAPP must be developed based on the requirements and presented in this template, which was last updated on December 3, 2019.

Once the completed QAPP has been submitted, Ecology must approve this prior to start of the work. The information provided in the QAPP must be sufficiently detailed to allow reviewers and those who implement the plan to understand what is to be done and the reasons for doing so.

The approved final QAPP must be published or shared by the MAR project proponent, according to the grant requirements.

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Special Accommodations

To request ADA accommodation, including materials in a format for the visually impaired, call Ecology at 360-407-6872 or visit <https://ecology.wa.gov/accessibility>. People with impaired hearing may call Washington Relay service at 711. People with speech disability may call TTY at 877-833-6341.

Insert photo here

Quality Assurance Project Plan

Feasibility Study for the Proposed
River Name

Managed Aquifer Recharge Project:
Water Quality Components

TEMPLATE

Month Year

Publication Information

Each study conducted for the Washington State Department of Ecology (Ecology) must have an approved Quality Assurance Project Plan (QAPP). This QAPP describes the objectives of the Proposed _____ River Managed Aquifer Project feasibility study components.

The final completed QAPP is available at www.website.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website: <https://fortress.wa.gov/ecy/eimreporting/default.aspx>; at www.data.wa.gov; and from Project Proponent's NAME and phone number. In EIM, search on Study ID xxxx and [additional study information].

Author and Contact Information

For more information contact:

Publications Coordinator
Organization
Address:
Phone:

Cover photo: xxx provide credit if used

Instructions for using this Document

Remove this section from the final QAPP. This is a QAPP template approved by Ecology's Water Quality Program QA Coordinator. The MAR project proponent is instructed to provide information to complete all of the items highlighted in yellow and replace/respond to the instructions in *orange color italic font sections*. The final completed QAPP document will have no yellow highlights or *orange color italic font*. The black font sections, with the exception of this entire section 2.1, are not to be changed or removed by the MAR project proponent except following discussion with the Designated Ecology WQP Region Contact and the Water Quality Program Quality Assurance Coordinator (see Roles and Responsibilities, Table 2).

Accommodation Requests: *this text stays on final QAPP*

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Quality Assurance Project Plan

Feasibility Study for the Proposed **River Name** Managed Aquifer Recharge Project: Water Quality Components

by xxxx, xxxx, and xxxx

Month Year

Approved by:

Signature:	Date:
Name, Principal Investigator, TITLE, Organization	
Signature:	Date:
Name, MAR Project Manager, TITLE, Organization	
Signature:	Date:
Name, Monitoring Lead, Organization	
Signature:	Date:
Name, Grant Manager, Ecology Water Resources Program	
Signature:	Date:
Name, Designated Regional Contact, Ecology Water Quality Program	
Signature:	Date:
Name, Ecology Water Quality Program Quality Assurance Coordinator	
Signature:	Date:
Name, Lab name, Contract laboratory project manager	
Signature:	Date:
Name, Lab name, Contract laboratory project manager	

*Signatures are not available on the Internet version.

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2.0 Abstract

This Quality Assurance Project Plan (QAPP) details the source water and receiving water – and, if required, conveyance characterization – monitoring requirements necessary for demonstrating feasibility of the proposed Managed Aquifer Recharge (MAR) project in the _____ River basin in _____ County or Counties in the State of Washington. The findings of this feasibility study will be submitted to the Washington State Department of Ecology Water Resources Program for consideration of additional MAR project funding.

This type of monitoring will be conducted during MAR project feasibility studies associated with the Streamflow Restoration Act funding process. This QAPP template may also be used for other MAR projects beyond those funded under the Streamflow Restoration Act.

This characterization is designed to answer the question, “Will this proposed MAR project, when operational, be protective of groundwater and surface water quality?” The QAPP ensures quality data collection, analysis, reporting, and management of the characterization monitoring.

3.0 Background

3.1 Introduction

Operational Managed Aquifer Recharge (MAR) projects are intended to augment low stream flows by capturing a portion of high-season streamflows, diverting that water to adjacent spreading basins or other infiltration facilities, and having that water migrate through the surficial aquifer and discharge back to the stream later in the year when it is more beneficial to fish.

