Quality Assurance Project Plan

Oil and Gas Development Water Quality Monitoring

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ACRONYM LIST

Acronym	Definition
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
DEQ	Department of Environmental Quality (Montana)
EDD	Electronic Data Deliverable
EPA	Environmental Protection Agency (US)
HDPE	High-Density Polyethylene
LCS	Laboratory Control Samples
LQAP	Laboratory Quality Assurance Plan
MAS	Monitoring and Assessment Section
MS	Matrix Spikes
MSA	Method of Standard Additions
NIOSH	National Institute for Occupational Safety and Health
PAH	Polynuclear / Polycyclic Aromatic Hydrocarbon
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
STORET	EPA STOrage and RETrieval database
SVF	Site Visit Forms
TDS	Total Dissolved Solids
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USGS	United States Geological Survey
VOA	volatile organic compound analysis
WQPB	Water Quality Planning Bureau (DEQ)

1.0 PROJECT TASK/ORGANIZATION

The Oil and Gas Monitoring Project will assess water quality at targeted stations across the state of Montana. The Monitoring and Assessment Section (MAS) of Montana Department of Environmental Quality's (DEQ) Water Quality Planning Bureau will complete this project. Darrin Kron, the section manager, will oversee the project. Jess Clarke of the MAS section will lead the sampling and analysis planning effort and field monitoring efforts for the project. Various staff from the section will assist in monitoring activities for this project. Mindy McCarthy oversees the Water Quality Planning Bureau quality assurance program. See **Figure 1-1** for the project organizational chart.

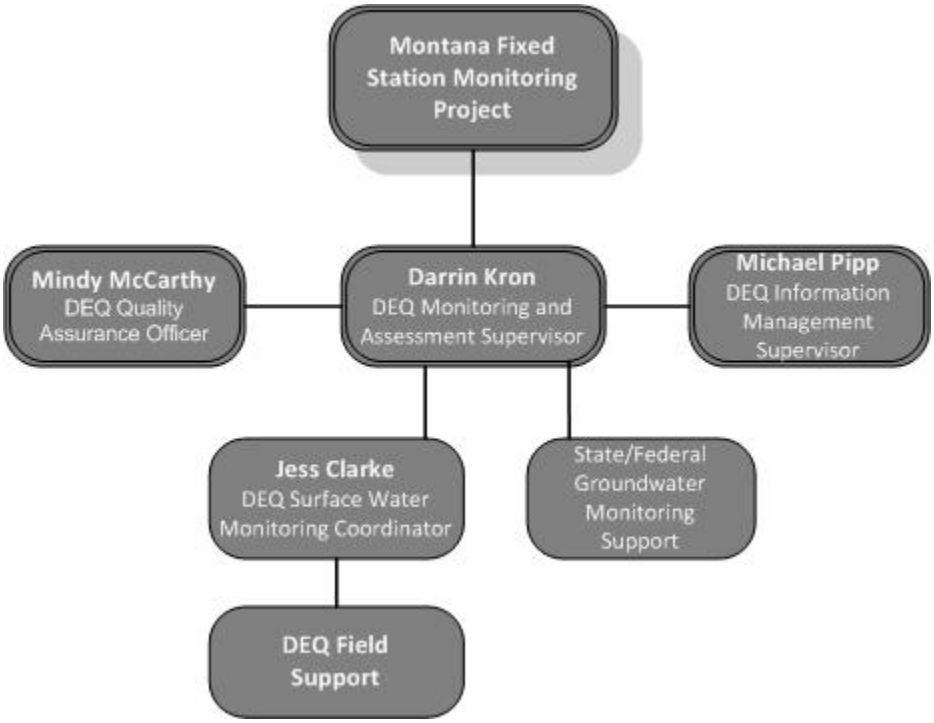

Figure 1-1. Project organization chart

2.0 PROBLEM DEFINITION/BACKGROUND

Public concern over health effects associated oil and gas development activities in Montana appears to be heightened. DEQ has been contacted by a number of concerned citizens about potential environmental effects of increased oil and gas production within the state. Oil and natural gas production in Montana may have adverse consequences to water quality. This monitoring supports an assessment program in the Lower Missouri Basin which investigates baseline water quality and potential water quality contamination that may occur with new oil and gas extraction techniques. Contamination routes could potentially come from compromised well casing, mishandled hydraulic fracturing fluids, increased population on inadequate sewage systems, or associated transportation and industrial

process associated with increase oil and gas development. This project will investigate baseline conditions in small watersheds where oil and gas development are occurring.

3.0 PROJECT TASK/DESCRIPTION

This monitoring effort will collect baseline surface water quality data in watersheds where oil and natural gas development has occurred, and will likely continue. Pollutants associated with oil and gas development likely disperse to low levels in surface waters. Therefore, areas of heavy development were targeted. Monitoring resources lead to a targeted approach where a broad array of pollutants are analyzed at relatively few monitoring sites. The targeted sites identified in **Table 3-1** and **Figure 3-1** are located where pollutants associated with oil and natural gas development have the highest probability of detection. Monitoring and analysis of pollutants associated with hydraulic fracturing fluids, industrial activities, flaring, oil and increased local population will be completed at each site.

The objectives of this monitoring are outlined a Quality Assurance Project Plan (QAPP) in further detail but the general objectives of the monitoring are as follows:

- Assess baseline conditions in areas of previous conventional oil and gas development
- Assess pollutants associated with hydrologic fracturing fluids or oil and gas byproducts
- Assess pollutants associated with increased population and industrial activities

Table 3-1. Targeted waterbodies in the Lower Missouri basin to be sampled for nutrients, metals, low-level mercury, TOC, and specific oil and gas parameters for 2012.

Waterbody	Site Description
Charlie Creek	East Charlie Creek near heavy oil development
West Charlie Creek	West Charlie Creek near heavy oil development
Big Muddy Creek	Near Culbertson USGS Station
Whitewater Creek	Whitewater Creek near mouth before confluence with Milk River, near heavy oil and gas development
West Fork Willow Creek	West Fork Willow Creek near Devon
Willow Creek	Willow Creek just below confluence with Black Coulee
Little Boxelder Creek	Little Boxelder Creek just above the confluence with Milk River near heavy gas development

Although it is envisioned that this project will include multiple years of monitoring, the duration and scope of this project will depend upon the results from each year's targeted monitoring. Each year a Sampling and Analysis Plan (SAP) will be completed for the project and will be informed from the prior year's gained knowledge. The primary objective of the project design will be to gather a data that can be used to compare to future conditions (trends or other time comparisons). Another objective will be to report existing water quality conditions in areas of oil and gas development. If conditions are found that warrant a larger or smaller sampling design, the project will be tailored to the findings.

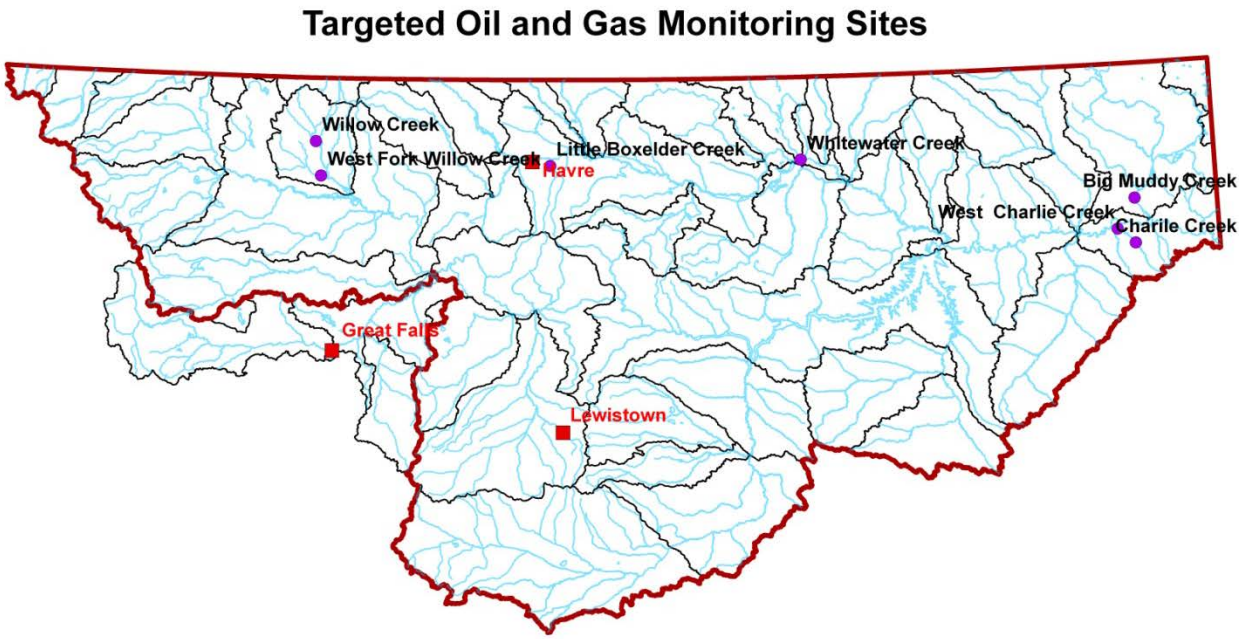

Figure 3-1. Oil and Gas Monitoring Locations for 2012

4.0 Measurement Quality Objectives and Criteria

To ensure the quality of the data for decision-making, the data quality indicators (DQIs) need to be defined. DQIs which include precision, accuracy, representativeness, completeness, comparability, and sensitivity are quantitative and qualitative criteria established for the data acquired within this design to assure it is of sufficient quality for its intended use. The DQIs for this project are defined below.

4.1 Precision

Precision is the degree of mutual agreement between or among independent measurements of a similar property (often reported as relative percent difference [RPD]). This indicator relates to the analysis of duplicate laboratory or field samples. Duplicates document the effect of the sample homogeneity and matrix limitations on method performance. This project will rely on analytical and field duplicates to assess precision based on their relative percent difference (RPD).

RPD (as %) = ((Sample Result – Duplicate Result)/((Sample Result-Duplicate Result)/2)) x 100

Analytical Precision (Laboratory Duplicates)
Precision quality control (QC) for all laboratory methods will follow the frequency specified in the analytical method or as described in a laboratory quality assurance plan (LQAP). Precision for laboratory duplicates will be assessed by ensuring that the RPD is ≤20%.

Field Precision (Field Duplicates)
Field duplicates shall be collected for 10% of all samples collected. Precision for field duplicates will be assessed by ensuring that the RPD is ≤25%.

If duplicates fail the above criteria, qualify all associated sample results with a “J”.

4.2 ACCURACY

Accuracy is the degree of agreement of a measurement with a known or true value. To determine accuracy, a laboratory or field value is compared to a known or true concentration. Measures of accuracy include calibrations (accuracy over a range of values), laboratory control samples (LCS) and sample specific controls such as matrix spikes (MS).