Though water quality permits are not required for MAR projects, both ground and surface waters of the state need to be protected. The findings of the MAR project feasibility study will provide Ecology with assurance that the proposed MAR project will (1) fulfill requirements for water rights mitigation or otherwise offset new exempt uses or aquifer declines, and (2) protect quality of both groundwater and surface water.

The first objective will be met via the QAPP template provided in Publication 18-11-018, <https://fortress.wa.gov/ecy/publications/documents/1811018.pdf>. The second objective will be met by implementing the study described in this QAPP, and by using this information to properly design, construct, operate, and maintain the MAR project. This study will provide the necessary data and analysis for project proponents and Ecology staff to evaluate conditions and provide appropriate assurance that water quality (surface and groundwater) will be protected when the MAR project is operational.

3.2 Study area and surroundings

The study location (Figure 1, to be provided by project proponent) is along the _____ side of the _____ River in _____ County or Counties. The proposed diversion location and spreading basin outline are included.

Insert figure here and modify figure caption below as needed.

Figure 1. Map of larger study area

3.2.1 Summary of existing data

Previous studies of water quality in the [redacted] River in the vicinity of the location of the proposed MAR project include:

- *Add a bullet for each study. Include all studies from which existing data will be used for this study, and summarize the findings. Provide a brief description and include the publication information in the references section at the end of this document.*

These existing data may be used in addition to or in lieu of collecting new data.

In order to determine the full extent of data required for the source water comparison, the project proponent will check the [WQ atlas](#) for any 303(d) listings in the [redacted] River reach where the proposed MAR project is located, as well as upstream reaches. Any listed parameters will be added to the source water characterization. *The ensuing sections of the final QAPP will include these parameters in the protocols, data summary tables, and reports.*

- The [redacted] River reach where the MAR project has proposed is 303(d) listed for the following parameters: **list parameters or say “none identified”**.
- Reaches of the [redacted] River upstream from the location where the MAR project has proposed are 303(d) listed for the following parameters: **list parameters or say “none identified”**.

3.2.3 Regulatory criteria or standards

Project proponents must assess the source water and aquifer water compatibility, potential water quality changes that might occur during infiltration, and potential water quality standards compliance issues. If either of the surface (source) water or groundwater characterizations produce results exceeding applicable receiving water standards, then the project, if implemented, may require further monitoring.

Table 1 lists the minimum parameters that must be tested for this study. Additional parameters may be applicable per the review of the Water Quality Atlas (see section 3.2.1). Add any additional necessary water quality standards in Table 1.

The sampling parameters are listed in Table 1, along with the applicable water quality standards to which the samples collected during this feasibility study will be compared. See [WAC 173-201A-200 and WAC 173-201A-240](#) for applicable surface water criteria and [WAC 173-200-040](#) for applicable ground water criteria. Surface water criteria are dependent on ambient water chemistry conditions, such as temperature, pH, or hardness. The summary report will include the necessary calculations. *We developed a [spreadsheet](#) that will make these calculations for you.*

Table 1. Parameters and groundwater quality standards for comparison

Indicator/Parameter	Surface Water Quality ¹ Standard WAC 173-201A-200 WAC 173-201A-240	Groundwater Quality Standard WAC 173-200-040
Total Suspended Solids	NA	NA
Total Nitrogen (TN)	NA	10 mg/L
Hardness	NA	NA
Fecal coliform	100 CFU	1/100 cells/ml
Escherichia coli	100 CFU	NA
Dissolved Arsenic	190 ug/L	NA
Dissolved Cadmium	Hardness Dependent	NA
Dissolved Chromium	10 ug/L	NA
Dissolved Lead	Hardness Dependent	NA
Dissolved Zinc	Hardness Dependent	NA
Total Arsenic	NA	0.05 mg/L
Total Cadmium	NA	0.01 mg/L
Total Chromium	NA	0.05 m/L
Total Lead	NA	0.05 mg/L
Total Zinc	NA	5 mg/L
Add additional parameters as needed		

NA = not applicable. CFU = colony forming units. mg/L = milligrams per liter. ml = milliliter. ug/L = micrograms per liter.

¹Freshwater aquatic life criteria for dissolved Cadmium, Lead and Zine are hardness dependent and standard must be calculated for each sampling event. Ecology provides a [spreadsheet](#) that can be used to make those calculations.