Laboratories are responsible for method accuracy in initial and continuing calibrations in accordance with the analytical method requirements. LCS and MS are common measures of accuracy in analytical laboratories. LCSs are prepared by spiking reagent water with a known concentration of analyte. The results are compared to the known value to determine a percent % Recovery.

% Recovery (LCS) = (Analytical Result/True Value) x 100%

Matrix Spikes are prepared by spiking a sample with a known concentration of analyte. The results are compared to the known value to determine a percent % Recovery.

% Recovery (MS) = ((Spiked Sample Result – Sample Result)/Amount Spiked) x 100%

4.2 REPRESENTATIVENESS

Representativeness is the expression of the degree to which data accurately and precisely represents an environmental condition in time and space. The selection of the sampling design (e.g., sample location, number of samples, and collection period) affects the monitoring project's representativeness. For this project, representativeness will be achieved by ensuring that spatial and temporal components are properly selected to adequately characterize the environmental condition and that this QAPP, project SAP and field collection Standard Operating Procedures (SOP) are followed.

4.3 COMPLETENESS

Any loss of data due to site access issues, spillage, QC failures, or laboratory mistakes may result in no decisions being made due to insufficient data and a possible return trip to remote sites, or lessen the decision-making certainty. To calculate completeness, compare the number of valid measurements completed (samples collected or samples analyzed) with those you originally planned to take. The completeness goal for this monitoring project is at least 90% of planned samples collected and passing QC evaluation.

4.4 COMPARABILITY

Comparability is the extent to which data from one study can be compared directly to data from another study. To achieve a comparable result, both the field collection method and the analytical method must be comparable. This is achieved through the use of standardized sampling and analytical methods and by adhering to this QAPP, project SAP and field collection SOPs.

4.5 SENSITIVITY

The minimum concentrations (required reporting limits) necessary to effectively evaluate the project data to the project objectives are specified in project SAP.

Analytical Sensitivity QC (Method Blanks)
Sensitivity QC for all laboratory methods will follow the frequency specified in the analytical method or as described in a laboratory quality assurance plan.

Field Sensitivity QC (Field Blanks)
Field blanks shall be collected for 10% of all samples collected. Sensitivity for field blanks will be assessed by ensuring that the field blank is less than the required reporting limit.

5.0 TRAINING REQUIREMENTS AND CERTIFICATION

The employment criteria for DEQ monitoring and assessment staff assures that all staff have a minimum level of education and experience to perform the tasks. In addition, monitoring staff are trained and experienced in proper sampling and field analysis as described in the DEQ Field Procedures Manual (Montana Department of Environmental Quality, 2012) and associated SOPs. Initial training for field procedures is performed by experienced monitoring staff. Experienced field staff accompanies new field staff during monitoring activities until the new staff member exhibits proficiency in the field as determined by the trainer, direct supervisor or QA Officer.

Laboratories analyzing samples under this QAPP are responsible for providing personnel qualified for the methods requested and adhering to their LQAP. The laboratories that DEQ uses for analyzing samples are either certified through the State of Montana, accredited under national programs, or their quality system is known and meets DEQ's requirements.

6.0 DOCUMENTATION AND RECORDS

Documentation of the measurements, observations and conditions at each site monitored is critically important for a decision to be made and validated at a later date. Site Visit Forms (SVF) and field data sheets document the activities for each site visit. SVFs and field forms will be completed on-site as the sampling occurs. The Field Procedures Manual provides instruction on completing the SVF and field forms. Adherence to the Field Procedures Manual will result in all required metadata and measurements on the field forms to produce a deliverable that is compatible for Montana DEQ's MT-eWQX database.

All hardcopy and electronic information produced from the monitoring effort will be retained indefinitely at DEQ in the WQPB library. In addition, all monitoring data will be submitted to MT-eWQX which will be submitted to EPA's National STORET Warehouse. This is discussed further in **Section 14**, Data Management.

7.0 Sampling Process Design

General considerations for sampling design are provided in **Sections 2.0** and **3.0** of this QAPP and will be further defined in yearly SAPs. Sampling timeframes or locations may need to be adjusted due to site access problems such as impassable unpaved roads during rain events in eastern Montana, land owner access denial, or ice conditions during cold weather.

8.0 Sampling Methods

Water (grab) samples will be collected at each site from MAS staff. Samples will be collected according to DEQ's Field Procedures Manual (Montana Department of Environmental Quality, 2012).

8.1 Nutrient and Other Water Chemistry Sample Collection

Table 8.1 summarizes sampling volumes, containers, preservation and holding time requirements for all water chemistry samples collected from these waterbodies.

Dissolved Aluminum: A 60 cm^3 syringe and a 0.45 um filter disposable filter are used. 50 ml of the filtrate will be placed in a 250 ml HDPE bottle, preserved with nitric acid, and kept on ice until analyzed (**Table 8.1**). Filtration will be accomplished with a large syringe connected to a disposal filter capsule. A small amount of the sample will be wasted through the filter before the filtered sample is collected. Sample bottles and lids will be pre-rinsed with a small amount of the filtered sample before collecting the final filtered sample. Detailed methodology can be found in the DEQ Field Procedures Manual (Montana Department of Environmental Quality, 2012).