If diverted stream flow will be routed through a ditch or other pre-existing conduit, then the project proponent must demonstrate that there is little potential for the conveyance to contribute pollutants during the MAR project's operation. For example, new flow through an abandoned irrigation water canal could contribute additional nutrients and pesticides.

The project proponent will consult with the Ecology grant manager to determine appropriate analyses for this characterization based on known prior uses or conditions surrounding the proposed conveyance. If conveyance sampling is required include a third column with agreed upon benchmarks for comparison in Table 1.

4.0 Project Description

4.1 Project goals

The goal of this characterization study is to describe key chemical water quality attributes of the MAR surface water source and the receiving groundwater. Surface water sampling needs to occur during ambient high streamflow conditions in the *(Insert name of waterbody)*. Ground water sampling needs to occur near the MAR spreading basin.

4.2 Project objectives

Objective 1- Does the seasonal high flow in the _____ River have potential to affect ground water quality?

1. a Measure nutrients, metals, and bacteria *(include 303(d) listed parameters if required)* in the _____ River during normal ambient high flow and compare these surface water quality results with groundwater quality standards.

Measure nutrients, metals, and bacteria *(author will include 303(d) listed parameters if appropriate)* in groundwater within the proposed MAR catch basin during normal ambient high flow and compare with groundwater quality standards.

1. b Evaluate whether the proposed operational MAR will likely improve, not affect, or deteriorate groundwater quality in the vicinity of the proposed spreading basin for the MAR project.
1. c Evaluate whether treatment or settling to remove total suspended solids might be advisable to protect functional MAR operation in the long term.

1. d *If required:* evaluate whether the proposed means for conveying source water for the MAR project has potential to deteriorate water quality.

4.3 Tasks required

- Collect three (3) surface water quality samples, a minimum of one week apart, during the ambient high flow period from proposed MAR diversion location in the _____ River and compare these surface water results with ground water quality standards. Existing data may/will be used as described in sections 3.2.1 and 6.3.
- Collect one (1) water quality sample from groundwater monitoring well screened in the surficial aquifer near the project site and compare the ground water result with water quality standards for surface water. Existing data may/will be used as described in sections 3.2.1 and 6.3.
- Prepare a source water and receiving water characterization report.
- *If required:* conduct conveyance characterization and report.

5.0 Organization and Schedule

5.1 Key individuals and their responsibilities

Table 2. Organization of project staff and responsibilities

Staff	Title	Responsibilities
Name Ecology Water Resources Program Phone Number and/or Email	Ecology MAR Project Manager	Manages the MAR project at Ecology. Receives periodic updates and final project deliverables.
Name Ecology Water Quality Program Phone Number and/or Email	Designated WQP Regional Contact	Coordinates Ecology review of the QAPP and reports. Approves the final QAPP and all required deliverables.
Name Organization Phone Number and/or Email	<div></div> MAR project Manager	Oversees all characterization study staff and serves as the project liaison to the Ecology MAR Project Manager. <i>May also serve as Principal Investigator.</i>
Name(s) Organization Phone Number and/or Email	<div></div> MAR project Principal Investigator	Finalizes the QAPP. Oversees field sampling and transportation of samples to the laboratory. Conducts QA review of data. Analyzes and interprets data. Oversees entry of data into EIM. Writes the draft report and final report. <i>May also serve as Field Lead.</i>
Name Organization Phone Number and/or Email	<div></div> MAR project Field Lead	Oversees all field work and ensures crew safety.
Name(s) or TBD Organization Phone Number and/or Email	<div></div> MAR project Field Assistant(s)	Helps make field measurements, collect samples and prepare them for shipping, manage continuous data, maintain instruments, and record field information.
Name Organization Phone Number and/or Email	<div></div> MAR project Data Manager	Coordinates upload of data to required databases with the Environmental Information Management database (EIM) Data Coordinator.

Staff	Title	Responsibilities
Name Ecology Water Quality Program Phone Number and/or Email	QA Coordinator	Reviews the draft QAPP and approves the final QAPP.
Name of Project Manager Contract Laboratory Name Phone Number and/or Email <i>(repeat this section for as many laboratories as will be contracted for the study)</i>	Contract Laboratory Project Manager	Reviews draft QAPP and coordinates with Manchester Environmental Laboratory (MEL) Quality Assurance (QA) Coordinator as needed.