Nutrients, TSS, TDS, Common Anions, and Metals: TP and NO_{2+3} will be collected in a 250 ml HDPE bottle. This sample will be preserved with sulfuric acid, and held on ice. TN will be collected in another 250 ml HDPE bottle, no preservative, and held on ice. TSS, TDS, common anions (sulfate, chloride, and alkalinity), bromide, and fluoride will be collected in a 1000 ml HDPE bottle, no preservative, and held on ice. NOTE THE SHORT HOLDING TIME FOR TSS and TDS. Detailed methodology can be found in the DEQ Field Procedures Manual (Montana Department of Environmental Quality, 2012). Total recoverable metals will be collected in a 250 ml HDPE bottle, preserved with nitric acid, and held on ice. Hardness will be calculated from the Total Recoverable metals bottle. Sediment metals will be passed with a minimal amount of ambient stream water through a Teflon 60-micron sieve using a Buchner funnel into a 2000 ml HDPE bottle without preservative and held on ice (not frozen) until analyzed (see **Table 8.1**). Total recoverable mercury using the ultra-low level method follows a different procedure. A detailed explanation can be found in DEQ's Field Procedures Manual (Montana Department of Environmental Quality, 2012).

Total Organic Carbon (TOC): TOC will be collected in a 125 ml glass bottle, preserved with sulfuric acid, and held on ice.

Gross Alpha and Beta Radioactivity: Gross Alpha and Gross Beta can be analyzed together and will be collected in two 1000 ml HDPE bottles. These will be preserved with nitric acid.

Formaldehyde: Formaldehyde will be collected in a 100 ml HDPE bottle and kept on ice until analysis.

Benzene, Toluene, Ethylbenzene, Xylene (BTEX), Methane, and Methanol: Methane will be collected with a 40 ml volatile organic compound analysis (VOA) vial and preserved with sulfuric acid. BTEX and methanol will each be collected in three 40 ml VOA vials, preserved with hydrochloric acid, and then kept on ice until analysis.

PAH: PAH will be collected in two 1000 ml glass bottles and kept on ice until analysis.

Table 8-1. Sampling Volumes, Containers, Preservation, and Holding Times

Analyte	Bottle Size	Container	Preservation and Storage	Holding Time
TN	250 ml	HDPE Bottle	Cool to <6 °C (on ice)	28 days
TP, NO_{2+3}	250 ml	HDPE Bottle	H_2SO_4, Cool to <6 °C (on ice)	28 days
TSS, TDS, Common Anions (Sulfate, Chloride, total alkalinity), Bromide, and Fluoride	1000 ml	HDPE Bottle	Cool to <6°C (on ice)	7 days
Total Recoverable Metals	500 ml	HDPE Bottle	5 ml conc. HNO_3, cool to <6°C (on ice)	180 days
Dissolved Aluminum	250 ml	HDPE Bottle	Field filter 0.45 um, 1.5 ml conc. HNO_3, cool to <6°C (on ice)	180 days
Sediment Metals	2000 ml	HDPE Bottle	Cool to <6°C (on ice)	180 days
Ultra-low Level Mercury	100 ml	Glass Bottle	0.5 ml 12N HCl, cool to <6 °C (on ice)	28 days
TOC	125 ml	Glass Bottle	H_2SO_4 to pH <2, cool ≤6°C (on ice)	NA
Gross Alpha and Beta Radioactivity	2 -1000 ml	HDPE Bottle	HNO_3 to pH <2	180 days
Formaldehyde	100 ml	HDPE Bottle	Cool ≤6°C (on ice)	NA
BTEX	3 -40 ml	VOA Vial – no headspace	5-10 drops of HCl to pH <2; Cool ≤6°C	14 days
Methane	40 ml	VOA Vial – no headspace	4 drops H_2SO_4	NA
Methanol	3 -40 ml	VOA Vial – no headspace	5-10 drops of HCl to pH <2; Cool ≤6°C	14 days
PAH	2 -1000 ml	Glass Bottles	Cool ≤6°C	7 days

9.0 Sample Handling and Custody

DEQ sampling crews are responsible for the integrity of the sample from the time of collection until shipment to the laboratory for analysis. This responsibility includes proper preservation, labeling, sample custody documentation, and storage according to the specifications in the Field Procedures Manual.

9.1 Sample Handling Procedures

After samples are collected and labeled according to the specifications in the Field Procedures Manual, they are placed in a clean cooler on dry ice to sufficient drop the temperature of the samples to 6°C within 6 hours of sampling. This temperature will be maintained until received by the laboratory. The laboratory will keep samples in a refrigerator maintained at a constant 4°C until the time of analysis.

DEQ will ship/deliver samples to the DEQ contracted laboratory as needed to meet the EPA required holding times and temperature requirements. **Table 8.1** details the standardized analytical chemistry measurements that will be used for water quality assessments and includes sample container, preservation and maximum holding time information for each sample type.

9.2 Sample Custody

Custody documentation (i.e., SVF or chain of custody) will accompany all DEQ samples from the field to the laboratory. Monitoring personnel will initiate custody documentation before samples are stored in the cooler and maintain the custody forms until the samples are submitted to the DEQ Field Tech/Laboratory Coordinator or contracted laboratory. The DEQ Field Tech/Laboratory Coordinator or laboratory will sign the custody documentation and inspect the integrity of the samples and documentation during the sample receipt. Any missing information or discrepancies will be communicated to the applicable monitoring staff. If the samples are submitted to the DEQ Field Tech/Laboratory Coordinator, the samples will be taken to the laboratory and the laboratory sample custodian will sign the custody documentation indicating that the laboratory is now the custodian of the samples. The laboratory sample custodian shall inspect the integrity of the samples and documentation during the sample receipt. Any issues or discrepancies identified by the laboratory will be communicated to the DEQ Field Tech/Laboratory Coordinator.

10.0 Analytical Methods

Analytical methods listed in **Table 10.1** represent standard accepted procedures. Analytical method requirements and procedures are described in the associated method documents (i.e., Standard Methods, EPA). Required reporting limits are the minimum reporting limits that the laboratory should provide results so that the data can be assessed to Montana's water quality standards.

Table 10-1. Analytical Methods and Required Reporting Limits

Analyte	Method	Required Reporting Limit (mg/L)
Water Sample - Nutrients		
Total Phosphorus (TP)	EPA 365.1	0.003
Total Nitrogen (TN)	4500-N B or C	0.04
Nitrate + Nitrite-Nitrogen (NO_2+NO_3-N)	EPA 353.2	0.01
Water Sample – Common Ions		
Total Suspended Solids (TSS)	A 2540 D	4
Total Dissolved Solids (TDS)	A 2540 C	4
Total Organic Carbon	A 5310 C	0.5
Alkalinity	A 2320 B	1
Sulfate	EPA 300.0	0.05
Chloride	EPA 300.0	0.05
Water Sample – Calculated Results		
Total Hardness as $CaCO_3$	A 2340 B (Calc)	1
Sodium Absorption Ratio	Calc	-
Water Sample – Dissolved Metals		
Aluminum	EPA 200.7	0.03
Water Sample – Total Recoverable Metals		
Arsenic	EPA 200.8	0.003

Table 10-1. Analytical Methods and Required Reporting Limits

Analyte	Method	Required Reporting Limit (mg/L)
Barium	EPA 200.7	0.005
Boron	EPA 200.7	0.01
Cadmium	EPA 200.8	0.00008
Calcium	EPA 200.7	1
Chromium	EPA 200.8	0.001
Copper	EPA 200.8	0.001
Iron	EPA 200.7	0.05
Lead	EPA 200.8	0.005
Magnesium	EPA 200.7	1
Nickel	EPA 200.7	0.01
Potassium	EPA 200.7	1
Selenium	EPA 200.8	0.001
Sodium	EPA 200.7	1
Strontium	EPA 200.7	0.00001
Zinc	EPA 200.7	0.01
Total Recoverable Metals Digestion	EPA 200.2	n/a
Water Sample – Total Metals		
Ultra low level Mercury	EPA 245.7	0.000005
Sediment Sample – Total Recoverable Metals		
Arsenic	EPA 200.8	1 mg/kg
Cadmium	EPA 200.8	0.2 mg/kg
Chromium	EPA 200.8	9 mg/kg
Copper	EPA 200.8	15 mg/kg
Iron	EPA 200.7	10 mg/kg
Lead	EPA 200.8	5 mg/kg
Zinc	EPA 200.7	20 mg/kg
Total Recoverable Metals Digestion	EPA 200.2	n/a
Sediment Sample – Total Metals		
Mercury	EPA 74718	0.05 mg/kg
Water Sample – Non-metal		
Flouride, Electrode	A 4500 F-C	0.1
Formaldehyde	NIOSH 3500 Mod.	0.250
Methane	EPA 8015 Mod.	0.0002
Bromide	EPA 300.0	0.5
Water Sample – Radiochemistry		
Gross Alpha and Beta Radioactivity	EPA 900.0/900.1	3.0/4.0 pCi/L
Water Sample – Volatile Organics		
Benzene, Toluene, Ethylbenzene, Xylene (BTEX)	EPA 602.0	0.0005
Water Sample – Semi-Volatile Organics		
Polycyclic Aromatic Hydrocarbons (PAH)	EPA 610	0.0001
Water Sample – Other Organics		
Methanol	EPA 8015	-

11.0 QUALITY CONTROL REQUIREMENTS

The data collected as part of this project are used in making decisions regarding the condition of the state's water quality. QC is the system of technical activities used to assure and document the quality of the monitoring data. Examples of quality control activities include instrument calibration, field logbooks, SVFs, field and laboratory QC samples (e.g., duplicates, blanks, spikes, and laboratory control standards), training and data qualifiers. DEQ follows specific procedures to ensure that the design is properly implemented.

11.1 FIELD QUALITY CONTROL

The field quality controls for this project will consist of duplicate and blank samples (one per each sampling event).

Field blanks are used to determine if the sampling and handling of the samples has introduced contamination. The field blanks will consist of laboratory-grade deionized water, transported to the field and poured into a sampling container. The blank will be prepared and preserved at the same time as samples are collected from the stream. Field blanks will be collected at a minimum frequency of 10% of the total number of monitoring sites. The sensitivity requirements for field blanks are described in **Section 4.5**.

Field duplicates are used to determine field and laboratory precision as well as the natural variability. Field duplicates will be used as an indicator of inconsistencies in the sampling technique, homogeneity of the samples, and laboratory control. The field duplicates consist of a co-located duplicate sample that is collected at the same time and the same way that the regular stream sample is collected. Field duplicates will be collected at a frequency of 10% of the total number of monitoring sites. The precision requirements for field duplicates are described in **Section 4.1**.

Field duplicate and blank samples are handled in the same way that regular samples are handled. Field duplicates and blanks will be labeled according to the labeling protocol outlined in the Field Procedures Manual.