5.2 Special training and certifications

List relevant field staff and experience here. All field staff involved with this project have relevant training and experience following SOPs.

5.3 Proposed project schedule

The project proponent will prepare and submit each of the reports and deliverables listed below. The reports and deliverables will articulate the results and related procedures clearly. Written reports will be submitted electronically to the Ecology Designated WQP Regional Contact and MAR Grant Manager.

Table 3. Proposed schedule for completing data entry into EIM, and required reports

Report Type/Title	Target date	Description
Monitoring preparation reports		
Final QAPP	date	Revised completed QAPP, responsive to all comments from Ecology's Designated WQP Regional Contact and QA Coordinator.
Data entry or upload		
Entry of Study ID and monitoring locations into EIM	No later than three months following receipt of all data from lab	Sampling location coordinates and descriptions entered.
Entry of laboratory results into EIM	No later than three months following receipt of all data from lab	All quality assured and quality controlled lab data and modified version for data analysis if necessary.

Summary report		
Report summarizing results of characterization monitoring, including tables of data comparing concentrations to applicable standards.	No later than six months following receipt of all data from lab	Submit to Ecology's Designated WQP Regional Contact and MAR Project Grant Manager.

6.0 Quality Objectives

6.1 Data quality objectives

The main data quality objective (DQO) for this project is to the required number of water samples representative of *(Insert name of waterbody)* and ground water within the receiving basin and to have them analyzed. The analysis will use standard methods to obtain data that meet measurement quality objectives (MQOs) that are described below and that are comparable to previous study results.

If conveyance sampling is required, the number of samples will agreed upon based on type, length, and prior use of the proposed conveyance.

6.2 Measurement quality objectives

Field sampling precision will be addressed by submitting replicate samples. *(Insert analytical laboratory name here)* will assess precision and bias in the laboratory using duplicates and blanks.

Table 5 outlines expected precision of sample duplicates and method reporting limits. The reporting limits of the methods listed in the table are appropriate for the expected range of results and the required level of sensitivity to meet project objectives.

6.2.1 Targets for precision, bias, and sensitivity

The MQOs for project results, expressed in terms of acceptable precision, bias, and sensitivity, are described in this section and summarized in Table 5.

Table 5. Measurement Quality Objectives for this study

Parameter	LCS ¹ (Recovery)	Lab duplicates (RPD) ²	Method Blanks	Matrix Spike (Recovery)	Matrix Spike Duplicates
TSS	NA	5%	±0.3 mg/L	NA	NA
Metals	85 – 115%	<20%	<LOQ	75 – 125%	<20%
Total Nitrogen	80-120%	<20%	<MDL	75-125%	<20%
Fecal coliform	NA	40%	<MDL	NA	NA
E. coli	NA	40%	<MDL	NA	NA

(Add additional parameters as needed)

¹Lab Control Samples

²Relative percent difference

6.3 Acceptance criteria for quality of existing data

If known, describe the quality of existing data available for the study area described in section 3.2.1. If not known, describe the criteria that will be used to assess quality and usability of the existing data, whether the project will also collect new environmental data, analyze the data (only), or use the data for modeling. It may be possible to cite other document that already contains this information.

Or, if this project is not using existing data, write **Not applicable.**

7.0 Study Design

7.1 Study boundaries

This study will focus on describing key chemical water quality attributes of MAR source in the *(Insert name of waterbody)* and receiving groundwater during ambient high streamflow conditions. Sampling location are presented in Figure 4.

Insert figure here and modify caption below as needed.

Figure 2. Map showing boundary of project study area

7.2 Field data collection

7.2.1 Sampling locations and frequency

Following the protocols in this QAPP, three surface water quality grab samples will be collected during the ambient high flow month(s) of October through April, and one groundwater quality sample will be collected near the surface water infiltration site. Surface water sampling events will be spaced at least one week apart, and will not occur during flooding events where the banks are exceeded and the river flow has exited the channel. Locations and descriptions are summarized in Table 4.