11.2 LABORATORY QUALITY CONTROL

All samples are analyzed by laboratories that have established QA programs that implement the following elements:

- Documented QA Plan and standardized procedures employed by the laboratory
- A demonstration of the laboratory's capabilities and qualifications to perform analytical methods
- Clear quality requirements and QC objectives for each analytical method to provide a means to evaluate the quality of the data

12.0 Instrument and Equipment Maintenance and Calibration

12.1 Field Equipment

DEQ will prepare all field instruments and equipment prior to each field season by performing routine maintenance and inspection and initial calibration. Maintenance procedures are outlined in the specific instruction manuals. A maintenance logbook will be maintained by the DEQ Field Tech/Laboratory Coordinator for each instrument. Instruments will be calibrated prior to each field season according to the manufacturer's instructions and using approved calibration standards (National Institute of Standards and Technology traceable standards as appropriate) and buffers.

Continuing calibration will occur according to the frequency prescribed in the instrument manufacturer's instructions and prior to sampling. Calibration shall be performed as often as necessary to ensure that sample readings are with the specified tolerances. Calibrations will be documented in calibration logs stored with the instrument. Corrective actions for failed calibrations are detailed in the manufacturer's instructions.

During monitoring, any field sample readings that are out of expected range are recorded on the Site Visit Form. If equipment failures are the cause of failure, equipment should be replaced immediately. The QA Officer will ensure that calibration/maintenance techniques are appropriate and will make the appropriate corrective actions.

12.2 Laboratory Equipment

Analytical method calibration criteria are specified in the reference analytical method from EPA, American Public Health Association, or USGS. Calibrations can include initial and continuing calibrations as well as internally calibrated methods such as the Method of Standard Additions (MSA). The reporting of a result under a referenced method is a statement by the laboratory that the calibration criteria for that method have been performed, examined and pass the control limits established in the method. Results reported under a reference method without the calibrations and control limits specified in the method will not be accepted by DEQ.

13.0 Inspection and Acceptance requirements for supplies

Before mobilization to the field, all field monitoring supplies will be inspected to ensure they are in good working condition. Calibration standards, buffers and preservatives shall be inspected to ensure they are not past the expiration date and will be discarded appropriately when expired or contamination is suspected. Extra monitoring supplies and containers will be brought into the field in the event that damage occurs.

14.0 Data Management

Data that is collected for this project will be stored in the Montana EQuIS Water Quality Exchange (MT-eWQX) database. MT-eWQX is DEQ's main repository for storing water quality monitoring data, which includes physical, chemical, biological, and habitat data as well as the metadata describing the results

from a variety of monitoring projects across the state. Metadata includes, but is not limited to, quality assurance documentation, laboratory analytical flags and other quality control flags, analytical methods, detection limits, and sampling location descriptions.

Data submitted to MT-eWQX is sent to EPA's National STORET Warehouse. DEQ's Information Management and Technical Services Section manages MT-eWQX and uploads copies of the state's database to the national STORET database, which is maintained by the US EPA.

Figure 14.1 describes the flow of DEQ data into MT-eWQX.