For the surface water sampling location, include GPS coordinates at the upstream and downstream ends of the reach and provide a narrative description of their location (e.g., East Fork Lewis River, extending 1,500 meters upstream from the NE 82nd Avenue/Daybreak Road bridge)

Describe the groundwater sampling location and include it in Table 4. Groundwater will be sampled from a monitoring well screened in the surficial aquifer near the project site, or, if no monitoring wells exist at or near the project site, a nearby well may be used, or a simple temporary well may be constructed for the sampling. Determination of appropriate wells will occur in consultation with Ecology's Designated WQP Regional Contact.

If conveyance sampling is required, describe the location and timing of the sample and include it in Table 4.

Table 4. Proposed sampling locations

Location ID	Site ID	Location Description	Latitude	Longitude
<i>Fill in as needed</i>				

7.2.2 Field parameters and laboratory analytes to be measured

All water quality samples will be analyzed for total suspended solids, total nitrogen, total phosphorus, dissolved and total metals (arsenic, cadmium, chromium, zinc, and lead) and fecal coliform and E. coli bacteria *(Include additional parameters as needed)*.

7.3 Assumptions underlying design

This study makes the assumption that the target analytes will be representative of water quality conditions during the period of time when MARs projects will be operational, and that the analytical and reporting limits for the laboratory analysis are appropriate for the water quality standards comparisons.

7.4 Possible challenges and contingencies

The study design was developed to achieve the desired goals and objectives of this project. However, logistical problems, practical constraints, and scheduling limitations do exist, which presents some challenges. Potential problems associated with sediment sampling logistics include the following:

8.0 Field Procedures

8.1 Invasive species evaluation

Assess the possibility of invasive species contamination of both protective gear and sampling equipment, including boats, rafts, and other water-borne devices. Ecology's SOP EAP070 addresses invasive species transport and contamination. This document is at Ecology's QA website: [Published SOPs](#).

8.2 Sampling procedures

TSS and nutrients will be collected following [Standard Operating Procedures, EAP034, Version 1.5, Collection, Processing, and Analysis of Stream Samples](#) (EAP034, 2017). Metal samples will be collected following guidance outline in [Standard Operating Procedure EAP029, Version 1.6: Collection and Field Processing of Metals Samples](#) (EAP029, 2018) and [Standard Operating Procedure EAP098, Version 1.1: Collecting Groundwater Samples for Metals Analysis from Water Supply Wells](#) (EAP098). Fecal coliform and e. coli will be collected following guidance outlined in [Standard Operating Procedure for the Collection of Fecal Coliform Bacteria Samples](#) (EAP030, 2017). All other groundwater samples will be collected following [Standard Operating Procedure EAP099, Version 1.0: Purging and Sampling Monitoring Wells for General Chemistry Parameters](#) (EAP099). *If additional parameters are to be analyzed, include appropriate SOP.*

8.3 Containers, preservation methods, holding times

Table 5. Sample containers, preservation, and holding times *(Modify this example table as needed)*

Parameter	Matrix	Container	Holding Time	Preservative
Total Solids	Water	1000 mL w/m poly bottle	7 days	Cool to $\leq 6^{\circ}\text{C}$
Suspended Solids (TSS)	Water	1000 mL w/m poly bottle	7 days	Cool to $\leq 4^{\circ}\text{C}$
Total Nitrogen (TN)	Water	125 mL w/m poly bottle	28 days	H ₂ SO ₄ or HCl to pH <2, preservation in field Cool to $\leq 4^{\circ}\text{C}$
Hardness	Water	500 mL w/m poly bottle	14 days	Cool to $\leq 6^{\circ}\text{C}$, fill bottle completely
Total Metals	Water	500 mL poly bottle with Teflon or polypropylene lid	6 months	adjust pH to <2 with HNO ₃ , cool to $\leq 6^{\circ}\text{C}$

Parameter	Matrix	Container	Holding Time	Preservative
Dissolved Metals	Water	500 mL poly bottle with Teflon or polypropylene lid	6 months	Filter (0.45 um) within 15 minutes of collection; then add HNO ₃ to pH <2 , Cool to ≤6°C
Fecal Coliform	Water	100 mL plastic bottle	24 hours	Fill bottle to shoulder, Cool to ≤4°C
Escherichia coli	Water	1000 mL w/m poly bottle	24 hours	Cool to ≤6°C

8.4 Equipment decontamination

Explain your procedure for decontamination that may be necessary when sampling substances that contain high levels of contaminants, bacterial contamination, or organic materials that stick to the sampling devices. Refer to Ecology's SOP EAP090, Decontamination of Sampling Equipment for Use in Collecting Toxic Chemical Samples.