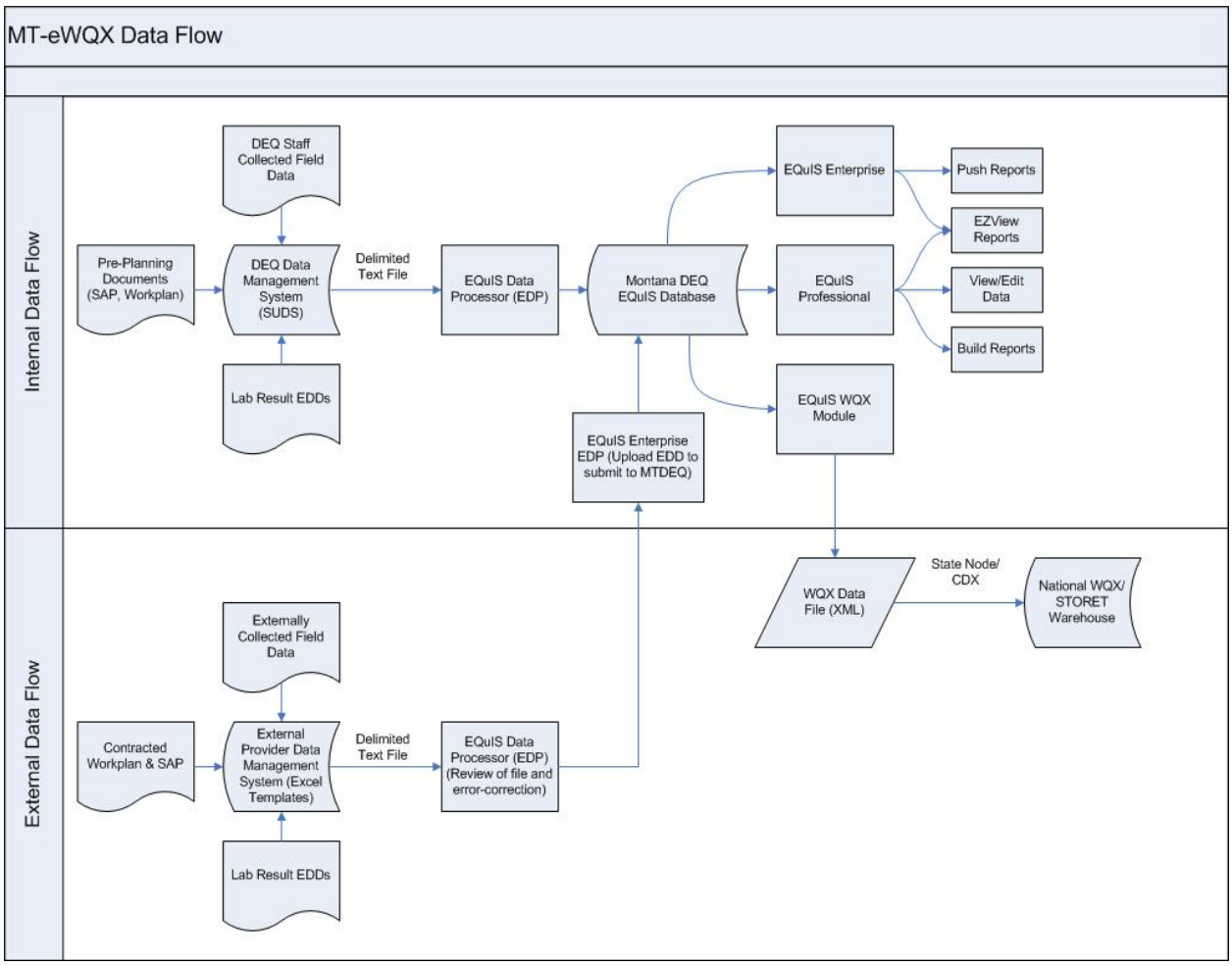

Figure14-1. MT-eWQX Data Flow Overview

14.1 Field Forms

DEQ uses a series of field forms to document the various field measurements and observations made by field crews. These forms are scanned so that they can be captured and uploaded to MT-eWQX. The field forms that are used by DEQ and the instructions for completing those forms are given in the Field Procedures Manual (Montana Department of Environmental Quality, 2012).

Monitoring staff, typically the Field Technician is the first line of defense for the data quality control. The Field Technician reviews all incoming field forms for adequacy, calculates flow values, and applies

corrections if necessary. Once all data is entered into the database, the MT-eWQX Database Manager performs a final quality control check of the results. The field form data flow is provided in **Figure 14.2**.

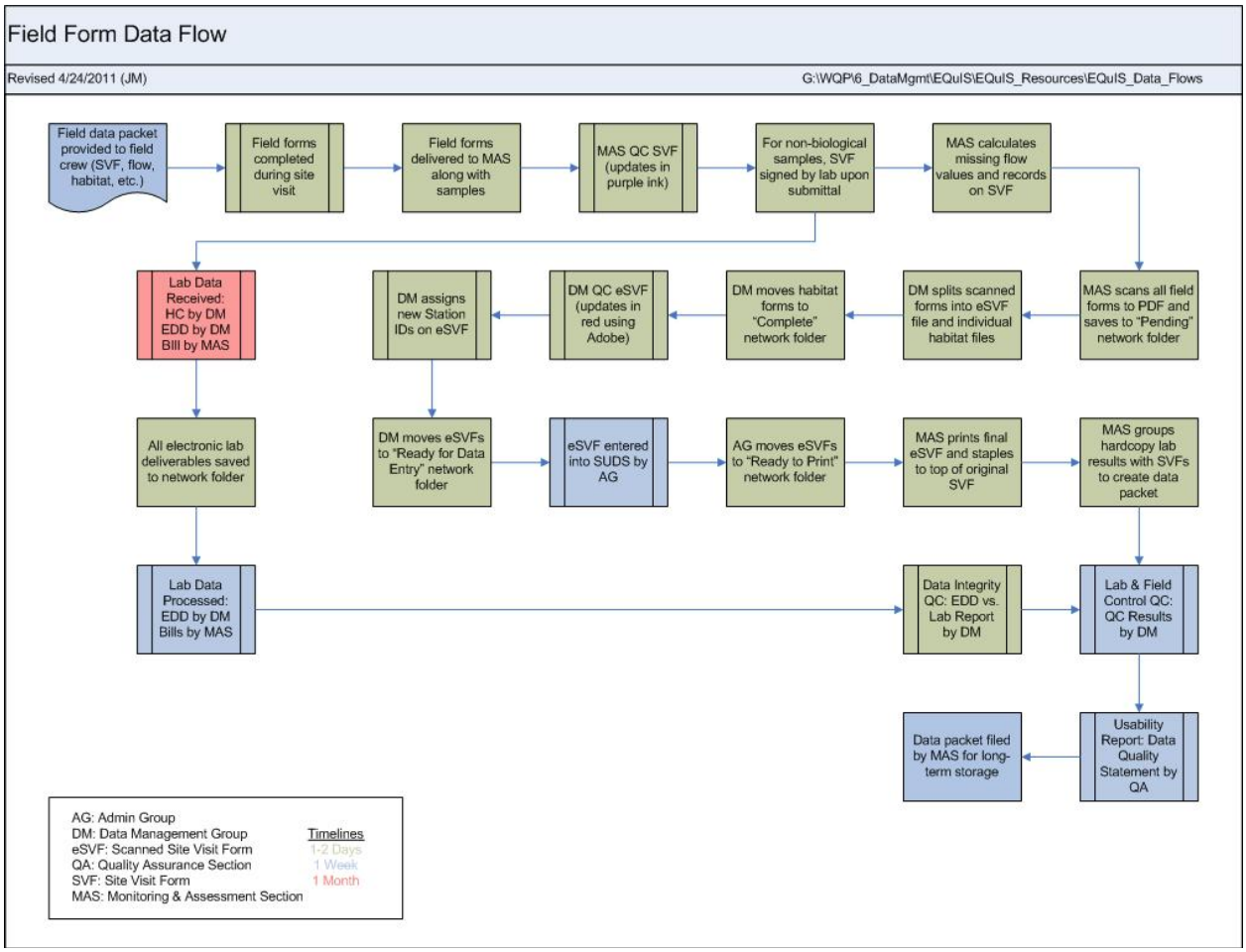

Figure 14-2. Field Form Data Flow

14.2 Laboratory Reports and Electronic Deliverables

Analytical laboratories are required to return analytical results in a MT-eWQX specific format known as an Electronic Data Deliverable (EDD). The general EDD reporting requirements can be found on the DEQ Website located at: http://deq.mt.gov/wqinfo/datamgmt/MTEWQX.mcpx. DEQ will perform the necessary validation and verification as outlined in **Section 16**.