8.5 Sample ID

Provide a specific protocol for establishing sample IDs. If such a protocol is lacking, adopt one (e.g., from an analytical laboratory) or develop and describe a new one.

8.6 Chain of custody

Maintaining environmental samples under chain of custody is standard practice. If standard procedures and forms are not available, adopt them, for example, from an analytical laboratory or develop and describe new ones here.

Chain of custody will be maintained for all samples throughout the project. Samples will be stored in a cooler and *(insert analysis laboratory's name)* chain of custody form will be used for documentation of shipment to laboratories.

9.0 Laboratory Procedures

9.1 Lab procedures table

All lab-analyzed samples will be analyzed at *(Insert analyzing lab here)* Methods for all lab procedures are described in Table 6. QA/QC protocols are discussed in the *Quality Control* section of this plan.

Information required for this table may be provided by the analytical lab that will be performing the analyses.

9.2 Sample preparation method(s)

Sample preparation methods are listed in standard operating procedures for lab analyses or in analytical methods (Table 6).

Table 6. Measurement methods (laboratory) *(Modify this example table as needed)*

Analyte	Sample Matrix	Expected Range of Results	Method	Method Reporting Limit	Analytical Instrument
Total Suspended Solids (TSS)	Water	<1 – 2,000 mg/L	SM 2540D	1 mg/L	
Total Nitrogen (TN)	Water	0.5-50 mg/L	SM4500NB	0.013 mg/L	
Hardness	Water	0.5-500 mg/L	SM2340B	0.01 mg/L	
Fecal Coliform	Water	1-15,000 cfu	SM 9222D	1 cfu/100 mL	
Escherichia coli	Water	1-15,000 cfy	SM 9223B or EPA1105	1 MPN	
Arsenic	Water	0.01-50 mg/L	EPA200.8	0.01 ug/L	
Cadmium	Water	0.008 – 10 mg/L	EPA 200.8	0.008 ug/L	
Chromium	Water	0.007 – 10 mg/L	EPA200.8	0.007 ug/L	
Lead	Water	0.007 – 10 mg/L	EPA200.8	0.007 ug/L	
Zinc	Water	0.2 – 10 mg/L	EPA200.8	0.2 ug/L	

9.3 Laboratories accredited for methods

You must use an accredited laboratory to analyze your samples. That laboratory must also be accredited for the specific method that you are using for analysis. Ecology only accredits methods published by EPA, Standard Methods, or ASTM. This is an Ecology legal requirement, and exceptions for it are difficult to obtain. If your technical work involves the use of non-standard methods or analytes, a waiver process is available. Contact the Ecology Lab Accreditation Unit for more information.

All chemical analysis performed at *(Insert name of analytical laboratory)* which is accredited for all methods (Table 6).

10.0 Quality Control Procedures

10.1 Table of field and laboratory quality control

Identify the QC samples that will be measured in the field, analyzed in the lab or otherwise evaluated. You may do this with a table similar to Table 7.

Table 7. Quality control samples, types, and frequency *(Modify table as appropriate for the project)*

Parameter	Field Replicates	LCS ¹	Method blanks	Matrix spikes	Matrix spike duplicates	Laboratory duplicates
Total Suspended Solids (TSS)	1/batch	1/batch	1/batch			1/batch
Metals	1/batch	1/batch	1/batch	1/batch	1/batch	---
Total nitrogen	1/batch	1/batch	1/batch	1/batch	1/batch	1/batch
Fecal Coliform	1/batch		1/batch			1/batch
Escherichia coli	1/batch		1/batch			1/batch

¹Lab Control Samples

Each type of QC sample listed above will have MQOs associated with it (Section 6.2) that will be used to evaluate the quality and usability of the results.

10.2 Corrective action processes

The project manager will work closely with the contract laboratory staff reviewing preliminary results to identify any data that fall outside of QC criteria. The project manager will determine whether data should be re-analyzed, rejected, or used with appropriate qualification.