15.0 Assessment & Response

All field and laboratory activities under this project are subject to an assessment by the DEQ QA Officer. An assessment may consist of a site visit to evaluate sample collection and/or laboratory activities or an inquest for information to support that data activities are meeting the required rigor.

15.1 Field Activity Assessments and Corrective Actions

The DEQ QA Officer may conduct field assessments of the sampling crews as needed to determine adherence with the training, project plans and SOPs. Results of field assessments will be reported to the WQPB Monitoring and Assessment Section (MAS) Supervisor and Bureau Chief. Recommendations resulting from field assessments will be communicated to the crews at the time of the assessment and followed up with written comments summarizing the observations and findings. Any corrective actions identified by the QA Officer will be laid out and are effective immediately. Corrective actions will be addressed by the MAS Supervisor. If it is determined that the quality of the data may have been compromised, a thorough review of the data will be performed, and questionable data will be flagged in the database.

If any QC issues arise in the field, it is the responsibility of the monitoring staff to communicate the issues to the MAS Supervisor and QA Officer right away so that corrective actions can be made. Any procedural problems will be corrected immediately based on recommendations from the QA Officer.

15.2 Laboratories and Contractors

Laboratories used by DEQ have been certified by external bodies with certification authority. The DEQ QA Officer may review the laboratory QAPs to ensure that they meet the requirements for the project. The DEQ QA Officer may conduct an assessment of the laboratory as needed to ensure adherence to laboratory quality systems procedures as described in laboratory QAPs. Results of laboratory assessments will be reported to the WQPB Monitoring and Assessment Section (MAS) Supervisor, WQPB Bureau Chief, and Laboratory Manager. Recommendations resulting from laboratory assessments will be communicated to the Laboratory Manager at the time of the assessment and followed up with written comments summarizing the observations and findings. Any corrective actions identified by the DEQ QA Officer will be laid out and are effective immediately. Corrective actions will be addressed by the Laboratory Manager. If it is determined that the quality of the data may have been compromised by the laboratory based on assessments or during data QC review, a thorough review of the data will be performed, and questionable data will be flagged in the database.

The methods and required reporting limits for the project will be communicated to the laboratory before analysis to ensure that the laboratory can adequately provide the necessary services.

16.0 Data Review, Verification &Validation

To determine the adequacy of the data set to support its use for this project, the data are analyzed by comparing the results to the original objectives. Data returned from the laboratories, including analytical reports, EDDs, and QC summaries, will be QC reviewed by the DEQ's data management group and quality assurance section to ensure the data is adequate for use.

All field and laboratory data is reviewed by MAS, Data Management and QA staff to determine if the data meet project objectives described in this QAPP and associated SAPs. Decisions to qualify or reject data are made by the QA Officer or delegated authority.

16.1 Laboratory Verification

It is the responsibility of the laboratory to ensure that analytical results conform to the requirements of the methods that they perform. Methods must be reported under a reference analytical method from EPA, Standard Methods, USGS, or other recognized organization. Where a substantial modification to a recognized method is being performed, the laboratory must ensure that DEQ approves the modification and a reference must note this by including “mod” or “modified” following the method citation.

Laboratories will provide a QC summary of the results.

16.3 Verification and Validation Responsibilities

All data collected by DEQ undergo a series of checks to endure that the data are of sufficient quality and conform to the project’s objectives. As soon as possible after receipt of data from the laboratory, data verification and validation should occur. The QA Officer or the MT-EWQX Database Administrator is responsible for verifying that the laboratory data deliverables are complete and consistent with the requirements established in this QAPP and project SAP.

Supporting Documents that may be needed for the data verification and validation process include:

- Copy of this QAPP
- Copy of the SAP
- Site Visit Forms and Field Forms
- Data Packages from Labs (Analytical Report, EDD, QC Summary)
- Equipment/Instrument Calibration Logs

Data will not be validated to the level of raw data unless systemic problems become evident from review of results and QC summaries. If analytical results are routinely failing to meet the data quality indicators specified in this QAPP, the QA Officer may request all raw data for a data set and perform a full data validation.

The QA Officer is responsible for resolving any data quality issues. Data that does not meet the objectives and project requirements specified in this document will be qualified and flagged accordingly. A description of the data qualifiers used by DEQ are specified in **Table 16.1**. Qualified data may be used, provided the uncertainties are known and understood. Any rejected data (data qualified with an “R”) are considered unusable for this project. Data are considered useable once the data verification and validation process is complete and the data is successfully loaded to the EQuIS database.

Table 16-1. Data Result Qualifiers

Result Qualifier	Result Qualifier Description
B	Detection in field blank
D	Reporting limit increased due to sample matrix
H	EPA holding time exceeded
J	Estimated: The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
R	Rejected: The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

17.0 REFERENCES

Montana Department of Environmental Quality. 2012. Field Procedures Manual for Water Quality Assessment Monitoring. Helena, MT: Montana Department of Environmental Quality. Report WQPBWQM-020.v.3.