11.0 Data Management Procedures

11.1 Data recording and reporting requirements

Projects funded by or submitting data to Ecology must submit the data formatted for entry into Ecology's Environmental Information Management database IM data system. Before sampling begins, Project Manager or Data Manager will coordinate with Ecology's EIM Data Coordinator to assign the EIM study identification number and site IDs.

All field data and observations will be recorded on waterproof paper kept in field notebooks. Staff will transfer information contained in field notebooks to Excel spreadsheets after they return from the field. Data entries will be independently verified for accuracy by another member of the project team. Field and laboratory data for the project will be entered into [Ecology's EIM database](#). Laboratory data will be uploaded into EIM using the EIM XML results template.

11.2 Laboratory data package requirements

Laboratory data will be sent to Project Manager directly from each laboratory following completion of each set of analyses for a sampling event. Reporting times may vary depending on holding time and analytical methods but should not exceed six months from the documented sampling date. Laboratory reports will be reviewed by the Data Manager for errors or missing data. The Data Manager and Project Manager will implement corrective actions if needed. Finalized electronic laboratory data will be loaded to Ecology's EIM database by the Project Manager with the assistance of Ecology's EIM Data Coordinator.

11.3 Electronic transfer requirements

Analytical laboratory will deliver case narratives (in PDF format) and electronic data deliverables of contract laboratory data (in Excel spreadsheet format) to the project manager. Finalized electronic laboratory data will be loaded to Ecology's EIM database by the Data Manager with the assistance of Ecology's EIM Data Coordinator.

12.0 Audits and Reports

12.1 Reporting

The Project Manager will prepare a source water characterization report that includes all laboratory data presented in a table. Groundwater quality standards for all applicable parameters will also be included in the table for comparison purposes.

13.0 Data Verification

Throughout field sampling, the field lead and all crew members are responsible for carrying out station positioning, and sample collection as specified in the QAPP and SOPs. Additionally, technicians systematically review all field documents (such as field logs, chain-of-custody sheets, holding times, and sample labels) to ensure data entries are consistent, correct, and complete, with no errors or omissions. A second staff person always checks the work of the staff person who primarily collected or generated data results.

13.1 Field data verification, requirements, and responsibilities

Field notes will be verified by the project manager. No data other than sampling location and event will be generated in the field.

13.2 Laboratory data verification

Data verification involves examining the data for errors, omissions, and compliance with QC acceptance criteria. Analytical laboratory staff will perform laboratory verification following standard laboratory practices (MEL, 2016). Staff will provide a written report of their data review, which will include a discussion of whether:

1. MQOs were met.
2. Proper analytical methods and protocols were followed.
3. Calibrations and controls were within limits.
4. Data was consistent, correct, and complete, without errors or omissions.

The project manager is responsible for the final acceptance of the project data. The complete data package along with laboratory's written report will be assessed for completeness and reasonableness. Based on these assessments, the data will either be accepted, accepted with qualifications, or rejected and re-analysis considered.

14.0 Data Quality (Usability) Assessment

14.1 Process for determining project objectives were met

After the project data have been reviewed and verified, the principal investigator/project manager will determine if the data are of sufficient quality to make determinations and decisions for which the study was conducted. The data from the laboratory's QC procedures will provide information to determine if MQOs have been met. Laboratory and QA staff familiar with assessment of data quality may be consulted. The project final report will discuss data quality and whether the project objectives were met. If limitations in the data are identified, they will be noted.

Some analytes will be reported near the detection capability of the selected methods. MQOs may be difficult to achieve for these results. Best professional judgment will be used in the final determination of whether to accept, reject, or accept the results with qualification. The assessment will be based on a review of laboratory QC results. This will include assessment of laboratory precision, contamination (blanks), accuracy, matrix interferences, and the success of laboratory QC samples meeting MQOs.

14.2 Treatment of non-detects

Laboratory data will be reported down to the method detection limit, with an associated “U” or “UJ” qualifier for non-detected results. If averaging concentrations, non-detects will be assigned a value of half the detection limit while a value of zero will be assigned for other parameters.

15.0 References

Include references in this section

16.0 Appendices

Appendices should include:

- *Standard Operating Procedures (SOPs)*
- *Historical data*